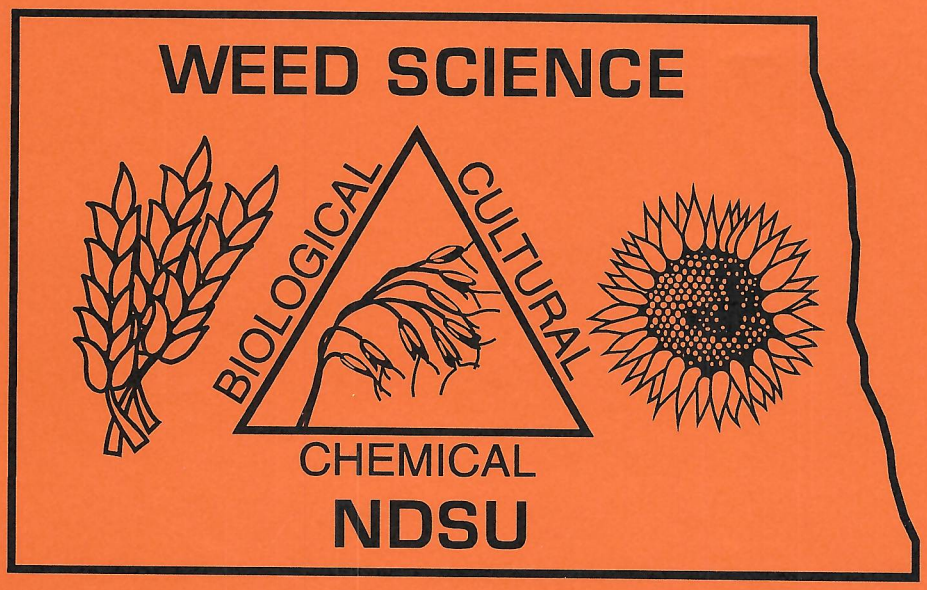
2000
NORTH DAKOTA
Weed Control
Research



Weed Research Projects, Department of Plant Sciences
NORTH DAKOTA STATE UNIVERSITY
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NOT FOR PUBLICATION

SUMMARY OF 2000
WEED CONTROL EXPERIMENTS

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Reference to commercial products or trade names is made with no intended endorsement, and failure to mention products or trade names is done with no intended discrimination by North Dakota State University. Experiments with pesticides on non-labeled crops or target species does not imply endorsement on non-labeled uses of pesticides by North Dakota State University.

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CLIMATIC DATA, 2000 CARRINGTON

	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.06	0.00	0.00	0.00	54	28	70	37	58	46	89	63	81	56	59	44
2	0.15	0.00	0.00	0.01	0.07	0.20	46	33	82	46	65	38	68	58	82	52	58	55
3	0.00	0.00	0.22	0.01	0.05	0.02	41	24	76	51	58	44	72	59	78	62	64	57
4	0.00	0.00	0.00	1.48	0.00	0.00	58	22	81	46	68	45	84	62	83	45	66	56
5	0.00	0.00	0.00	0.00	0.43	0.09	55	30	83	48	71	42	77	63	79	63	74	57
6	0.00	0.03	0.00	0.27	0.00	0.16	39	23	70	50	79	49	78	63	78	57	80	57
7	0.00	0.11	0.00	0.00	0.00	0.00	42	24	68	44	90	55	83	69	80	53	71	51
8	0.00	0.15	0.00	0.01	0.00	0.00	60	26	63	40	86	56	85	65	79	57	81	46
9	0.00	0.00	0.00	0.00	0.00	0.00	43	25	68	35	91	56	81	59	85	56	81	50
10	0.00	0.02	0.03	0.00	0.00	0.00	32	19	69	49	69	49	82	59	89	60	75	48
11	0.00	0.20	0.00	1.12	0.00	0.00	34	15	54	45	80	46	75	60	94	70	65	42
12	0.00	0.15	0.10	0.00	0.04	0.00	37	24	45	33	86	58	87	60	82	56	77	41
13	0.00	0.00	2.01	0.00	0.00	0.02	48	23	53	33	69	60	85	60	82	50	72	46
14	0.00	0.00	1.01	0.00	0.17	0.00	23	14	65	33	65	54	85	63	87	56	66	38
15	0.00	0.05	0.23	0.06	0.00	0.00	30	7	63	38	61	48	85	62	74	49	73	35
16	0.00	0.00	0.00	0.00	0.72	0.00	40	18	64	38	57	44	76	55	59	48	81	42
17	0.00	0.00	0.02	0.01	0.00	0.00	58	28	60	41	61	42	65	48	71	49	84	44
18	0.00	0.00	0.00	0.02	0.00	0.04	56	34	61	34	69	41	62	52	71	45	75	53
19	0.00	0.02	0.14	0.04	1.18	0.03	52	28	76	40	67	52	66	51	67	57	62	49
20	0.00	0.02	0.01	0.00	0.95	0.07	61	24	71	49	66	57	70	44	70	58	57	39
21	0.00	0.00	0.00	0.00	0.00	0.56	75	37	77	46	69	55	74	46	74	50	56	38
22	0.00	0.00	0.30	0.00	0.00	0.20	68	39	79	47	81	45	78	48	80	49	46	34
23	0.00	0.00	0.00	0.00	0.00	0.00	70	34	77	43	76	59	84	56	80	47	48	29
24	0.00	0.00	0.05	0.00	0.00	0.00	72	44	70	46	74	54	86	61	90	61	60	30
25	0.00	0.00	0.05	0.09	0.00	0.00	68	43	73	34	67	52	75	61	84	62	70	34
26	0.00	0.02	0.00	0.00	0.00	0.00	71	41	74	46	66	49	83	56	83	58	60	34
27	0.00	0.32	0.00	0.00	0.03	0.00	60	39	58	48	69	45	84	54	81	66	66	34
28	0.00	0.00	0.11	0.00	0.01	0.00	61	34	75	48	75	48	85	61	71	48	80	35
29	0.00	0.02	0.00	0.00	0.00	0.00	68	38	63	49	81	50	84	60	75	45	77	45
30	0.25	0.00	0.00	0.00	0.10	0.00	67	42	71	44	87	58	90	64	74	53	77	47
31		0.06		0.01	0.00				64	40			87	63	66	46		
Total	0.40	1.17	4.34	3.13	3.75	1.39	53	29	69	43	72	50	80	58	78	55	59	44

CLIMATIC DATA, 2000 Casselton																			
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.06	0.15	0.00	0.00	0.00	49	31	67	40	63	50	83	61	87	63	58	52
2	0.04	0.00	0.00	0.00	0.00	0.02	56	37	69	36	64	44	91	65	85	54	64	52
3	0.06	0.00	0.00	0.00	0.00	1.3	49	31	81	46	68	43	76	62	81	62	68	57
4	0.00	0.00	0.55	0.00	0.00	0.00	43	25	85	45	68	43	85	65	87	62	68	60
5	0.00	0.00	0.02	1.86	0.00	0.00	53	38	85	48	67	43	84	62	87	62	73	53
6	0.06	0.00	0.00	0.00	0.00	0.05	56	26	75	58	71	47	81	63	84	62	74	55
7	0.00	0.00	0.00	1.66	0.00	0.04	39	27	74	51	78	56	86	68	84	55	80	56
8	0.00	0.71	0.00	0.22	0.00	0.00	43	24	70	52	90	55	84	69	85	61	73	47
9	0.00	0.10	0.00	0.00	0.00	0.00	61	26	70	40	87	55	84	64	84	56	82	49
10	0.00	0.00	0.00	0.00	0.00	0.00	41	28	69	47	94	49	85	64	87	55	89	43
11	0.40	0.08	0.00	0.00	0.00	0.00	44	05	64	50	84	68	82	62	87	61	76	52
12	0.00	0.04	0.00	0.16	0.00	0.00	40	06	64	45	74	66	75	61	94	71	68	40
13	0.05	0.02	0.35	0.00	0.00	0.00	36	28	56	33	84	63	86	65	89	54	80	45
14	0.15	0.00	0.28	0.00	0.65	0.16	50	19	55	30	76	58	88	64	85	64	66	45
15	0.00	0.00	0.50	0.00	0.00	0.00	23	17	67	39	68	55	88	65	76	50	66	38
16	0.00	0.38	0.60	0.32	0.00	0.00	36	17	68	47	63	44	86	59	80	50	82	44
17	0.00	0.00	0.02	0.00	0.95	0.00	47	17	69	47	63	43	77	50	67	53	85	44
18	0.02	0.00	0.43	0.06	0.00	0.00	49	33	69	40	65	46	67	52	71	50	83	48
19	0.13	0.00	0.00	0.04	0.00	0.05	57	32	69	38	71	53	67	50	74	50	89	52
20	0.02	0.00	4.40	0.07	0.00	0.02	50	29	73	43	66	53	68	48	78	60	67	43
21	0.00	0.25	0.02	0.00	0.15	0.05	61	31	65	43	72	53	72	49	74	60	58	35
22	0.00	0.08	0.07	0.00	0.00	1.05	69	40	75	49	70	55	76	50	76	50	59	36
23	0.00	0.06	0.10	0.00	0.00	0.45	74	34	74	50	81	61	77	50	80	53	48	36
24	0.00	0.00	0.00	0.00	0.01	0.00	74	42	78	54	77	58	83	58	82	53	61	30
25	0.00	0.00	0.73	0.00	0.04	0.00	72	42	70	43	76	57	84	59	89	60	61	32
26	0.00	0.00	0.02	0.00	0.03	0.00	73	45	74	47	76	54	84	59	89	58	70	32
27	0.25	0.00	0.00	0.00	0.00	0.00	69	49	79	48	70	48	85	60	87	60	64	33
28	0.00	0.37	0.07	0.00	0.00	0.00	63	36	68	49	72	48	84	61	87	60	63	33
29	0.00	0.00	0.30	0.00	0.00	0.00	65	35	68	52	75	49	89	62	79	44	79	48
30	0.14	0.59	0.00	0.00	0.00	0.00	69	40	70	40	81	49	88	62	78	47	79	50
31		0.00		0.00	0.95				65	46			88	63	81	52		
Total	1.32	2.74	8.61	4.39	2.78	3.19	54	30	70	45	74	52	82	60	82	57	71	45

CLIMATIC DATA, 2000 McLeod (Colfax)																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.00	0.12	0.00	0.00	55	29	69	42	65	48	92	65	82	62	63	53
2	0.09	0.00	0.00	0.01	0.00	2.05	50	36	79	43	66	45	80	63	82	56	63	55
3	0.00	0.00	0.11	0.00	0.00	0.01	42	27	81	51	57	45	79	62	77	63	68	60
4	0.00	0.00	0.33	0.39	0.00	0.00	54	22	83	49	68	49	83	63	82	62	74	55
5	0.00	0.00	0.00	1.63	0.01	0.00	61	38	91	61	70	43	82	63	82	63	74	55
6	0.00	0.00	0.00	0.00	0.00	0.12	39	28	74	57	77	47	84	66	81	60	82	60
7	0.00	0.66	0.00	0.03	0.00	0.06	42	26	67	53	87	59	84	69	84	55	74	50
8	0.00	0.38	0.00	0.07	0.00	0.00	61	25	64	49	91	59	84	68	83	59	82	47
9	0.00	0.00	0.00	0.00	0.00	0.13	42	27	66	42	93	64	85	64	86	55	88	50
10	0.00	0.02	0.13	0.00	0.00	0.00	36	24	60	52	83	59	82	64	91	57	76	42
11	0.12	0.03	0.00	0.82	0.00	0.00	41	19	56	50	84	53	78	64	94	70	67	43
12	0.05	0.01	0.00	0.00	0.00	0.00	35	25	53	38	82	67	90	61	86	60	80	41
13	0.01	0.00	0.52	0.00	0.00	0.00	56	27	54	35	76	61	85	64	83	53	66	45
14	0.00	0.00	0.44	0.00	0.00	0.00	32	20	66	31	67	53	86	64	85	65	66	40
15	0.00	0.05	0.55	0.03	0.00	0.00	35	20	66	42	65	53	84	65	75	52	71	33
16	0.00	0.00	0.02	0.01	0.15	0.00	46	26	70	46	60	45	77	60	66	48	81	43
17	0.00	0.00	0.05	0.00	0.00	0.00	50	34	62	50	68	45	66	54	71	50	82	46
18	0.10	0.00	0.01	0.40	0.00	0.00	45	38	62	42	72	46	59	53	74	45	92	49
19	1.00	0.00	0.47	0.03	0.00	0.00	48	36	71	38	78	56	69	50	76	55	67	49
20	0.00	0.23	0.01	0.00	0.00	0.03	58	33	67	50	72	59	70	50	74	64	58	37
21	0.00	0.01	0.00	0.00	0.00	0.20	68	33	77	45	72	56	76	48	77	56	60	32
22	0.00	0.07	0.00	0.00	0.00	0.76	72	44	74	50	82	52	78	52	81	45	48	41
23	0.00	0.00	0.00	0.00	0.00	0.00	71	39	76	51	77	63	82	56	86	50	47	32
24	0.00	0.00	0.00	0.00	0.01	0.00	71	45	68	47	75	57	84	63	88	53	59	28
25	0.00	0.00	0.33	0.00	0.03	0.00	72	44	73	43	63	53	82	59	85	62	70	29
26	0.03	0.00	0.00	0.00	0.00	0.00	67	49	74	52	69	51	84	61	87	55	69	35
27	0.00	0.34	0.00	0.00	0.00	0.00	59	45	62	47	71	48	87	58	86	59	63	32
28	0.00	0.00	0.13	0.00	0.00	0.00	62	39	69	42	74	50	87	61	82	46	82	36
29	0.00	0.00	0.00	0.00	0.00	0.00	66	40	72	54	81	50	84	62	77	40	81	47
30	0.32	0.49	0.00	0.00	0.45	0.00	60	46	71	52	84	58	86	60	86	54	80	44
31		0.03		0.00	0.52				64	50			84	64	60	52		
Total	1.72	2.32	3.10	3.47	1.17	3.36	53	33	67	45	74	53	79	59	78	54	71	71

CLIMATIC DATA, 2000 Crookston																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.00	0.00	0.00	0.00	54	35	58	34	59	44	65	61	84	54	64	51
2	0.00	0.00	0.06	0.03	0.00	0.20	47	30	81	43	68	42	74	55	84	62	59	54
3	0.36	0.00	0.00	0.00	0.00	0.04	41	22	83	40	59	51	76	62	78	55	66	55
4	0.00	0.00	0.01	0.50	0.00	0.00	48	26	82	49	0	38	84	63	87	65	71	50
5	0.00	0.00	0.00	0.82	0.02	0.06	50	22	89	55	73	47	81	62	87	61	72	54
6	0.27	0.00	0.00	0.00	0.00	0.02	34	22	76	46	77	56	80	64	81	57	75	56
7	0.00	0.10	0.00	0.98	0.30	0.00	40	26	72	51	91	53	73	60	80	62	71	44
8	0.00	0.34	0.02	0.02	0.00	0.00	57	25	66	40	86	59	84	62	83	51	81	54
9	0.00	0.00	0.00	0.00	0.00	0.00	40	25	68	45	95	59	84	61	85	55	89	46
10	0.04	0.00	0.01	0.00	0.00	0.00	32	17	63	45	71	46	81	60	90	59	78	50
11	0.00	0.02	0.00	0.45	0.00	0.02	39	20	57	46	79	50	74	63	94	68	68	35
12	0.00	0.02	0.00	0.00	0.10	0.00	39	27	54	33	84	56	86	64	88	53	80	42
13	0.00	0.00	0.36	0.00	0.00	0.00	48	17	48	34	73	57	85	63	80	62	76	43
14	0.15	0.00	2.25	0.00	0.03	0.00	25	13	65	33	64	51	87	59	80	53	65	31
15	0.00	0.00	0.32	0.04	0.00	0.00	38	19	70	36	63	43	85	59	76	45	70	34
16	0.00	0.00	0.02	0.00	0.44	0.00	46	28	69	44	58	38	78	50	69	55	81	41
17	0.00	0.00	0.15	0.00	0.00	0.00	48	32	63	36	65	49	66	49	72	47	81	45
18	0.00	0.00	0.18	0.00	0.00	0.00	57	30	63	35	70	47	67	48	73	53	80	55
19	0.00	0.00	0.88	0.20	0.31	0.16	54	29	73	48	75	57	68	49	78	59	67	40
20	0.00	0.11	0.50	0.00	0.10	0.05	60	26	63	40	66	55	72	46	74	58	55	29
21	0.00	0.10	0.48	0.00	0.00	0.10	70	38	73	43	65	56	77	52	78	47	58	34
22	0.00	0.00	0.00	0.00	0.00	0.87	68	37	73	52	77	59	79	59	78	51	46	32
23	0.00	0.00	0.00	0.00	0.00	0.00	72	42	75	51	78	57	84	62	82	53	49	33
24	0.00	0.00	0.00	0.00	0.00	0.00	73	47	69	41	77	55	82	61	87	61	60	30
25	0.00	0.00	0.04	0.17	0.00	0.00	74	47	70	41	69	53	80	58	86	57	70	34
26	0.19	0.00	0.02	0.00	0.00	0.00	60	49	77	50	70	51	86	60	87	64	59	30
27	0.00	0.02	0.00	0.00	0.00	0.08	62	34	57	40	70	50	88	60	79	65	48	34
28	0.00	0.00	0.40	0.00	0.01	0.00	62	31	71	50	73	46	87	62	73	40	76	41
29	0.00	0.37	0.02	0.00	0.00	0.00	67	37	64	45	81	56	86	65	78	48	79	46
30	0.02	0.00	0.00	0.00	0.07	0.00	68	38	75	43	85	60	89	66	77	51	80	50
31		0.00		0.00	0.00				63	49			89	59	63	48		
Total	1.03	1.08	5.72	3.21	1.38	1.6	61	37	67	42	72	52	77	57	78	54	69	42

CLIMATIC DATA, 2000 Steele (Dawson)

	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.16	0.00	0.00	NA	56	28	69	38	59	46	87	58	91	59	NA	NA
2	0.00	0.00	0.00	0.00	0.00	NA	46	28	74	45	55	37	91	61	84	58	NA	NA
3	0.00	0.00	0.00	0.36	0.73	NA	51	28	80	52	63	46	68	59	84	61	NA	NA
4	0.00	0.00	0.19	0.05	0.00	NA	45	23	79	48	63	47	81	62	82	57	NA	NA
5	0.21	0.00	0.00	0.00	0.47	NA	63	25	82	51	66	42	86	60	82	63	NA	NA
6	0.00	0.04	0.00	0.13	0.03	NA	63	22	85	47	71	52	76	63	82	55	NA	NA
7	0.04	0.00	0.00	0.03	0.00	NA	41	21	72	45	79	52	85	67	81	58	NA	NA
8	0.00	0.41	0.00	0.00	0.00	NA	43	21	65	42	89	59	86	66	82	61	NA	NA
9	0.00	0.00	0.00	0.00	0.00	NA	63	21	65	34	83	56	82	61	82	56	NA	NA
10	0.00	0.00	0.00	0.00	0.00	NA	48	26	68	34	91	55	81	59	85	64	NA	NA
11	0.04	0.26	0.00	0.00	0.00	NA	30	16	71	50	74	47	84	67	89	69	NA	NA
12	0.00	0.30	0.00	2.20	0.00	NA	46	24	57	39	83	53	78	60	96	65	NA	NA
13	0.00	0.16	0.03	0.00	0.00	NA	45	27	43	32	85	60	88	61	85	54	NA	NA
14	0.30	0.00	1.67	0.00	0.22	NA	59	19	57	33	70	53	87	62	89	60	NA	NA
15	0.00	0.00	0.10	0.00	0.01	NA	23	16	66	40	70	53	87	65	88	65	NA	NA
16	0.00	0.10	0.54	0.00	0.02	NA	32	17	59	38	61	43	89	54	87	42	NA	NA
17	0.00	0.00	0.00	0.00	0.07	NA	46	25	67	45	60	42	78	51	65	48	NA	NA
18	0.12	0.00	0.07	0.09	0.00	NA	59	28	59	35	62	41	67	50	72	45	NA	NA
19	0.00	0.00	0.00	0.08	0.00	NA	56	31	59	38	70	52	60	50	75	55	NA	NA
20	0.00	0.00	0.35	0.23	0.10	NA	52	24	73	48	71	54	64	46	73	60	NA	NA
21	0.00	0.00	0.00	0.17	0.11	NA	61	31	70	46	68	53	68	52	74	48	NA	NA
22	0.00	0.00	0.00	0.00	0.00	NA	74	38	78	51	74	47	70	52	75	48	NA	NA
23	0.00	0.00	0.67	0.00	0.00	NA	70	35	78	47	74	47	77	56	83	48	NA	NA
24	0.00	0.00	0.00	0.35	0.00	NA	71	35	77	43	75	53	83	63	85	55	NA	NA
25	0.00	0.00	0.12	0.00	0.00	NA	73	41	77	40	74	55	83	57	93	64	NA	NA
26	0.00	0.00	0.00	0.00	0.00	NA	66	43	71	44	68	49	76	57	86	57	NA	NA
27	0.32	0.66	0.00	0.00	0.09	NA	73	46	70	52	69	45	83	58	89	62	NA	NA
28	0.00	0.03	0.00	0.00	0.02	NA	62	36	67	47	72	45	84	60	84	66	NA	NA
29	0.00	0.00	0.00	0.00	0.00	NA	63	--	74	52	74	50	87	62	74	43	NA	NA
30	0.47	0.04	0.04	0.00	0.00	NA	70	--	64	47	81	55	87	62	78	48	NA	NA
31		0.00		0.00	0.00				71	46			90	64	82	48		
Total	1.5	2.00	3.94	3.69	1.87	--	63	28	67	42	70	51	78	57	80	54	--	--

CLIMATIC DATA, 2000 FARGO																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.02	0.00	0.00	0.00	56	30	64	39	65	49	89	61	84	62	64	53
2	0.14	0.00	0.00	0.00	0.00	1.15	51	36	81	38	66	43	79	61	84	54	64	56
3	0.00	0.00	0.23	0.00	0.00	0.01	42	25	82	56	57	46	78	61	80	64	69	60
4	0.00	0.00	0.41	0.57	0.00	0.00	52	22	86	41	67	48	84	66	86	65	74	57
5	0.08	0.00	0.00	0.51	0.00	0.00	54	37	95	62	70	46	82	65	85	66	74	56
6	0.00	0.00	0.00	0.00	0.00	0.58	38	24	74	54	78	45	85	63	82	61	79	57
7	0.00	0.28	0.00	0.78	0.00	0.03	42	27	71	48	89	63	80	68	83	55	72	56
8	0.00	0.42	0.00	0.04	0.00	0.00	61	26	65	49	88	59	84	65	84	62	81	52
9	0.00	0.00	0.00	0.00	0.00	0.00	42	26	69	38	96	64	85	61	87	55	89	54
10	0.00	0.00	0.34	0.00	0.00	0.00	36	17	58	51	81	54	82	64	92	60	75	48
11	0.12	0.08	0.00	0.30	0.00	0.00	39	10	56	51	84	49	75	66	94	73	68	45
12	0.02	0.03	0.00	0.00	0.00	0.00	37	25	55	37	83	66	87	62	89	62	78	43
13	0.00	0.00	0.21	0.00	0.00	0.16	53	27	51	33	73	64	86	65	84	55	66	49
14	0.00	0.00	0.64	0.00	0.33	0.00	32	20	66	28	67	54	88	62	82	64	65	42
15	0.10	0.33	1.15	0.05	0.00	0.00	36	18	69	39	64	53	86	68	75	54	70	38
16	0.00	0.01	0.02	0.00	1.00	0.00	47	26	68	48	58	44	78	61	69	51	81	50
17	0.00	0.00	0.22	0.00	0.00	0.00	49	33	64	48	68	43	66	50	71	52	83	46
18	0.11	0.00	0.01	0.03	0.00	0.00	57	39	62	41	70	46	63	54	73	48	88	59
19	0.10	0.00	4.91	0.18	0.00	0.04	52	35	72	42	76	57	68	50	76	60	68	52
20	0.00	0.02	1.99	0.00	0.01	0.03	60	27	66	48	71	60	71	51	74	65	57	37
21	0.00	0.17	0.15	0.00	0.09	0.27	69	33	77	42	69	57	75	47	76	56	59	35
22	0.00	0.04	0.05	0.00	0.00	1.37	72	44	75	48	80	55	79	51	79	52	49	41
23	0.00	0.00	0.02	0.00	0.00	0.00	72	40	78	51	78	64	83	61	82	53	49	34
24	0.00	0.00	0.00	0.00	0.00	0.00	73	46	70	49	75	60	83	66	90	60	60	32
25	0.00	0.00	0.90	0.00	0.12	0.00	74	49	72	38	65	57	79	65	84	67	70	34
26	0.00	0.00	0.00	0.00	0.00	0.00	68	51	78	52	70	54	84	62	88	59	63	39
27	0.00	0.26	0.01	0.00	0.00	0.00	64	40	62	51	71	48	88	58	81	65	63	34
28	0.00	0.00	0.01	0.00	0.00	0.00	64	34	68	41	74	51	86	59	77	52	79	45
29	0.00	0.26	0.00	0.00	0.00	0.00	68	40	67	53	80	50	86	66	78	46	79	51
30	0.22	0.29	0.00	0.00	1.31	0.00	62	45	73	53	84	61	88	66	82	59	81	52
31		0.09		0.00	0.57				67	45			90	67	62	53		
Total	0.89	2.28	11.29	2.46	3.43		54	32	70	46	74	54	81	61	81	59	66	44

CLIMATIC DATA, 2000 Felton MN																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.01	0.00	0.02	0.00	0.00	0.00	54	31	62	36	64	48	89	60	85	60	64	53
2	0.13	0.00	0.00	0.00	0.00	0.70	50	36	82	35	66	44	77	62	85	52	63	55
3	0.00	0.00	0.12	0.00	0.00	0.00	41	30	84	54	56	41	77	61	83	58	68	59
4	0.00	0.00	0.18	0.27	0.00	0.00	49	25	85	41	67	45	83	66	87	57	73	55
5	0.11	0.00	0.00	0.54	0.00	0.00	53	35	97	60	70	42	83	64	86	65	70	52
6	0.00	0.00	0.00	0.00	0.00	0.03	36	24	78	51	77	46	84	63	83	59	76	58
7	0.00	0.14	0.00	0.12	0.00	0.00	40	28	71	46	90	58	78	66	83	52	73	49
8	0.00	0.53	0.00	0.01	0.00	0.00	57	27	65	44	86	54	86	63	86	58	81	47
9	0.00	0.00	0.00	0.00	0.00	0.00	41	26	68	37	95	63	85	59	87	53	90	50
10	0.02	0.01	0.27	0.00	0.00	0.00	34	15	60	46	82	54	82	62	90	55	76	44
11	0.11	0.12	0.00	0.30	0.00	0.02	38	04	56	50	82	46	74	62	93	72	69	41
12	0.00	0.07	0.00	0.00	0.00	0.00	36	26	54	36	81	65	86	59	89	61	78	37
13	0.00	0.00	0.26	0.00	0.00	0.00	52	30	50	32	72	64	85	63	84	50	70	44
14	0.00	0.00	0.56	0.00	0.35	0.00	32	20	66	29	66	50	87	58	81	61	67	39
15	0.08	0.27	0.62	0.05	0.00	0.00	37	17	70	36	65	52	86	61	75	50	70	33
16	0.00	0.00	0.02	0.00	0.65	0.00	48	28	68	46	58	44	78	56	70	47	81	47
17	0.00	0.00	0.36	0.00	0.00	0.00	47	30	64	47	66	38	676	50	70	51	83	42
18	0.17	0.00	0.01	0.04	0.00	0.00	57	34	62	40	71	45	65	49	73	46	86	55
19	0.00	0.00	4.11	0.17	0.32	0.02	53	33	74	38	74	49	69	45	77	57	69	53
20	0.00	0.04	2.39	0.00	0.19	0.05	60	29	68	49	70	60	73	48	72	63	57	32
21	0.00	0.20	0.23	0.00	0.47	0.11	69	29	77	42	67	57	76	45	76	53	60	30
22	0.00	0.02	0.09	0.00	0.08	1.33	72	41	74	46	78	54	79	48	78	48	48	41
23	0.00	0.00	0.08	0.00	0.01	0.00	72	37	79	49	79	63	83	55	82	49	49	31
24	0.00	0.00	0.00	0.04	0.00	0.00	73	40	69	51	75	58	82	63	91	53	60	30
25	0.00	0.00	0.31	0.03	0.08	0.00	74	41	72	38	64	55	79	60	85	65	70	31
26	0.01	0.00	0.01	0.00	0.00	0.00	70	45	78	48	69	52	86	59	87	57	63	35
27	0.00	0.38	0.03	0.00	0.00	0.00	64	37	61	51	70	46	89	56	78	60	62	32
28	0.00	0.00	0.06	0.00	0.02	0.00	65	33	69	41	74	49	87	58	76	49	79	40
29	0.00	0.43	0.00	0.00	0.00	0.00	68	33	65	53	79	48	86	60	78	41	81	50
30	0.15	0.03	0.00	0.00	0.69	0.00	62	42	73	49	82	57	90	61	78	54	82	48
31		0.09		0.00	0.19				65	42			90	64	62	52		
Total	0.79	2.33	9.73	1.57	3.05	2.26	58	37	68	43	73	53	98	56	78	53	73	51

CLIMATIC DATA, 2000 Northwood (Hatton)																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.08	0.00	0.00	0.00	55	31	62	40	59	46	86	62	84	59	61	46
2	0.21	0.00	0.00	0.18	0.00	0.14	43	35	82	38	68	40	68	55	84	54	58	54
3	0.00	0.00	0.07	0.00	0.02	0.01	41	26	81	51	55	42	74	54	79	59	62	56
4	0.00	0.00	0.00	1.14	0.00	0.00	52	23	83	41	69	42	82	64	87	53	66	55
5	0.01	0.04	0.00	0.11	0.00	0.03	58	35	88	52	71	36	78	62	84	65	68	53
6	0.00	0.00	0.00	0.01	0.00	0.03	36	22	75	53	76	45	80	62	79	58	76	57
7	0.00	0.16	0.00	0.75	0.00	0.00	42	24	71	44	88	56	77	68	81	52	69	46
8	0.00	0.12	0.00	0.00	0.00	0.00	58	28	64	46	85	52	83	66	81	57	81	42
9	0.00	0.00	0.00	0.00	0.00	0.03	41	24	69	40	91	56	81	61	84	56	86	50
10	0.00	0.00	0.00	0.00	0.00	0.00	31	19	65	48	67	50	79	62	90	53	76	48
11	0.02	0.00	0.00	0.42	0.00	0.00	39	17	56	45	77	44	71	58	93	71	66	46
12	0.01	0.01	0.00	0.00	0.09	0.00	38	23	53	35	83	63	86	61	84	59	78	41
13	0.00	0.00	1.57	0.00	0.00	0.00	48	24	50	33	71	61	83	62	81	51	73	46
14	0.00	0.00	2.41	0.00	0.03	0.00	24	15	66	28	65	54	86	60	83	61	65	39
15	0.02	0.00	0.26	0.07	0.00	0.00	35	13	69	33	62	51	83	60	76	48	70	33
16	0.00	0.00	0.01	0.00	0.52	0.00	44	23	68	44	56	44	75	56	63	45	81	44
17	0.00	0.00	0.15	0.00	0.01	0.00	50	26	61	43	63	43	66	49	72	50	81	42
18	0.00	0.00	0.00	0.00	0.00	0.00	57	36	62	37	70	48	65	50	72	47	79	55
19	0.00	0.00	1.48	0.07	0.45	0.05	52	29	74	37	71	51	67	51	76	55	63	50
20	0.00	0.06	0.23	0.01	0.78	0.04	60	28	63	45	66	59	71	47	70	63	56	36
21	0.00	0.00	0.15	0.00	0.01	0.21	73	33	74	40	67	56	75	45	75	54	58	36
22	0.00	0.02	0.01	0.00	0.00	0.61	69	42	76	46	78	55	78	47	81	47	46	39
23	0.00	0.00	0.00	0.00	0.00	0.00	71	32	76	51	75	60	83	57	82	50	47	32
24	0.00	0.00	0.00	0.00	0.00	0.00	74	41	67	44	75	55	84	59	90	53	61	32
25	0.00	0.00	0.13	0.00	0.01	0.00	74	40	71	38	68	55	77	56	83	61	69	31
26	0.00	0.00	0.01	0.00	0.00	0.00	63	41	77	42	67	50	85	59	86	58	55	32
27	0.08	0.17	0.17	0.00	0.07	0.00	63	39	60	42	70	46	85	55	81	63	60	30
28	0.00	0.00	0.01	0.00	0.09	0.00	63	37	69	40	71	52	86	58	72	52	78	33
29	0.00	0.04	0.00	0.00	0.00	0.00	68	34	64	50	79	47	85	59	77	49	75	48
30	0.49	0.00	0.00	0.00	0.08	0.00	68	47	73	44	84	59	90	63	74	54	77	43
31		0.03		0.01	0.00				62	39			90	66	64	46		
Total	0.84	0.65	6.74	2.77	2.16	1.15	62	39	67	41	72	53	77	56	77	53	69	45

CLIMATIC DATA, 2000 HETTINGER																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.07	0.00	0.02	0.54	0.01	0.00	57	24	77	41	52	40	98	60	87	63	82	49
2	0.07	0.00	0.00	0.00	0.01	0.05	42	29	80	48	64	33	82	56	87	59	87	59
3	0.00	0.00	0.30	0.23	0.00	0.01	42	25	76	51	74	48	80	65	89	54	80	57
4	0.00	0.00	0.01	0.00	0.00	0.00	69	22	81	54	65	45	77	58	92	64	88	60
5	0.04	0.03	0.00	0.11	0.00	0.00	54	24	81	48	72	41	84	54	87	56	95	65
6	0.00	0.02	0.00	0.23	0.00	0.00	41	24	66	45	81	51	90	61	89	51	69	51
7	0.00	1.16	0.00	0.00	0.00	0.00	44	24	58	43	89	55	85	66	89	54	77	43
8	0.00	0.00	0.00	0.00	0.00	0.00	62	24	61	36	89	64	84	66	89	56	89	39
9	0.00	0.00	0.01	0.05	0.00	0.00	54	23	66	35	77	56	76	61	92	55	80	42
10	0.00	0.01	0.00	0.04	0.00	0.00	52	20	69	45	78	52	84	57	103	68	79	44
11	0.00	0.11	0.05	0.23	0.38	0.00	44	10	55	40	87	52	83	63	103	66	66	40
12	0.00	0.01	0.12	0.00	0.29	0.00	64	33	43	29	84	54	94	58	89	62	80	39
13	0.02	0.00	1.32	0.00	0.00	0.00	68	29	56	25	61	52	94	57	92	61	81	42
14	0.00	0.00	0.00	0.13	0.00	0.00	30	17	64	31	72	51	98	62	89	60	75	38
15	0.01	0.01	0.09	0.00	0.00	0.00	37	16	70	43	62	45	91	62	81	52	84	48
16	0.00	0.00	0.30	0.00	0.00	0.00	49	20	65	38	58	40	76	58	83	56	93	44
17	0.00	0.63	0.04	0.55	0.00	0.00	72	27	56	38	61	36	76	55	77	46	94	57
18	0.00	0.00	0.00	0.23	0.00	0.00	57	40	60	32	71	40	64	50	84	50	89	53
19	0.00	0.00	0.00	0.26	0.00	0.00	50	33	74	39	76	51	80	51	89	60	66	47
20	0.00	0.01	0.00	0.00	0.01	0.03	66	17	69	42	67	50	73	50	84	50	58	43
21	0.00	0.00	0.00	0.00	0.00	0.07	78	36	76	46	76	48	79	55	80	40	51	41
22	0.00	0.00	0.02	0.00	0.00	0.16	75	35	78	48	90	46	83	54	86	54	41	30
23	0.00	0.00	0.08	0.00	0.00	0.00	72	36	76	48	74	48	88	57	90	53	44	27
24	0.62	0.00	0.01	0.01	0.00	0.00	51	46	66	38	80	52	85	58	100	57	60	23
25	0.12	0.00	0.04	0.00	0.00	0.00	66	40	67	38	67	50	84	53	94	63	72	28
26	0.14	0.80	0.00	0.00	0.00	0.00	58	41	70	42	66	43	86	49	94	61	74	35
27	0.00	0.00	0.00	0.00	0.00	0.00	60	37	73	42	71	38	87	61	88	65	80	33
28	0.00	0.00	0.00	0.00	0.00	0.00	62	33	71	52	76	39	93	57	73	44	85	36
29	0.06	0.14	0.00	0.00	0.00	0.00	64	45	64	47	82	51	91	64	84	42	84	40
30	0.01	0.01	0.00	0.00	0.00	0.00	66	44	66	44	94	53	97	62	76	55	75	45
31		0.13		0.00	0.00				57	45			96	65	67	49		
Total	1.16	3.07	2.41	2.61	0.70	0.32	57	29	67	42	74	48	85	58	87	56	82	49
						0.00												

CLIMATIC DATA, 2000 Hillsboro																			
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.01	0.00	0.04	0.00	0.00	0.00	55	27	61	38	63	48	89	61	82	60	63	52
2	0.17	0.00	0.00	0.00	0.00	0.19	49	35	82	34	68	45	74	60	84	52	60	55
3	0.00	0.00	0.22	0.00	0.00	0.01	42	28	86	51	57	42	76	61	81	59	65	58
4	0.00	0.00	0.03	0.77	0.00	0.00	50	20	83	39	69	45	84	65	87	57	73	58
5	0.11	0.00	0.00	0.29	0.01	0.00	55	35	96	58	71	40	82	64	85	64	71	50
6	0.00	0.04	0.00	0.00	0.00	0.27	36	24	77	55	77	44	83	62	80	56	75	58
7	0.00	0.09	0.00	0.19	0.00	0.00	40	24	71	46	92	59	76	65	82	50	71	48
8	0.00	0.18	0.00	0.00	0.00	0.00	60	23	66	47	88	54	85	62	82	55	82	47
9	0.00	0.00	0.00	0.00	0.00	0.00	40	25	69	36	94	62	82	59	84	51	90	50
10	0.01	0.02	0.02	0.00	0.00	0.00	34	17	62	46	80	55	80	60	91	53	77	44
11	0.09	0.05	0.00	0.21	0.00	0.01	38	09	57	49	80	48	75	59	95	72	68	41
12	0.01	0.02	0.00	0.00	0.02	0.00	38	23	53	36	82	66	86	59	86	60	81	38
13	0.00	0.00	0.25	0.00	0.00	0.00	49	28	51	33	73	63	83	62	83	51	73	43
14	0.00	0.00	0.79	0.00	0.59	0.00	28	18	69	27	66	52	85	58	79	60	65	37
15	0.13	0.09	0.36	0.00	0.00	0.00	36	14	70	34	64	52	84	60	75	50	70	32
16	0.00	0.00	0.00	0.00	0.74	0.00	45	25	68	47	57	44	77	54	66	47	81	45
17	0.00	0.00	0.32	0.00	0.01	0.00	50	26	65	45	66	38	65	49	70	51	83	43
18	0.04	0.00	0.05	0.00	0.00	0.00	58	35	63	39	70	46	64	50	72	50	83	52
19	0.00	0.00	0.67	0.18	1.31	0.04	52	28	73	35	73	48	67	48	77	57	67	52
20	0.00	0.00	0.34	0.00	0.01	0.01	61	27	66	52	70	59	71	47	72	62	57	31
21	0.00	0.10	0.26	0.00	0.56	0.17	71	28	76	44	68	56	75	43	75	52	60	29
22	0.00	0.02	0.03	0.00	0.00	1.15	72	36	73	44	79	52	80	48	79	49	47	40
23	0.00	0.00	0.02	0.00	0.00	0.00	73	34	80	49	76	61	84	56	82	54	50	31
24	0.00	0.00	0.00	0.00	0.00	0.00	74	38	71	50	76	54	84	61	90	54	61	30
25	0.00	0.00	0.23	0.00	0.01	0.00	76	36	72	42	65	51	78	56	82	62	71	31
26	0.18	0.00	0.00	0.00	0.00	0.00	61	50	77	47	69	50	83	60	86	57	61	32
27	0.00	0.17	0.00	0.00	0.00	0.00	62	40	60	45	71	44	87	56	78	63	61	31
28	0.00	0.00	0.07	0.00	0.01	0.00	64	37	69	39	73	47	88	55	74	47	77	35
29	0.00	0.30	0.00	0.00	0.00	0.00	69	35	62	54	81	45	86	59	77	42	78	46
30	0.16	0.00	0.00	0.00	0.21	0.00	69	42	74	49	83	56	89	61	75	55	81	46
31		0.10		0.00	0.04				66	42			89	63	61	51		
Total	0.91	1.18	3.7	1.64	3.52	1.85	62	35	68	42	73	52	78	56	77	53	72	49

CLIMATIC DATA, 2000 MINOT																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.04	0.00	0.42	0.00	0.00	0.01	54	27	75	38	53	41	87	61	86	55	54	49
2	0.12	0.00	0.00	0.50	1.28	0.42	45	32	84	50	63	36	65	52	84	58	60	52
3	0.00	0.00	0.18	0.01	0.01	0.05	44	25	74	52	65	44	74	59	82	60	62	55
4	0.00	0.00	0.00	0.48	0.25	0.18	68	25	83	48	69	43	69	60	83	60	69	55
5	0.04	0.00	0.00	0.26	0.03	0.00	58	27	74	52	74	47	78	56	78	59	82	60
6	0.00	0.41	0.00	0.00	0.00	0.28	40	19	66	46	82	49	80	62	79	55	74	55
7	0.00	0.14	0.00	0.16	0.00	0.00	42	23	58	50	89	59	83	64	79	56	72	47
8	0.00	0.00	0.06	0.00	0.00	0.00	58	25	62	42	81	57	84	64	73	58	85	48
9	0.00	0.35	0.00	0.00	0.00	0.04	44	21	69	36	63	53	778	62	84	56	72	49
10	0.00	0.06	0.00	0.00	0.00	0.03	32	17	65	41	68	49	81	57	91	66	73	48
11	0.06	1.16	0.14	0.10	0.04	0.00	37	17	52	40	83	43	78	64	96	66	65	44
12	0.00	0.22	0.06	0.00	0.00	0.00	47	25	40	32	69	55	85	58	79	58	77	44
13	0.00	0.00	1.49	0.00	0.01	0.00	35	24	54	33	62	55	85	59	84	52	75	49
14	0.01	0.00	0.13	0.02	0.01	0.00	24	8	64	38	69	52	86	61	81	52	68	42
15	0.02	0.06	0.35	0.00	0.00	0.00	28	4	54	41	60	50	87	57	75	48	77	45
16	0.00	0.00	0.00	0.00	0.10	0.00	37	12	65	40	56	42	74	54	72	50	83	54
17	0.00	0.00	0.00	0.00	0.00	0.00	62	28	59	39	60	42	66	48	74	50	88	48
18	0.00	0.00	0.00	0.00	0.00	0.00	54	35	62	32	70	43	67	50	74	45	68	56
19	0.00	0.00	0.00	0.53	0.16	0.00	54	26	74	47	69	50	64	51	67	57	61	46
20	0.00	0.00	0.00	0.00	0.11	0.03	66	26	71	53	66	56	68	44	69	54	57	40
21	0.00	0.00	0.00	0.00	0.00	0.30	78	43	75	55	74	54	73	54	75	46	46	40
22	0.00	0.00	0.00	0.00	0.00	0.00	68	38	80	52	83	50	80	55	80	52	47	37
23	0.00	0.00	0.59	0.00	0.00	0.00	72	33	73	47	76	52	86	62	85	50	51	33
24	0.23	0.00	0.14	0.00	0.00	0.00	59	39	68	47	74	48	80	62	94	62	63	35
25	0.15	0.00	0.00	0.05	0.00	0.00	67	44	73	41	70	53	77	59	84	61	72	38
26	0.04	0.07	0.00	0.00	0.00	0.00	66	45	72	44	67	49	82	55	87	62	74	38
27	0.00	0.45	0.00	0.00	0.00	0.00	64	42	75	53	68	46	84	59	80	57	76	38
28	0.00	0.00	0.00	0.00	0.02	0.00	63	36	78	53	76	48	88	60	70	48	82	48
29	0.01	0.00	0.00	0.00	0.00	0.00	67	39	61	50	82	58	88	66	78	46	78	45
30	0.00	0.00	0.00	0.00	0.00	0.00	69	45	71	45	87	55	90	65	72	50	76	48
31		0.22		0.00	0.00				58	42			86	65	65	44		
Total	0.72	3.14		2.11	2.02	1.34	53	28	67	44	71	49	79	58	79	55	70	46

CLIMATIC DATA, 2000 Dazey (Oriska)																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.06	0.00	0.00	0.00	52	29	70	38	60	46	88	59	83	57	62	47
2	0.22	0.00	0.00	0.00	0.00	0.14	45	32	80	41	65	40	68	57	84	51	58	54
3	0.00	0.00	0.27	0.03	0.01	0.01	41	28	79	50	55	44	71	59	80	61	67	57
4	0.00	0.00	0.05	0.73	0.00	0.00	54	23	81	44	66	45	81	63	85	56	68	56
5	0.09	0.00	0.00	0.02	0.12	0.00	54	32	92	53	69	39	78	61	81	64	73	54
6	0.00	0.00	0.00	0.00	0.00	0.00	38	23	73	53	76	49	82	60	80	57	80	58
7	0.00	0.37	0.00	0.01	0.00	0.00	43	25	67	46	87	58	82	69	83	50	71	49
8	0.00	0.18	0.00	0.00	0.00	0.00	59	27	63	43	83	54	83	64	80	59	80	49
9	0.00	0.00	0.00	0.00	0.00	0.00	43	23	67	36	91	57	84	57	83	54	86	51
10	0.03	0.00	0.01	0.00	0.00	0.00	31	42	66	50	70	50	80	60	90	58	76	45
11	0.03	0.01	0.00	1.01	0.00	0.00	35	19	55	44	78	45	74	60	92	71	66	41
12	0.01	0.03	0.00	0.00	0.02	0.00	34	19	49	34	85	61	87	58	84	56	79	36
13	0.00	0.00	0.25	0.00	0.00	0.18	47	23	53	31	74	61	83	59	81	50	70	46
14	0.00	0.00	1.50	0.00	0.48	0.00	23	15	66	27	65	53	85	59	81	59	65	38
15	0.00	0.23	0.51	0.33	0.00	0.00	32	13	65	38	61	50	83	63	72	47	70	33
16	0.00	0.00	0.00	0.00	0.78	0.00	42	24	66	42	57	42	76	55	64	49	82	47
17	0.00	0.00	0.01	0.00	0.00	0.00	50	28	60	42	66	39	66	51	70	48	83	42
18	0.18	0.00	0.00	0.08	0.00	0.00	56	34	61	36	70	43	60	51	73	43	82	50
19	0.00	0.00	1.15	0.00	0.01	0.01	48	30	73	38	68	52	68	51	76	56	63	50
20	0.00	0.28	0.18	0.00	0.56	0.02	60	26	68	46	69	57	70	46	70	62	57	37
21	0.00	0.01	0.01	0.00	0.00	0.05	71	33	78	43	69	56	75	44	74	51	57	32
22	0.00	0.07	0.34	0.00	0.00	0.46	69	39	76	47	79	52	78	46	80	46	45	35
23	0.00	0.00	0.03	0.00	0.00	0.46	69	33	76	47	73	58	83	56	82	48	48	30
24	0.00	0.00	0.00	0.00	0.16	0.00	71	43	68	46	76	54	87	60	89	59	60	30
25	0.00	0.00	0.23	0.04	0.00	0.00	71	40	73	38	65	52	74	56	85	62	69	31
26	0.12	0.00	0.03	0.00	0.00	0.00	67	41	74	48	67	40	84	59	86	54	61	35
27	0.17	0.43	0.00	0.00	0.06	0.00	61	39	58	46	74	45	85	53	81	65	63	30
28	0.00	0.00	0.00	0.00	0.08	0.00	60	36	72	43	73	48	87	58	74	48	81	35
29	0.00	0.60	0.04	0.00	0.00	0.00	67	39	62	52	79	46	84	63	76	43	78	45
30	0.37	0.00	0.16	0.00	0.07	0.00	67	45	71	45	83	58	90	64	73	57	78	47
31		0.12		0.00	0.00				63	43			85	63	65	44		
Total	1.22	2.33	4.83	2.25	2.35	1.33	52	30	66	42	72	50	77	56	77	53	69	43

CLIMATIC DATA, 2000 Prosper																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.00	0.00	0.00	0.00	54	31	66	40	64	49	89	60	84	59	63	52
2	0.14	0.00	0.00	0.00	0.00	0.67	48	35	83	33	67	43	77	63	85	54	61	55
3	0.00	0.00	0.17	0.00	0.00	0.01	42	30	87	50	56	41	76	62	81	62	67	60
4	0.00	0.00	0.14	0.41	0.00	0.00	50	27	87	42	67	48	83	65	87	62	72	57
5	0.07	0.00	0.00	0.17	0.03	0.00	55	37	97	59	71	40	81	64	86	64	72	54
6	0.00	0.00	0.00	0.00	0.00	0.02	38	26	78	55	78	44	84	62	83	58	80	59
7	0.00	0.25	0.00	0.37	0.00	0.00	41	28	70	50	90	59	80	66	84	53	74	49
8	0.00	0.37	0.00	0.00	0.00	0.00	58	27	64	47	87	54	83	64	84	58	82	45
9	0.00	0.00	0.00	0.00	0.00	0.00	40	27	69	38	97	64	84	61	87	54	89	49
10	0.10	0.07	0.03	0.00	0.00	0.00	34	13	60	48	80	53	80	63	92	54	77	42
11	0.03	0.04	0.00	0.18	0.00	0.02	38	1	56	50	83	48	74	61	93	72	69	40
12	0.02	0.03	0.00	0.01	0.00	0.00	35	26	54	37	84	66	87	59	88	60	80	38
13	0.00	0.00	0.18	0.00	0.00	0.18	49	29	53	32	74	64	86	63	84	52	67	47
14	0.00	0.00	0.57	0.00	0.25	0.00	29	18	66	28	66	54	88	60	80	62	66	39
15	0.09	0.29	0.20	0.16	0.00	0.00	35	16	69	36	63	53	84	61	76	50	70	35
16	0.00	0.01	0.01	0.01	1.23	0.00	46	27	69	47	59	44	77	58	67	48	82	44
17	0.00	0.00	0.20	0.00	0.00	0.00	48	31	65	47	68	41	67	49	71	52	85	44
18	0.17	0.00	0.00	0.09	0.00	0.00	56	35	64	40	70	46	64	53	75	50	88	48
19	0.00	0.00	4.03	0.06	0.01	0.02	51	32	74	36	74	51	69	47	76	57	70	53
20	0.00	0.13	0.51	0.00	0.04	0.02	61	30	66	50	70	59	73	48	74	65	58	35
21	0.00	0.10	0.07	0.00	0.27	0.24	69	30	76	43	69	57	76	46	76	53	60	31
22	0.00	0.04	0.16	0.00	0.00	1.04	73	36	74	46	80	54	80	48	80	48	48	41
23	0.00	0.00	0.02	0.00	0.00	0.00	72	35	79	50	77	63	84	55	83	52	50	32
24	0.00	0.00	0.00	0.00	0.00	0.00	73	37	70	48	76	57	82	63	89	52	61	30
25	0.00	0.00	0.93	0.01	0.10	0.00	74	39	73	42	64	55	77	58	83	64	71	30
26	0.00	0.00	0.00	0.00	0.00	0.00	66	48	78	43	69	52	84	60	88	57	63	34
27	0.02	0.24	0.01	0.00	0.00	0.00	63	44	62	46	70	48	87	56	81	61	63	32
28	0.00	0.00	0.02	0.00	0.01	0.00	65	38	70	40	73	50	88	58	76	49	79	37
29	0.00	0.37	0.00	0.00	0.00	0.00	69	34	64	53	80	47	86	60	79	43	81	41
30	0.17	0.05	0.00	0.00	1.17	0.00	65	45	73	51	83	62	88	58	80	53	83	45
31		0.14		0.00	0.07				65	46			86	62	60	52		
Total	0.81		7.25	1.47	3.21	2.22	53	30	70	44	74	52	81	58	81	56	63	52

CLIMATIC DATA, 2000 St. Thomas																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.05	0.00	0.00	0.00	55	30	60	41	56	45	88	55	85	58	58	45
2	0.25	0.00	0.00	0.00	0.00	0.18	49	34	87	33	70	41	66	51	85	55	58	54
3	0.00	0.00	0.02	0.00	0.00	0.00	46	28	82	52	65	44	77	48	80	62	61	55
4	0.00	0.00	0.00	0.27	0.00	0.04	51	20	80	38	70	44	83	64	88	58	61	54
5	0.01	0.00	0.00	0.00	1.29	0.05	58	29	85	55	76	39	76	61	85	64	69	53
6	0.00	0.00	0.00	0.03	0.14	0.26	35	19	73	49	78	44	77	56	77	62	73	60
7	0.00	0.00	0.00	0.05	0.00	0.00	43	22	74	40	89	57	78	65	78	56	68	48
8	0.00	0.06	0.03	0.00	0.00	0.00	58	23	67	44	73	54	84	65	80	59	81	46
9	0.00	0.00	0.08	0.00	0.00	0.00	40	22	68	37	77	54	78	59	84	55	87	54
10	0.00	0.00	0.07	0.00	0.00	0.00	30	24	66	48	61	49	80	57	89	55	75	52
11	0.01	0.17	0.34	0.29	0.00	0.00	40	19	58	43	74	47	70	59	94	70	69	45
12	0.00	0.23	0.57	0.00	1.00	0.00	44	18	53	35	80	56	85	56	82	59	77	42
13	0.00	0.00	0.82	0.00	0.01	0.00	45	25	48	33	74	62	84	62	80	54	76	50
14	0.00	0.00	1.11	0.00	0.03	0.00	27	15	63	33	65	51	85	60	85	61	67	43
15	0.00	0.00	1.11	0.13	0.00	0.00	39	12	66	34	64	46	85	57	76	51	72	36
16	0.00	0.00	0.00	0.00	0.00	0.00	48	18	69	39	55	43	76	54	64	47	82	46
17	0.00	0.00	0.00	0.00	0.00	0.00	53	22	57	41	64	40	66	48	74	50	80	44
18	0.06	0.00	0.00	0.00	0.00	0.17	57	35	62	32	72	45	71	49	71	46	70	55
19	0.00	0.00	0.57	0.00	0.18	0.11	56	23	76	42	74	48	71	50	78	54	63	49
20	0.00	0.02	0.06	0.00	0.62	0.04	63	24	65	46	67	59	74	48	71	62	56	39
21	0.00	0.00	0.24	0.00	0.11	0.14	78	29	74	41	67	56	78	48	77	55	55	35
22	0.00	0.01	0.07	0.00	0.00	0.30	68	40	74	40	77	54	80	46	81	49	46	37
23	0.00	0.00	0.00	0.00	0.00	0.00	69	31	73	46	75	56	87	56	83	50	47	33
24	0.00	0.00	0.04	0.00	0.00	0.00	75	42	67	46	75	52	85	61	92	53	60	34
25	0.00	0.00	0.00	0.18	0.00	0.00	74	42	68	36	74	56	81	56	88	64	70	33
26	0.00	0.00	0.03	0.00	0.00	0.00	70	41	77	40	68	52	88	60	87	57	52	36
27	0.00	0.00	0.05	0.00	0.00	0.06	66	47	62	46	69	49	89	54	81	66	52	31
28	0.00	0.00	0.01	0.00	2.33	0.00	64	35	72	41	72	49	89	58	72	53	74	33
29	0.00	0.00	0.00	0.00	0.00	0.00	69	32	64	45	81	45	87	61	77	49	79	45
30	0.08	0.00	0.00	0.00	0.19	0.00	72	50	75	37	87	53	93	61	72	53	78	42
31		0.00		0.27	0.01				64	38			91	59	64	49		
Total	0.41	0.49	5.27	1.22	5.91	1.35	72	40	67	40	72	49	78	55	78	54	68	44

CLIMATIC DATA, 2000 Valley City																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.11	0.18	0.00	0.00	NA	50	25	69	37	61	45	85	57	86	61	NA	NA
2	0.09	0.00	0.00	0.00	0.00	NA	55	25	71	37	63	43	92	63	85	53	NA	NA
3	0.12	0.00	0.00	0.00	0.04	NA	47	30	81	38	67	41	73	61	85	53	NA	NA
4	0.00	0.00	0.41	0.00	0.00	NA	44	17	83	43	58	48	77	63	83	57	NA	NA
5	0.00	0.00	0.04	0.46	0.07	NA	55	17	83	44	67	37	85	62	84	60	NA	NA
6	0.05	0.00	0.00	0.00	0.00	NA	56	25	93	57	71	39	81	62	83	60	NA	NA
7	0.00	0.00	0.00	0.22	0.00	NA	34	25	76	47	78	48	84	65	83	54	NA	NA
8	0.00	0.68	0.00	0.09	0.00	NA	45	22	67	47	90	53	85	70	85	55	NA	NA
9	0.00	0.00	0.00	0.00	0.00	NA	62	23	66	37	86	56	84	61	84	55	NA	NA
10	0.00	0.00	0.00	0.00	0.00	NA	43	23	64	37	94	60	85	62	88	55	NA	NA
11	0.37	0.00	0.00	0.00	0.00	NA	33	18	65	50	74	47	82	62	92	57	NA	NA
12	0.00	0.10	0.00	0.26	0.00	NA	39	20	56	44	83	59	74	60	96	70	NA	NA
13	0.00	0.00	0.10	0.00	0.00	NA	36	23	53	35	86	61	90	61	86	53	NA	NA
14	0.28	0.00	0.23	0.00	0.70	NA	47	18	53	29	80	58	88	61	83	61	NA	NA
15	0.00	0.00	0.35	0.00	0.00	NA	22	16	68	30	68	53	88	62	84	51	NA	NA
16	0.00	0.32	0.32	0.56	0.00	NA	33	15	65	37	61	45	87	56	77	49	NA	NA
17	0.00	0.00	0.00	0.00	1.46	NA	45	24	67	43	60	48	80	53	63	50	NA	NA
18	0.00	0.00	0.11	0.07	0.00	NA	51	24	61	38	69	44	68	52	73	45	NA	NA
19	0.00	0.00	0.00	0.06	0.00	NA	57	31	62	34	71	45	60	52	74	45	NA	NA
20	0.00	0.00	0.46	0.05	0.00	NA	48	24	73	35	71	54	70	47	74	58	NA	NA
21	0.00	0.07	0.00	0.00	1.02	NA	62	23	70	41	73	58	73	46	72	58	NA	NA
22	0.00	0.06	0.00	0.00	0.00	NA	71	27	79	41	71	51	75	48	77	47	NA	NA
23	0.00	0.05	0.34	0.00	0.00	NA	70	37	77	47	83	54	84	52	83	47	NA	NA
24	0.00	0.00	0.00	0.00	0.00	NA	71	39	79	48	77	55	83	51	84	50	NA	NA
25	0.00	0.00	0.46	0.00	0.04	NA	71	41	70	37	77	55	88	57	90	62	NA	NA
26	0.00	0.00	0.02	0.02	0.00	NA	73	41	74	38	66	52	78	58	85	58	NA	NA
27	0.20	0.16	0.00	0.00	0.00	NA	69	45	76	53	70	46	84	55	87	58	NA	NA
28	0.00	0.25	0.00	0.00	0.00	NA	60	33	58	42	73	47	86	55	83	65	NA	NA
29	0.00	0.00	0.06	0.00	0.06	NA	62	37	72	41	76	47	87	60	83	43	NA	NA
30	0.00	0.65	0.09	0.00	0.00	NA	67	39	65	49	83	48	86	63	78	43	NA	NA
31		0.00		0.00	0.00				73	42			92	66	74	52		
Total	1.11	2.45	3.17	1.79	3.39	--	59	32	68	40	72	47	79	56	80	53	--	--

CLIMATIC DATA, Breckenridge (Wahpeton)																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.73	0.06	NA	0.00	NA	--	--	65	43	71	54	NA	NA	91	67	NA	NA
2	0.00	0.00	0.00	NA	0.00	NA	--	--	67	41	67	47	NA	NA	84	60	NA	NA
3	0.00	0.00	NA	NA	0.00	NA	--	--	81	41	68	NA	NA	NA	83	63	NA	NA
4	0.00	0.00	0.62	NA	0.00	NA	41	23	84	50	61	NA	NA	NA	79	63	NA	NA
5	0.00	0.00	0.09	NA	0.00	NA	54	23	85	55	66	43	NA	NA	--	--	NA	NA
6	0.00	--	0.00	NA	0.00	NA	56	28	--	--	71	46	NA	NA	--	--	NA	NA
7	--	--	0.00	NA	0.00	NA	--	--	--	--	77	55	NA	NA	85	58	NA	NA
8	--	1.06	0.00	NA	0.00	NA	--	--	66	53	88	59	NA	NA	86	64	NA	NA
9	--	0.03	0.00	NA	0.00	NA	--	--	65	44	94	67	NA	NA	86	60	NA	NA
10	--	1.27	0.00	NA	0.00	NA	--	--	67	48	93	NA	NA	NA	87	58	NA	NA
11	0.19	0.21	0.00	NA	0.00	NA	40	20	57	50	77	NA	NA	NA	93	65	NA	NA
12	0.00	0.12	0.00	NA	0.00	NA	43	21	56	49	82	64	NA	NA	--	--	NA	NA
13	0.12	0.00	0.58	NA	0.00	NA	36	27	--	--	83	64	NA	NA	--	--	NA	NA
14	0.00	0.00	0.00	NA	0.00	NA	59	29	--	--	73	56	NA	NA	--	--	NA	NA
15	0.00	0.00	0.51	NA	0.00	NA	--	--	63	32	67	54	NA	NA	92	57	NA	NA
16	0.00	0.02	0.38	NA	0.00	NA	--	--	69	48	64	45	NA	NA	75	50	NA	NA
17	0.00	0.00	NA	NA	0.63	NA	--	--	70	51	62	NA	NA	NA	73	56	NA	NA
18	0.00	0.00	NA	NA	0.00	NA	44	38	65	42	71	NA	NA	NA	72	53	NA	NA
19	0.01	0.00	0.04	NA	--	NA	58	39	64	40	71	57	NA	NA	--	--	NA	NA
20	1.44	0.00	0.28	NA	--	NA	48	35	--	--	81	61	NA	NA	--	--	NA	NA
21	0.00	0.00	0.00	NA	0.02	NA	58	35	--	--	73	58	NA	NA	75	60	NA	NA
22	0.00	0.00	0.05	NA	0.00	NA	--	--	79	46	72	54	NA	NA	78	52	NA	NA
23	0.00	0.05	0.19	NA	0.00	NA	--	--	76	52	83	60	NA	NA	80	56	NA	NA
24	0.00	0.00	0.09	NA	0.00	NA	--	--	76	53	82	58	NA	NA	84	57	NA	NA
25	0.00	0.00	NA	NA	0.00	NA	72	44	69	45	78	NA	NA	NA	92	61	NA	NA
26	0.00	0.00	0.18	NA	0.00	NA	74	46	73	53	70	54	NA	NA	--	--	NA	NA
27	0.14	0.00	0.00	NA	0.00	NA	70	51	76	44	71	48	NA	NA	--	--	NA	NA
28	0.00	0.55	0.00	NA	0.00	NA	65	41	67	47	72	55	NA	NA	--	--	NA	NA
29	0.00	--	0.08	NA	0.00	NA	--	--	--	--	76	48	NA	NA	81	45	NA	NA
30	0.00	0.45	0.08	NA	0.00	NA	--	--	74	52	82	57	NA	NA	79	50	NA	NA
31		0.00		NA	0.46				73	51			NA	NA	87	54		
Total	1.90	4.49	3.23	--	1.11		--	--	--	--	--	--	--	--	--	--	--	--

CLIMATIC DATA, 2000 WILLISTON																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.03	0.00	0.07	0.00	0.00	0.63	52	25	79	41	54	40	91	62	91	63	58	51
2	0.06	0.00	0.00	0.16	0.00	0.60	41	32	87	51	65	35	75	61	92	62	72	55
3	0.00	0.00	0.30	0.92	0.00	0.00	44	21	76	46	68	46	82	59	82	56	63	58
4	0.00	0.00	0.00	0.15	0.00	0.01	71	29	75	55	68	40	79	58	94	62	76	57
5	0.07	0.00	0.00	0.00	0.01	0.00	61	24	67	49	77	45	83	56	79	60	79	59
6	0.07	0.02	0.00	0.20	0.00	0.08	30	22	70	44	81	55	82	63	86	56	72	52
7	0.16	0.00	0.00	0.00	0.00	0.00	44	28	60	42	88	58	84	62	86	61	74	45
8	0.00	0.00	0.09	0.11	0.00	0.00	58	27	65	34	79	60	86	62	86	57	87	51
9	0.00	0.15	0.01	0.67	0.00	0.00	54	27	67	40	65	52	80	60	93	54	67	47
10	0.00	0.01	0.22	0.04	0.04	0.00	36	23	69	41	74	50	84	58	102	64	72	43
11	0.00	0.36	0.00	0.01	0.02	0.00	47	20	59	40	76	53	83	63	100	65	66	41
12	0.00	0.02	0.11	0.00	0.00	0.00	55	33	40	30	73	53	87	60	87	59	76	48
13	0.00	0.00	0.54	0.00	0.27	0.00	39	21	59	28	59	55	97	62	97	62	73	52
14	0.11	0.00	0.00	0.00	0.00	0.00	26	18	67	34	74	48	95	66	79	54	72	41
15	0.00	0.03	0.43	0.00	0.00	0.00	31	16	63	44	61	52	87	56	81	47	87	49
16	0.01	0.00	0.06	0.00	0.17	0.00	46	17	67	39	59	44	77	52	83	58	88	50
17	0.00	0.00	0.00	0.15	0.00	0.00	70	32	62	42	63	46	68	51	77	51	93	57
18	0.00	0.00	0.00	0.01	0.00	0.02	57	34	70	36	74	43	76	53	82	55	70	54
19	0.00	0.19	0.00	0.21	0.00	0.00	59	30	75	52	67	52	69	52	73	57	65	44
20	0.00	0.01	0.00	0.04	0.03	0.02	71	30	75	49	66	51	69	48	75	53	56	44
21	0.00	0.00	0.00	0.00	0.00	0.11	77	45	76	55	76	52	79	56	79	43	46	36
22	0.00	0.00	0.00	0.00	0.00	0.02	73	41	79	56	77	50	87	57	84	48	41	33
23	0.02	0.00	0.01	0.00	0.00	0.00	70	45	74	52	78	47	94	60	90	54	48	30
24	0.13	0.00	0.00	0.00	0.00	0.00	63	44	69	40	78	50	82	64	93	54	63	28
25	0.00	0.00	0.04	0.00	0.00	0.00	66	39	75	43	73	50	81	56	92	62	72	37
26	0.27	0.42	0.02	0.00	0.00	0.00	58	42	69	47	68	47	90	57	98	58	68	43
27	0.00	0.00	0.00	0.00	0.00	0.00	64	36	77	46	71	42	90	62	81	60	78	40
28	0.00	0.00	0.00	0.00	0.02	0.00	68	38	77	57	78	44	96	63	72	51	83	43
29	0.07	0.00	0.04	0.00	0.00	0.00	63	43	63	48	86	56	101	68	85	43	78	44
30	0.00	0.00	0.00	0.00	0.00	0.00	70	38	71	45	93	54	100	65	67	49	78	48
31		0.49		0.00	0.00				57	44			90	67	68	45		
Total		1.70	1.94	2.67	0.56	1.49	56	31	69	44	72	49	85	59	85	56	58	51

CLIMATIC DATA, 2000 Wyndmere																		
	Precipitation						April		May		June		July		August		Sept	
Date	April	May	June	July	August	Sept	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	0.00	0.00	0.00	0.51	0.00	0.00	56	30	70	41	66	49	94	64	83	62	64	54
2	0.10	0.00	0.00	0.00	0.00	0.00	51	36	79	38	66	46	81	63	84	56	62	55
3	0.00	0.00	0.09	0.00	0.00	0.01	42	29	83	53	58	43	79	61	76	63	68	56
4	0.00	0.00	0.51	0.00	0.00	0.00	54	23	86	46	66	48	83	66	82	61	75	55
5	0.01	0.00	0.00	0.95	0.03	0.00	57	38	94	61	70	43	80	63	83	63	74	55
6	0.00	0.00	0.00	0.00	0.00	0.29	38	29	75	57	78	50	85	62	80	60	82	58
7	0.00	1.11	0.00	0.09	0.00	0.05	42	25	70	54	89	62	84	69	85	54	74	52
8	0.00	0.17	0.00	0.26	0.00	0.00	60	24	64	49	95	57	85	67	84	58	83	47
9	0.00	0.00	0.00	0.00	0.00	0.01	43	27	66	42	96	68	84	62	87	53	91	52
10	0.00	0.08	0.00	0.00	0.00	0.00	37	25	58	50	82	59	83	63	91	56	79	41
11	0.07	0.09	0.00	1.25	0.00	0.00	42	22	56	50	85	52	76	63	90	69	69	44
12	0.15	0.03	0.00	0.01	0.00	0.00	35	25	53	37	84	67	89	61	86	64	81	40
13	0.00	0.00	0.57	0.00	0.00	0.00	57	24	54	34	75	61	85	63	83	52	69	46
14	0.00	0.00	0.36	0.00	0.00	0.00	36	20	66	31	66	53	88	62	87	64	67	38
15	0.00	0.02	0.28	0.31	0.00	0.00	36	21	66	42	64	54	84	63	76	51	72	34
16	0.00	0.00	0.07	0.01	0.56	0.00	41	30	70	47	59	45	75	61	68	47	82	44
17	0.00	0.00	0.00	0.00	0.00	0.00	45	33	65	49	68	44	67	53	72	52	82	43
18	0.05	0.00	0.00	0.49	0.00	0.00	56	35	65	42	72	49	60	52	74	48	94	54
19	0.99	0.00	0.25	0.02	0.00	0.00	47	37	72	39	81	55	67	48	76	54	69	52
20	0.08	0.08	0.00	0.00	0.01	0.03	58	35	69	50	73	60	70	49	72	63	59	40
21	0.00	0.01	0.00	0.00	0.03	0.10	68	34	78	47	73	58	75	52	79	53	59	33
22	0.00	0.03	0.00	0.00	0.00	1.06	72	39	75	49	82	52	78	50	79	48	50	40
23	0.00	0.00	0.00	0.00	0.00	0.00	71	39	76	51	81	64	82	57	83	54	48	30
24	0.00	0.00	0.00	0.00	0.01	0.00	71	43	70	51	76	56	82	63	88	52	59	27
25	0.00	0.00	0.35	0.00	0.16	0.00	73	41	72	44	63	55	82	60	84	62	68	31
26	0.28	0.00	0.00	0.00	0.00	0.00	68	46	75	50	70	51	84	60	86	57	71	41
27	0.01	0.23	0.00	0.00	0.00	0.00	61	43	62	47	72	49	88	58	82	58	64	31
28	0.00	0.00	0.12	0.00	0.00	0.00	63	39	69	42	75	53	86	59	82	49	83	38
29	0.00	0.00	0.00	0.00	0.00	0.00	67	38	74	54	80	50	84	58	78	42	82	47
30	0.24	0.48	0.00	0.00	0.16	0.00	58	47	70	52	86	57	86	59	86	54	80	45
31		0.01		0.00	0.14				67	51			86	62	61	52		
Total	1.98	2.34	2.60	3.90	1.10	1.55	57	39	68	45	76	53	79	58	78	54	72	53

Soil Test Results at Various Weed Experimen Locations						
	Soil Texture	Organic Matter	pH	lb/A N	PPM P	PPM K
A. K. Eckre Grassland Preserve (ND)	Loamy sand	2.9	6.8	3	3	70
Camp Grafton, ND	Loamy sand	2.8	7.0	3	3	98
Carrington, ND	Loam	3.7	6.0	Fertilized by test		
Casselton, ND	Silty clay	4.0	7.9	Fertilized by test		
Colfax, ND (corn)	Sandy loam	6.8	3.0			
Colfax, ND (soybean)	Sandy loam	6.2	2.5			
Colfax, ND (sugarbeat)	Loam	2.9	6.5	39	18	230
Crookston, MN	Loam	4.0	8.1	142	10	150
Cuba, ND	Sandy loam	7.0	8.2	3	4	100
Dawson, MN	Sandy loam	7.7	2.6			
Drayton, ND	Silty clay	5.4	8.1	168	55	760
Fargo, ND (campus)	Silty clay	6.8	7.2	Fertilized by test		
Fargo, ND (Dexter)	Silty clay	5.3	7.0	83	35	470
Fargo, ND (section 22)	Silty clay	4.5-6.0	7.5	Fertilized by test		
Felton, MN	Loam	4.1	8.4	86	17	190
Felton, MN (Zollinger)	Sandy loam	7.8	4.1			
Geneseo, ND	Loam	6.0	4.0			
Grand Forks, ND (English coulee)	Loam	5.1	8.3	17	14	225
Hatton, ND	Sandy loam	2.8	7.9	Fertilized by test		
Hawley, MN	Loam	2.2	8.5	3	4	105
Hettinger, ND	Silty loam	2.9	6.7	Fertilized by test		
Hillsboro, ND	Clay loam	6.1	7.7	82	32	405
Jamestown, ND (Pipestream Dam)	Loam	6.8	6.8	28	5	290
Medora, ND	Silty clay loam	3.6	8.2	10	2	230
Minot, ND	Loam	2.7	7.0	Fertilized by test		
Minto, ND	Silty clay	4.2	7.9	337	18	480
Oriska, ND	Silty clay	4.1	7.4	Fertilized by test		
Oriska, ND (Howatt)	Clay loam	3.2	7.8	Fertilized by test		
Oriska, ND (sunflower)	Sandy loam	5.9	3.2			
Oriska, ND (wheat)	Loam	7.4	4.2			
Prosper, ND	Clay loam	3.5	7.5	90	23	315
Prosper, ND (Zollinger)	Loam	4.0	7.2	Fertilized by test		
Sheyenne, ND, Grasslands (Insect)	Loamy sand	2.5	6.9	3	7	125
St. Thomas, ND	Loam	4.1	8.0	189	35	295
Valley City, ND	Fine loam	8.2	6.7	11	15	640
Valley City, ND (wheat)	Sandy loam	7.3	6.1			
Wahpeton, ND	Silty clay	6.4	6.1	Fertilized by test		
Wendell, MN	Loam	4.0	7.8	250	55	245
West Fargo, ND	Silty clay	3.6	7.2	8	42	1460
Williston, ND	Loam	2.3	6.8	Fertilized by test		
Wyndmere, ND	Loamy sand	1.9	5.7	Fertilized by test		

KEY TO ABBREVIATIONS AND EVALUATIONS

Crop injury, crop stand and weed control ratings are based on a visual estimate using a scale of 0 = no effect to 100 = complete kill.

Alfa = Alfalfa	Mael = marshelder
Amaz = Amaranth	Mesa = Meadow salsify
Barl, Bar = Barley	Nabe = Navy bean
Bdlf = Broadleaf	Nfcf = Nightflowering catchfly
Biww = Biennial wormwood	Oats = Tame oats
Bubu = Buffalobur	Pest = Perennial sowthistle
Bygr = Barnyardgrass	Pesw = Pennsylvania smartweed
Cath = Canada thistle	Pibe = Pinto bean
Cano = Canola	Pota = Potato
Cocb = Common cocklebur	Powe = Ponweed
Colq = Common lambsquarters	Prle = Prickley lettuce
Coma = Common mallow	Prmi = Proso millet (tame)
Copu = Common purslane	Prpw = Prostrate pigweed
Corw = Common ragweed	Qugr = Quackgrass
Cram = Crambe	Rrpw = Redroot pigweed
Dali = Dandelion	Ruth = Russian thistle
Dobr = Downy brome	Safl, Saff = Safflower
Drbe = Dry bean	Shpu = Shepherdspurse
Duru = Durum wheat	Smwe = Annual smartweed
Ebns = Eastern black nightshade	Soyb, Sobe = Soybean
Fach = False chamomile	Spsp = Spotted spurge
Fibw = Field bindweed	Sugb, Sgbt = Sugarbeet
Fipc = Field pennycress	Snfl, Sufl = Sunflower
Fisb = Field sandbur	Swcl = Sweet clover
Flwe = Flixweed	Tabw = Tame buckwheat
Foba = Foxtail barley	Tamu = Tansy mustard
Fomi, Ftmi = Foxtail millet	Tumu = Tumble mustard
Fota, Fxtl = Foxtail species	Tymu = Tame yellow mustard
Girw = Giant ragweed	Vowh = Volunteer wheat
Grft = Green foxtail	Vele = Velevetleaf
Gsft = Goosefoot	Vema = Venice mallow
HNS, Hans = Hairy nightshade	Wht = Volunteer wheat
Howe = Horseweed	Wibw = Wild buckwheat
HRSW = Hard red spring wheat	Wimu = Wild mustard
KOCZ = Kochia	Wioa = Wild oat
Lath = Ladysthumb	Wipm = Wild-proso millet
Lent = Lentils	Yeft = Yellow foxtail
Llsa = Lanceleaf sage	

METHODS

PPI = Preplant incorporated
PEI = Preemergence incorporated
PRE, PE = Preemergence
EPOST = Early postemergence
MPOST = Mid postemergence
LPOST = Late postemergence
LLPOST = Late-late postemergence
P, PO, POST - Postemergence
POSTDIR = Postemergence directed

FORMULATION

DF = Dry Flowable
E, EC = Emulsifiable concentrate
FL = F = Flowable
L = Liquid flowable
ME = Micro-encapsulated
WP = Wettable powder
WG,WDG = Water dispersible granules
WSP, SP = Soluble powder
G = Granules or gallon/A
S = Solution
SG = Soluble granules

MISCELLANEOUS

F = Fall
S = Spring
Inc. = I = Incorporation
%ir = inju = Percent injury rating
%sr = %std, strd = Percent stand reduction
HT = Plant height
SPK = Spike stage
Tswt = TW = Test weight
Yld = Yield
alk = alkanolamine salt
AMN = ammonium nitrate
AMS = ammonium sulfate
bee = butoxyethyl ester
dea = diethanolamine salt
dga = diglycolamine
dma = dimethylamine salt
ioe = isoctyl ester
MSO, MVO = methylated vegetable oil
NIS = nonionic surfactant
PO, OC = Petroleum oil concentrate (17% emulsifier)
SURF = S = Surfactant
tms = trimethylsulfonium salt
28N, UAN = 28% liquid nitrogen fertilizer

Herbicide Spray Additives

Surfactants

Activate Plus	Agriliance	$17.00 gal	2 to 4 pt/100 gal
Activator 90	Loveland	$18.50 gal	2 to 4 pt/100 gal
Activate-It	AGSCO	$17.00 gal	2 to 4 pt/100 gal
Preference	Agriliance	$15.70 gal	2 to 4 pt/100 gal
Crnblt Premier 90	West Central	$16.50 gal	2 to 4 pt/100 gal
Induce	Helena	$20.00 gal	2 to 4 pt/100 gal
LI-700	Loveland	$25.00 gal	2 to 4 pt/100 gal
Purity 100	Rosens	$17.00 gal	2 to 4 pt/100 gal
R-11	Wilbur-Ellis	$21.00 gal	2 to 4 pt/100 gal
Tradition 93	Rosens	$19.00 gal	2 to 4 pt/100 gal
Unifilm 707	Cust. Chem.	$16.00 gal	2 to 4 pt/100 gal
X-77 Spreader	Loveland	$18.00 gal	2 to 4 pt/100 gal

Surfactants with Silicone

Galactic	Cust. Chem.	$95.00 gal	0.75 to 4 pt/100 gal
Kinetic	Helena	$93.00 gal	0.75 to 4 pt/100 gal
Silkin	Agriliance	$80.00 gal	0.75 to 4 pt/100 gal
Silwet l-77	Loveland	$40.00 gal	0.38 to 1 pt/100 gal
Sylgard 309	Wilbur-Ellis	$80.00 gal	0.75 to 4 pt/100 gal

Surfactants + Fertilizer

Cayuse Plus	Wilbur-Ellis	$11.00 gal	1 to 2 qt/A
ClassActNewGen	Agriliance	$ 7.00 gal	2.5% v/v
Cornbelt Combo	West Central	$ 5.00 gal	2.25 to 2.5 pt/A
Cornbelt Combo II	West Central	$ 4.50 gal	4 to 6 pt/A
Dispatch 2N	Loveland	$ 5.00 gal	2.5 qt/A
Impressive DB	Rosens	$ 0.70 lb	2.5 to 3 lb/A
Patrol	Helena	$ 6.00 gal	2.25 to 2.5 pt/A
Recon	Rosens	$ 5.50 gal	2.25 to 2.5 pt/A
Surfate	AGSCO	$14.50 gal	1% v/v

Water Conditioning Agents

AMS Plus	Agriliance	$14.00 gal	4 to 6 pt/A
Choice	Loveland	$17.00 gal	2 to 6 pt/A
Infactant	Cust. Chem.	$13.00 gal	2 to 6 pt/A
Quest	Helena	$20.00 gal	2 to 6 pt/A

Basic Blend

Dispatch 111	Loveland	$15.25 gal	1% v/v
Linkage	West Central	$14.25 gal	1% v/v
Newtone	Agriliance	$15.25 gal	1% v/v
Quad 7	AGSCO	$15.25 gal	1% v/v
Transactive	Helena	$15.25 gal	1% v/v

Petroleum Oil Concentrates

Agri-Dex	Helena	$ 7.00 gal	2 to 4 pt/A
DSV (Score)	Syngenta		Copak W/Discover
Herbimax	Loveland	$ 7.00 gal	2 to 4 pt/A
Hi-Per-Oil	Agriliance	$ 9.75 gal	1 to 4 pt/A
Premium COC	West Central	$ 5.00 gal	2 to 4 pt/A
Ortech	Rosens	$ 7.00 gal	2 to 4 pt/A
Paraspread	Cust. Chem.	$ 6.50 gal	2 to 4 pt/A
Prime Oil	Agriliance	$ 6.25 gal	2 to 4 pt/A
ROC Crop Oil	Wilbur-Ellis	$ 7.00 gal	2 to 4 pt/A
R-Way	Rosens	$6.00 gal	2 to 4 pt/A

Vegetable Oil Concentrates

Amigo	Loveland	$ 7.50 gal	2 to 4 pt/A
Prime Oil EV	Agriliance	$ 6.50 gal	2 to 4 pt/A

Methylated Seed Oils (MSO)

Destiny Next Gen.	Agriliance	$13.00 gal	1.5 to 2 pt/A
MSO	Helena	$16.00 gal	1.5 to 2 pt/A
MSO	Loveland	$15.00 gal	1.5 to 2 pt/A
Perform	United Supp	$16.00 gal	1.5 to 2 pt/A
Scoil	AGSCO	$15.00 gal	1.5 to 2 pt/A
Soy-Stik	West Central	$16.00 gal	1.5 to 2 pt/A
Sundance II	Rosens	$15.00 gal	1.5 to 2 pt/A
Unifilm MSO	Cust. Chem.	$16.00 gal	1.5 to 2 pt/A

MSO + Basic Blend

FirstMate	Agriliance	$15.00 gal	1 to 2.5 gal/100 gal

MSO based Basic Blend

Base	West Central	$15.25 gal	1 to 2% v/v
Renegade	Wilbur-Ellis	$15.25 gal	1 to 2% v/v

MSO + Water Conditioning Agent

SuperCharge	Syngenta	w/Achieve	0.5% v/v
Vortex	Loveland	$43.00 gal	1.5 to 2 pt/A

MSO + Organosilicone Surfactant

Dyne-Amic	Helena	$43.00 gal	4 pt/100 gal
Pearless	Cust. Chem.	$40.00 gal	3 to 5 pt/100 gal
Phase	Loveland	$40.00 gal	2 pt/100 gal
Rivet	Agriliance	$42.00 gal	4 pt/100 gal

Fertilizer

AMS (Dry)	Various	$ 0.32 lb	2 to 4 lb/A
AMS (Liquid)	Various	$ 3.00 gal	2 to 4 qt/A
28% UAN	Various	$ 4.00 gal	2 to 4 qt/A
28% UAN (bulk)	Various	$ 3.50 gal	2 to 4 qt/A

AMS Fertilizer + Drift Retardant

Array	Rosens	$ 1.60 lb	9 to 14 lb/100 gal
Corral AMS Liq.	Agriliance	$ 5.40 gal	2.5 to 5 gal/100gal
Corral AMS Dry	Agriliance	$ 0.85 lb	10 to 17 lb/100 gal
Dryve	Loveland	$ 1.50 lb	7 to 17 lb/100 gal
Placement ProPak	Agriliance	$15.75 gal	1 to 2 gal/100 gal
Surf Plus	AGSCO	$ 3.50 gal	2.5 to 5 gal/100gal

AMS Fertilizer + Defoamer

Herb-Stik	West Central	$ 4.00 gal	2 to 4 qt/A

AMS Fertilizer + Deposition + Defoamer

Dri-Gard	West Central	$ 1.30 lb	9 lb/100 gal
Guardian Plus	West Central	$ 5.50 gal	2.5 gal/100 gal

Drift Retardants

Chem-trol	Loveland	$16.25 gal	2 qt/100 gal
Drift Retardant	AGSCO	$13.25 qt	2 to 4 fl oz/100 gal
Placement	Agriliance	$26.00 gal	4 fl oz/pt of L herb. 2 fl oz/lbDF herbicide 2 oz/qt F herbicide
Sta-Put	Wilbur-Ellis	$12.00 gal	1 qt/100 gal
Target LC	Loveland	$14.25 pt	2 to 4 fl oz/100gal
Windbreak	Agriliance	$13.00 gal	4 to 12 fl oz/100gal

Drift Retardant + Defoamer

Guardian	West Central	$20.00	1 to 3 qt/100 gal

Drift Retardant + Defoamer + Water Conditioning Agent

Ultra-Gard	Loveland	$44.00 gal	1 qt/100 gal

Compatibility Agents

Combine	Agriliance	$27.00 gal	1 to 3 pt/100 gal
EZ-Mix	Loveland	$28.00 gal	1 to 2 pt/100 gal
Unite	Loveland	$37.00 gal	1 to 3 pt/100 gal

Spray Tank Cleaners

Tank Cleaner	Various	$22.00 gal	1 to 2 qt/100 gal
Tank Cleaner	Various	$ 6.00 lb	1 to 2 qt/100 gal

LIST OF HERBICIDES TESTED IN 2000				
Common Name	**Abbreviation**	**Company**	**Formulation**	**Trade Name**
Acetochlor + EPTC	Acet + EPTC	Syngenta	1.4 + 5.6 E	Doubleplay
Acetochlor + Atrazine	Acet + Atra	Dow	2.4 + 1.6 L	FulTime
Acetochlor + Dichlormid	Acet + Dcmd	Dow	6.4 EC 3.2 ME	Surpass, TopNotch
Acetochlor + Mesotrione		Syngenta	3.5 SC	
Acetochlor + MON 4660	Acet + 4660	Monsanto	7 EC	Harness
Acifluorfen	Acif	BASF	2 E, S	Ultra blazer
Acifluorfen + Bentazon	Acif + Bent	BASF	0.67 + 3 EC 1.33 + 2.67 EC	Galaxy, Storm
Alachlor	Alac	Monsanto	4 MT	Lasso, Several
Atrazine + 2, 4-D + Fluroxypyr	PCC-196	UAP	3.25L	
Atrazine	Atra	Various	90 DF	Several
Atrazine + 2, 4-D		UAP	3.25 F	Shotgun
Atrazine + Flufenacet + Metribuzin		Bayer	50.5 + 19.6 + 4.9 DF	Axiom AT
Azafenidin	Azaf	DuPont	80 DF	Milestone
BAS 635	BAS 635	BASF	71.4 DF	BS 635
Bentazon	Bent, Bsgn	BASF	4 S	Basagran
Bromoxynil	Brox	Agreva	2 EC	Buctril, Several
Bromacil		DuPont	2L	Hyvar XL
Carfentrazone		FMC	40 WG	Aim
Chlorsulfuron		DuPont	75 WG	Telar
Clethodim	Clet, Slct	Valent	2 , 0.94 EC	Select, Prisim
Clodinafop	Clfd	Syngenta	2 EC	Discover
Clopyralid	Clpy	Dow	3 S	Stinger
Clopyralid + 2,4D	Clpy + 2,4-D	Dow	0.38 + 2 S	Curtail
Cloransulam	Clor, FrstRt	Dow	84 DF	FirstRate
Cyanazine	Cyan	DuPont	90 DF	Bladex
Cycloate	Cycl	Syngenta	6 EC	Ro-Neet
Desmedipham + Phenmedipham + Ethofumesate	Desm + Phen + Etho	Agreva	0.6 + 0.6 + 0.6 E	Progress
Desmedipham	Desm	Agreva	1.3 EC	Betanex
Desmedipham + Phenmedipham	Desm + Phen	Agreva	0.65 + 0.65 E	Betamix
Dicamba + Primisulfuron		Syngenta	43.9 + 7.5 WDG	Northstar
Dicamba + Atrazine		BASF	1.1 + 2.1 L	Marksman
Dicamba	Dica	NuFarm	4 S	Banvel, Several
Dicamba + Nicosulfuron + Diflufenzopyr	Dica + Nico+ Difl	BASF	42.7 + 17 + 10.6 WDG	Celebrity Plus
Diclofop	Dcfp	Agreva	3 EC	Hoelon
Diflufenzopyr + Dicamba	BAS 662	BASF	50 + 20 WDG	Distinct

Difenzoquat	Dife	BASF	2 S	Avenge
Diflufenzoypyr	BAS 664	BASF	70 WG	None
Dimethenamid + Atrazine		BASF	2.33 + 2.67 F	Lead-off, Guardsman
Dimethenamid	Dime, Frtr	BASF	6 EC	Frontier
Dimethenamid-P, s-Dimethenamid	s-Dime	BASF	6 EC	Outlook
Diquat	Diqu	Syngenta	2 S	Diquat
Diuron		DuPont	80 DF	Karmex
Endothall	Endo	Elf Atochem	3 S	Desicate II
EPTC + Dichlormid	EPTC, Dcmd	Syngenta	6.7 EC, 25 G	Eradicane
EPTC	EPTC	Syngenta	7 EC, 25 G	Eptam
EPTC + Dichlormid + Acetochlor	EPTC + Dcmd + Acet	Syngenta	6.8 EC	DoublePlay
Ethalfluralin	Etha	Dow	3 EC, 10 G	Sonalan
Ethametsulfuron		DuPont	75 DF	Muster
Ethofumesate	Etho	Agreva	4 F	Nortron
Fenoxaprop-P	Fenx-P	Agreva	1 EC	Puma
Fenx-P + MCPA + Thifensulfuron + Tribenuron		Agreva	1.6:7.6:0.187:0.092	Cheyenne
Fenx-P + 2,4-D & MCPA		Agreva	0.44 + 0.58 + 1.75 EC	Tiller
Fenx-P + MCPA		Agreva	0.67 + 4 EC	Dakota
Fluazifop-P + Fenoxaprop-P	Flfp + Fenx	Syngenta	2 + 0.66 EC	Fusion
Fluazifop-P	Flfp-P	Syngenta	2 EC	Fusilade DX
Flucarbazone-Na	Flcz	Bayer	70 WDG	Everest
Flufenacet + Isoxaflutole	Fluf + Isox	Bayer	48 + 10 DF	Epic
Flufenacet		Bayer	60 WDG	Define
Flufenacet + Metribuzin		Bayer	54.4 + 13.6 DF	Axiom
Flumetsulam + Clopyralid	Flms + Clpy	Dow	23.1 + 62.3 DF	Hornet
Flumetsulam + Metolachlor	Flms + Meto	Dow	0.2 + 7.47 EC	Broadstrike + Dual
Flumetsulam + Trifluralin	Flms + Trif	Dow	0.25 + 3.4 EC	Broadstrike +Treflan
Flumetsulam	Flms	Dow	80 WG	Python
Flumioxazin	V-53482	Valent	50 WP	Valor
Flurochloridone		Syngenta	2 EC	Racer
Fluroxypyr	Flox	Dow	1.5 EC	Starane
Fluroxypyr + 2, 4-Dioe		Dow	0.75 + 3 EC	Starane + Salvo
Fluroxypyr + MCPAioe		Dow	0.71 + 2.84 EC	Starane + Sword
Fluroxypyr + 2, 4-Ddma		Dow	0.5 + 2 EC	Starane + Saber
Fluroxypyr + 2,4-De		Dow	3.75 EC	Starane + Esteron
Fluroxypyr + MCPAe		Dow	3.55 EC	Starane + MCPA
Flurtamone + Aclonifen		Syngenta	3 EC	Nikyl

Fomesafen		Zeneca	2 EC	Reflex
Fomesafen + Adjuvant		Zeneca	1.88 EC	Flexstar
Foramsulfuron + Safener	AEF130360 01	Agreva	70 WDG	
Foramsulfuron + Safener + other	AEF130360 02	Agreva	62 WDG	
Fosamine		DuPont	4 S	Krenite
Glufosinate + Atrazine	Gluf + Atra	Agreva	1 + 3.3 L	Liberty ATZ
Glufosinate	Gluf, Lbrty	Agreva	1 EC	Liberty/Rely
Glyphosate + 2, 4-D		Monsanto	0.9 + 1.5 S	LandmasterBW
Glyphosate-ipa	Glyt	Monsanto	3 lb ae/gal S	Roundup, Several
Glyphosate-tms	Glyt	Syngenta	3.45 ae/gal S	Touchdown
Halosulfuron	Halo, Prmt	Monsanto	75 DF	Permit
Hexazinone	Hexa	DuPont	75 DF + 90 SP	Velpar
Imazamethabenz	Immb	BASF	2.5 EC	Assert
Imazamox	Imam	BASF	1 S	Raptor
Imazamox + Imazethapyr		BASF	35 + 35 WDG	Odyssey
Imazapic		BASF	2 EC	Plateau
Imazapyr		BASF	2.5 L	Arsenal
Imazethapyr + Glyphosate		BASF	0.17 + 2SL	Extreme
Imazethapyr + Pendimethalin	Imep + Pend	BASF	2.9 EC	Pursuit Plus
Imazethapyr + Imazapyr	Imep + Impr	BASF	70 WDG	Lightning
Imazethapyr	Imep, Prst	BASF	2 S	Pursuit
Isoxaflutole	RP 201772	Agreva	75 DF	Balance
Lactofen	Lact	Valent	2 S	Cobra
MCPA	MCPA	Agreva	4 EC, S	Several
Mesotrione	ZA1296	Syngenta	4 SC	Callisto
Metolachlor + Metribuzin		Syngenta	6.3 + 1.5 L	Boundary
(s)-Metolachlor + Benoxacor (active isomer)		Syngenta	7.6 E	Dual/II/ Magnum
Metolachlor + Atrazine		Syngenta	2.4 + 3.1 L	Bicep II Magnum
Metribuzin	Metr	Bayer	4 F, 75 DF	Sencor
Metsulfuron	Mets	DuPont	60 DF	Ally/Escort
Meturon		Griffin	4L, 80DF	Meturon
Nicosulfuron	Nico	DuPont	75 DF	Accent
Nicosulfuron + Rimsulfuron	DPX-79406	DuPont	50 + 25 DF	Steadfast
Nicosulfuron + Rimsulfuron + Atrazine		DuPont	89.46 DF	Basis Gold
Nicosulfuron+Rimsulfuron +Clopyralid+Flumetsulam		Dupont	6.2 + 6.2 + 51.7 + 19.3 DF	Accent Gold
Oxadiargyl		Agreva	80 WG	Raft
Oxadiazon		Agreva	2 G	Ronstar

Oxyfluorfen	Oxyf	Rohm & Haas	1.6 EC	Goal
Paraquat	Para	Syngenta	2.5 S	Several
Pendimethalin	Pend	BASF	3.3 EC	Prowl
Picloram		Dow	2 S	Tordon 22K
Primisulfuron		Syngenta	75 DF	Beacon
Promatryne		Various		Caparol
Propanil	Prnl	Rohm&Haas	80 DF	Stampede 80 EDF
Prosulfuron	Pros	Syngenta	75 DF	Peak
Pyraflufen	ET-751		0.02 EC	Ecopart
Pyrazon	Pyzn	BASF	4.2 F	Pyramin
Quinclorac		BASF	75 WP	Paramount
Quizalofop-P	Qufp-P	DuPont	0.88 EC	Assure II
Rimsulfuron + Thifensulfuron	Rims + Thif, Bsis	DuPont	75 DF	Basis
Rimsulfuron		DuPont	25 DF	Matrix
Sethoxydim	Seth	BASF	1.5 EC	Poast
Sulfentrazone	Suen	DuPont/FMC	75 DF	Authority, Spartan
Sulfometuron	Sume	DuPont	75 DF	Oust
Tebuthiuron		Dow	20 WG	Spike
Thifensulfuron + Tribenuron	Thif + Trib	DuPont	50 + 25 DF	Harmony Extra
Thifensulfuron	Thif, Pinn ,Pncl	DuPont	75 DF	Harmony GT
Tralkoxydim	Tral	Zeneca	40 DF	Achieve
Tribenuron	Trib	DuPont	75 DF	Express
Triclopyr	Trcp	Dow	4 EC	Garlon, Remedy
Trifluralin	Trif	Dow	4 EC, 10 G	Several
Triflusulfuron	Tfsu	DuPont	50 DF	UpBeet
2, 4-D	2, 4-D	Various	Various EC, S, WSP	Several
2, 4-DB	2, 4-DB	Various	2	Several

[a]Abbreviations in the tables may consist of only the first one, two, or three listed letters when space was limited. Abbreviations of numbered compounds vary with available space, but usually use the first letters and numbers.

Fall and Spring applied Metolachlor, Fargo, 2000. (Dexter) Metolachlor-M was soil applied October 14, 1999 with or without incorporation and May 9 with incorporation. Incorporation October 14 was with a rototiller set two inches deep. Incorporation May 9 was with a 'Kongskilde Triple K' field cultivator with rolling baskets set two inches deep. 'Hilleshog Blazer' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 9. Postemergence herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots May 31, June 6 and June 12. Sugarbeet injury and yellow foxtail and Pennsylvania smartweed control were evaluated July 6 and July 19. Wild oats control was evaluated July 19.

Date	Oct.14,1999	May 9	May 31	June 6	June 12
Time of Day	2:00 pm	12:00 pm	10:00 am	9:30 am	1:00 pm
Air Temp. (°F)	64	65	66	57	77
6" Soil Temp. (°F)	45	57	56	51	62
Rel. Humidity (%)	54	36	44	63	51
Wind Velocity (mph)	7	8	6	10	50
Cloud Cover (%)	70	0	0	10	50
Soil Moisture	fair	good	good	good	fair
Sugarbeet Stage	---	---	v1.2-v2.0	v2.0-v3.8	v4.0-v6.3
Yellow Foxtail	---	---	0.5-1 inch	0.5-2 inch	1-4 inch
Pennsylvania Smartweed	---	---	cot-1 leaf	1-2 leaf	1-3 leaf
Wild Oats	---	---	1-3 inch	2-5 inch	4-8 inch

Summary

Metolachlor alone used PRE, PPI, Fall or Spring gave poor control of yellow foxtail and Pennsylvania smartweed. PRE metolachlor applied Oct. 14 and PPI metolachlor applied May 9 followed by POST micro-rate gave weed control similar to the POST micro-rate alone. However, PPI metolachlor applied Oct. 14 followed by POST micro-rate gave better weed control in some comparisons than the POST micro-rate alone. Weed control from two applications of POST micro-rate over metolachlor was or tended to be less than from three applications of POST micro-rate over metolachlor. Two applications of POST micro-rate over metolachlor gave weed control similar to three applications of POST micro-rate alone.

(Experiment continued on next page.)

Fall and Spring applied Metolachlor, Fargo, 2000. (continued)

Treatment*	Date of (Application)	Rate	July 6 Sgbt inj	July 6 Yeft cntl	July 6 Pesw cntl	July 19 Sgbt inj	July 19 Yeft cntl	July 19 Pesw cntl	July 19 Wioa cntl
		lb/A	%	%	%	%	%	%	%
Untreated Check		0	0	0	0	0	0	0	0
Desm+Tfsu+Clpy+Clet+MethOil	(May 31, June 6)	0.08+0.004+0.03+0.03+1.5%	0	80	85	0	74	68	100
Desm+Tfsu+Clpy+Clet+MethOil	(May 31, June 6, June 12)	0.08+0.004+0.03+0.03+1.5%	0	94	92	0	87	79	100
Metolachlor-M	(PRE Oct. 14)	1.9	0	48	3	0	23	3	0
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PRE Oct. 14) (May 31, June 6)	1.9 0.08+0.004+0.03+0.03+1.5%	0	88	92	0	83	70	100
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PRE Oct. 14) (May 31, June 6, June 12)	1.9 0.08+0.004+0.03+0.03+1.5%	0	98	96	0	97	81	100
Metolachlor-M	(PPI May 9)	1.6	0	18	0	0	5	0	0
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PPI May 9) (May 31, June 6)	1.6 0.08+0.004+0.03+0.03+1.5%	0	86	90	0	70	70	100
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PPI May 9) (May 31, June 6, June 12)	1.6 0.08+0.004+0.03+0.03+1.5%	0	96	94	0	97	84	100
Metolachlor-M	(PPI Oct. 14)	1.9	0	56	10	0	44	10	0
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PPI Oct. 14) (May 31, June 6)	1.9 0.08+0.004+0.03+0.03+1.5%	0	90	93	0	91	79	100
Metolachlor-M Desm+Tfsu+Clpy+Clet+MethOil	(PPI Oct. 14) (May 31, June 6, June 12)	1.9 0.08+0.004+0.03+0.03+1.5%	0	99	100	0	99	97	100
EXP MEAN			0	71	63	0	64	53	67
C.V. %			0	10	9	0	14	14	0
LSD 5%			NS	10	8	NS	13	11	0
LSD 1%			NS	13	11	NS	18	15	0
# OF REPS			4	4	4	4	4	4	4

*MethOil=methylated seed oil from Terra.

Weed control in sugarbeet, Colfax, 2000. (Dexter) 'Beta 2084', 'Hilleshog 8277 Roundup Ready', and 'Beta 2012 Liberty Link' sugarbeet were seeded 1.25 inches deep in 22 inch rows in adjacent experiments April 25. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Preemergence herbicide treatments were applied April 25 after planting. Postemergence herbicide treatments were applied May 12, May 19, May 26 and June 6. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed and common lambsquarters control were evaluated June 16 and June 22. Marshelder control was evaluated June 16.

Date of Application	April 25	May 12	May 19	May 26	June 6
Time of Day	2:30 pm	11:00 am	2:30 pm	9:30 am	9:00 am
Air Temperature (°F)	72	55	72	65	67
Relative Humidity (%)	10	57	25	48	52
Soil Temperature(°F at 6")	51	52	57	53	56
Wind Velocity (mph)	16	19	17	13	9
Cloud Cover (%)	15	10	0	100	20
Soil Moisture	good	good	good	good	good
Sugarbeet	---	v1.0	v1.0-v1.8	v2.7-v4.2	v4.0-v6.5
Redroot Pigweed	---	cotyledon	cot-2 leaf	2-4 leaf	1-2 inch
Common Lambsquarter	---	cot-2 leaf	cot-4 leaf	4-8 leaf	2-4 inch
Marshelder	---	cotyledon	2 leaf	4 leaf	6-8 leaf

Roundup Ready sugarbeet

Treatment*	Date of (Application)	Rate	June 16 Sgbt inj	June 16 Colq cntl	June 16 Rrpw cntl	June 22 Sgbt inj	June 22 Colq cntl	June 22 Rrpw cntl
		lb/A	%	%	%	%	%	%
Glyphosate+AMS	(May 19, June 6)	0.75+2	0	100	100	0	99	100
Glyphosate+AMS+Dime	(May 19)	0.75+2+1						
Glyphosate+AMS	(June 6)	0.75+2	0	100	100	0	100	100
Glyphosate+AMS+Dime	(May 12)	0.75+2+1						
Glyphosate+AMS	(June 6)	0.75+2	0	97	100	0	97	100
Glyphosate+AMS	(May 19)	0.75+2						
Glyphosate+AMS+Dime	(June 6)	0.75+2+1	0	100	100	0	100	100
Glyphosate+AMS+Meto	(May 19)	0.75+2+2						
Glyphosate+AMS	(June 6)	0.75+2	0	100	100	0	100	100
Glyphosate+AMS+Meto	(May 12)	0.75+2+2						
Glyphosate+AMS	(June 6)	0.75+2	0	100	100	0	99	100
Glyphosate+AMS	(May 19)	0.75+2						
Glyt+AMS+Meto	(June 6)	0.75+2+2	0	100	100	0	100	100
EXP MEAN			0	99	100	0	99	100
C.V. %			0	1	0	0	1	0
LSD 5%			NS	1	NS	NS	2	NS
LSD 1%			NS	1	NS	NS	2	NS
# OF REPS			4	4	4	4	4	4

*AMS=ammonium sulfate; Dime=d-dimethenamid, active isomer of dimethenamid, trade name "Outlook"; Meto=m-Metolochlor, active isomer of metolachlor, trade name "Dual Magnum".

SUMMARY: All treatments gave 97% or greater control of common lambquarters and redroot pigweed. Weed control was slightly less when dimethenamid was applied May 12 as compared to other treatments.

(Experiment continued on next page.)

Weed control in sugarbeet, Colfax, 2000. (continued)

Liberty Link sugarbeet

Treatment*	Date of (Application)	Rate	June 16 Sgbt inj	June 16 Colq cntl	June 16 Rrpw cntl	June 16 Mael cntl	June 22 Sgbt inj	June 22 Colq cntl	June 22 Rrpw cntl
		lb/A	%	%	%	%	%	%	%
Glufosinate+AMS	(May 19, June 6)	0.312+3	0	90	100	100	0	88	100
Gluf+AMS+Dime	(May 19)	0.312+3+1							
Glufosinate+AMS	(June 6)	0.312+3	0	88	100	100	0	85	100
Gluf+AMS+Dime	(May 12)	0.312+3+1							
Glufosinate+AMS	(June 6)	0.312+3	0	90	100	100	0	89	100
Glufosinate+AMS	(May 19)	0.312+3							
Gluf+AMS+Dime	(June 6)	0.312+3+1	0	93	100	100	0	95	100
Gluf+AMS+Meto	(May 19)	0.312+3+2							
Glufosinate+AMS	(June 6)	0.312+3	0	97	100	100	0	97	100
Gluf+AMS+Meto	(May 12)	0.312+3+2							
Glufosinate+AMS	(June 6)	0.312+3	0	83	98	100	0	83	100
Glufosinate+AMS	(May 19)	0.312+3							
Gluf+AMS+Meto	(June 6)	0.312+3+2	0	95	100	100	0	95	100
EXP MEAN			0	91	100	100	0	90	100
C.V. %			0	6	2	0	0	6	0
LSD 5%			NS	8	NS	NS	NS	7	NS
LSD 1%			NS	NS	NS	NS	NS	10	NS
# OF REPS			4	4	4	4	4	4	4

*AMS=ammonium sulfate; Dime=d-dimethenamid, active isomer of dimethenamid, trade name "Outlook"; Meto=m-Metolochlor, active isomer of metolachlor, trade name "Dual Magnum".

Summary

All treatments gave nearly total control of redroot pigweed and marshelder. Based on June 22 evaluations, adding dimethenamid to glufosinate on June 6, or adding metolachlor on May 19 or June 6 improved common lambsquarters control compared to glufosinate + AMS alone.

(Experiment continued on next page.)

Weed control in sugarbeet, Colfax, 2000. (continued)

Conventional sugarbeet

Treatment*	Date of (Application)	Rate	June 16 Sgbt inj	June 16 Colq cntl	June 16 Rrpw cntl	June 16 Mael cntl	June 22 Sgbt inj	June 22 Colq cntl	June 22 Rrpw cntl
		lb/A	%	%	%	%	%	%	%
Desm&Phen&Etho+Tfsu+Clpy+Clet+Scoil	(May 12, May 19, May 26, June 6)	0.08+0.004+0.03+0.03+1.5%	0	99	100	100	0	99	100
Desm+Tfsu+Clpy+Clet+Scoil	(May 12, May 19, May 26, June 6)	0.08+0.004+0.03+0.03+1.5%	1	99	100	100	0	100	100
Desm&Phen&Etho+Tfsu+Clpy+Clet	(May 12, May 19, May 26)	0.25+0.008+0.047+0.04	4	100	100	100	0	99	99
Desm&Phen&Etho+Tfsu+Clpy+Clet	(May 12, May 19, May 26)	0.25+0.008+0.047+0.04 0.33+0.008+0.047+0.04 0.5+0.008+0.047+0.04	4	100	100	100	0	100	100
Desm+Tfsu+Clpy+Clet	(May 12, May 19, May 26)	0.25+0.008+0.047+0.04 0.33+0.008+0.047+0.04 0.5+0.008+0.047+0.04	5	100	100	100	0	100	100
Ethofumesate (PRE) Desm&Phen&Etho+Tfsu+Clpy+Clet+Scoil	3 (May 12, May 19, May 26, June 6)	0.08+0.004+0.03+0.03+1.5%	4	100	100	100	0	100	100
Ethofumesate (PRE) Desm&Phen&Etho+Tfsu+Clpy+Clet	3 (May 12, May 19, May 26)	0.25+0.008+0.047+0.04 0.33+0.008+0.047+0.04 0.5+0.008+0.047+0.04	13	100	100	100	0	100	100
EXP MEAN			4	100	100	100	0	100	100
C.V. %			111	1	0	0	0	1	1
LSD 5%			7	NS	NS	NS	NS	NS	NS
LSD 1%			NS	NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4	4

*Scoil=methylated seed oil from AGSCO.

Summary

All treatments gave nearly total control of common lambsquarters, redroot pigweed and marshelder. Ethofumesate PRE followed by the high rate of desmedipham & phenmedipham & ethofumesate + triflusulfuron + clopyralid + clethodim caused more sugarbeet injury than the other treatments.

Weed control in sugarbeet, Wendell, 2000. (Dexter) 'Beta 2084', 'Hilleshog 8277 Roundup Ready', and 'Beta 2012 Liberty Link' sugarbeet were seeded 1.25 inches deep in 22 inch rows in adjacent experiments April 25. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Preemergence herbicide treatments were applied April 25 after planting. Postemergence herbicide treatments were applied May 12, May 19, May 26 and June 3. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and lanceleaf sage, green foxtail, redroot pigweed, common lambsquarters and eastern black nightshade control were evaluated June 16 and June 28.

Date of Application	April 25	May 12	May 19	May 26	June 3
Time of Day	11:15 am	2:00 pm	11:30 am	1:00 pm	8:30 am
Air Temperature (°F)	67	63	66	76	53
Relative Humidity (%)	37	41	28	28	45
Soil Temperature(°F at 6")	51	54	53	57	52
Wind Velocity (mph)	6	21	12	15	10
Cloud Cover (%)	0	50	0	90	90
Soil Moisture	good	good	good	fair	good
Sugarbeet	---	v1.0-v1.3	v1.5-v2.2	v4.0-v6.2	v6.5-v7.8
Redroot Pigweed	---	cot-1 leaf	cot-4 leaf	1-6 leaf	4 lf - 4"
Common Lambsquarter	---	cot-2 leaf	cot-4 leaf	cot-8 leaf	6 lf - 4"
Lanceleaf Sage	---	cotyledon	cot-2 leaf	2-4 leaf	cot-8 lf
Eastern Black Nightshade	---	cot-1 leaf	cot-3 leaf	2-5 leaf	3-7 leaf
Green Foxtail	---	emerg-0.5"	0.5-2 inch	0.5-3 inch	2-5 inch

Roundup Ready Sugarbeet

		June 16						June 28					
Treatment*	Date of (Application) Rate	Sgbt inj	Rrpw cntl	Colq cntl	Lasa cntl	Ebns cntl	Grft cntl	Sgbt inj	Rrpw cntl	Colq cntl	Lasa cntl	Ebns cntl	Grft cntl
	lb/A	%	%	%	%	%	%	%	%	%	%	%	%
Glyphosate+AMS	(May 19,June 3) 0.75+2	0	100	100	100	100	100	0	99	99	99	100	100
Glyphosate+AMS+Dime	(May 19) 0.75+2+1												
Glyphosate+AMS	(June 3) 0.75+2	8	100	100	100	100	100	0	100	100	100	100	100
Glyphosate+AMS+Dime	(May 12) 0.75+2+1												
Glyphosate+AMS	(June 3) 0.75+2	3	100	100	100	100	100	0	100	100	100	100	100
Glyphosate+AMS	(May 19) 0.75+2												
Glyphosate+AMS+Dime	(June 3) 0.75+2+1	5	100	100	100	100	100	0	100	100	100	100	100
Glyphosate+AMS+Meto	(May 19) 0.75+2+2												
Glyphosate+AMS	(June 3) 0.75+2	3	100	100	100	100	100	0	100	100	100	100	100
Glyphosate+AMS+Meto	(May 12) 0.75+2+2												
Glyphosate+AMS	(June 3) 0.75+2	1	100	100	100	100	100	0	99	100	100	100	100
Glyphosate+AMS	(May 19) 0.75+2												
Glyphosate+AMS+Meto	(June 3) 0.75+2+2	1	100	100	100	100	100	0	100	100	100	100	100
EXP MEAN		3	100	100	100	100	100	0	100	100	100	100	100
C.V. %		118	0	0	0	0	0	0	1	1	1	0	0
LSD 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

*AMS=ammonium sulfate; Dime=d-dimethenamid, active isomer of dimethenamid, trade name "Outlook" ; Meto=m-Metolochlor, active isomer of metolachlor, trade name "Dual Magnum".

SUMMARY: All treatments gave nearly total weed control.

(Experiment continued on next page.)

Weed control in sugarbeet, Wendell, 2000. (continued)

Liberty Link sugarbeet

Treatment*	Date of (Application)	Rate	June 16 Sgbt inj	June 16 Rrpw cntl	June 16 Colq cntl	June 16 Lasa cntl	June 16 Ebns cntl	June 16 Grft cntl	June 28 Sgbt inj	June 28 Rrpw cntl	June 28 Colq cntl	June 28 Lasa cntl	June 28 Ebns cntl	June 28 Grft cntl
		lb/A	%	%	%	%	%	%	%	%	%	%	%	%
Gluf+AMS	(May 19, June 3)	0.312+3	0	98	83	100	100	99	0	97	84	100	100	100
Gluf+AMS+Dime	(May 19)	0.312+3+1												
Gluf+AMS	(June 3)	0.312+3	10	100	95	100	100	100	0	100	94	100	100	100
Gluf+AMS+Dime	(May 12)	0.312+3+1												
Gluf+AMS	(June 3)	0.312+3	5	99	95	100	100	100	0	99	96	100	100	100
Gluf+AMS	(May 19)	0.312+3												
Gluf+AMS+Dime	(June 3)	0.312+3+1	5	100	92	100	100	99	0	100	90	100	100	100
Gluf+AMS+Meto	(May 19)	0.312+3+2												
Gluf+AMS	(June 3)	0.312+3	10	100	93	100	100	100	0	99	93	100	100	100
Gluf+AMS+Meto	(May 12)	0.312+3+2												
Gluf+AMS	(June 3)	0.312+3	14	99	90	100	100	98	0	99	92	100	100	99
Gluf+AMS	(May 19)	0.312+3												
Gluf+AMS+Meto	(June 3)	0.312+3+2	6	98	94	100	100	99	0	94	93	100	100	100
EXP MEAN			7	99	92	100	100	99	0	98	92	100	100	100
C.V. %			54	2	4	0	0	1	0	3	5	0	0	1
LSD 5%			6	NS	6	NS	NS	NS	NS	NS	7	NS	NS	NS
LSD 1%			8	NS	8	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4	4	4	4	4	4	4

*AMS=ammonium sulfate; Dime=d-dimethenamid, active isomer of dimethenamid, trade name "Outlook" ; Meto=m-Metolochlor, active isomer of metolachlor, trade name "Dual Magnum".

Summary

Dimethenamid plus glufosinate on May 19 followed by glufosinate on June 3 caused more sugarbeet injury than glufosinate on May 19 and June 3. Adding metolachlor on May 19 or May 12 also increased sugarbeet injury. Common lambsquarters control was improved by dimethenamid and metolachlor.

(Experiment continued on next page.)

Weed control in sugarbeet, Wendell, 2000. (continued)

Conventional sugarbeet

Treatment*	Rate	June 16 Sgbt inj	Rrpw cntl	Colq cntl	Lasa cntl	Ebns cntl	Grft cntl	June 28 Sgbt inj	Rrpw cntl	Colq cntl	Lasa cntl	Ebns cntl	Grft cntl
	lb/A	%	%	%	%	%	%	%	%	%	%	%	%
Desm+Tfsu+Clpy+Clet (4X) 0.25+0.008+0.09+0.03		20	100	100	90	100	100	0	99	100	99	100	100
Desm+Tfsu+Clpy+Clet+Scoil (4X) 0.08+0.004+0.03+0.03+1.5%		15	100	95	75	100	100	0	97	96	89	100	100
Desm+Tfsu+Clpy+Clet+Scoil (4X) 0.08+0.004+0.06+0.03+1.5%		16	100	100	89	100	100	0	99	99	99	100	100
Desm+Tfsu+Clpy+Clet+Scoil (4X) 0.08+0.004+0.09+0.03+1.5%		18	100	100	97	100	100	0	99	100	99	100	100
De&Ph&Et+Tfsu+Clpy+Clet+Scl(4X) 0.08+0.004+0.06+0.03+1.5%		18	98	100	91	100	100	0	99	100	96	100	100
Ethofumesate (PRE)/ Desm+Tfsu+Clpy+Clet+Scoil(4X) 3/0.08+0.004+0.06+0.03+1.5%		18	100	100	100	100	100	0	100	100	100	100	100
Metolachlor (PRE)/ Desm+Tfsu+Clpy+Clet+Scoil(4X) 1.5/0.08+0.004+0.06+0.03+1.5%		19	100	99	99	100	100	0	100	100	100	100	100
EXP MEAN		18	96	99	92	100	100	0	99	99	97	100	100
C.V. %		17	18	3	4	0	0	0	2	2	3	0	0
LSD 5%		NS	NS	NS	5	NS	NS	NS	NS	2	5	NS	NS
LSD 1%		NS	NS	NS	7	NS	NS	NS	NS	3	7	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

*Scoil=methylated seed oil from AGSCO.

Summary

Four applications of desmedipham + triflusulfuron + clopyralid + clethodim + Scoil at 0.08 + 0.004 + 0.03 + 0.03 lb/A + 1.5% (micro-rate) gave less control of lanceleaf sage than four applications of desmedipham + triflusulfuron + clopyralid + clethodim at 0.25 + 0.008 + 0.09 + 0.03 lb/A (standard rate). Increasing the rate of clopyralid from 0.03 to 0.06 lb/A in the micro=rate increased the June 28 control rating from 89% to 99%. Substituting desmedipham & phenmedipham & ethofumesate for desmedipham did not improve control of lanceleaf sage. The micro-rate over PRE ethofumesate or PRE metolachlor gave 100% or 99% control of lanceleaf sage on June 16 compared to 75% from the micro-rate alone.

Molasses as a spray adjuvant, Fargo, 2000. (Dexter) 'Jud' oats at 53 lb/A, 'Foster' barley at 64 lb/A and Siberian foxtail millet at 100 lb/A were seeded in 3 feet wide strips across herbicide plots May 18. 'Empire Roundup Ready' sugarbeet and a blend of 'Beta 8088 Liberty Link' and 'Beta 992 Liberty Link' sugarbeet were each seeded in three 22 inch rows across the herbicide plots May 18. 'A60901 Roundup Ready' soybean at 100 lb/A and 'Garst 8773 Liberty Link' corn were seeded in 5 feet wide strips across herbicide plots May 18. All single application herbicide treatments were applied June 29. Micro-rate treatments were applied June 6, June 29 and July 11. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center 6.67 feet of 11 foot wide plots. Roundup Ready sugarbeet, Liberty Link sugarbeet, soybean, corn, barley, oats and foxtial millet were evaluated July 17 and July 27. Data for the July 17 and July 27 evaluations are presented separately. Another table presents the mean of these two evaluations and the average control rating. Average control is the mean of the seven species evaluated.

Date of Application	June 6	June 29	July 11
Time of Day	9:30 am	11:00 am	11:00 am
Air Temperature (°F)	57	70	79
Relative Humidity (%)	63	69	68
Soil Temperature(°F at 6")	51	62	72
Wind Velocity (mph)	10	5	11
Cloud Cover (%)	10	0	100
Soil Moisture	good	good	good
Sugarbeet	v 1.0 - v 2.0	v 4.5 - v 9.2	8 - 12 leaf
Soybean	cotyledon	1st-2nd trifol.	4th-6th trifol.
Corn	1-2 leaf(1-2")	3-8 in. tall	20 inches tall
Barley	2 leaf (3-4")	14-20 in. tall	heading
Oats	1 leaf (2-3")	10-16 in. tall	heading
Foxtail Millet	0.5-1.5" tall	5-12 in. tall	20 inches tall

(Experiment continued on next page.)

Molasses as a spray adjuvant, Fargo, 2000. (continued)

Treatment*	Rate	July 17 RR Sgbt	LL Sgbt	RR Soyb	LL Corn	Barl	Oats	Fxmi
	lb/A	%	%	%	%	%	%	%
Glyphosate	0.047	0	7	0	3	40	10	85
Glyphosate+Molasses	0.047+2%	0	50	0	57	98	73	99
Glyphosate+AMS	0.047+3	0	30	0	50	98	85	99
Glyt+AMS+Molasses	0.047+3+2%	0	43	0	53	87	78	98
Glyphosate+R-11	0.047+0.25%	0	40	0	13	45	42	86
Glyt+R-11+Molasses	0.047+0.25%+2%	0	60	0	13	60	60	95
Glyphosate+AMS+R-11	0.047+3+0.25%	0	47	0	43	98	93	97
Glyt+AMS+R-11+Molasses	0.047+3+0.25%+2%	0	33	0	47	97	80	90
Glufosinate	0.26	88	0	43	0	60	53	87
Glufosinate+Molasses	0.26+2%	100	0	87	0	86	86	100
Glufosinate+AMS	0.26+3	97	0	73	0	60	50	89
Glyphosate+ClassActII	0.047+2.5%	0	43	0	47	97	82	98
Glyphosate+CL9804	0.047+2.5%	0	47	0	53	99	95	99
Glyphosate+Corral Liquid	0.047+2.5%	0	33	0	35	92	68	85
Glufosinate+AMS+Molasses	0.26+3+2%	88	0	43	0	46	53	98
Glufosinate+R-11	0.26+0.25%	60	0	50	0	50	50	88
Glufosinate+R-11+Molasses	0.26+0.25%+2%	80	0	40	0	57	56	96
Glufosinate+Scoil	0.26+1.5%	77	0	37	0	20	20	97
Glufosinate+Scoil+Molasses	0.26+1.5%+2%	67	0	37	0	51	38	93
Glufosinate+AMS+R-11	0.26+3+0.25%	82	0	60	0	77	73	99
Gluf+AMS+R-11+Molasses	0.26+3+0.25%+2%	95	0	60	0	73	57	94
Glufosinate+AMS+Scoil	0.26+3+1.5%	92	0	52	0	63	63	99
Gluf+AMS+Scoil+Molasses	0.26+3+1.5%+2%	85	0	58	0	80	75	96
Glufosinate+ClassActII	0.26+2.5%	84	0	42	0	73	81	96
Glufosinate+AG0006	0.26+2.5%	85	0	47	0	72	50	97
Glufosinate+CL9913	0.26+2.5%	60	0	50	0	89	78	99
Glufosinate+CL9804	0.26+2.5%	86	0	50	0	70	53	96
Imazamox	0.021	47	37	0	0	53	20	68
Imazamox+Molasses	0.021+2%	88	85	7	0	80	66	78
Imazamox+AMS	0.021+3	90	77	3	0	77	43	77
Imazamox+AMS+Molasses	0.021+3+2%	95	93	0	0	73	65	77
Imazamox+R-11	0.021+0.25%	93	94	0	0	96	91	97
Imazamox+R-11+Molasses	0.021+0.25%+2%	92	92	0	0	88	95	91
Imazamox+Scoil	0.021+1.5%	95	92	0	0	97	98	98
Imazamox+Scoil+Molasses	0.021+1.5%+2%	95	95	0	0	93	90	97
Imazamox+AMS+R-11	0.021+3+0.25%	96	96	0	0	96	99	98
Imazamox+AMS+R-11+Molas	0.021+3+0.25%+2%	96	93	0	0	93	91	90
Imazamox+AMS+Scoil	0.021+3+1.5%	97	96	0	0	99	99	99
Imaz+AMS+Scoil+Molasses	0.021+3+1.5%+2%	97	96	0	3	98	99	99
Desm+Tfsu+Clpy+Qufp (3X)	0.08+0.004+0.03+0.017	0	0	100	22	95	43	47
Desm+Tfsu+Clpy+Qufp+Molasses (3X)	0.08+0.004+0.03+0.017+2%	0	0	100	47	40	48	57
Desm+Tfsu+Clpy+Qufp+AMS (3X)	0.08+0.004+0.03+0.017+3	0	0	100	47	80	73	88
Desm+Tfsu+Clpy+Qufp+AMS+Molasses (3X)	0.08+0.004+0.03+0.017+3+2%	0	0	100	37	83	68	89
Desm+Tfsu+Clpy+Qufp+Scoil (3X)	0.08+0.004+0.03+0.017+1.5%	0	0	100	100	100	100	100
Desm+Tfsu+Clpy+Qufp+Scoil+Molasses (3X)	0.08+0.004+0.03+0.017+1.5%+2%	0	0	100	97	99	97	100
Desm+Tfsu+Clpy+Qufp+AMS+Scoil (3X)	0.08+0.004+0.03+0.017+3+1.5%	0	0	100	99	100	100	100
Desm+Tfsu+Clpy+Qufp+AMS+Scoil+Molas (3X)	0.08+0.004+0.03+0.017+3+1.5%+2%	0	0	100	100	100	100	100
Nicosulfuron	0.016	3	3	3	0	65	57	57
Nicosulfuron+Molasses	0.016+2%	13	10	3	0	83	65	77
Nicosulfuron+Scoil	0.016+1.5%	16	15	9	0	100	100	99
Nicosulfuron+Scoil+Molasses	0.016+1.5%+2%	60	40	23	0	97	98	90
EXP MEAN		49	30	33	19	79	71	91
C.V. %		26	38	35	28	21	21	8
LSD 5%		21	19	19	9	27	24	11
LSD 1%		28	25	25	12	36	31	15
# OF REPS		3	3	3	3	3	3	3

(Experiment continued on next page.)

Molasses as a spray adjuvant, Fargo, 2000. (continued)

Treatment*	Rate	July 27 RR Sgbt	LL Sgbt	RR Soyb	LL Corn	Barl	Oats	Fxmi
	lb/A	%	%	%	%	%	%	%
Glyphosate	0.047	0	13	0	0	43	10	87
Glyphosate+Molasses	0.047+2%	0	57	0	40	96	73	94
Glyphosate+AMS	0.047+3	0	27	0	48	99	91	100
Glyt+AMS+Molasses	0.047+3+2%	0	47	0	47	87	87	92
Glyphosate+R-11	0.047+0.25%	0	23	0	10	40	32	77
Glyt+R-11+Molasses	0.047+0.25%+2%	0	70	0	10	60	48	83
Glyphosate+AMS+R-11	0.047+3+0.25%	0	40	0	33	99	92	87
Glyt+AMS+R-11+Molasses	0.047+3+0.25%+2%	0	47	0	30	98	78	90
Glufosinate	0.26	82	0	53	0	47	35	78
Glufosinate+Molasses	0.26+2%	100	0	87	0	75	82	98
Glufosinate+AMS	0.26+3	90	0	73	0	53	35	80
Glyphosate+ClassActII	0.047+2.5%	0	48	0	38	96	83	91
Glyphosate+CL9804	0.047+2.5%	0	47	0	40	99	88	93
Glyphosate+Corral Liquid	0.047+2.5%	0	20	0	25	89	73	80
Glufosinate+AMS+Molasses	0.26+3+2%	67	0	52	0	51	47	90
Glufosinate+R-11	0.26+0.25%	60	0	58	0	40	43	75
Glufosinate+R-11+Molasses	0.26+0.25%+2%	65	0	45	0	53	43	94
Glufosinate+Scoil	0.26+1.5%	73	0	50	0	15	13	88
Glufosinate+Scoil+Molasses	0.26+1.5%+2%	47	0	43	0	43	25	70
Glufosinate+AMS+R-11	0.26+3+0.25%	63	0	70	0	73	70	90
Gluf+AMS+R-11+Molasses	0.26+3+0.25%+2%	77	0	58	0	73	60	85
Glufosinate+AMS+Scoil	0.26+3+1.5%	85	0	73	0	53	53	93
Gluf+AMS+Scoil+Molasses	0.26+3+1.5%+2%	80	0	62	0	77	65	93
Glufosinate+ClassActII	0.26+2.5%	67	0	47	0	68	72	84
Glufosinate+AG0006	0.26+2.5%	75	0	60	0	53	25	83
Glufosinate+CL9913	0.26+2.5%	50	0	55	0	78	67	91
Glufosinate+CL9804	0.26+2.5%	80	0	65	0	60	37	85
Imazamox	0.021	40	37	0	0	57	30	90
Imazamox+Molasses	0.021+2%	80	83	0	0	87	77	88
Imazamox+AMS	0.021+3	67	67	0	0	75	43	82
Imazamox+AMS+Molasses	0.021+3+2%	87	87	0	0	85	67	90
Imazamox+R-11	0.021+0.25%	93	93	0	0	95	87	98
Imazamox+R-11+Molasses	0.021+0.25%+2%	88	90	0	0	95	93	96
Imazamox+Scoil	0.021+1.5%	83	90	0	0	98	98	99
Imazamox+Scoil+Molasses	0.021+1.5%+2%	90	90	0	0	98	95	98
Imazamox+AMS+R-11	0.021+3+0.25%	95	95	0	0	100	100	100
Imazamox+AMS+R-11+Molas	0.021+3+0.25%+2%	93	93	0	0	93	80	88
Imazamox+AMS+Scoil	0.021+3+1.5%	97	97	0	0	100	100	100
Imaz+AMS+Scoil+Molasses	0.021+3+1.5%+2%	97	97	0	0	100	100	100
Desm+Tfsu+Clpy+Qufp (3X)	0.08+0.004+0.03+0.017	0	0	100	33	99	43	47
Desm+Tfsu+Clpy+Qufp+Molasses (3X)	0.08+0.004+0.03+0.017+2%	0	0	100	63	40	53	63
Desm+Tfsu+Clpy+Qufp+AMS (3X)	0.08+0.004+0.03+0.017+3	0	0	100	47	87	80	83
Desm+Tfsu+Clpy+Qufp+AMS+Molasses (3X)	0.08+0.004+0.03+0.017+3+2%	0	0	100	45	81	73	86
Desm+Tfsu+Clpy+Qufp+Scoil (3X)	0.08+0.004+0.03+0.017+1.5%	0	0	100	100	100	100	100
Desm+Tfsu+Clpy+Qufp+Scoil+Molasses (3X)	0.08+0.004+0.03+0.017+1.5%+2%	0	0	100	99	100	100	100
Desm+Tfsu+Clpy+Qufp+AMS+Scoil (3X)	0.08+0.004+0.03+0.017+3+1.5%	0	0	100	100	100	100	100
Desm+Tfsu+Clpy+Qufp+AMS+Scoil+Molas (3X)	0.08+0.004+0.03+0.017+3+1.5%+2%	0	0	100	100	100	100	100
Nicosulfuron	0.016	0	0	0	0	58	55	53
Nicosulfuron+Molasses	0.016+2%	17	3	0	0	87	62	82
Nicosulfuron+Scoil	0.016+1.5%	0	0	0	0	100	100	98
Nicosulfuron+Scoil+Molasses	0.016+1.5%+2%	55	38	0	0	97	100	96
EXP MEAN		44	29	34	18	77	68	88
C.V. %		36	43	33	50	20	23	11
LSD 5%		26	20	19	14	26	25	15
LSD 1%		34	27	25	19	34	34	21
# OF REPS		3	3	3	3	3	3	3

(Experiment continued on next page.)

Molasses as a spray adjuvant averaged over July 17 and July 27, Fargo, 2000. (continued)

Treatment*	Rate	RR Sgbt	LL Sgbt	RR Soyb	LL Corn	Barl	Oats	Fxmi	Avg. Cntl
	lb/A	%	%	%	%	%	%	%	%
Glyphosate	0.047	0	10	0	2	42	10	86	21
Glyphosate+Molasses	0.047+2%	0	53	0	48	97	73	96	52
Glyphosate+AMS	0.047+3	0	28	0	49	98	88	99	51
Glyt+AMS+Molasses	0.047+3+2%	0	45	0	50	87	82	94	51
Glyphosate+R-11	0.047+0.25%	0	32	0	12	42	36	82	29
Glyt+R-11+Molasses	0.047+0.25%+2%	0	65	0	12	60	54	89	40
Glyphosate+AMS+R-11	0.047+3+0.25%	0	43	0	38	98	92	92	52
Glyt+AMS+R-11+Molasses	0.047+3+0.25%+2%	0	40	0	38	97	79	90	49
Glufosinate	0.26	85	0	48	0	53	44	83	44
Glufosinate+Molasses	0.26+2%	100	0	86	0	80	84	98	64
Glufosinate+AMS	0.26+3	93	0	73	0	57	42	84	49
Glyphosate+ClassActII	0.047+2.5%	0	46	0	42	96	82	94	51
Glyphosate+CL9804	0.047+2.5%	0	47	0	47	99	91	96	54
Glyphosate+Corral Liquid	0.047+2.5%	0	27	0	30	90	71	82	42
Glufosinate+AMS+Molasses	0.26+3+2%	77	0	47	0	48	50	94	45
Glufosinate+R-11	0.26+0.25%	60	0	54	0	45	47	81	41
Glufosinate+R-11+Molasses	0.26+0.25%+2%	72	0	42	0	55	50	95	44
Glufosinate+Scoil	0.26+1.5%	75	0	43	0	17	17	92	35
Glufosinate+Scoil+Molasses	0.26+1.5%+2%	57	0	40	0	47	31	81	36
Glufosinate+AMS+R-11	0.26+3+0.25%	73	0	65	0	75	72	94	54
Gluf+AMS+R-11+Molasses	0.26+3+0.25%+2%	86	0	59	0	73	58	89	52
Glufosinate+AMS+Scoil	0.26+3+1.5%	88	0	62	0	58	58	96	52
Gluf+AMS+Scoil+Molasses	0.26+3+1.5%+2%	82	0	60	0	78	70	94	55
Glufosinate+ClassActII	0.26+2.5%	75	0	44	0	70	76	90	51
Glufosinate+AG0006	0.26+2.5%	80	0	53	0	62	37	90	46
Glufosinate+CL9913	0.26+2.5%	55	0	52	0	83	72	95	51
Glufosinate+CL9804	0.26+2.5%	83	0	57	0	65	45	90	48
Imazamox	0.021	43	37	0	0	55	25	79	34
Imazamox+Molasses	0.021+2%	84	84	3	0	83	71	83	58
Imazamox+AMS	0.021+3	78	72	2	0	76	43	79	49
Imazamox+AMS+Molasses	0.021+3+2%	91	90	0	0	79	66	83	58
Imazamox+R-11	0.021+0.25%	93	93	0	0	96	88	97	67
Imazamox+R-11+Molasses	0.021+0.25%+2%	90	91	0	0	91	94	93	66
Imazamox+Scoil	0.021+1.5%	89	91	0	0	97	98	98	67
Imazamox+Scoil+Molasses	0.021+1.5%+2%	92	92	0	0	95	92	97	67
Imazamox+AMS+R-11	0.021+3+0.25%	95	95	0	0	98	99	99	69
Imazamox+AMS+R-11+Molas	0.021+3+0.25%+2%	95	93	0	0	93	85	89	65
Imazamox+AMS+Scoil	0.021+3+1.5%	97	96	0	0	99	99	99	70
Imaz+AMS+Scoil+Molasses	0.021+3+1.5%+2%	97	96	0	2	99	99	99	70
Desm+Tfsu+Clpy+Qufp (3X)	0.08+0.004+0.03+0.017	0	0	100	27	96	43	47	45
Desm+Tfsu+Clpy+Qufp+Molasses (3X)	0.08+0.004+0.03+0.017+2%	0	0	100	55	40	51	60	43
Desm+Tfsu+Clpy+Qufp+AMS (3X)	0.08+0.004+0.03+0.017+3	0	0	100	47	83	77	86	56
Desm+Tfsu+Clpy+Qufp+AMS+Molasses (3X)	0.08+0.004+0.03+0.017+3+2%	0	0	100	41	82	70	87	54
Desm+Tfsu+Clpy+Qufp+Scoil (3X)	0.08+0.004+0.03+0.017+1.5%	0	0	100	100	100	100	100	71
Desm+Tfsu+Clpy+Qufp+Scoil+Molasses (3X)	0.08+0.004+0.03+0.017+1.5%+2%	0	0	100	98	99	98	100	70
Desm+Tfsu+Clpy+Qufp+AMS+Scoil (3X)	0.08+0.004+0.03+0.017+3+1.5%	0	0	100	99	100	100	100	71
Desm+Tfsu+Clpy+Qufp+AMS+Scoil+Molas (3X)	0.08+0.004+0.03+0.017+3+1.5%+2%	0	0	100	100	100	100	100	71
Nicosulfuron	0.016	2	2	2	0	62	56	55	25
Nicosulfuron+Molasses	0.016+2%	15	7	2	0	85	63	79	35
Nicosulfuron+Scoil	0.016+1.5%	8	7	5	0	100	100	98	45
Nicosulfuron+Scoil+Molasses	0.016+1.5%+2%	57	39	12	0	97	99	93	56

(Table continued on next page.)

Molasses as a spray adjuvant, Fargo, 2000. (continued)

Treatment*	Rate	RR Sgbt	LL Sgbt	RR Soyb	LL Corn	Barl	Oats	Fxmi	Avg. Cntl
	lb/A	%	%	%	%	%	%	%	%
EXP MEAN		46	30	34	18	78	69	89	52
C.V. %		29	38	33	34	20	21	8	11
LSD 5%		22	18	18	10	25	23	12	9
LSD 1%		29	24	24	13	33	31	16	12
# OF REPS		3	3	3	3	3	3	3	3

*AMS=ammonium sulfate; Scoil=methylated seed oil from AGSCO; R-11=non-ionic surfactant from Wilbur-Ellis; Class Act II=surfactant and fertilizer blend from Cenex; Corral Liquid=liquid ammonium sulfate from Cenex.

Summary

The summary is from the data averaged over both evaluation dates and all species, the last column in the last table. The standard adjuvant for glyphosate (Roundup Ultra) and glufosinate was AMS. Glyphosate alone, glyphosate + R-11, glyphosate + AMS + R-11, and glyphosate + Corral Liquid gave less control than glyphosate + AMS. All other adjuvants plus glyphosate gave control similar to glyphosate + AMS. Glufosinate + Scoil and glufosinate + Scoil + molasses gave less control than glufosinate + AMS. Glufosinate + molasses gave greater control than glufosinate + AMS. All other adjuvants plus glufosinate gave control similar to glufosinate + AMS.

The standard adjuvant for imazamox, the micro-rate and nicosulfuron was Scoil. Imazamox alone or plus molasses, AMS, or AMS + molasses gave less control than imazamox + Scoil. All other adjuvants plus imazamox gave control similar to imazamox + Scoil. The micro-rate alone or plus molasses, AMS, or AMS + molasses gave less control than any treatment that included the micro-rate + Scoil. Nicosulfuron + Scoil gave greater control than nicosulfuron alone or nicosulfuron + molasses but nicosulfuron + Scoil + molasses gave greater control than nicosulfuron + Scoil.

Molasses was as good as the standard adjuvant with glyphosate and was worse than the standard adjuvant with imazamox and the micro-rate. Molasses was better than the standard adjuvant with glufosinate and molasses + Scoil was better than Scoil with nicosulfuron.

Glufosinate and conventional herbicides on sugarbeet, Crookston, 2000. (Dexter) 'Beta 2012 Liberty Link' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 2. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Herbicide treatments were applied May 22, May 29, June 6 and June 12. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 19. Redroot pigweed and common lambsquarters control were evaluated June 19 and July 15.

Date of Application	May 22	May 29	June 6	June 12
Time of Day	11:20 am	11:00 am	12:00 pm	1:00 pm
Air Temperature (°F)	68	70	77	77
Relative Humidity (%)	71	71	30	51
Soil Temperature(°F at 6")	54	58	64	62
Wind Velocity (mph)	5	3	9	20
Cloud Cover (%)	100	100	10	50
Soil Moisture	good	fair	poor	fair
Sugarbeet	v 2.0	v2.0-v4.0	v4.5-v6.5	v6.2-v8.5
Redroot Pigweed	cot-2 leaf	2-4 leaf	4-8 leaf	1-4" tall
Common Lambsquarter	cot-4 leaf	2-8 leaf	4lf-2" tall	8lf-8" tall

Summary

Desmedipham & phenmedipham & ethofumesate + triflusulfuron at full or micro-rate gave better control of redroot pigweed than desmedipham & phenmedipham & ethofumesate at a full rate. Desmedipham + triflusulfuron + clopyralid + sethoxydim + Scoil at the micro-rate applied four times gave better redroot pigweed control than the micro-rate applied twice followed by desmedipham at 0.12 lb/A applied twice. Redroot pigweed control from glufosinate + AMS was less on July 15 than on June 19. Control from other treatments did not decline as much from June 19 to July 15 even though the date of last application was identical. Apparently some redroot pigweed plants recovered from the glufosinate treatment applied June 12.

(Experiment continued on next page.)

Glufosinate and conventional herbicides on sugarbeet, Crookston, 2000.
(continued)

Treatment*	Date of (Application)	Rate	June 19 Sgbt inj	June 19 Rrpw cntl	June 19 Colq cntl	July 15 Rrpw cntl	July 15 Colq cntl
		lb/A	%	%	%	%	%
Untreated Check		0	0	0	0	0	0
Desm&Phen&Etho (May 22)		0.33					
Desm&Phen&Etho (May 29)		0.33					
Desm&Phen&Etho+Sethoxydim (June 6)		0.33+0.3	12	75	99	65	98
Desm&Phen&Etho (May 22)		0.33					
Desm&Phen&Etho+Tfsu (May 29)		0.33+0.0156					
De&Ph&Et+Tfsu+Seth (June 6)		0.33+0.0156+0.3	8	96	99	95	100
Desm+Tfsu+Clpy+Seth+Scoil (May 22, May 29, June 6, June 12)		0.08+0.004+0.03+0.06+1.5%	3	98	92	98	98
De&Ph&Et+Tfsu+Clpy+Seth+Scoil (May 22, May 29, June 6, June 12)		0.08+0.004+0.03+0.06+1.5%	3	98	99	98	100
Desm+Tfsu+Clpy+Seth+Scoil (May 22, May 29)		0.08+0.004+0.03+0.06+1.5%					
Desmedipham (June 6, June 12)		0.12	7	77	89	63	83
Glufosinate+AMS (May 29, June 12)		0.26+3	0	93	83	78	73
Glufosinate+AMS (May 29, June 12)		0.31+3	7	94	93	60	90
Glufosinate+AMS (May 29, June 12)		0.36+3	2	96	93	81	87
EXP MEAN			5	81	83	71	81
C.V. %			70	4	6	14	7
LSD 5%			6	5	9	18	10
LSD 1%			8	7	12	24	14
# OF REPS			3	3	3	3	3

*Scoil=methylated seed oil from AGSCO; AMS=ammonium sulfate.

Sugarbeet tolerance to desmedipham and phenmedipham formulations, St. Thomas, 2000. (Dexter) 'Hilleshog 8277 Roundup Ready' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 27. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. All herbicide treatments were applied three times. The first application was 10:30 am May 23, when the air temperature was 72F, relative humidity was 26%, soil temperature at six inches was 52F, wind velocity was 12 mph, sky was clear, soil moisture was fair and sugarbeet was in the v 1.0 to v 2.8 stage. The second application was 4:00 pm May 29, when the air temperature was 72F, relative humidity was 71%, soil temperature at six inches was 58F, wind velocity was 2 mph, cloud cover was 100%, soil moisture was poor and sugarbeet was in the v 1.0 to v 3.5 stage. The third application was 2:30 pm June 5, when the air temperature was 76F, relative humidity was 21%, soil temperature at six inches was 54F, wind velocity was 12 mph, cloud cover was 10%, soil moisture was poor and sugarbeet was in the v 2.5 to v 7.5 stage. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Lorsban 4E insecticide at 1 quart per acre + clethodim at 8 fluid ounces per acre was applied over all plots June 7. Glyphosate at 1.5 quarts per acre was applied over all plots June 28. Sugarbeet was hand thinned to an eight inch spacing June 22 and cultivated June 27. Sugarbeet injury was evaluated June 19 and July 14. Sugarbeet from the center two rows of 30 foot long plots was counted and harvested September 28.

Summary

The entire plot area was treated with glyphosate on June 28 and weed control from glyphosate was excellent. Weed density was low in the plots but weed competition between April 27 planting and the hand thinning, cultivation and glyphosate treatment from June 22 to June 28 may have reduced sugarbeet yield in the control plots. The other plots were first treated with herbicide on May 23, about one month earlier than weed control practices in the control plots. Therefore, the base yield in the experiment will be considered the average of desmedipham & phenmedipham, desmedipham & phenmedipham & ethofumesate and desmedipham all at 0.125 lb/A. The average yield for these three treatments was 6364 lb/A extractable sucrose and 20.3 T/A. Treatments with significantly lower yields were: control; AE38584 at 0.25 and 0.5 lb/A; desmedipham & phenmedipham at 0.25 and 0.5 lb/A; AE38584 + Scoil; desmedipham & phenmedipham + Scoil; AE49913 at 0.5 lb/A; desmedipham & phenmedipham & ethofumesate at 0.5 lb/A; AE38107 at 0.5 lb/A; and desmedipham at 0.5 lb/A.

Plots treated with AE38584 + Scoil yielded less than plots treated with desmedipham & phenmedipham + Scoil. Other comparisons of old and new formulations showed no significant difference in yield. AE38584 caused more sugarbeet injury than desmedipham & phenmedipham. Desmedipham & phenmedipham & ethofumesate caused more sugarbeet injury than AE49913. Desmedipham and AE38107 caused similar levels of sugarbeet injury.

(Experiment continued on next page.)

Sugarbeet tolerance to desmedipham and phenmedipham formulations, St. Thomas, 2000. (continued)

Treatment	Rate	6-19 Sgbt inj	7-14 Sgbt inj	Sgbt Popl	Sucr	Root Yield	Impur Index	Extr Sucr
	lb/A	%	%	plt/60'	%	ton/A		lb/A
Control	0	0	9	74	17.4	16.9	592	5334
AE38584[2] (3X)	0.125	10	14	85	17.5	19.0	619	6083
AE38584 (3X)	0.25	36	21	80	17.4	17.1	597	5433
AE38584 (3X)	0.5	78	50	70	17.1	14.7	645	4524
Desmedipham&Phenmedipham (3X)	0.125	5	9	87	17.4	20.0	643	6325
Desmedipham&Phenmedipham (3X)	0.25	31	13	82	16.7	18.1	761	5391
Desmedipham&Phenmedipham (3X)	0.5	61	31	76	17.0	15.7	704	4820
AE38584+Scoil[1] (3X)	0.25+1.5%	56	26	76	16.5	14.7	762	4281
Desm&Phen+Scoil (3X)	0.25+1.5%	55	25	82	16.9	17.3	711	5235
AE49913[3] (3X)	0.125	16	14	88	17.1	19.6	649	6084
AE49913 (3X)	0.25	40	16	100	16.7	18.5	702	5560
AE49913 (3X)	0.5	66	26	86	16.8	16.8	707	5044
Desm&Phen&Etho (3X)	0.125	14	18	82	17.3	19.4	625	6095
Desm&Phen&Etho (3X)	0.25	40	23	83	16.9	18.3	790	5459
Desm&Phen&Etho (3X)	0.5	78	48	63	17.0	13.6	639	4185
AE49913+Scoil (3X)	0.25+1.5%	31	17	98	17.0	19.2	688	5852
Desm&Phen&Etho+Scoil (3X)	0.25+1.5%	35	18	84	16.8	18.3	744	5419
AE38107[4] (3X)	0.125	11	14	84	16.8	20.0	756	5864
AE38107 (3X)	0.25	25	17	85	17.3	21.4	660	6603
AE38107 (3X)	0.5	71	41	73	16.9	17.4	672	5295
Desmedipham (3X)	0.125	8	14	92	17.2	21.6	662	6671
Desmedipham (3X)	0.25	24	15	83	17.0	20.3	708	6199
Desmedipham (3X)	0.5	61	38	73	17.5	16.9	553	5431
AE38107+Scoil (3X)	0.25+1.5%	39	21	86	17.2	18.8	642	5829
Desmedipham+Scoil (3X)	0.25+1.5%	51	26	89	16.9	18.9	685	5771
EXP MEAN		38	22	82	17.0	18.1	677	5551
C.V. %		19	27	13	2.7	11.8	14	12
LSD 5%		10	9	15	NS	3.0	NS	946
LSD 1%		14	11	20	NS	4.0	NS	1256
# OF REPS		4	4	4	4	4	4	4

[1]Scoil=methylated seed oil from AGSCO
[2]AE38584=new formulation of desmedipham&phenmedipham (Betamix)
[3]AE49913=new formulation of desmedipham&phenmedipham&ethofumesate (Progress)
[4]AE38107=new formulation of desmedipham (Betanex)

New formulations in the micro-rates, Fargo, 2000. (Dexter) 'Hilleshog Blazer' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 9. All herbicide treatments were applied three times. The first application was 10:00 am May 31, when the air temperature was 66F, relative humidity was 44%, soil temperature at six inches was 56F, wind velocity was 6 mph, sky was clear, soil moisture was good, sugarbeet was in the v 1.2 to v 2.0 stage and redroot pigweed was in the cotyledon to 2 leaf stage. The second application was 9:30 am June 6, when the air temperature was 57F, relative humidity was 63%, soil temperature at six inches was 51F, wind velocity was 10 mph, cloud cover was 10%, soil moisture was good, sugarbeet was in the v 2.0 to v 3.8 stage and redroot pigweed was in the 1 to 4 leaf stage. The third application was 1:00 pm June 12, when the air temperature was 77F, relative humidity was 51%, soil temperature at six inches was 62F, wind velocity was 20 mph, cloud cover was 50%, soil moisture was fair, sugarbeet was in the v 4.0 to v 6.3 stage and redroot pigweed was in the 2 to 8 leaf stage. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sethoxydim + crop oil at 0.3 lb ai/A + 1 quart per acre was applied over all plots June 2 and July 10. Sugarbeet was hand thinned to an 8 inch spacing July 17 and cultivated July 11. Sugarbeet injury and redroot pigweed control were evaluated July 6. Sugarbeet from the center two rows of 30 foot long plots was counted and harvested September 18.

Summary

All treatments gave good control of redroot pigweed. AE38584 (new formulation) gave more sugarbeet injury than desmedipham & phenmedipham (old formulation) at full rates. Desmedipham & phenmedipham & ethofumesate gave more sugarbeet injury than AE49913 at full rates. AE38107 and desmedipham gave similar sugarbeet injury. Desmedipham & phenmedipham & ethofumesate at 0.25/0.33/0.33 lb/A caused more sugarbeet injury than any other treatment. Treatments had no significant effect on sugarbeet population or yield.

(Experiment continued on next page.)

New formulations in the micro-rates, Fargo, 2000. (continued)

Treatment	Rate	Sgbt inj	Rrpw cntl	Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	lb/A	%	%	plt/60'	%	%	ton/a		lb/A
AE38584[2]+Tfsu+Clpy+Scoil[1] (3X)	0.08+0.004+0.03+1.5%	4	97	96	16.7	2.0	18.3	633	5542
AE38584+Tfsu+Clpy (3X)	0.08+0.004+0.03	0	92	96	16.4	2.2	18.9	648	5625
Des&Phen+Tfsu+Clpy+Scoil(3X)	0.08+0.004+0.03+1.5%	0	100	97	16.8	1.3	17.8	607	5436
AE38584 (3X)	0.25/0.33/0.33	10	100	105	16.9	2.7	18.4	640	5654
Desmedipham&Phenmedipham (3X)	0.25/0.33/0.33	4	100	94	16.7	2.0	17.8	635	5385
AE49913[3]+Tfsu+Clpy+Scoil (3X)	0.08+0.004+0.03+1.5%	0	96	94	16.7	1.8	17.4	630	5242
AE49913+Tfsu+Clpy (3X)	0.08+0.004+0.03	3	98	97	16.8	2.2	16.9	638	5143
De&Ph&Et+Tfsu+Clpy+Scoil (3X)	0.08+0.004+0.03+1.5%	1	100	93	16.3	2.6	17.6	675	5166
AE49913 (3X)	0.25/0.33/0.33	9	96	92	16.8	1.7	15.7	620	4794
Desm&Phen&Etho(3X)	0.25/0.33/0.33	18	99	94	16.9	2.3	16.6	617	5097
AE38107[4]+Tfsu+Clpy+Scoil (3X)	0.08+0.004+0.03+1.5%	4	100	97	17.2	1.1	17.3	598	5401
AE38107+Tfsu+Clpy (3X)	0.08+0.004+0.03	0	94	97	16.5	1.8	17.1	653	5103
Desm+Tfsu+Clpy+Scoil (3X)	0.08+0.004+0.03+1.5%	1	100	94	16.8	1.4	17.6	620	5363
AE38107 (3X)	0.25/0.33/0.33	6	100	99	16.8	1.9	17.5	612	5341
Desmedipham (3X)	0.25/0.33/0.33	6	100	94	17.2	1.5	16.8	576	5290
EXP MEAN		4	98	96	16.8	1.9	17.5	627	5305
C.V. %		91	4	7	2.3	43.7	7.8	8	9
LSD 5%		6	NS	NS	NS	NS	NS	NS	NS
LSD 1%		8	NS	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4	4

[1]Scoil=methylated seed oil from AGSCO
[2]AE38584=new formulation of desmedipham&phenmedipham (Betamix)
[3]AE49913=new formulation of desmedipham&phenmedipham&ethofumesate (Progress)
[4]AE38107=new formulation of desmedipham (Betanex)

Timing of weed removal in Roundup Ready sugarbeet, Crookston, 2000. (Dexter) 'Hilleshog Empire Roundup Ready' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 2. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Eminent fungicide at 13 oz per acre was applied to the entire plot area July 15 and July 26. Sugarbeet was hand thinned to an 8 inch spacing July 6. Sugarbeet injury and volunteer wheat, redroot pigweed and green and yellow foxtail control were evaluated July 21 and August 4. Sugarbeet from the center two rows of 30 foot long plots was counted and harvested October 3.

Date of Application	May 19	May 26	June 2	June 9	June 17	June 23	June 30	July 10	July 14
Time of Day	11:00 am	10:00 am	3:30 pm	10:30 am	11:30 am	12:30 pm	12:30 pm	4:00 pm	10:30 am
Air Temperature (°F)	67	63	70	86	59	82	84	87	80
Rel. Humidity (%)	34	65	60	37	78	62	58	58	72
Soil Temp.(°F at 6")	56	59	59	69	58	69	68	72	70
Wind Velocity (mph)	9	4	5	5	3	2	9	2	0
Cloud Cover (%)	10	20	50	10	85	60	20	30	30
Soil Moisture	good	fair	good	fair	good	good	good	good	good
Sugarbeet	coty	v2.0-2.5	v3.5-4.5	v5.5-6.7	v9.3-12.7	v10-14	v11-16	v14-19	v15-20
Redroot Pigweed	cot-2 lf	2-5 lf	2lf-4"	5lf-5"	4lf-8"	10-15"	2lf-16"	3lf-42"	1-48"
Volunteer Wheat	2-4"	6-8"	8-12"	6-13"	7-18"	18-24"	24-36"	8"-42"	4-48"
Green & Yellow Foxtail	emer-1"	1-2"	emer-3.5"	3-4.5"	3-5"	3-10"	1-12"	emer-30"	2-36"

		July 21				August 4			
Treatment*	Date of (Application)	Rate	Sgbt inj	Rrpw cntl	Vowh cntl	Gr&Y Fxtl cntl	Sgbt inj	Rrpw cntl	Vowh cntl	Gr&Y Fxtl cntl
Glyphosate	(May 26, June 9)	0.75	0	97	98	99	3	100	99	99
Glyphosate	(May 26, June 9, June 23)	0.75	0	99	99	100	3	100	100	100
Glyphosate	(May 26, June 9, July 10)	0.75	0	98	100	100	3	99	100	100
Glyphosate	(June 2, June 17)	0.75	3	98	99	99	5	98	99	98
Glyt	(June 2, June 17, June 30)	0.75	3	99	100	100	4	99	100	100
Glyt	(June 2, June 17, July 14)	0.75	6	99	100	100	5	97	100	100
Desm+Tfsu+Clpy+Clet+MethOil	(May 19, May 26, June 2, June 9)	0.08+0.004+0.03+0.03+1.5%	1	98	98	100	4	99	98	99
C.V. %			112	1	1	1	71	1	1	1
LSD 5%			3	1	1	1	NS	NS	1	NS
LSD 1%			4	1	1	NS	NS	NS	1	NS
# OF REPS			4	4	4	4	4	4	4	4

*MethOil=methylated seed oil from Terra.

(Experiment continued on next page.)

Timing of weed removal in Roundup Ready sugarbeet, Crookston, 2000. (continued)

Treatment*	Rate	Sgbt Popl	Sucrose	Root Yield	Impurity Index	Extract Sucrose
	lb/A	plt/60'	%	ton/a		lb/A
Glyphosate (May 26, June 9)	0.75	84	17.8	23.2	605	7421
Glyphosate (May 26, June 9, June 23)	0.75	88	17.5	26.0	636	8183
Glyphosate (May 26, June 9, July 10)	0.75	89	17.3	26.3	687	8134
Glyphosate (June 2, June 17)	0.75	84	17.8	24.1	548	7831
Glyt (June 2, June 17, June 30)	0.75	91	18.3	22.5	549	7523
Glyt (June 2, June 17, July 14)	0.75	87	18.3	22.2	526	7441
Desm+Tfsu+Clpy+Clet+MethOil (May 19, May 26, June 2, June 9)	0.08+0.004+0.03+0.03+1.5%	87	17.5	22.6	582	7145
C.V. %		6	4.3	12.0	22	10
LSD 5%		NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4

*MethOil=methylated seed oil from Terra.

Summary

All treatments gave 97% or greater weed control and 6% or less sugarbeet injury. Yields were statistically similar but plots treated three times with glyphosate starting at the two-leaf sugarbeet stage had the greatest extractable sucrose per acre. Plots treated four times with conventional herbicides yielded the least.

Betanal on ALS resistant kochia, Hillsboro, 2000. (Dexter) 'Beta 2084' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 24. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Postemergence herbicide treatments were applied May 12, May 18, May 25 and June 1. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and kochia, redroot pigweed and common lambsquarters control were evaluated June 16.

Date of Application	May 12	May 18	May 25	June 1
Time of Day	7:00 pm	10:00 am	7:00 pm	1:00 pm
Air Temperature (°F)	50	59	75	66
Relative Humidity (%)	61	23	21	50
Soil Temperature(°F at 6")	50	50	69	58
Wind Velocity (mph)	10	12	0	0
Cloud Cover (%)	0	0	5	75
Soil Moisture	good	fair	fair	good
Sugarbeet	cotyledon	2 leaf	4 leaf	6 leaf
Redroot Pigweed	2 leaf	4 leaf	6-8 leaf	8 lf-2 inch
Common Lambsquarter	2-4 leaf	4-6 leaf	6 leaf	6-8 leaf
Kochia	1 inch	1.5-2 inch	2-3 inch	3-4 inch

Summary

Phenmedipham + triflusulfuron gave better control of kochia, common lambsquarters and redroot pigweed than phenmedipham alone. The 77% kochia control from phenmedipham + triflusulfuron indicates that a portion but not all of the kochia population at this location was resistant to ALS inhibitor herbicides like triflusulfuron. Desmedipham & phenmedipham & ethofumesate gave better kochia control than phenmedipham.

(Experiment continued on next page.)

Betanal on ALS resistant kochia, Hillsboro, 2000. (continued)

Treatment*	Rate	Sgbt inj	Kocz cntl	Colq cntl	Rrpw cntl
	lb/A	%	%	%	%
Untreated Check	0	0	0	0	0
Phenmedipham/Phenmedipham/Phenmedipham	0.25/0.33/0.33	1	55	95	3
Phenmedipham+Tfsu/Phen+Tfsu/ Phenmedipham+Tfsu	0.25+0.0156/0.33+0.0156 0.33+0.0156	3	77	100	90
Phenmedipham+Triflusulfuron+Clpy/ Phenmedipham+Triflusulfuron+Clpy/ Phenmedipham+Triflusulfuron+Clpy	0.25+0.0156+0.089 0.33+0.0156+0.089 0.33+0.0156+0.089	4	84	100	96
Desm&Phen&Etho/Desm&Phen&Etho/De&Ph&Et	0.25/0.33/0.33	5	91	100	83
Desm&Phen&Etho+Triflusulfuron/ Desm&Phen&Etho+Triflusulfuron/ Desm&Phen&Etho+Triflusulfuron	0.25+0.0156 0.33+0.0156 0.33+0.0156	7	91	99	100
Desm&Phen&Etho+Tfsu+Clpy/ Desm&Phen&Etho+Tfsu+Clpy/ Desm&Phen&Etho+Tfsu+Clpy	0.25+0.0156+0.089 0.33+0.0156+0.089 0.33+0.0156+0.089	13	94	100	100
AE49913/AE49913/AE49913	0.25/0.33/0.33	16	73	100	87
AE49913+Tfsu/AE49913+Tfsu/ AE49913+Triflusulfuron	0.25+0.0156/0.33+0.0156 0.33+0.0156	13	93	100	100
AE49913+Triflusulfuron+Clopyralid/ AE49913+Triflusulfuron+Clopyralid/ AE49913+Triflusulfuron+Clopyralid	0.25+0.0156+0.089 0.33+0.0156+0.089 0.33+0.0156+0.089	20	92	100	100
EXP MEAN		8	75	89	76
C.V. %		101	19	4	11
LSD 5%		12	20	5	12
LSD 1%		NS	27	6	16
# OF REPS		4	4	4	4

*AE49913=new formulation of desmedipham & phenmedipham & ethofumesate (Progress).

Grass control in sugarbeet, Crookston, 2000. (Dexter) 'Jud' oats at 59 lb/A and 'Foster' barley at 67 lb/A were seeded in 5 foot wide strips and Siberian foxtail millet at 40 lb/A was seeded in a 10 foot wide strip across herbicide plots May 1. 'Beta 2012 Liberty Link' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 1. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. The first herbicide treatments were applied 10:15 am May 22 when the air temperature was 68F, relative humidity was 71%, soil temperature at six inches was 54F, wind velocity was 5 mph, cloud cover was 80%, soil moisture was good, sugarbeet was in the v2.0 stage, oats and barley were 3 to 4 inches tall, redroot pigweed was in the cotyledon to 2 leaf stage and foxtail millet was 0.5 inches tall. The second herbicide application was 12:00 pm June 6 when the air temperature was 77F, relative humidity was 30%, soil temperature at six inches was 64F, wind velocity was 9 mph, cloud cover was 10%, soil moisture was poor, sugarbeet was in the v 4.5 to v 6.5 leaf stage, oats and barley were 6 to 8 inches tall, redroot pigweed was in the 4 to 8 leaf stage and foxtail millet was 2 to 4 inches tall. The third herbicide application was 4:00 pm June 19 when the air temperature was 69F, relative humidity was 72%, soil temperature at six inches was 66F, wind velocity was 10 mph, cloud cover was 100%, soil moisture was good, sugarbeet was in the v 8.8 to v 12.5 leaf stage, oats and barley were 10 to 12 inches tall, redroot pigweed was 2 to 6 inches tall and foxtail millet was 8 inches tall. All herbicide treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and barley, oats, foxtail millet and redroot pigweed control were evaluated July 3 and July 15.

(Table on next page.)

Summary

Clethodim, BAS62000H, and sethoxydim gave total or nearly total grass control. Glufosinate + Scoil gave less control of grass and redroot pigweed than glufosinate + AMS. Glufosinate + clethodim + Scoil gave total grass control but less control of redroot pigweed than glufosinate + AMS. Glufosinate + clethodim gave redroot pigweed control similar to glufosinate + AMS. These results suggest that Scoil antagonized weed control from glufosinate.

(Experiment continued on next page.)

Grass control in sugarbeet, Fargo, 2000. (continued)

Treatment*	Date of (Application)	Rate	July 3 Barl cntl	July 3 Oats cntl	July 3 Fxmi cntl	July 3 Rrpw inj	July 3 Sgbt cntl	July 15 Barl cntl	July 15 Oats cntl	July 15 Fxmi cntl	July 15 Rrpw cntl	July 15 Sgbt inj
		lb/A	%	%	%	%	%	%	%	%	%	%
Clethodim+Scoil	(June 6)	0.094+1.5%	100	100	100	0	0	100	100	100	0	0
Clethodim+Scoil	(June 6)	0.125+1.5%	100	100	100	0	0	100	100	100	0	0
Glufosinate+AMS	(May 22, June 6)	0.26+3	33	43	99	86	0	25	24	98	91	0
Glufosinate+AMS	(May 22, June 6, June 19)	0.26+3	93	94	100	100	0	86	88	100	100	0
Glufosinate+AMS	(June 6, June 19)	0.26+3	86	91	99	88	0	78	79	99	91	0
Glufosinate+Scoil	(May 22, June 6)	0.26+1.5%	16	23	90	61	0	10	4	95	73	0
Glufosinate+Scoil	(June 6, June 19)	0.26+1.5%	35	59	98	71	0	33	38	98	76	0
Glufosinate+Clethodim+Scoil	(May 22, June 6)	0.26+0.03+1.5%	100	100	100	70	0	100	100	100	75	0
Glufosinate+Clethodim+Scoil	(June 6, June 19)	0.26+0.03+1.5%	100	100	100	62	0	100	99	100	64	0
Glufosinate+Clethodim+Scoil	(May 22,June 6,June 19)	0.26+0.03+1.5%	100	100	100	85	0	100	100	100	94	0
Glufosinate+Clethodim	(June 6, June 19)	0.26+0.03	100	100	100	81	0	100	100	100	86	0
BAS62000H+Herbimax+28%N	(June 6)	0.124+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
BAS62000H+Herbimax+28%N	(June 6)	0.248+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
Sethoxydim+Herbimax+28%N	(June 6)	0.188+1.25%+1.25%	99	100	100	0	0	99	100	100	0	0
Sethoxydim+Herbimax+28%N	(June 6)	0.28+1.25%+1.25%	99	100	100	1	0	100	100	100	1	0
BAS62000H+Herb+28%N	(June 6, June 19)	0.124+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
BAS62000H+Herbimax+28%N	(June 6)	0.248+1.25%+1.25%										
	(June 19)	0.124+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
Seth+Herbimax+28%N	(June 6, June 19)	0.188+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
Sethoxydim+Herbimax+28%N	(June 6)	0.28+1.25%+1.25%										
	(June 19)	0.188+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
BAS62000H+Herbimax	(June 6)	0.091+1.25%	100	100	100	0	0	100	100	100	0	0
BAS62000H+Herbimax+28%N	(June 6)	0.091+1.25%+1.25%	100	100	100	0	0	100	100	100	0	0
Clethodim+Scoil+28%N	(June 6)	0.125+1.5%+1.5%	100	100	100	0	0	100	100	100	0	0
EXP MEAN			89	91	99	32	0	88	88	100	34	0
C.V. %			6	5	1	28	0	6	6	1	19	0
LSD 5%			8	6	1	13	NS	7	7	1	9	NS
LSD 1%			11	8	2	17	NS	10	9	2	12	NS
# OF REPS			4	4	4	4	4	4	4	4	4	4

*Herbimax=petroleum oil from Loveland; AMS=ammonium sulfate; 28%N=28% nitrogen solution containing urea and NH_4NO_3; Scoil=methylated seed oil from AGSCO.

Fungicide and herbicide combinations, Fargo, 2000. (Dexter) 'Jud' oats at 59 lb/A and 'Foster' barley at 67 lb/A were seeded in 5 foot wide strips and Siberian foxtail millet at 40 lb/A was seeded in a 10 foot wide strip across herbicide plots May 18. 'Empire Roundup Ready' sugarbeet and a blend of 'Beta 8088 Liberty Link' and 'Beta 992 Liberty Link' sugarbeet were each seeded in three 22 inch rows across the herbicide plots May 18. All herbicide treatments were applied twice in 17 gpa water at 40 psi through 8002 nozzles to the center 6.67 feet of 11 foot wide plots. The first herbicide application was 11:30 am June 29 when the air temperature was 70F, relative humidity was 69%, soil temperature at six inches was 62F, wind velocity was 5 mph, sky was clear, soil moisture was good, sugarbeet was in the v4.5 to v7.5 stage, oats and barley were 14-20 inches tall, and foxtail millet and yellow foxtail were 8-10 inches tall. The second herbicide application was 11:00 am July 11 when the air temperature was 79F, relative humidity was 68%, soil temperature at six inches was 72F, wind velocity was 11 mph, cloud cover was 100%, soil moisture was good, sugarbeet was in the 8 to 12 leaf stage and oats, barley, foxtail millet and yellow foxtail were all heading. Oats, barley, foxtail millet, Roundup Ready sugarbeet, Liberty Link sugarbeet and yellow foxtail were evaluated July 16 and July 27.

		July 16						July 27					
Treatment*	Rate	Oats cntl	Barl cntl	Fxmi cntl	RR Sgbt inj	LL Sgbt inj	Yeft cntl	Oats cntl	Barl cntl	Fxmi cntl	RR Sgbt inj	LL Sgbt inj	Yeft cntl
	lb/A	%	%	%	%	%	%	%	%	%	%	%	%
BAS50000F+Herbimax	0.2+1%	0	0	0	0	0	0	0	0	0	0	0	0
BAS50000F+Seth+Herbimax	0.2+0.188+1%	95	100	98	0	0	94	94	99	99	0	0	99
BAS50000F+Clet+Herbimax	0.2+0.094+1%	100	100	100	0	0	98	100	100	100	0	0	100
BAS50000F+Qufp+Herbimax	0.2+0.055+1%	85	100	96	0	0	82	94	100	100	0	0	100
Sethoxydim+Herbimax	0.188+1%	100	100	100	0	0	96	99	100	100	0	0	100
Clethodim+Herbimax	0.094+1%	100	100	100	0	0	100	100	100	100	0	0	100
Quizalofop+Herbimax	0.055+1%	100	100	100	0	0	99	100	100	100	0	0	100
BAS50000F+Herbimax+Gluf+AMS	0.2+1%+0.357+3	100	100	100	100	0	100	97	100	100	98	0	100
Glufosinate+AMS	0.357+3	100	100	100	100	0	100	97	99	100	98	0	100
BAS50000F+Herbi+Glyphosate	0.2+1%+0.75	100	100	100	0	100	100	100	100	100	0	100	100
Glyphosate	0.75	100	100	100	0	100	100	100	100	100	0	100	100
EXP MEAN		89	91	90	18	18	88	89	91	91	18	18	91
C.V. %		5	0	1	0	0	4	3	1	0	4	0	0
LSD 5%		6	0	2	0	0	5	4	1	0	1	0	1
LSD 1%		8	0	3	0	0	7	6	2	1	1	0	1
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

*Herbimax=petroleum oil from Loveland; AMS=ammonium sulfate.

Summary

The fungicide BAS50000F, gave no weed control. BAS5000F antagonized grass control from sethoxydim and quizalofop but not from clethodim, glufosinate or glyphosate.

Fungicide combinations on weed free sugarbeet, Fargo, 2000. (Dexter) 'Empire Roundup Ready' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 9. All treatments were applied two times. The first application was 4:00 pm June 28 when the air temperature was 81F, relative humidity was 36%, soil temperature at six inches was 70F, wind velocity was 10 mph, cloud cover was 90%, soil moisture was good and sugarbeet was in the 8 to 10 leaf stage. The second application was 11:00 am July 11 when the air temperature was 79F, relative humidity was 68%, soil temperature at six inches was 72F, wind velocity was 11 mph, cloud cover was 100%, soil moisture was good and sugarbeet was in the 10 to 14 leaf stage. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Glyphosate at 1.5 and 1.0 quarts per acre was applied over all plots May 31 and July 10 respectively. Sethoxydim + Dash HC at 0.3 lb ai/A + 1 pt/A was applied over the entire experiment June 2. Sugarbeet was hand thinned to an eight inch spacing July 17 and cultivated July 11. Sugarbeet injury was evaluated July 16. Sugarbeet from the center two rows of 30 foot long plots was counted and harvested September 18.

Treatment*	Rate	Sgbt inj	Sgbt Popl	Sucr	Root Yield	Impur Index	Extr Sucr
	lb/A	%	plt/60'	%	ton/A		lb/A
BAS50000F+Herbimax	0.2+1%	0	87	14.2	21.0	1129	4940
BAS50000F+Seth+Herbimax	0.2+0.188+1%	0	98	15.0	22.1	957	5668
BAS50000F+Clet+Herbimax	0.2+0.094+1%	0	91	15.2	23.6	943	6153
BAS50000F+Qufp+Herbimax	0.2+0.055+1%	0	91	14.1	24.0	1159	5584
Sethoxydim+Herbimax	0.188+1%	0	90	14.6	22.0	1105	5319
Clethodim+Herbimax	0.094+1%	0	90	14.5	22.9	1114	5521
Quizalofop+Herbimax	0.055+1%	0	90	15.0	22.3	994	5701
BAS50000F+Herbi+Gluf+AMS	0.2+1%+0.357+3	99	38	11.7	5.6	1596	1025
BAS50000F+Herbi+Glyphosate	0.2+1%+0.75	0	91	15.0	21.4	965	5444
Glyphosate	0.75	0	91	14.6	22.8	1119	5535
EXP MEAN		10	86	14.4	20.8	1108	5089
C.V. %		0	7	6.3	8.6	17	11
LSD 5%		0	8	1.3	2.6	266	819
LSD 1%		0	11	1.8	3.5	360	1106
# OF REPS		4	4	4	4	4	4

*Herbimax=petroleum oil concentrate from Loveland; AMS=ammonium sulfate.

Summary

Glyphosate was applied twice to all plots to achieve total weed control. The variety was Roundup Ready but not Liberty Link so the glufosinate severely damaged the sugarbeet. Combining BAS 50000F with sethoxydim, clethodim, quizalofop or glyphosate had no significant influence on yield compared to the herbicides used alone.

Carryover of soybean herbicides, Fargo, 1998-2000. (Dexter) Preplant incorporated herbicides were applied 11:30 am May 5, 1998 when the air temperature was 70F, relative humidity was 30%, soil temperature at six inches was 56F, wind velocity was 7 mph, sky was clear and soil moisture was poor. PPI treatments were incorporated with a rototiller set 3 inches deep. 'Roundup Ready' soybean was solid seeded in seven inch rows at 70 pounds per acre May 5. Postemergence treatments were applied 12:00 pm July 2, 1998 when the air temperature was 80F, relative humidity was 61%, soil temperature at six inches was 70F, wind velocity was 5 mph, cloud cover was 100%, soil moisture was good and soybean was in the 3 to 4 trifoliolate stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of 20 foot wide by 50 foot long plots. Roundup Ultra at 1 quart per acre was applied to all plots June 4 and July 13, 1998. Soybean was flail shredded August 25, 1998. The plot area was tilled twice with a tandem disk and once with an 'Alloway Seed Better' field cultivator August 25. All tillage was parallel with the direction herbicides were applied. 'Beta 3712' sugarbeet was seeded 1.25 inches deep in 22 inch rows August 25. Sugarbeet injury was evaluated October 2. Spring tillage in 1999 was one pass with an 'Alloway Seed Better' field cultivator. 'SDF0402' wheat at 90 lb/A, 'Stander' barley at 66 lb/A, 'Neche' flax at 31 lb/A, 'Crusher' and 'Hyola 401' canola, 'Van der Have 66168' sugarbeet, 'IS Hybrid 5757' sunflower, 'Interstate Payco 3X417' corn, 'Upland' Navy bean at 116 lb/A, and 'Garst BPR23456' soybean at 116 lb/A were seeded in four foot wide drill strips across each herbicide plot May 27, 1999. Wheat, barley, soybean, navy bean, corn, sunflower, canola, sugarbeet and flax injury were evaluated June 21, 1999. Crop drill strips were flail shredded in September, 1999 and fall tillage was one pass with 'Conser-Till' chisel plow. Spring tillage was one pass with a 'Kongskilde Triple K' field cultivator May 5, 2000. 'Hilleshog Empire Roundup Ready' sugarbeet was seeded on the entire plot area May 5, 2000. Roundup Ultra herbicide at 1.5 qt/A and 1.0 qt/A was applied to the entire experiment May 25, 2000 and June 11, 2000 respectively. Sugarbeet injury was evaluated June 19 and July 19, 2000.

Summary

Herbicides were applied in the spring of 1998 and sugarbeet was seeded in August of 1998. All herbicides except CGA-277476 caused severe sugarbeet injury October 2, 1998. Several crops were seeded across the plots on May 27, 1999. Cloransulam POST and imazethapy POST caused significant injury to some crops while none of the other treatments caused significant crop injury on June 21, 1999. PPI and PRE cloransulam at 0.031 lb/A did not cause injury while cloransulam POST at 0.016 lb/A injured barley, corn, sunflower, canola, sugarbeet and flax. Sugarbeet was seeded across the plots on May 5, 2000. Chloransulam and imazethapyr caused severe sugarbeet injury on June 19 and July 29, 2000.

(Experiment continued on next page.)

Carryover of soybean herbicides, Fargo, 1998-2000. (continued)

1998 Treatment*	(Trade Name)	Time of Application	Rate	10-2-98	June 21, 1999									6-19-00	7-19-00
				Sgbt inj	Wht inj	Barl inj	Soyb inj	Nabe inj	Corn inj	Sufl inj	Cano inj	Sgbt inj	Flax inj	Sgbt inj	Sgbt inj
			lb/A	%	%	%	%	%	%	%	%	%	%	%	%
CGA-277476+X-77	(Expert)	POST	0.036+0.25%	38	0	0	0	0	0	0	0	0	0	0	0
CGA-277476+X-77	(Expert)	POST	0.071+0.25%	13	0	0	0	0	0	0	0	0	0	0	0
CGA-277476+X-77	(Expert)	POST	0.142+0.25%	3	0	0	0	0	0	0	0	0	0	0	0
Cloransulam	(FirstRate)	PPI	0.031	69	0	0	0	0	0	3	0	8	5	3	3
Cloransulam	(FirstRate)	PRE	0.031	89	0	0	0	0	0	0	0	3	3	5	5
Cloransulam+X-77	(FirstRate)	POST	0.016+.25%	100	0	28	0	0	38	89	81	98	85	65	59
Imazethapyr+X-77	(Pursuit)	POST	0.063+0.25%	100	0	0	0	0	0	9	39	100	59	82	72
Sulfentrazone	(Authority)	PPI	0.375	88	0	0	0	0	0	0	0	4	0	1	3
Isoxaflutole	(Balance)	PPI	0.094	85	0	0	0	0	0	0	0	0	0	0	5
EXP MEAN				65	0	3	0	0	4	11	13	23	17	17	16
C.V. %				27	0	207	0	0	151	48	84	26	33	72	104
LSD 5%				26	0	9	0	0	9	8	16	9	8	18	25
LSD 1%				35	0	12	0	0	12	11	22	12	11	25	33
# OF REPS				4	4	4	4	4	4	4	4	4	4	4	4

*X-77=non-ionic surfactant from Loveland.

Carryover of corn herbicides, Fargo, 1998-2000. (Dexter) Preplant incorporated herbicides were applied 11:30 am May 5, 1998 when the air temperature was 70F, relative humidity was 30%, soil temperature at six inches was 56F, wind velocity was 7 mph, sky was clear and soil moisture was poor. PPI treatments were incorporated with a rototiller set 3 inches deep. 'Liberty Link' corn was solid seeded in seven inch rows May 5. Postemergence treatments were applied 12:00 pm July 2, 1998 when the air temperature was 80F, relative humidity was 61%, soil temperature at six inches was 70F, wind velocity was 5 mph, cloud cover was 100%, soil moisture was good and corn was 5 to 9 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of 20 foot wide by 50 foot long plots. Corn stand was poor so all plots were tilled once with a 'Kongskilde Triple K' field cultivator and corn was replanted June 4. Liberty herbicide at 28 fluid ounces per acre was applied to all plots July 13, 1998. Corn was flail shredded August 25, 1998. The plot area was tilled twice with a tandem disk and once with an 'Alloway Seed Better' field cultivator August 25. Tillage was parallel with the direction herbicides were applied. 'Beta 3712' sugarbeet was seeded 1.25 inches deep in 22 inch rows August 25. Sugarbeet injury was evaluated October 2. Spring tillage in 1999 was one pass with an 'Alloway Seed Better' field cultivator. 'SDF0402' wheat at 90 lb/A, 'Stander' barley at 66 lb/A, 'Neche' flax at 31 lb/A, 'Crusher' and 'Hyola 401' canola, 'Van der Have 66168' sugarbeet, 'IS Hybrid 5757' sunflower, 'Interstate Payco 3X417' corn, 'Upland' Navy bean at 116 lb/A, and 'Garst BPR23456' soybean at 116 lb/A were seeded in four foot wide drill strips across each herbicide plot May 27, 1999. Wheat, barley, soybean, navy bean, corn, sunflower, canola, sugarbeet and flax injury were evaluated June 21, 1999. Crop drill strips were flail shredded in September, 1999 and fall tillage was one pass with 'Conser-Till' chisel plow. Spring tillage was one pass with a 'Kongskilde Triple K' field cultivator May 5, 2000. 'Hilleshog Empire Roundup Ready' sugarbeet was seeded on the entire plot area May 5, 2000. Roundup Ultra herbicide at 1.5 qt/A and 1.0 qt/A was applied to the entire experiment May 25, 2000 and June 11, 2000 respectively. Sugarbeet injury was evaluated June 19 and July 19, 2000.

			10-2-98	June 21, 1999									6-19-00	7-19-00
1998 Treatment*	Time of Application	Rate	Sgbt inj	Wht inj	Barl inj	Soyb inj	Nabe inj	Corn inj	Sufl inj	Cano inj	Sgbt inj	Flax inj	Sgbt inj	Sgbt inj
		lb/A	%	%	%	%	%	%	%	%	%	%	%	%
Isoxaflutole	PPI	0.047	13	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole	PPI	0.094	38	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole	PPI	0.186	89	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole	PRE	0.047	18	0	0	0	0	0	0	0	0	0	9	0
Isoxaflutole	PRE	0.094	35	0	0	0	0	0	0	0	0	0	4	0
Isoxaflutole	PRE	0.186	83	0	0	0	0	0	0	0	0	0	0	0
BAS635+X-77	POST	0.027+0.25%	38	0	0	0	0	0	0	0	0	0	0	0
BAS635+X-77	POST	0.045+0.25%	68	0	0	0	0	0	0	0	0	0	1	0
Azafenidin	POST	0.067	45	0	0	0	0	0	0	0	0	0	0	0
Azafenidin	POST	0.134	35	0	0	0	0	0	0	0	0	0	3	0
Azafenidin	POST	0.268	28	0	0	0	0	0	0	0	0	0	0	0
EXP MEAN			44	0	0	0	0	0	0	0	0	0	1	0
C.V. %			69	0	0	0	0	0	0	0	0	0	208	0
LSD 5%			44	NS	NS	NS	NS	NS	NS	NS	NS	NS	4	NS
LSD 1%			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	6	NS
# OF REPS			4	4	4	4	4	4	4	4	4	4	4	4

*X-77=non-ionic surfactant from Loveland.

Summary

Herbicides were applied in the spring of 1998 and sugarbeet was seeded in August of 1998. Isoxaflutole at 0.186 lb/A and BAS635 at 0.045 lb/A gave significant sugarbeet injury on October 2, 1998. Several crops were seeded across the plots on May 27, 1999 but none of the herbicides caused crop injury on June 21, 1999. Sugarbeet was seeded across the plots on May 5, 2000. Slight injury was observed from PRE isoxaflutole on June 19, 2000 but no injury was observed on July 19, 2000.

Carryover from corn herbicides, Fargo (NW section 22), 1999-2000. (Dexter) 'Interstate Hybrid 155' corn was seeded May 26, 1999. Preplant incorporated herbicides and preemergence treatments were applied 11:45 am May 26, 1999 when the air temperature was 73F, relative humidity was 24%, soil temperature at six inches was 55F, wind velocity was 11 mph, sky was clear and soil moisture was good. Incorporation was two passes with a 'Kongskilde Triple K' field cultivator with rolling baskets. Preemergence treatments were applied after planting. Postemergence treatments were applied 2:00 pm June 17, 1999 when the air temperature was 79F, relative humidity was 29%, soil temperature at six inches was 65F, wind velocity was 6 mph, sky was clear, soil moisture was fair and corn was 8 to 12 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of 20 foot wide by 50 foot long plots. Corn was flail shredded in September of 1999. Fall 1999 tillage was one pass with a chisel plow parallel with the direction herbicides were applied. Spring tillage was one pass with a field cultivator and harrow parallel to the herbicide plots May 18, 2000. 'VDH 66168' sugarbeet, 'IS Hybrid 6039' sunflower, 'Foster' barley at 66 lb/A, 'Neche' flax at 31 lb/A, 'Q2' canola at 32 lb/A, 'Gus' wheat at 88 lb/A and 'Upland' Navy beans at 131 lb/A were seeded in four foot wide strips across herbicide plots May 18, 2000. Roundup Ultra at 2 quart/A was applied preemergence to the entire plot area May 25, 2000. Crop injury was evaluated June 28, 2000 and July 19, 2000.

1999 Treatment*	Time of (Application)	Rate	June 28, 2000							July 19, 2000						
			Sgbt	Sufl	Flax	Cano	Wheat	Nabe	Barl	Sgbt	Sufl	Flax	Cano	Wht	Nabe	Barl
			percent control													
Control		0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole (PPI)		0.047	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole (PPI)		0.094	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole (PPI)		0.186	18	0	5	0	0	8	0	0	0	0	0	0	0	0
Isoxaflutole (Pre)		0.047	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole (Pre)		0.094	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Isoxaflutole (Pre)		0.186	19	0	13	5	3	10	3	0	0	0	0	0	0	0
Flufenacet&Metribuzin (PPI)		0.98	3	0	8	0	0	0	0	0	0	0	0	0	0	0
Dicamba&Diflufenzoypyr+ X-77 (POST)		0.265+0.25%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DPX-R6447 (POST)		0.067	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DPX-R6447 (POST)		0.268	3	3	0	0	0	0	0	0	0	0	0	0	0	0
Sulfentrazone (PPI)		0.375	56	0	3	3	0	8	0	0	0	0	0	0	0	0
EXP MEAN			9	0	2	1	0	2	0	0	0	0	0	0	0	0
C.V. %			146	693	387	523	693	416	693	0	0	0	0	0	0	0
LSD 5%			19	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 1%			25	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4	4	4	4	4	4	4	4	4

*X-77=non-ionic surfactant from Loveland.

Summary

Herbicides were applied in the spring of 1999 and several crops were seeded in 2000. Isoxaflutole at 0.186 lb/A caused sugarbeet injury on June 28, 2000. Other crops were not significantly injured on June 28 and none of the crops had visible injury on July 19, 2000.

Fomesafen on sugarbeet and alfalfa, Fargo (NW section 22), 1999-2000. (Dexter) Fomesafen was applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of each 20 foot wide plot May 26, 1999 when the air temperature was 73F, relative humidity was 24%, six inch soil temperature was 55F, wind was 11 mph, sky was clear, and soil moisture was good. Incorporation was 2 passes with a 'Kongskilde Triple K' field cultivator. 'Van der Have 66168', 'Hilleshog Horizon' and 'Beta 2084' sugarbeet were each seeded 1.25 inches deep in four 22 inch rows across the herbicide plots May 26. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. 'Avalanche' and 'Imperial' alfalfa at 38 lb/A were seeded in 7.5 inch rows and four foot strips across the herbicide plots May 26, 1999. Sugarbeet and alfalfa injury were visually evaluated June 16 and July 1, 1999. Sugarbeet was counted in 20 feet of treated row and alfalfa was counted in 3 feet of treated row June 18, 1999. Sugarbeet and alfalfa were flail shredded in September of 1999. Fall 1999 tillage was one pass with a chisel plow parallel with the direction herbicides were applied. Spring tillage was one pass with a field cultivator and harrow parallel to the herbicide plots May 18, 2000. 'VDH 66168' sugarbeet, 'IS Hybrid 6039' sunflower, 'Foster' barley at 66 lb/A, 'Neche' flax at 31 lb/A, 'Q2' canola at 32 lb/A, 'Garst 359SG' corn, 'Traill' soybean at 100 lb/A, 'Gus' wheat at 88 lb/A and 'Upland' Navy bean at 131 lb/a were seeded in four foot wide strips across herbicide plots May 18, 2000. Roundup Ultra at 2 quart/A was applied preemergence to the entire plot area May 25, 2000. Crop injury was evaluated June 28, 2000 and July 19, 2000.

		6-16-99		7-1-99		June 18, 1999				
1999 Treatment	Rate	Sgbt inj	Alfa inj	Sgbt inj	Alfa inj	Sgbt[1] Popul	Sgbt[2] Popul	Sgbt[3] Popul	Alfa[4] Popul	Alfa[5] Popul
	lb/A	%	%	%	%	---plants/20feet---			--plt/3 ft--	
Control	0	0	0	0	0	58	67	46	152	177
Fomesafen (PPI)	0.05	3	0	5	5	47	50	46	182	186
Fomesafen (PPI)	0.075	26	9	25	9	31	31	29	212	160
Fomesafen (PPI)	0.1	28	10	36	8	38	36	30	108	146
Fomesafen (PPI)	0.15	40	19	53	28	22	26	27	132	118
Fomesafen (PPI)	0.2	60	29	60	34	31	34	25	140	164
Fomesafen (PPI)	0.25	83	48	78	48	20	18	17	70	72
EXP MEAN		34	16	37	19	35	37	31	142	146
C.V. %		35	46	27	44	18	32	26	45	36
LSD 5%		18	11	15	12	9	18	12	NS	NS
LSD 1%		24	15	20	17	13	24	17	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4

[1]Van der Have 66168 sugarbeet
[2]Hilleshog Horizon sugarbeet
[3]Beta 2084 sugarbeet
[4]Avalanche alfalfa
[5]Imperial alfalfa

(Experiment continued on next page.)

Fomesafen on sugarbeet and alfalfa, Fargo (NW section 22), 1999-2000. (continued)

1999 Treatment	Rate	June 28, 2000									July 19, 2000								
		Sgbt	Sufl	Flax	Cano	Soyb	Corn	Wht	Nabe	Barl	Sgbt	Sufl	Flax	Cano	Soyb	Corn	Wht	Nabe	Barl
Control	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.05	15	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.075	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.15	8	8	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.2	10	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fomesafen (PPI)	0.25	13	3	0	0	0	0	0	0	0	10	5	0	0	0	0	0	0	0
EXP MEAN		8	4	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
C.V. %		103	150	0	529	0	0	0	0	0	529	529	0	0	0	0	0	0	0
LSD 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Summary

Fomesafen was applied in 1999 and sugarbeet and alfalfa were seeded after incorporation. Significant injury to sugarbeet occurred at 0.075 lb/A or higher. Significant injury to alfalfa started at 0.15 lb/A. The tested sugarbeet and alfalfa varieties responded similarly to fomesafen. Several crops were seeded over the plots May 18, 2000. Fomesafen caused no significant visible injury to any crop on June 28 or July 19, 2000.

Carryover from wheat herbicides, Fargo (NW section 22), 1999-2000. (Dexter) 'Gus' wheat at 90 lb/A was seeded May 26, 1999. Herbicide treatments were applied 2:00 pm June 17, 1999 when the air temperature was 79F, relative humidity was 29%, soil temperature at six inches was 65F, wind velocity was 6 mph, sky was clear, soil moisture was fair and wheat was six inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of 20 foot wide by 50 foot long plots. Buctril at 1.5 pint/A was applied to the entire experiment June 24, 1999. Wheat was flail shredded in September of 1999. Fall 1999 tillage was one pass with a chisel plow parallel with the direction herbicides were applied. Spring tillage was one pass with a field cultivator and harrow parallel to the herbicide plots May 18, 2000. 'VDH 66168' sugarbeet, 'IS Hybrid 6039' sunflower, 'Foster' barley at 66 lb/A, 'Neche' flax at 31 lb/A, 'Q2' canola at 32 lb/A, 'Garst 359SG' corn, 'Traill' soybean at 100 lb/A, 'Gus' wheat at 88 lb/A, 'Majorette' field pea at 113 lb/A and lentil were seeded in four foot wide strips across herbicide plots May 18, 2000. Roundup Ultra at 2 quart/A was applied preemergence to the entire plot area May 25, 2000. Crop injury was evaluated June 28, 2000 and July 19, 2000.

1999		June 28, 2000										July 19, 2000								
Treatment*	Rate	Sgbt	Corn	Soyb	Peas	Lent	Cano	Sufl	Flax	Barl	Wht	Sgbt	Sufl	Flax	Cano	Soyb	Corn	Barl	Lent	Peas
	lb/A	percent control																		
Untreated Check		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Imazamethabenz+Activator 90	0.48+0.25%	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
Flucarbazone+Activ. 90	0.03+0.25%	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0
Flucarbazone+Activ. 90	0.06+0.25%	10	0	0	13	13	6	15	6	9	9	0	0	0	0	0	0	0	0	0
Clopyralid	0.15	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluroxypyr	0.13	3	0	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXP MEAN		2	0	2	4	3	1	3	1	2	2	0	0	0	0	0	0	0	0	0
C.V. %		236	0	310	318	385	490	313	490	203	203	0	0	0	0	0	0	0	0	0
LSD 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

*Activator 90=non-ionic surfactant from Loveland.

Summary

None of the herbicides applied in 1999 caused significant crop injury in 2000.

2000 VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER

Injury: 2 = susceptible, 1 = moderate tolerance, 0 = tolerant

HRSW	6/9
Ernest	1
Butte 86	1
Ivan	0
Russ	0
Oxen	1
Ingot	0
Ember	0
2375	0
Grandin	1
2398	0
Parshall	0
Reeder	2
Alsen	2
Keene	0
Gunner	2
HJ98	0
Dandy	0
McKenzie	0
Mercury	0
Aurora	0
Norpro	0
Conan	0
Scholar	0
AC Vista	0
GC Impervo	0
Prodigy	0
377S	2
ND709-9	2
ND721	0
ND722	0
ND724	0
ND725	0
ND726	0
ND729	0
ND730	0
ND731	2
ND732	2

Durum	6/9
Rugby	0
Monroe	0
Munich	0
Belzer	2
1AS/1D2	2
AC Melita	0
Ben	0
Lebsock	2
Mountrail	2
Maier	0
Plaza	0
Renville	1
Plenty	0
Kari	2
Dressler	0
D96622	2
D941030	0
D941033	1
D941038	0
D941261	0
D941515	0
D95077	2
D95081	2
D95672	0
D95061	1
D95097	0
D95517	0
D95565	0
D95595	0
D95747	0
D95123	0
D95066	0
D96005	0
D96596	0
D96604	0
D96612	0

Planting date: 4/4/00
Date of application: 5/15/00
Crop: 3.5 leaf
Rate of application: 4 pts/A

HRSW VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

HRSW	1993	1994	1995	1996	1997	1998	1999	2000
Keene	0	1	0	1	1	1	0	0
Butte 86	0	1	+	1	1	1	1	1
Grandin	+	+	+	+	+	1	1	1
2375	0	1	1	1	0	1	0	0
2398	0	1	1	+	0	0	0	0
Ernest	0	1	0	1	0	0	0	1
Russ		+	1	1	1	1	0	0
Oxen			0	1	0	1	0	1
Gunner				+	+	+	+	+
Reeder				+	+	+	1	+
Parshall				+	+	+	0	0
HJ98					0	0	0	0
Ingot						1	0	0
Ivan						0	0	0
Ember						1	0	0
Scholar							0	0
Norpro							0	0
Dandy							0	0
McKenzie							0	0
Mercury							0	0
Aurora							0	0
Alsen							1	+
Conan								0
AC Vista								0
GC Impervo								0
Prodigy								0
2371	0	1	1	+	0	1	0	
Sharp	0	1	1	1	0	1	0	
Kulm	0	1	1	1	0	+	+	
Amidon	0	+	0	1	1	0	1	
Trenton	+	+	+	+	+	+	1	
Hamer		1	0	1	0	1	0	
Lars		1	1	1	0	1	0	
Verde		+	+	+	+	+	+	
AC Barrie			0	1	0	1	0	
Argent HWSW			+	+	+	1	0	
Forge				1	1	1	0	
Nora				+	+	+	+	
AC Cadillac					0	1	0	
Sharpshooter					0	1	0	
Hager					0	1	0	
McVey							0	
Majestic							0	
McNeal	0	+	1	1	1	0		
AC Eatonia		+	0	1	0	1		

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00

Rate of Application: 4 pts/A, (1999=3.5 pts/A)

Variety Tolerance to Triallate Herbicide at Hettinger (Eriksmoen)

Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

Variety	5/22/00	6/9/99	5/26/98	6/18/97	6/20/96	6/9/95
Butte 86	0	0	0	0	0	0
2375	0	0	0	0	0	0
2398	0	0	0	0	0	0
Grandin	0	0	0	0	0	0
Keene	0	0	+	0	+	0
Ernest	+	0	?	0	+	0
Russ	0	0	?	0	0	0
Oxen	0	0	0	0	0	0
Gunner	0	0	0	0	+	
Reeder	0	0	0	0	0	
Parshall	0	0	0	0	0	
HJ98	0	0	0	0		
Ingot	0	0	0			
Ivan	+	0	+			
Ember	0	0	0			
Norpro	0	0				
Scholar	0	0				
Dandy	0	0				
McKenzie	+	0				
Mercury	0	0				
Aurora	+	0				
Alsen	0	0				
Conan	0					
AC Vista	0					
GC Impervo	0					
Prodigy	0					
AC Barrie		0	?	0	+	+
Kulm		0	0	0	+	+
2371		0	0	0	0	0
Argent HWSW		0	0	0	0	0
Amidon		0	+	+	+	+
Trenton		0	0	0	0	0
Hammer		0	+	0	+	+
Lars		0	0	0	0	0
Sharp		0	0	0	0	0
Verde		0	0	0	0	0
Nora		0	0	0	0	
Forge		0	0	0	+	
AC Cadillac		0	0	0		
Sharpshooter		0	0	0		
Hager		0	+	0		
McVey		0				
Majestic		0				
AC Eatonia			0	0	0	+
McNeal			0	0	0	0
BacUp			0	0		
AC Crystal			+			

Planting date: 4/4/00, 4/13/99, 4/8/98, 4/29/97, 4/18/96, 4/7/95
Date of Application: 3/27/00, 4/12/99, 4/3/98, 4/3/97, 4/19/96, 4/24/95
Rate of Application: 1997-00 = 3 pts/A, 1995/6 = 2 pts/A

DURUM VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

Durum	1993	1994	1995	1996	1997	1998	1999	2000
Rugby	0	1	0	1	0	1	0	0
Ben	0	1	0	1	0	1	0	0
Monroe	0	1	0	1	0	1	0	0
Renville	1	+	1	+	1	1	0	1
Plenty	0	1	1	1	0	1	0	0
Munich	0	1	1	1	0	1	1	0
Belzer	+	+	+	+	+	+	+	+
Maier	0	1	0	1	0	1	0	0
Mountrail		+	+	1	1	+	0	+
Lebsock		+	1	+	+	+	0	+
AC Melita			0	1	0	1	0	0
Plaza			1	1	1	1	0	0
Dressler				1	1	1	0	0
Kari				+		+	1	+
Vic	+	+	+	+	+	+	1	
Lloyd	0		0	1	1	1	0	
Ward	0	1	1	1	0	1		
Medora	0	1	1	1	+	1		
Sceptre	0	1	1	1	1	1		
Laker	1	+	+	+	+	+		
Regold	1	+	+	+	1	+		
Voss	0	1	+	+	0	1		

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00

Rate of Application: 4 pts/A (1999=3.5 pts/A)

Response of durum and spring wheat to Avenge and Avenge plus Assert, Prosper ND, 2000. Michael D. Peel and Richard K. Zollinger. Released varieties of hard red spring wheat and durum were evaluated for their response to Avenge and Avenge plus Assert. The trial, planted on April 26, 2000, was a split plot design. Treatments constituted whole plots and varieties sub plots. Heading date, height, and yield were measured on all plots. All plots were rated for visual injury on a scale of 0-100 (0= no injury) on June 9, and June 26.

Treatments were applied on May 26 when the crop was in the 4 to 5 leaf stage. Treatments included Avenge 4 pt/A, Avenge 6 pt/A, and Avenge 2 pt/A plus Assert 0.75 pt/A. Average wind speed was 9 mph, and maximum air temp was 78° F. The week following the treatment was typified by daily high temperatures of 64 to 73° F and daily low temperatures of 40 to 53° F. At the time treatments were applied plant stands averaged 1.1 million plants/A and all varieties were healthy.

Significance variation due to treatments was detected using an approximate *F* test. Least significant differences (α=0.05) were used to separate means. Injury was observed on Gunner, Reeder and Verde spring wheat varieties and Belzer, Lebsock, and Mountrail durum varieties. Treatment by variety mean yields were significantly different for the same spring wheat varieties but only Belzer durum had a significantly lower yield due to treatment (Tables 1 and 2). Overall treatment mean yields were not different for either durum or spring wheat. Other subtle differences in height, heading date and visual injury between the two dates were observed, but were not always consistent with treatments.

High levels of bacterial leaf blight, septoria, tan spot and leaf rust were present on several varieties. No differences between treatments for level of these diseases were observed.

These results are comparable with results observed in 1998 where injury was observed on the same varieties, but is in contrast with 1999 where no injury was observed on any variety tested. Consistent with the injury observed in 1998 and in 2000 was temperatures that ranged from the 40's (F) during the night to highs in the 70's during the day. Compared with 1999 where night time temperatures were similar to slightly higher and daytime temperatures in the 80's (F). Also consistent with injury in 1998 and 2000 was substantial rain fall following treatments, 1.2" in 1998 and 0.8" in 2000. This compare with 1999 where no rain was received for the 12 days following treatment.

Table 1. Mean height, heading date, visual injury and yield of hard red spring wheat treated with Avenge and Assert. Treatments included: 1=Check, 2=Avenge 4 pt/A, 3=Avenge 6pt/A, 4=Avenge 2 pt/A plus Assert 0.75pt/A.

Variety	Treatment	Height	Heading Date	Visual Injury on 6-9-00	Visual Injury on 6-26-00	Yield
		Inches	June 1	%	%	bu/A
Argent	1	37	25	0.0	0.0	39.6
	2	36	26	5.0	1.7	30.2
	3	36	25	11.7	1.7	36.0
	4	37	25	3.3	0.0	48.4
Auror	1	32	27	0.0	0.0	45.5
	2	32	29	6.7	0.0	39.7
	3	30	29	10.0	0.0	47.2
	4	31	28	5.0	0.0	52.3
Dandy	1	34	25	0.0	0.0	46.0
	2	35	26	5.0	0.0	49.1
	3	34	27	6.7	0.0	47.9
	4	35	25	3.3	0.0	53.0
Gunner	1	35	27	0.0	0.0	33.1
	2	34	31	25.0	36.7	23.8
	3	30	31	43.3	76.7	14.7
	4	34	27	10.0	3.3	37.2
Ivan	1	33	28	0.0	0.0	34.3
	2	32	31	6.7	0.0	31.8
	3	32	31	11.7	0.0	31.4
	4	34	30	6.7	0.0	39.6
McKenzie	1	37	24	0.0	0.0	40.8
	2	38	25	3.3	0.0	37.0
	3	37	25	5.0	0.0	41.5
	4	39	25	0.0	0.0	42.9
McVey	1	35	28	0.0	0.0	34.8
	2	34	30	8.3	0.0	37.2
	3	32	30	8.3	0.0	32.5
	4	34	29	8.3	0.0	43.2
Mercury	1	33	26	0.0	0.0	53.7
	2	34	27	8.3	0.0	49.1
	3	32	27	6.7	0.0	51.9
	4	33	26	5.0	0.0	66.0
Parshall	1	41	25	0.0	0.0	48.0
	2	40	27	1.7	0.0	39.6
	3	40	26	10.0	0.0	41.0
	4	40	26	0.0	0.0	47.7
Reeder	1	36	25	0.0	0.0	46.7
	2	33	28	6.7	13.3	32.6
	3	32	31	21.7	46.7	23.7
	4	37	25	1.7	0.0	46.2
Verde	1	33	28	0.0	0.0	43.6
	2	31	31	31.6	33.3	21.0
	3	30	32	60.0	81.7	20.8
	4	33	29	11.7	8.3	39.2
Entry LSD(0.05)		2.6	2.4	21.6	40.7	12.9
Treatment means	1	35.2	26.3	0.0	0.0	42.4
	2	34.4	28.4	9.8	7.7	35.6
	3	33.2	28.5	17.7	18.8	35.3
	4	35.3	26.8	5.0	1.1	46.9
Treatment LSD(0.05)		1.9	1.3	8.6	11.7	9.3
R-Square		0.9	0.92	0.88	0.91	0.85

Table 2. Mean height, heading date, visual injury and yield of durum wheat treated with Avenge and Assert. Treatments included: 1=Check, 2=Avenge 4 pt/A, 3=Avenge 6pt/A, 4=Avenge 2 pt/A plus Assert 0.75pt/A.

Variety	Treatment	Height	Heading Date	Visual Injury on 6-9-00	Visual Injury on 6-26-00	Yield
Belzer	1	40	28	0.0	0.0	40.1
	2	38	31	33.3	33.3	36.0
	3	36	30	63.3	56.7	24.3
	4	41	29	15.0	3.3	41.4
Ben	1	41	27	0.0	0.0	51.1
	2	40	38	4.3	0.0	46.4
	3	38	28	10.0	0.0	49.2
	4	41	27	5.0	0.0	48.4
Kari	1	40	28	0.0	0.0	40.8
	2	38	30	28.3	11.7	41.3
	3	35	31	60.0	43.3	36.3
	4	40	27	8.3	0.0	47.1
Lebsock	1	38	27	0.0	0.0	44.9
	2	36	30	26.7	25.0	42.2
	3	35	31	68.3	53.3	40.5
	4	38	27	6.7	0.0	50.3
Maier	1	38	28	0.0	0.0	39.8
	2	38	29	5.0	0.0	39.3
	3	37	29	11.7	0.0	39.5
	4	38	28	6.7	0.0	33.4
Mountrail	1	40	28	0.0	0.0	36.8
	2	38	30	23.3	11.7	38.8
	3	36	31	50.0	63.3	35.5
	4	39	29	10.0	0.0	44.8
Plaza	1	33	29	0.0	0.0	38.7
	2	35	31	11.7	3.3	36.6
	3	32	31	13.3	5.0	34.4
	4	36	29	8.3	0.0	36.8
Entry LSD(0.05)		2.5	1.7	34.2	38.6	10.4
Treatment means	1	38.5	28.0	0.0	0.0	41.7
	2	37.6	29.9	19.0	12.1	40.1
	3	35.5	30.1	39.5	31.7	37.1
	4	38.8	28.2	8.6	0.5	43.2
Treatment LSD(0.05)		2.4	1.1	9.6	13.9	10.9
R-Square		0.82	0.87	0.95	0.90	0.60

General Grass Control in hard red spring wheat, Fargo. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 26. First split application treatments (preceding /) were applied to 2 leaf wheat and wild oat on May 15 with 65° F, 33% RH, 60% cloud cover, 6 mph wind, and dry topsoil with moist subsoil at 59° F. Second split application and single application treatments (following /) were applied to 3 to 4 leaf wheat and wild oat on May 23 with 70° F, 39% RH, 4 to 8 mph wind and damp topsoil with moist subsoil at 62° F. All treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat density was wild oat 270 plants/ft^2. Plot area was over-sprayed with 8 oz/A bromoxynil&MCPA for broadleaf control. Wheat injury and weed control were visually estimated. Harvest for yield was on August 7.

		6/12		6/30	7/18	8/07
Treatment	Rate	Wheat injury	Wioa	Wioa	Wioa	Yield
	oz/A	%				bu/A
Difp+brox+PO	16+4+0.12G	5	18	23	40	29
Difp+PO/difp+brox+PO	5.3+0.12G/5.3+4+0.12G	3	49	50	59	51
Immb+thif&trib+Act90	5+0.22+0.25%	0	46	28	35	29
Immb+Act90/immb+thif&trib+Act90	1.7+0.25%/1.7+0.22+0.25%	0	48	30	59	42
Difenzoquat+thif&trib	12+0.22	0	48	38	48	30
Dife/dife+thif&trib	4/4+0.22	0	25	15	35	24
Tral+Supercharge+AMS+brox&MCPA	2.9+0.5%+20+8	0	86	93	93	55
Tral+Supercharge+AMS/ tral+Supercharge+AMS+brox&MCPA	1.0+0.5%+20/ 1.0+0.5%+20+8	0	97	98	99	65
Clodinafop+Score+brox&MCPA	0.8+.8%+8	0	83	92	93	54
Clfp+Score/clfp+Score+brox&MCPA	0.27+.8%/0.27+.8%+8	0	90	95	95	56
Fenx+brox&MCPA	1.32+8	0	84	93	93	57
Fenx /fenx+brox&MCPA	0.44/0.44+8	0	68	75	78	51
Flucarbazone+brox&MCPA+Act90	0.42+8+0.25%	0	66	85	90	48
Flucarbazone+thif&trib+2,4-Dioe+Act90	0.42+0.22+4+0.25%	0	60	77	86	38
Flcz+Act90/Flcz+ thif&trib+2,4-Dioe+Act90	0.14+0.25%/0.14+ 0.22+4+0.25%	0	70	78	74	42
Untreated	0	0	0	0	0	11
C.V. %		53	14	15	12	17
LSD 5%		0	12	13	11	10
# OF REPS		4	4	4	4	4

Split treatments consisted of two applications at one-third the single application rate. Less total herbicide was used to offset extra application costs of a second timing. Wheat injury was only observed with diclofop, and the full rate was more injurious than split treatment. Greatest injury was 5% chlorosis and was not observed on 6/30. Diclofop, imazamethabenz, and difenzoquat provided poor wild oat control. Split application of diclofop produced an unusually high yield of 51 bu/A given the wild oat control achieved. Split application improved weed control and yield with diclofop and imazamethabenz compared to single application. Split application did not affect wild oat control with tralkoxydim and clodinafop but did improve yield with tralkoxydim. Tralkoxydim, clodinafop, and fenoxaprop elicited more rapid wild oat response than other chemicals. Split application reduced wild oat control with fenoxaprop and flucarbazone but had no effect on yield compared to single application.

General Grass Control in hard red spring wheat, Carrington. (Endres) 'Russ' hard red spring wheat and 'Paul' tame oat (planted in first strip of each rep) were seeded May 3. Treatments preceding (/) were applied to 3 to 3.5 leaf wheat, 2 to 3 leaf tame oat, 2 to 4 leaf green and yellow foxtail, and 3 to 4 leaf wild oat on May 16 with 64° F, 47% RH, 50% cloud cover and dry soil surface with adequate moisture in subsoil. Treatments succeeding (/) were applied to 4.5 leaf wheat and tame oat, 2 to 4 leaf green and yellow foxtail, and 4 to 4.5 leaf wild oat on June 2 with 64° F, 31% RH, 10% cloud cover, 7 mph wind and dry topsoil with adequate moisture in subsoil. Treatments were applied with a CO_2-hand-boom sprayer delivering 10.4 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were foxtail moderate and wild oat variable. Wheat injury and weed control were visually estimated. Harvest for yield was on August 9.

		6/16			7/19	8/09
Treatment	Rate	Wheat injury	Oat& Wioa	Fota	Oat& Wioa	Yield
	oz/A		%			bu/A
Diclofop+brox+PO	16+4+0.12G	9	90	91	94	33
Difp+PO/difp+brox+PO	5.3+0.12G/5.3+4+0.12G	2	91	94	90	39
Immb+thif&trib+Act90	5+0.22+0.25%	4	91	43	76	28
Immb+Act90/immb+thif&trib+Act90	1.7+0.25%/1.7+0.22+0.25%	9	93	67	78	36
Dife+thif&trib	12+0.22	5	-	72	64	31
Dife/dife+thif&trib	4/4+0.22	10	74	69	66	34
Tral+Supercharge+AMS+brox&MCPA	2.9+0.5%+20+8	8	92	91	91	31
Tral+Supercharge+AMS/ Tral+Supercharge+AMS+brox&MCPA	1.0+0.5%+20/ 1.0+0.5%+20+8	11	84	82	92	30
Clfp+Score+brox&MCPA	0.8+.8%+8	8	-	96	97	33
Clfp+Score/clfp+Score+brox&MCPA	0.27+.8%/0.27+.8%+8	0	96	90	96	31
Fenx+brox&MCPA	1.32+8	22	80	87	55	27
Fenx/fenx+brox&MCPA	0.44/0.44+8	0	85	94	88	31
Flucarbazone+brox&MCPA+Act90	0.42+8+0.25%	6	96	79	95	32
Flcz+thif&trib+2,4-Dioe+Act90	0.42+0.22+4+0.25%	5	93	84	97	28
Flucarbazone+Act90/ Flcb+thif&trib+2,4-Dioe+Act90	0.14+0.25%/ 0.14+0.22+4+0.25%	6	91	76	97	27
Untreated	0	0	0	0	0	27
C.V. %		70	9	14	11	19
LSD 5%		6	11	16	12	NS
# OF REPS		4	4	4	4	4

Split treatments consisted of two applications at one-third the single application rate. Less total herbicide was used to offset extra application costs of a second timing. Wheat injury of 0 to 11% was observed for most treatments with fenoxaprop+bromoxynil&MCPA causing 22% injury on June 16. Injury diminished through the season and was not visible on August 2. Split applications provided control comparable to or better than single applications. Split application of fenoxaprop improved wild oat control by 33%. This was opposite from the effect observed at other locations. Wild oat density was very low. This resulted in no yield difference even when weed control was poor.

Wild oat control in hard red spring wheat, Hettinger. (Eriksmoen) 'Keene' hard red spring wheat was seeded April 19. Treatments were applied to 3 leaf wheat and to 1 to 3 leaf wild oat on May 16 with 58° F, 64% RH, clear sky and 7 mph wind. A second split application was applied to 4.5 leaf wheat and 3 to 4.5 leaf wild oats on May 22 with 56° F, 75% RH, clear sky and 11 mph wind. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 ft plots. The experiment was a randomized complete lock design with four replications. Wild oat population was 13 plants/ft^2. The trial was sprayed with 10 oz/A fluroxypyr (Starane) + 1 pt/A bromoxynil (Buctril) on May 30 for broadleaf weed control. Evaluations were on June 19 and July 10 for weed control. The trial was harvested on August 7.

Treatment	Rate	6/19 Wioa	7/10 Wioa	8/7 Yield
	oz/A		%	bu/A
Diclofop+bromoxynil+PO	16+4+0.12G	96	98	54
Difp+PO/difp+brox+PO	5.3+0.12G/5.3+4+0.12G	97	98	54
Immb+thif&trib+Act90	5+0.22+0.25%	97	99	51
Immb+Act90/immb+thif&trib+Act90	1.7+0.25%/1.7+0.22+0.25%	97	99	53
Dife+thifensulfuron&tribenuron	12+0.22	92	84	47
Dife/dife+thif&trib	4/4+0.22	55	22	45
Tral+Supercharge+AMS+brox&MCPA	2.9+0.5%+20+8	99	91	53
Tral+Sprchg+AMS/tral+Sprchrg+AMS+brox&MCPA	1.0+.5%+20/1.0+.5%+20+8	99	99	54
Clodinafop+Score+brox&MCPA	0.8+.8%+8	97	99	55
Clodinafop+Score/clodinafop+Score+brox&MCPA	0.27+.8%/0.27+.8%+8	99	99	54
Fenx+bromoxynil&MCPA	1.32+8	96	99	49
Fenx/fenx+bromoxynil&MCPA	0.44/0.44+8	98	98	52
Flucarbazone+bromoxynil&MCPA+Activator 90	0.42+8+0.25%	97	99	52
Flcz+thif&trib+2,4-Dioe+Activator 90	0.42+0.22+4+0.25%	98	99	53
Flcz+Act90/Flcz+thif&trib+2,4-Dioe+Act90	0.14+.25%/.14+.22+4+.25%	96	99	50
Untreated	0	0	0	38
C.V. %		12	10	5
LSD 5%		15	12	4
# OF REPS		4	4	4

Crop injury was not observed (data not shown). Season long wild oat control was good on all herbicide treatments except for the difenzoquat split application (trt 6) which had poor wild oat control. Split applications did not enhance wild oat control or yields over the single application. All treatments had significantly higher yields than the untreated check. The difenzoquat treatments (trts 5 & 6) had significantly lower yields and wild oat control than the other herbicide treatments.

Wild oat control in wheat, Williston 2000. (Riveland) 'Reeder' hrs wheat was planted on recrop (land cropped to hrs wheat in 1999) in 7 inch rows at 80 lbs/a on May 4. Treatments were applied on May 25 to 3- to 3.5-leaf wheat, 1-4 leaf wild oats (most were in the 3-leaf stage) with 60 F, 25% RH, partly cloudy sky, and 5 to 10 mph SE wind. The second application of split treatments was made on May 30 to 4 leaf wheat and 2-5 leaf but mostly 4 leaf wild oats with 65 F, 39% RH, mostly clear sky and 5-10 mph WSW winds. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Wild oat populations were greater than 20 plants/ ft2. Plots were evaluated for wild oat control on June 18. Wheat was machine harvested on August 15.

		6/18	7/12	8/15	
Treatment[a]	Rate	Wioa	Wioa	Test weight	Yield
	oz/A	%	%	lb/bu	bu/A
Diclofop+bromoxynil+PO	16+4+0.12G	66	77	62.0	23.7
Diclofop+PO/ diclofop+bromoxynil+PO	5.3+0.12G/ 5.3+4+0.12G	65	83	62.1	21.4
Imazamethabenz+thif&trib+Act90	5+0.22+0.25%	61	70	61.8	15.6
Immb+Activator 90/ immb+thifensulfuron&trib+Act 90	1.7+0.25%/ 1.7+0.22+.25%	66	69	61.7	17.5
Difenzoquat+thif&tribenuron	12+0.22	16	20	61.8	9.3
Difenzoquat/difenzoquat+thif&trib	4/4+0.22	3	13	62.3	5.8
Tral+Supercharge+AMS+brox&MCPA	2.9+0.5%+20+8	86	83	61.8	25.8
Tralkoxydim+Sprchg+AMS/ tral+Sprchg+AMS+brox&MCPA	1.0+0.5%+20/ 1+0.5%+20+8	84	83	61.7	20.8
Clodinafop+Score+brox&MCPA	0.8+0.8%+8	91	95	62.1	31.9
Clodinafop+Score/ clodinafop+Score+brox&MCPA	0.27+0.8%/ 0.27+0.8%+8	76	86	61.9	24.4
Fenoxaprop +brox&MCPA	1.32+8	74	87	61.8	24.7
Fenoxaprop/ fenoxaprop+brox&MCPA	0.44/ 0.44+8	53	70	61.9	18.0
Flucarbazone+brox&MCPA+Activator 90	0.42+8+0.25%	93	93	61.2	22.7
Flcz+thif&trib+2,4-Dioe+Act90	0.42+0.22+4+0.25%	93	93	61.6	24.7
Flcz+Act90/ flcz+thif&trib+2,4-Dioe+Act90	0.14+0.25%/ 0.14+0.22+4+0.25%	91	89	61.2	20.9
Untreated	0	0	0	62.1	6.6
C.V. %		18	10	0.5	25.3
LSD 5%		16	9	NS	7.1
# OF REPS		4	4	2	4

[a] Act90 was Activator 90 nonionic surfactant from Loveland.

Split treatments consisted of two applications at one-third the single application rate. Less total herbicide was used to offset extra application costs of a second timing. Diclofop, imazamethabenz, and difenzoquat provided poor wild oat control. Control with difenzoquat was as low as 3% on 6/18. Split application did not improve wild oat control or yield compared to single application for any product. Split application of clodinafop or fenoxaprop resulted in lower weed control than single application. Flucarbazone treatments provided 89 to 93% wild oat control.

REDUCED RATES FOR SPLIT APPLICATION OF HERBICIDES FOR WILD OAT CONTOL IN HARD RED SPRING WHEAT, GRANDIN. (Lockhart and Howatt)

'2375' hard red spring wheat was seeded at Grandin, ND on May 7. Experimental design was randomized complete block with 4 replicates and plot size was 10 by 32 ft. All treatments were applied at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Wheat was harvested for yield on August 16 and 22. Single full rates and single reduced rates were applied the same time as the first split applications.

Date	May 31	June 10
Treatment	1st Split	2nd Split
Air Temperature (F)	60	70
Relative humidity (%)	41	60
Wind (mph)	6	10-13
Sky	partly cloudy	partly cloudy
Wheat	2.5-3 lf	3.5-4 lf
Wild oat	2-2.5 lf	3.5-4 lf

Table. Comparing Tralkoxydim, Clodinafop, Flucarbazone and Fenoxaprop with multiple reduced rates.

		Wild oat		
Treatment[a]	Rate	June 14	June 28	Yield
	oz ai/oz	——% control——		bu/acre
Tralkoxydim	0.72	79	89	57.1
Tralkoxydim	0.96	83	90	54.9
Tralkoxydim	0.72/0.72	93	95	53.3
Tralkoxydim	0.96/0.96	95	96	59
Tralkoxydim	2.88	95	96	54.9
Clodinafop	0.25	89	92	55.1
Clodinafop	0.33	88	95	58.3
Clodinafop	0.25/0.25	94	98	60.2
Clodinafop	0.33/0.33	95	97	65.5
Clodinafop	1	89	95	60.6
Flucarbazone	0.105	69	80	59.3
Flucarbazone	0.139	63	77	56.7
Flucarbazone	0.105/0.105	70	87	57.5
Flucarbazone	0.139/0.139	73	91	59.7
Flucarbazone	0.42	90	94	63.8
Fenoxaprop	0.335	28	39	38.7
Fenoxaprop	0.442	56	61	53.1
Fenoxaprop	0.335/0.335	69	60	50.7
Fenoxaprop	0.442/0.442	73	80	56.4
Fenoxaprop	1.34	89	94	61.1
Untreated		--	--	25.3
LSD (5%)		7.8	5.4	8.6

[a] Tralkoxydim treatments were applied with 1.5% v/v Supercharge (MSO), clodinafop treatments were applied with 1% v/v DSV (P0), flucarbazone treatments were applied with 0.25% v/v NIS, and there was no adjuvant added with fenoxaprop.

REDUCED RATES FOR SPLIT APPLICATION OF HERBICIDES FOR WILD OAT CONTOL IN HARD RED SPRING WHEAT, FARGO (Lockhart and Howatt)

'Oxen' hard red spring wheat was seeded at Fargo on April 26. Experimental design was randomized complete block with 4 replicates and plot size was 10 by 30 ft. All treatments were applied at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Wheat was harvested for yield on August 1. Single full rates and single reduced rates were applied the same time as the first split applications.

Date	May 15	May 25
Treatment	1st Split	2nd Split
Air Temperature (F)	65	71
Relative humidity (%)	33	35
Wind (mph)	6	4
Sky	partly cloudy	sunny
Wheat	1.5-2 lf	3.5 lf
Wild oat	2 lf	3.5-4 lf

Table. Comparing Tralkoxydim, Clodinafop, Flucarbazone and Fenoxaprop with multiple reduced rates.

		Wild oat		
Treatment[a]	Rate	June 8	June 22	Yield
	oz ai/oz	——% control——		bu/acre
Tralkoxydim	0.72	77	77	47.5
Tralkoxydim	0.96	83	82	47.5
Tralkoxydim	0.72/0.72	91	95	54.2
Tralkoxydim	0.96/0.96	96	95	50.8
Tralkoxydim	2.88	96	95	54.7
Clodinafop	0.25	61	68	44.2
Clodinafop	0.33	62	69	42.6
Clodinafop	0.25/0.25	92	94	46.2
Clodinafop	0.33/0.33	94	96	48.3
Clodinafop	1	65	70	43.6
Flucarbazone	0.105	61	54	39.1
Flucarbazone	0.139	62	54	38.4
Flucarbazone	0.105/0.105	82	58	30.1
Flucarbazone	0.139/0.139	83	74	39.1
Flucarbazone	0.42	84	70	39.8
Fenoxaprop	0.335	36	33	29.8
Fenoxaprop	0.442	49	38	31.7
Fenoxaprop	0.335/0.335	54	64	32.7
Fenoxaprop	0.442/0.442	72	81	43.2
Fenoxaprop	1.34	74	69	40.3
Untreated		--	--	14.4
LSD (5%)		12.5	13.4	8.6

[a] Tralkoxydim treatments were applied with 1.5% v/v Supercharge (MSO), clodinafop treatments were applied with 1% v/v DSV (P0), flucarbazone treatments were applied with 0.25% v/v NIS, and there was no adjuvant added with fenoxaprop.

SUMMARY OF REDUCED RATES FOR SPLIT APPLICATION OF REDUCED HERBICIDE RATES FOR WILD OAT CONTROL IN HARD RED SPRING.
(Lockhart and Howatt)

Fenoxaprop and flucarbazone as single treatments at 25% and 33% rates did not provide consistent wild oat control. Excellent full-season wild oat control was obtained with two reduced-rate treatments of clodinafop, flucarbazone, and tralkoxydim. Wild oat control was significantly less than the full rate with single reduced-rate treatments of clodinafop, tralkoxydim, flucarbazone, and fenoxaprop. Tralkoxydim or clodinafop split-applied at 25% and 33% rates provided wild oat control equal to labeled rates. Fenoxaprop and flucarbazone split-applied at 33% rate provided control equal to labeled rates. Wheat yields were similar following treatment with clodinafop and tralkoxydim when applied either once at the labeled rate or split-applied at 25% or 33% rates (total equaled 50% and 67% of full rate).

Split application of tralkoxydim for wild oat control, Fargo. (Ramsdale and Messersmith) 'Oxen' hard red spring wheat was seeded on April 26, 2000. Treatments were a single application at standard timing and two applications at one-half the single rate. Experimental design was a randomized complete block with four replicates, and plot size was 10 by 30 ft. All treatments were applied at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Wild oat control was evaluated visually on June 8, July 9, and July 28 and wheat was harvested on August 7, 2000.

Date	May 10	May 22	May 25
Treatment	1st Split	Single	2nd Split
Air temperature (F)	57	70	70
Relative humidity (%)	80	40	30
Wind (mph)	8-14	8	5
Sky	cloudy	cloudy	clear
Wheat	1.5 leaf	2-4 leaf and 1-2 tillers	6-7 leaf and 2-3 tillers
Height	2-3 inch	3-5 inch	5-7 inch
Wild oat	1-1.5 leaf	1-4 leaf and 1 tiller	variable
Height	2-3 inch	2-5 inch	variable

Treatment[a]	Rate	June 8		July 9		July 28		Yield
		Wioa	Wht	Wioa	Wht	Wioa	Wht	
	oz ai/A	% injury						
Tralkoxydim + Supercharge	2.9 + 0.5%	94	11	83	11	93	30	28
Tralkoxydim + Scoil	2.9 + 1.5 pt	96	19	88	20	95	33	27
Tralkoxydim + Supercharge	2 + 0.5%	89	11	75	10	85	28	26
Tralkoxydim + Scoil	2 + 1.5 pt	97	14	88	20	96	28	32
Tralkoxydim + Supercharge	1.5 + 0.5%	88	9	70	11	81	26	23
Tralkoxydim + Scoil	1.5 + 1.5 pt	95	7	86	10	94	16	33
Tral + Super / Tral + Super	1 + 0.5% / 1 + 0.5%	93	0	88	1	96	0	46
Tral + Scoil / Tral + Scoil	1 + 1.5 pt / 1 + 1.5 pt	94	0	95	5	99	0	47
Tral + Super / Tral + Super	0.75 + 0.5% / 0.75 + 0.5%	92	0	87	0	96	0	46
Tral + Scoil / Tral + Scoil	0.75 + 1.5 pt / 0.75 + 1.5 pt	97	1	93	3	99	0	46
Untreated		-	-	-	-	-	-	15
CV		3	74	5	97	3	68	19
LSD (5%)		4	9	6	9	4	15	9

[a] Supercharge (Super) = methylated vegetable oil plus pH buffers, Scoil = methylated vegetable oil.

Wild oat control for the three dates was generally similar among evaluations, so discussion will be based on the July 28 evaluation. Tralkoxydim with Scoil provided 94% or greater control of wild oat for all treatments, regardless of application timing or herbicide rate. Wild oat control by tralkoxydim plus Supercharge applied once decreased from 93 to 81% as tralkoxydim rate decreased from 2.9 to 1.5 oz/A. However, tralkoxydim plus Supercharge in two 0.75 oz/A treatments provided 96% control of wild oat which was 15% greater than a single 1.5 oz/A treatment and similar to a single 2.9 oz/A treatment. All tralkoxydim treatments applied once to 2- to 4-leaf wheat caused significant wheat injury. Split-applied treatments caused slight wheat injury after the first split treatment (data not reported), but plants quickly recovered. Wheat yields were 13 to 23 bu/A less for single application treatments compared to split treatments. Although the increased yields for split treatments was primarily due to decreased wheat injury, eliminating early season wild oat competition may have been important as well. There was no visible wheat injury in the 1999 experiment. However, split treatments in 1999 also suggested wild oat control and wheat yields could be improved by reduced-rate split-applied treatment of tralkoxydim.

Split application of imazamethabenz for wild oat control, Fargo. (Ramsdale and Messersmith) 'Oxen' hard red spring wheat was seeded on April 26, 2000. Treatments were a single application at standard timing and two applications at one-half the single rate. Experimental design was a randomized complete block with four replicates, and plot size was 10 by 30 ft. All treatments were applied at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Wild oat control was evaluated visually on June 8, July 9, and July 28 and wheat was harvested on August 7, 2000.

Date	May 10	May 22	May 25
Treatment	1st Split	Single	2nd Split
Air temperature (F)	57	70	70
Relative humidity (%)	80	40	30
Wind (mph)	8-14	8	5
Sky	cloudy	cloudy	clear
Wheat	1.5 leaf	2-4 leaf and 1-2 tillers	6-7 leaf and 2-3 tillers
Height	2-3 inch	3-5 inch	5-7 inch
Wild oat	1-1.5 leaf	1-4 leaf and 1 tiller	variable
Height	2-3 inch	2-5 inch	variable

Treatment[a]	Rate	Wild oat			Yield
		June 8	July 9	July 28	
	oz ai/A	% control			bu/A
Immb + Activator 90	5 + 0.25%	71	56	76	26
Immb + Scoil	5 + 1.5 pt	81	81	89	33
Immb + Activator 90	2.5 + 0.25%	54	35	56	23
Immb + Scoil	2.5 + 1.5 pt	78	70	83	30
Immb + Act 90 / Immb + Act 90	2.5 + 0.25% / 2.5 + 0.25%	88	86	94	38
Immb + Scoil / Immb + Scoil	2.5 + 1.5 pt / 2.5 + 1.5 pt	94	97	99	44
Immb + Act 90 / Immb + Act 90	1.25 + 0.25% / 1.25 + 0.25%	80	81	88	39
Immb + Scoil / Immb + Scoil	1.25 + 1.5 pt / 1.25 + 1.5 pt	84	86	91	37
Untreated		-	-	-	15
CV		5	6	6	16
LSD (5%)		5	6	7	8

[a] Activator 90 = nonionic surfactant, Scoil = methylated vegetable oil.

Evaluations for the three dates were generally similar, so discussion will be based on the July 28 evaluation. Imazamethabenz at 2.5 oz/A with Activator 90 nonionic surfactant applied once provided 56% control of wild oat. However, imazamethabenz plus Activator 90 in two 1.25 oz/A treatments increased wild oat control by 32% over a single 2.5 oz/A treatment and 12% over a single 5 oz/A treatment. Imazamethabenz at 2.5 oz/A plus Scoil applied once provided 83% control of wild oat. Yet, imazamethabenz plus Scoil in two 1.25 oz/A treatments increased wild oat control by 8% over a single 2.5 oz/A treatment and was similar to imazamethabenz with Scoil at 5 oz/A applied once. Wheat yields were enhanced by 7 to 16 bu/A for split applied treatments compared to an equivalent single-rate treatments. The split treatments likely reduced early wild oat competition, which increased wheat yields. These data closely agree with data reported in 1999, which also showed enhanced wild oat control and wheat yields with reduced-rate split-applied treatments of imazamethabenz.

Reduced Rates of Discover for Wild Oat Control. (Terry Gregoire, 2000) Discover herbicide was applied June 18 to 4-6 leaf wild oats in a non crop land situation. Wild oat density was about 10 per square foot. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in a RCBD and replicated four times. Treatments were evaluated June 28th.

Trt No.	Treatment Name	Rate Product Per Acre	Growth Stage	Wild Oat % Control
1	untreated			0.0
2	Discover	4 oz/a	4-6 leaf	86.3
2	DSV	12.8 oz/a		
3	Discover	3.2 oz/a	4-6 leaf	81.3
3	DSV	12.8 oz.a		
4	Discover	2.4 oz/a	4-6 leaf	76.3
4	DSV	12.8 oz/a		
5	Discover	1.6 oz/a	4-6 leaf	67.5
5	DSV	12.8 oz/a		
LSD (P=.05)				13
Standard Deviation				8.45
CV				13.58

Summary
Evaluation 10 days after treatment indicated no difference in wild oat control at 60% of high labeled rate compared to the high labeled rate. Control was only fair to good without benefit of crop competition.

Wild oat control antagonism by a broadleaf herbicide tank-mixed with reduced clodinafop rates. (Lockhart and Howatt) 'Oxen' hard red spring wheat was seeded at Fargo on April 26. Experimental design was a randomized complete block with 4 replicates, and plot size was 10 by 30 ft. All treatments were applied at 8.5gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Wheat was harvest for yield on August 1. Single applications of reduced and full rates were made on the same date as the first split applications.

Date	May 15	May 25
Treatment	1st Split	2nd Split
Air Temperature (F)	65	71
Relative humidity (%)	33	35
Wind (mph)	6	4
Sky	partly cloudy	sunny
Wheat	1.5-2 lf	3.5-4
Wild oat	2 lf	3.5 lf

Table. Wild oat control and wheat yield with clodinafop tank-mixed with bromoxynil& MCPA.

		Wild oat		
Treatment[a]	Rate	June 8	June 22	Yield
	oz ai/A	——% control——		bu/acre
Clodinafop+PO	0.33+1%	64	59	35
Clodinafop+PO/ Clodinafop+PO	0.33+1%/0.33+1%	90	94	47
Clodinafop+PO	1+1%	68	61	38
Clodinafop+PO bromoxynil&MCPA	0.33+1%+4&4	63	50	31
Clodinafop+PO/Clodinafop+PO+ bromoxynil&MCPA	0.33+1%/0.33+1%+4&4	88	87	43
Clodinafop+PO bromoxynil&MCPA	1+1%+4&4	68	60	38
Untreated		--	--	5
LSD (5%)		9	8	8

[a] PO was DSV in copack with Discover from Norvartis.

There was no difference in wild oat control or yield when brox&MCPA (Bronate) wa added compared to the similar treatments without brox&MCPA on June 8. This experiment resulted in no significant wild oat control antagonism of reduced rate multiple applications or full rate of clodinafop tank-mixed with Bronate. Brox&MCPA only antagonized wild oat control with a single 1/3x rate of clodinafop at the June 22 evaluation. Wheat yield was not effected by including brox&MCPA in a tank-mix. Performance of 1 oz clodinafop was low compared to other experiments with no obvious explanation.

Grass herbicide evaluation with broadleaf tank-mixes. (Howatt, Roach, and Davidson-Harrington). The objective of this experiment was to evaluate antagonism between several graminicides and two broadleaf control programs commonly used in North Dakota cereal grains. 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 4 leaf tillering wheat, 3 to 4 leaf tillering wild oat, cotyledon to 4 leaf wild mustard, and cotyledon to 2 leaf wild buckwheat on May 23 with 70° F, 43% RH, 20% cloud cover, 2 to 5 mph wind, and dry topsoil with moist subsoil at 60° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat density was 270 plants/ft^2. Bromoxynil&MCPA was applied to control extraneous weeds after grass herbicides had time to effect wild oat. Wheat injury and weed control were visually estimated. Plots were not harvested because of water damage.

Treatment[a]	Rate	6/02 Wheat injury	6/12 Wioa	6/30 Wioa	7/18 Wioa
	(oz/A)	%	%	%	%
Clodinafop+Score	0.8+0.8%	1	93	96	96
Clodinafop+bromoxynil&MCPA+ Score	0.8+4&4+ 0.8%	2	86	94	94
Clodinafop+thifensulfuron+ MCPAioe+Score	0.8+0.37+ 6+0.8%	2	88	93	94
Fenoxaprop	1.34	5	91	92	93
Fenoxaprop+bromoxynil&MCPA	1.34+4&4	5	81	93	93
Fenoxaprop+thif+MCPAioe	1.34+0.37+6	4	88	92	95
Tralkoxydim+MSO+AMS	2.84+0.5%+20	2	81	88	84
Tralkoxydim+brox&MCPA+MSO+ AMS	2.84+4&4+0.5%+ 20	2	84	94	94
Tralkoxydim+thif+MCPAioe+ MSO+AMS	2.84+0.37+6+ 0.5%+20	2	68	70	65
Flucarbazone+NIS	0.42+0.25%	3	64	82	90
Flcz+bromoxynil&MCPA+NIS	0.42+4&4+0.25%	1	60	80	84
Flcz+thif+MCPAioe+ NIS	0.42+0.37+6+ 0.25%	2	64	86	91
Imazamethabenz+NIS	5+0.25%	1	51	45	54
Imazamethabenz+brox&MCPA+NIS	5+4&4+0.25%	1	48	28	49
Imazamethabenz+thif+MCPAe+NIS	5+0.37+6+0.25%	2	48	51	76
Untreated	0	0	0	0	0
C.V. %		56	9	10	9
LSD 5%		2	9	10	10
# OF REPS		4	4	4	4

[a] NIS was Activator 90 from Loveland Industries, Greeley, CO; Score was from Novartis, Greensboro, NC; and MSO was Supercharge a methylated seed oil with conditioning agent from Zeneca, Wilmington, DE.

All herbicide treatments initially elicited slight crop response. Injury to wheat was not apparent on June 12. Clodinafop and fenoxaprop elicited a quicker response in wild oat than tralkoxydim which was faster acting than flucarbazone and imazamethabenz. Imazamethabenz treatments provided an average of 50% control throughout the season. Broadleaf chemicals did not antagonize clodinafop or flucarbazone. Bromoxynil&MCPA antagonized early season wild oat control with fenoxaprop and mid-season weed control with imazamethabenz. Thifensulfuron+ MCPA antagonized wild oat control with tralkoxydim by up to 19%.

Wild Oat and Foxtail Control in Wheat at Hettinger. (Eriksmoen) '2375' hard red spring wheat was seeded on May 5. The treatment area was applied with fluroxypyr plus bromoxynil at 10 ounces plus 1 pint per acre, respectively, on June 2 to control broadleaf weeds. Treatments were applied to 4.5 leaf wheat and to 3 leaf foxtails and 3.5 leaf wild oats on June 7 with 88 F, 31% RH, clear sky and 6 mph wind. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 28 ft plots. The experiment was a randomized complete block design with four replications. The foxtail population was 22/ft^2 and the wild oat population was 7 plants/ft^2. Evaluations were on June 20 and July 4 for crop injury and on July 4 and August 2 for weed control. The trial was harvested on August 9.

		6/20	7/04			8/02		8/09
Treatment[a]	Rate	Wht	Wht	Fota	Wioa	Fota	Wioa	Yield
	oz/A			%				bu/A
Untreated	0	0	0	0	0	0	0	18.6
Clodinafop+Score	1+0.6%	0	0	99	99	89	100	26.3
Clfp+brox&MCPA+Score	1+8+0.6%	4	5	95	99	86	100	20.9
Clfp+thif+MCPE+Score	1+0.375+0.6%	0	0	98	96	80	100	25.9
Fenoxaprop-P&S	0.8	0	0	99	99	94	100	24.2
Fenx-P&S+brox&MCPA	0.8+8	3	1	94	93	92	81	19.7
Fenx-P&S+thif+MCPE	0.8+0.375+2	0	0	99	98	91	99	24.2
Tralkoxydim+ Super Charge+AMS	2.84+0.5%+40	0	1	94	99	89	100	25.4
Tral+brox&MCPA+ Super Charge+AMS	2.84+8+ 0.5%+40	3	5	89	99	89	100	23.9
Tral+thif+MCPE+ Super Charge+AMS	2.84+0.375+2+ 0.5%+40	0	0	94	98	88	100	22.9
Flucarbazone+ Class Preference	0.28+ 0.25%	11	8	94	96	92	100	22.1
Flcz+brox&MCPA+ Class Preference	0.28+8+ 0.25%	8	11	95	97	95	100	20.1
Flcz+thif+MCPE+ Class Preference	0.28+0.375+2+ 0.25%	22	19	95	98	91	99	19.4
Imazamethabenz+ Class Preference	5+ 0.25%	1	2	0	97	0	95	17.6
Immb+brox&MCPA+ Class Preference	5+8+ 0.25%	0	1	0	96	0	95	21.9
Immb+thif+MCPE+ Class Preference	5+0.375+2+ 0.25%	3	1	0	99	0	100	21.7
C.V. %		109	166	6	4	6	4	12.3
LSD 5%		5	8	6	5	6	5	3.9
# of REPS		4	4	4	4	4	4	4

[a]AMS=ammonium sulfate

Summary

Flucarbazone treatments caused significant crop injury. The addition of bromoxynil&MCPA tended to cause crop injury and reduced yields. Hot temperatures during treatment application probably contributed to this injury. Season long wild oat control was excellent on all herbicide treatments except for the fenoxaprop-P&S + bromoxynil&MCPA treatment which had significantly lower control than the other herbicide treatments. Season long foxtail control was good on all herbicide treatments except for the clodinafop + thifensulfuron + MCPE + Score treatment and the imazamethabenz treatments. Significant yield reductions tended to be associated with treatments causing crop injury.

Effect of thifensulfuron on grass herbicide performance (wild oat). (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded on April 26. Treatments were appled to 3 leaf tillering wheat, 3 to 4 leaf tillering wild oat, cotyledon to 4 leaf wild mustard, and cotyledon to 2 leaf wild buckwheat on May 22 with 74° F, 42% RH, 100% cloud cover, 2 to 4 mph wind, and damp topsoil with wet subsoil at 66° F. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft. The experiment was a randomized complete block design with four replicates. Weed densities were wild oat 270 plants/ft^2, wild mustard 15/ft^2, and wild buckwheat scattered. Wheat injury and weed control were visually estimated.

		6/05				6/30			7/17		
Treatment	Rate	Wheat injury	Wioa	Wibw	Wimu	Wioa	Wimu	Wibw	Wioa	Wimu	Wibw
	oz/A	%									
Fenoxaprop-P&S	1.32	4	88	0	0	92	0	0	96	0	0
Tralkoxydim+Spcg+AMS	2.8+0.5%+20	2	81	0	0	93	0	0	93	0	0
Clodinafop+Score	1+1%	2	90	0	0	96	0	0	97	0	0
Fenx&S+thif+NIS	1.32+0.37+0.125%	2	85	95	94	90	95	90	92	95	89
Tral+thif+Supercharge	2.8+0.37+0.5%	2	74	95	95	86	91	91	83	91	93
Clfp+thif+Score	1+0.37+1%	2	85	95	95	92	92	91	97	94	92
Fenx&S+thif+MCPA+NIS	1.32+0.37+8+0.125%	1	76	95	95	79	97	93	88	97	94
Tral+thif+MCPA+Spcg	2.8+0.37+8+0.5%	1	61	95	95	69	97	94	64	97	95
Clfp+thif+MCPA+Score	1+0.37+8+1%	1	75	95	95	88	98	88	94	97	89
Untreated	0	0	0	0	0	0	0	0	0	0	0
C.V. %		109	5	0	1	4	4	8	5	4	8
LSD 5%		NS	5	NS	1	5	4	6	6	4	6
# OF REPS		4	4	4	4	4	4	4	4	4	4

Wheat plants initially demonstrated a tip-burning response brought on by cool temperatures. The response was not different from the untreated control and was not apparent on 6/30. Tralkoxydim alone provided lower wild oat control than fenoxaprop or clodinafop on 6/05, but control among all three chemicals was equal at other evaluations. Thifensulfuron antagonized wild oat control with tralkoxydim by as much as 10% on 7/17, and the addition of MCPA further antagonized wild oat control by as much as 19%. MCPA antagonized early season wild oat control with fenoxaprop and clodinafop by up to 15%. Late season wild oat control with clodinafop+thifensulfuron+MCPA was not different from clodinafop alone. Thifensulfuron treatments provided 89 to 95% wild buckwheat control on 7/17 with no advantage of including MCPA in the tank-mix. MCPA slightly improved wild mustard control depending on grass product and evaluation timing.

Effect of thifensulfuron on grass herbicide performance (foxtail). (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat and 2 leaf green and yellow foxtail on June 6 with 62° F, 61% RH, 11 to 15 mph wind, and dry topsoil with damp subsoil at 58° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Green and yellow foxtail density was 20 plants/ft^2. Wheat injury and weed control were visually estimated.

Treatment	Rate	6/28 Fota
	oz/A	%
Fenoxaprop-P&S	1.32	95
Tralkoxydim+Supercharge+AMS	2.8+0.5%+20	13
Clodinafop+Score	1+1%	93
Fenoxaprop-P&S+thifensulfuron+NIS	1.32+0.37+0.125%	90
Tralkoxydim+thifensulfuron+Supercharge	2.8+0.37+0.5%	50
Clodinafop+thifensulfuron+Score	1+0.37+1%	86
Fenoxaprop-P&S+thifensulfuron+MCPA+NIS	1.32+0.37+8+0.125%	83
Tralkoxydim+thifensulfuron+MCPA+Supercharge	2.8+0.37+8+0.5%	72
Clodinafop+thifensulfuron+MCPA+Score	1+0.37+8+1%	82
Untreated	0	0
C.V. %		7
LSD 5%		8
# OF REPS		3

No treatment caused wheat injury (data not shown). Tralkoxydim provided inconsistent control of foxtails, especially yellow foxtail. Thifensulfuron did not antagonize foxtail control. MCPA antagonized foxtail control with fenoxaprop and clodinafop by 12% and 11% respectively. Clodinafop provided foxtail control similar to fenoxaprop. Flooding prevented the completion of this study.

Wild oat control with fenoxaprop-P&S tank-mixes. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to examine antagonism of fenoxaprop-P activity from broadleaf tank-mix components. 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 3 leaf wheat, 3 to 4 leaf wild oat, cotyledon to 4 leaf wild mustard, and cotyledon to 2 leaf wild buckwheat on May 22 with 73° F, 46% RH, 100% cloud cover, 4 to 8 mph wind, and damp to dry topsoil with wet subsoil at 65° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oat 270 plants/ft^2, wild mustard 15 plants/ft^2, and wild buckwheat scattered. The fenoxaprop alone treatment was sprayed with 8 oz/A bromoxynil&MCPA seven days after fenoxaprop application for broadleaf weed control. Wheat injury and weed control were visually estimated. Harvest for yield was on August 7.

		6/02		6/12	7/17			8/07
Treatment[a]	Rate	Wheat injury	Wioa	Wioa	Wioa	Wimu	Wibw	Wheat yield
	(oz/A)			%				bu/A
Fenoxaprop	1.32	2	86	93	95	99	95	52
Fenx+thif&trib+NIS	1.32+0.21+0.25%	2	85	90	95	96	85	52
Fenx+thif+NIS	1.32+0.3+0.25%	2	78	90	94	94	90	47
Fenx+thif+MCPAioe+NIS	1.32+0.3+6+0.25%	2	75	71	90	97	91	47
Fenx+thif+flox+NIS	1.32+0.22+1+.25%	3	85	90	91	94	90	52
Fenx+brox& MCPA	1.32+8	3	84	80	95	96	93	51
Fenx+MCPAester	1.32+6	3	83	85	95	98	10	44
Fenx+flox+MCPAioe	1.32+2+6	4	85	81	97	95	76	53
Fenx+brox+flox	1.32+4+1.5	3	80	85	93	95	89	50
Fenx+brox+thif+NIS	1.32+4+0.22+0.25 %	0	81	73	88	91	85	45
Untreated	0	0	0	0	0	0	0	10
C.V. %		67	5	5	3	4	8	14
LSD 5%		2	5	5	4	5	9	9
# OF REPS		4	4	4	4	4	4	4

[a] Fenoxaprop was formulated with a safener as Puma from Aventis, Research Triangle Park, NC.

Minor crop response of leaf bronzing was observed June 2 in nearly all treatments. No visible injury persisted on 6/12. Thifensulfuron tended to antagonize wild oat control more than other broadleaf chemicals. Thifensulfuron antagonism was prevalent at early evaluations and persisted when MCPA was included. Fluroxypyr minimized thifensulfuron antagonism. Lack of early or full season wild oat control tended to result in lower yield than when full season wild oat control was higher. Fenoxaprop+MCPA gave the lowest yield of treated plots primarily because MCPA did not control wild buckwheat. Bromoxynil or thifensulfuron tank-mixes provided good to excellent control of wild buckwheat.

Grass and broadleaf weed control with Everest and various tankmixes. Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot). Durum (Ben) was seeded May 19 into 6-inch rows at 100 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. Postemergence treatments were applied on June 22 with a CO_2 pressurized bicycle sprayer. The primary weeds were wild oat (Wioa), common lambsquarters (Colq), wild buckwheat (Wibw), and redroot pigweed (Rrpw). The crop was harvested on August 30.

Treatment[a]	Rate	Injury		Wioa	Colq		Rrpw	Yield
		Jul 20	Aug 15	Jul 20				
		—%—		—% Control—				bu/A
Untreated		0	0	0	0	0	0	28
Discover + DSV	3.2 fl oz + 0.5 %	1	0	95	0	0	0	36
Achieve + Supercharge	0.45 lb + 0.5 %	0	0	94	0	0	0	32
Puma	0.67 pt	1	0	95	0	0	0	37
Assert + Activator 90	1.37 pt + 0.25 %	0	0	92	0	77	0	37
Everest + 2,4-D ester	0.0382 lb + 1 pt	8	2	92	99	93	94	41
Everest + MCPA ester	0.0382 lb + 1 pt	12	7	82	99	91	94	36
Everest + Buctril	0.0382 lb + 1 pt	9	4	89	88	90	91	38
Everest + Bronate	0.0382 lb + 1 pt	10	6	90	98	93	95	39
Everest + Harmony GT + 2,4-D ester	0.0382 lb + 0.5 oz + 1 pt	8	3	91	99	99	99	38
Everest + Starane + 2,4-D ester	0.0382 lb + 0.5 pt + 1 pt	8	2	93	99	98	98	39
Everest + Curtail M + 2,4-D ester	0.0382 lb + 2 pt + 1 pt	7	2	92	99	99	96	41
Everest + Express	0.0382 lb + 0.33 oz	14	12	89	98	94	98	34
Everest + Express + 2,4-D ester	0.0382 lb + 0.167 oz + 1 pt	8	5	91	98	96	96	39
Everest + Aim + MCPA ester	0.0382 lb + 0.008 lb ai + 0.5 pt	10	4	89	96	92	95	35
Assert + Puma + R-11	1 pt + 0.33 pt + 0.25 %	1	0	93	0	78	0	36
LSD		2	2	6	10	8	9	NS
CV		23	40	5	9	7	8	14

[a] All Everest treatments were applied with Activator 90 at 0.25%.

Everest received full registration in fall 2000. All Everest treatments caused slight crop stunting soon after application. Injury was somewhat higher with MCPA ester or Express. Injury was generally lower where 2,4-D ester was included as a tankmix partner. Wild oat control with Everest was good to excellent with most treatments.

Foxtail control with quinclorac tank-mixes. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat and 2 leaf foxtail on June 6 with 56° F, 61% RH, 30% cloud cover, 11-15 mph wind, and dry topsoil with damp subsoil. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually estimated.

		6/28	
Treatment	Rate	Wheat injury	Fota
	oz/A	%	
Quinclorac+MSO	3+0.19G	0	93
Quinclorac+flucarbazone+MSO	3+0.3+0.19G	0	88
Quinclorac+flucarbazone+MSO	3+0.4+0.19G	0	93
Quinclorac+fenoxaprop+MSO	3+1+0.19G	0	91
Quinclorac+tralkoxydim+MSO+AMS	3+2.8+0.19G+20	0	88
Quinclorac+clodinafop+Score+MSO	3+0.8+0.8%+0.19G	0	94
Fenoxaprop+MSO	1+0.19G	0	91
Tralkoxydim+MSO+AMS	2.88+0.19G+20	0	89
Clodinafop+Score+MSO	0.8+.8%+0.19G	0	93
Flucarbazone+MSO	2.88+0.19G	0	94
Flucarbazone+MSO	0.4+0.19G	0	94
Fenoxaprop+bromoxynil&MCPA	1.7+8	0	91
Untreated	0	0	0
C.V. %		0	5
LSD 5%		NS	6
# OF REPS		4	4

Treatments did not produce a response in wheat. There was no difference among treatments receiving chemical application. Flooding prevented the completion of this study.

Wild oat control with quinclorac tank-mixes. (Howatt, Roach, and Davidson-Harrington) An experiment was established at Fargo with wild, wild mustard, and wild buckwheat present. Treatments were applied to 1 to 4 leaf wild oat, cotyledon to 4 leaf wild mustard, cotyledon to 2 leaf wild buckwheat on May 25 with 60° F, 53% RH, 5% cloud cover, 0 to 2 mph wind, and soil temperature 58° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Weed densities were wild oat 50 plant/ft^2, wild mustard 10 plants/ft^2, and wild buckwheat was scattered. Weed control was visually evaluated.

		6/03			6/23		7/19	
Treatments	Rate	Wioa	Wimu	Wibw	Wioa	Wimu	Wioa	Wimu
	oz/A				%			
Quinclorac+MSO	3+0.19G	0	0	0	0	0	0	0
Quinclorac+flucarbazone+MSO	3+0.3+0.19G	53	97	75	78	98	83	99
Quinclorac+flucarbazone+MSO	3+0.4+0.19G	53	98	75	76	98	83	73
Quinclorac+fenoxaprop+MSO	3+1+0.19G	70	0	0	86	0	78	0
Quinclorac+tralk+MSO+AMS	3+2.9+0.19G+20	60	0	0	88	0	89	0
Quinclorac+clfp+Score+MSO	3+0.8+0.8%+0.19G	65	0	0	96	0	91	0
Fenoxaprop+MSO	1+0.19G	85	0	0	95	0	96	0
Tralkoxydim+MSO+AMS	2.9+0.19G+20	79	0	0	92	0	84	0
Clodinafop+Score+MSO	0.8+.8%+0.19G	80	0	0	97	0	96	0
Flucarbazone+MSO	0.3+0.19G	53	92	80	91	99	94	97
Flucarbazone+MSO	0.4+0.19G	50	98	84	91	99	93	99
Fenoxaprop+bromoxynil&MCPA	1.7+8	88	98	98	90	99	86	94
Untreated	0	0	0	0	0	0	0	0
C.V. %		10	9	18	7	2	10	38
LSD 5%		8	5	8	8	1	11	20
# Of Reps		4	4	4	4	4	4	4

Quinclorac had no activity on wild oat, wild mustard, or wild buckwheat. Quinclorac antagonized wild oat control with each grass chemical evaluated. Data also indicate quinclorac antagonized broadleaf weed control with flucarbazone.

Reduced rates of herbicides for wild oat control, Ada 2000. (Li, Nandula, and Messersmith) The experiment was conducted to determine the effect of reduced rates of postemergence herbicides on wild oat control and seed production. '2375' hard red spring wheat was planted on May 3 2000. Wild oat density was 270 plants/m^2. Treatments were applied to 3- to 4-leaf wheat, 3- to 4-leaf wild oat on May 29, 71 °F, clear sky, and 6 mph wind. The treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Wioa		Wheatt yield
		Control	Seeds	
	oz ai/A	% control	no./m^2	bu/A
Clodinafop + Score	0.48 + 0.8%	98	56	16.3
Clodinafop + Score	0.72 + 0.8%	99	27	20.1
Clodinafop + Score	0.96 + 0.8%	98	8	20.8
Difenzoquat + X 77	8 + 0.25%	42	1840	8.3
Difenzoquat + X 77	12 + 0.25%	69	1080	17.2
Difenzoquat + X 77	16 + 0.25%	74	770	10.0
Fenoxaprop-P	0.64	92	240	21.2
Fenoxaprop-P	0.96	99	19	21.4
Fenoxaprop-P	1.28	99	9	21.0
Flucarbazone + X 77	0.21 + 0.25%	97	7	19.2
Flucarbazone + X 77	0.30 + 0.25%	98	9	18.4
Flucarbazone + X 77	0.42 + 0.25%	99	7	17.2
Imazamethabenz + MSO	2.9 + 1%	91	200	13.8
Imazamethabenz + MSO	4.4 + 1%	91	170	14.1
Imazamethabenz + MSO	5.8 + 1%	97	38	18.9
Tralkoxydim + AMS	1.4 + 1 lb/A	85	230	16.9
Tralkoxydim + AMS	2.1 + 1 lb/A	93	90	17.7
Tralkoxydim + AMS	2.8 + 1 lb/A	92	120	17.8
Nontreated			5700	3.9
LSD (5%)		9	390	4.4

[a] Score = petroleum oil concentrate, X 77 = nonionic surfactant, MSO = methylated seed oil, AMS = spray grade ammonium sulfate.

The highest rate for each herbicide was considered the 1× rate and corresponded to the lowest labeled rate. Also each herbicide was applied at 0.5× and 0.75× rate. Wild oat control by each herbicide was less with 0.5× than the 1× rate but was similar at the 0.75× and 1× rate. The treatment had 90% and higher wild oat control, except difenzoquat at all three rates and tralkoxydim at the 0.5× rate. Wild oat seed production was significantly reduced by herbicide treatments. No rate effects were found, except for difenzoquat. When wild oat control was 90% or more, seed production was reduced by 95% or more. Wheat yield was not reduced when reduced herbicide rates were applied, except difenzoquat at the 0.5× and Imazamethabenz at the 0.5× and 0.75× rates.

Application timings of herbicides for wild oat control, Ada 2000. (Li, Nandula, and Messersmith) The experiment was conducted to determine the effect of application timings of postemergence herbicides on wild oat control and seed production. '2375' hard red spring wheat was planted on May 3, 2000. Wild oat density was 270 plants/m^2. Herbicides were applied to 2- to 3-leaf and 4- to 5-leaf wild oat on May 19 and May 31, respectively. The treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa		Wheat
		Control	Seeds	Yield
	oz ai/A	% control	no./m^2	bu/A
Early application (2- to 3-leaf)				
Clodinafop + Score	0.96 + 0.8%	96	310	21.8
Difenzoquat + X 77	16 + 0.25%	80	1050	17.7
Imazamethabenz + MSO	5.8 + 1%	84	900	18.4
Clodinafop + difenzoquat+ Score + X77	0.48+ 8 + 0.8% + 0.25%	92	1160	19.0
Difenzoquat + imazamethabenz + X 77 + MSO	8 + 2.9 + 0.25% + 1%	93	390	18.7
Clodinafop + imazamethabenz + Score + MSO	0.48 + 2.9 + 0.8% + 1%	96	190	22.1
Clodinafop + difenzoquat + imazamethabenz + Score + X77 + MSO	0.32 + 5.3 + 1.9 + 0.8% + 0.25% + 1%	85	990	16.5
Late application (4- to 5-leaf)				
Clodinafop + Score	0.96 + 0.8%	99	7	13.1
Difenzoquat + X 77	16 + 0.25%	94	260	10.0
Imazamethabenz + MSO	5.8 + 1%	78	720	14.9
Clodinafop + difenzoquat+ Score + X77	0.48+ 8 + 0.8% + 0.25%	99	15	17.1
Difenzoquat + imazamethabenz + X 77 + MSO	8 + 2.9 + 0.25% + 1%	92	1330	13.2
Clodinafop + imazamethabenz + Score + MSO	0.48 + 2.9 + 0.8% + 1%	98	5	17.4
Clodinafop + difenzoquat + imazamethabenz + Score + X77 + MSO	0.32 + 5.3 + 1.9 + 0.8% + 0.25% + 1%	97	72	16.2
Nontreated			5400	6.1
LSD (5%)		10	620	3.6

[a] Score = petroleum oil concentrate, X 77 = nonionic surfactant, MSO = methylated seed oil.

Wild oat control and seed production were similar between the two application times for most herbicide treatments. The exception was difenzoquat applied at the four- to five-leaf stage, which provided higher wild oat control and less seed production than when applied to two- to three-leaf wild oat. However, wheat yield was significantly lower when herbicides were applied at the late than the early stage, apparently due to crop-weed competition.

Foxtail control in spring wheat. Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot). Spring wheat (Alsen) was seeded May 3 into 6-inch rows at 90 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. Postemergence treatments were applied on June 5 with a CO_2 pressurized bicycle sprayer. The primary weeds were yellow foxtail (Yeft) and wild buckwheat (Wibw). The crop was harvested on August 31.

Treatment	Rate	Wheat		Yeft		Wibw		Yield
		Jun 26	Jul 20	Jun 26	Jul 20	Jun 26	Jul 20	
		—% Injury—		——————% Control——————				bu/A
Untreated		0	0	0	0	0	0	0
Discover + DSV	4 fl oz + 12.8 fl oz	0	0	95	96	0	0	0
Discover + DSV + Bronate	4 fl oz + 12.8 fl oz + 1 pt	0	0	92	93	90	87	34
Discover + DSV + Harmony GT + MCPA ester	4 fl oz + 12.8 fl oz + 0.5 oz + 0.75 pt	0	0	88	87	96	95	33
Puma	0.4 pt	5	0	96	95	0	0	0
Puma + Bronate	0.4 pt + 1 pt	2	0	91	78	88	87	37
Puma + Harmony GT + MCPA ester	0.4 pt + 0.5 oz + 0.75 pt	1	0	90	88	97	96	37
Achieve + Supercharge + AMS	7.2 oz + 0.5 % + 15 lb/100 gal	0	0	92	93	0	0	0
Achieve + Bronate + Supercharge + AMS	7.2 oz + 1 pt + 0.5 % + 15 lb/100 gal	0	0	92	88	86	74	29
Achieve + Harmony GT + MCPA ester + Supercharge + AMS	7.2 oz + 0.5 oz + 0.75 pt + 0.5 % + 15 lb/100 gal	0	0	87	79	95	95	34
Everest + NIS	0.4 oz + 0.25 %	14	5	88	85	83	92	29
Everest + NIS + Bronate	0.4 oz + 0.25 % + 1 pt	13	5	83	77	86	86	36
Everest + NIS + Harmony GT + MCPA ester	0.4 oz + 0.25 % + 0.5 oz + 0.75 pt	15	5	90	91	95	95	35
LSD		2	NS	4	12	4	6	NS
CV		24	0	3	9	4	6	13

All products used in this study now have full registration. Everest caused significant early crop stunting, but the wheat generally recovered by late July. All grass products provided good to excellent early-season foxtail control. However, some tankmixes had slightly lower control as the season progressed. In treatments without a broadleaf herbicide, the wild buckwheat literally pulled the wheat to the ground resulting in no yield. Harmony GT was slightly more effective on wild buckwheat than Bronate. Everest alone had good activity on wild buckwheat.

Discover for Foxtail Control (Terry D. Gregoire, 2000) Durum wheat was sprayed June 5th near Devils Lake, North Dakota. The temperature during application was 70°, relative humidity near 36%, with full sunshine. The leaf stages of the wheat and weeds were: wheat 3 leaf, wild mustard 2-6 leaf, and green foxtail 2-3 lf. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in RCBD and replicated 4 times. Treatment evaluation dates were June 19th and July 26th, 2000. The final wheat stand was variable averaging less than 16 plants/sq ft and was not competitive with weeds.

Trt No.	Treatment Name	Rate Rate Unit	Growth Stage	June 19 % control Green Foxtail	June 19 Volunteer Sunflower	June 19 Wild Mustard	July 26 Green Foxtail
1	untreated			0	0	0	0
2	Discover	4 oz/a	3-4 lf	90	0	0	93
2	Dsv	1.17% v.v					
3	Discover	4 oz/a	3-4 lf	89	84	84	79
3	Bronate	16 oz/a	3-4 lf				
3	Dsv	1.17% v/v					
4	Discover	4 oz/a	3-4 lf	83	94	96	86
4	Harmony GT	.5 oz/a	3-4 lf				
4	Dsv	1.17% v/v					
4	Mcpa ester	12 fl oz/a	3-4 lf				
5	Puma	6.4 oz/a	3-4 lf	96	0	0	89
6	Puma	6.4 oz/a	3-4 lf	95	92	96	84
6	Bronate	16 oz/a	3-4 lf				
7	Puma	6.4 oz/a	3-4 lf	93	100	100	69
7	Harmony GT	.5 oz/a	3-4 lf				
7	Mcpa ester	12 fl oz	3-4 lf				
8	ACHIEVE 40 DG	7.1 oz/a	3-4 lf	76	0	0	78
8	Supercharge	.5% v/v					
8	Ams	1.25 lb/a	3-4 lf				
9	ACHIEVE 40 DG	7.1 oz/a	3-4 lf	86	91	94	88
9	Bronate	16 oz/a	3-4 lf				
9	Supercharge	.5% v/v					
9	Ams	1.25 lb/a	3-4 lf				
10	ACHIEVE 40 DG	7.1 oz/a	13-4 lf	50	98	98	0
10	Harmony GT	.5oz/a	3-4 lf				
10	Mcpa ester	12 fl oz/a	3-4 lf				
10	Supercharge	.5% v/v					
10	Ams	1.25 lb/a	3-4 lf				
11	Everest 70 DF	.4 oz/a	3-4 lf	81	43	73	59
11	Nis	.25% v/v					
12	Everest 70 DF	.4 oz/a	3-4 lf	78	94	95	88
12	Bronate	16 oz/a	3-4 lf				
12	Nis	.25% v/v					
13	Everest 70 DF	.4 oz/a	3-4 lf	84	98	100	93
13	Harmony GT	.5 oz/a	3-4 lf				
13	Mcpa ester	12 fl oz/a	3-4 lf				
13	Nis	.25% v/v					
LSD (P=.05)				11.7	20.5	19.2	19.2
Standard Deviation				8.2	14.3	13.8	13.9
DV				10.6	24.5	21.6	20.0

Summary

Discover gave satisfactory control of green foxtail alone or with tank mix partners. Harmony GT as a tank mix partner significantly reduced green foxtail control with Puma and Achieve. Everest alone did not give satisfactory green foxtail control but foxtail control was significantly improved with additional tank mix partners. Everest did have activity on wild mustard and volunteer sunflower when applied alone. Tank mix partners gave good to excellent broadleaf control.

Maverick for weed control in durum wheat, Williston. (Neil Riveland, Gordon Bradbury). Cooperatively with Dupont and James Harbour, this experiment was conducted to evaluate weed control and durum wheat response to Maverick and combinations with Finesse and Ally. 'Maier' durum wheat was planted on fallow in 7.5 inch rows at 90 lbs/a on May 22. Treatments were applied on June 22 to 5.5-leaf wheat, 3-5 leaf green foxtail, 1 to 2 inch Russian thistle and 0.5 to 3 inch red root pigweed with 70 F, 45% RH, clear sky, and less than 5mph SSE wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations were ranged from about 1 to 3 plants/ft2 for Ruth and rrpw and > 10 plts/ft2 for green foxtail. Plots were evaluated on July 1 (crop injury only) and on July 22. Wheat was machine harvested on August 29.

Treatment [a]	Rate	Crop Injury[b]		Crop[b] color	Weed Control			Test weight	Yield
		7-1	7-22		Rrpw	Ruth	Grft		
	oz/a ai	%		1-5	%			lbs/bu	bu/A
Mets&Clsu+Activator 90	0.15+0.125%	10	3	2	99	98	77	57.0	26.1
Metsulfuron+Activator 90	0.06+0.125%	13	8	3	99	97	23	57.0	23.0
Sulfosulfuron+Activator 90	0.5+0.5%	6	0	2	65	66	73	57.1	24.9
2,4-Dioe	6	1	0	1	94	74	0	56.4	23.6
Mets&Clsu +2,4-Dioe	0.15+6	9	3	2	99	97	63	57.0	23.7
Metsulfuron +2,4 Dioe	0.06+6	8	3	2	99	96	16	56.8	23.0
Susu+2,4-Dioe	0.5+6	3	1	1	99	97	75	56.9	24.1
Mets&Clsu+Susu+Activator 90	0.15+0.5+0.25%	18	15	3	99	99	90	56.8	19.6
Mets+Susu+Activator 90	0.06+0.5+0.25%	28	25	5	97	98	80	56.5	16.2
Mets&Clsu+Susu+2,4-Dioe	0.15+0.5+6	9	7	2	99	98	81	56.8	20.8
Mets+Susu+2,4-Dioe	0.06+0.5+6	11	5	2	99	99	71	56.7	21.1
Control	0	0	0	1	0	0	0	57.1	24.1
C.V. %		38	50	26	7	7	17	.8	10.6
LSD 5%		5	4	1	14	9	13	NS	3.4
# OF REPS		4	4	4	2	4	4	4	4

[a] - Activator 90 nonionic surfactant from Loveland.
[b] - Crop injury rated on July 1 and July 22. Severity of stunting to the crop was the main injury symptom rated. Crop color rated only on July 1 where 1 = dark green (no injury) to 5 = yellow green.

Significant crop injury occurred when Maverick was mixed with Finesse or Ally. However application with 2,4-D ester reduced crop injury by half compared to application with a non-ionic surfactant. This was particularly evident with the Maverick/Ally mixture. Crop yields of these mixtures were reduced from 12 to 33% compared to the untreated check and up to 38% when compared to the highest yielding treatment.

Hard red spring wheat and weed response to grass herbicides tank-mixed with carfentrazone. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to determine whether grass herbicides influenced wheat response to carfentrazone and if carfentrazone antagonized wild oat control. 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 3 leaf wheat and spike to 4 leaf wild oat on May 23 with 71° F, 39% relative humidity, 50% cloud cover, 4 to 6 mph wind, dry topsoil with moist subsoil at 62° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat density at time of application was 270/ft^2. Wheat injury and weed control were visually estimated. Harvest for yield was on August 7.

		5/26	6/02		6/12		6/30		7/18	8/07
Treatment	Rate	Wht inj	Wht inj	Wioa	Wht inj	Wioa	Wht inj	Wioa	Wioa	Yield
	oz/A	%								bu/A
Carf+MCPAester+Act90+UAN	128+4+0.25%+4%	24	4	0	1	0	0	0	0	11
Carf+fenx+MCPAester	128+1.7+4	10	3	83	2	86	0	90	93	50
Carf+immb+MCPA+At90+UAN	128+5+4+0.25%+4%	25	4	60	2	55	0	43	88	43
Carf+clfp+Score+MCPA	128+.8+.8%+4	18	4	85	2	84	0	93	94	53
Carf+tral+Scg+MCPA+AMS	128+2.9+.5%+4+20	30	4	87	2	76	0	89	90	52
Carf+flcz+MCPA+At90+UAN	128+.42+4+.25%+4%	5	1	65	2	68	0	85	90	48
Fenx+MCPAester	1.7+4	0	2	85	0	91	0	92	94	54
Immb+MCPAester+Act90	5+4+0.25%	0	0	60	0	53	0	51	84	39
Clfp+Score+MCPAester	0.8+.8%+4	0	2	52	0	88	0	93	94	53
Tral+Spchg+MCPA+AMS	2.9+0.5%+4+20	0	0	77	0	81	0	91	89	45
Flucarbazone+MCPA+Act90	0.42+4+0.25%	0	0	55	0	65	0	83	90	42
Untreated	0	0	0	0	0	0	0	0	0	12
C.V. %		28	53	23	51	6	0	8	2	16
LSD 5%		4	2	23	1	5	NS	8	3	10
# OF REPS		4	3	3	4	4	4	4	4	4

Wheat showed substantial response to carfentrazone at three days after application. Injury consisted of bleached leaf blades on upper leaves of the plant canopy. Tralkoxydim+supercharge with carfentrazone caused greater wheat response than carfentrazone alone. Flucarbazone caused the greatest reduction in carfentrazone injury. Injury rapidly faded and most of the damaged tissue recovered by ten days after application. Small necrotic spots 1 mm to 3 mm in diameter remained on affected leaf tissue. New tissue was unaffected. Minor leaf bronzing was observed on 6/02 from fenoxaprop and clodinafop applied without carfentrazone. Carfentrazone improved broadleaf weed control and tended to increase yield of carfentrazone+graminicide tank-mixes compared graminicides alone. Carfentazone did not antagonize wild oat control or cause a yield difference between treatments with the same graminicide.

General Broadleaf Control in hard red spring wheat, Fargo. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 5 leaf wheat, 0.5 to 2 inch kochia, 2 to 5 leaf redroot pigweed, and 2 to 4 leaf common lambsquarters on June 7 with 82° F, 53% RH, 0% cloud cover, 4 to 6 mph wind, and dry topsoil with damp subsoil at 78° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were kochia scattered, redroot pigweed 20 plants/ft^2, and common lambsquarters scattered. Wheat injury and weed control were visually estimated. Harvest for yield was on August 8.

Treatment	Rate	6/27			8/08
		KOCZ	Rrpw	Colq	Yield
	oz/A		%		bu/A
Fluroxypyr	0.25	10	0	3	59
Fluroxypyr	0.5	15	0	3	57
Fluroxypyr	1.0	25	13	10	60
Fluroxypyr	1.5	81	21	18	59
Fluroxypyr	2.0	90	30	28	60
Thifensulfuron&tribenuron+brox&MCPA	0.22+8	96	95	94	59
Fluroxypyr&MCPA	8	93	93	95	62
Dicamba-dga	2	97	96	95	59
Dicamba-dga+MCPA	1.5+4	97	96	95	57
Bromoxynil&MCPA	12	95	96	94	60
Carfentrazone+Act90+UAN	0.128+0.25%+4%	95	96	97	59
Carfentrazone+dicamba-dga+Act90+UAN	0.128+1.5+0.25%+4%	98	98	97	58
Carfentrazone+fluroxypyr&2,4-D+Act90+UAN	0.128+7.5+0.25%+4%	97	94	96	59
Carfentrazone+thif&trib+Act90+UAN	0.128+0.22+0.25%+4%	98	97	97	58
Untreated	0	0	0	0	57
C.V. %		6	9	9	7
LSD 5%		6	8	8	NS
# OF REPS		4	4	4	4

No wheat injury was observed (data not shown). Fluroxypyr at 1.5 oz/A was needed to obtain greater than 80% kochia control. Fluroxypyr did not control redroot pigweed or common lambsquarters. All other herbicide treatments provided over 92% control of kochia, redroot pigweed, and common lambsquarters. Crop competition aided weed control. Crop vigor was so aggressive that weeds were shaded out of untreated plots by 7/05.

General broadleaf control in hard red spring wheat, Oriska. (Howatt, Roach, and Davidson-Harrington) 'Pioneer 2375' hard red spring wheat was seeded May 1. Treatments were applied to 3 to 5 leaf wheat, 0.25 to 4 inch kochia, 2 to 8 leaf wild mustard, 1 to 4 leaf redroot pigweed, and cotyledon to 6 leaf common lambsquarters on June 2 with 64° F, 37% RH, 0% cloud cover, 0 to 2 mph wind, and dry topsoil with damp subsoil at 66° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually estimated.

		6/19			7/07			
Treatment	Rate	KOCZ	Rrpw	Colq	Wimu	KOCZ	Rrpw	Colq
	oz/A				%			
Fluroxypyr	0.25	15	8	10	21	8	0	0
Fluroxypyr	0.5	25	5	5	23	29	10	3
Fluroxypyr	1.0	58	20	10	45	55	24	8
Fluroxypyr	1.5	83	13	8	61	90	25	10
Fluroxypyr	2.0	91	21	10	65	90	18	10
Thif&trib+brox&MCPA	0.22+8	96	98	99	99	95	97	94
Fluroxypyr&MCPA	8	85	91	85	98	90	90	90
Dicamba-dga	2	88	96	86	94	89	93	92
Dicamba-dga+MCPA	1.5+4	85	95	94	97	91	94	93
Bromoxynil&MCPA	12	97	98	97	99	90	84	84
Carfentrazone+ Act90+UAN	0.128+ 0.25%+4%	95	93	95	90	88	78	71
Carf+dica-dga+ Act90+UAN	0.128+ 1.5+0.25%+4%	98	99	99	99	94	90	86
Carf+flox&2,4-D+ Act90+UAN	0.128+ 7.5+0.25%+4%	96	99	99	99	92	88	85
Carf+thif&trib+ Act90+UAN	0.128+0.22+ 0.25%+4%	97	99	99	99	87	95	92
Untreated	0	0	0	0	0	0	0	0
C.V. %		9	9	9	10	10	10	10
LSD 5%		9	8	8	10	11	9	7
# OF REPS		4	4	4	4	4	4	4

No wheat injury was observed (data not shown). Fluroxypyr at 1.5 oz/A provided 90% kochia control on 7/07. Fluroxypyr at any rate did not control redroot pigweed or common lambsquarters more than 25%. Weed control from fluroxypyr&MCPA was similar to control from dicamba alone. Carfentrazone tank-mixes provided better full season weed control than carfentrazone alone because of plant recovery and regrowth. This location contained a high percentage of ALS-resistant kochia. Bromoxynil&MCPA provided 90%kochia control and 84% redroot pigweed and common lambsquarters control on 7/07, but pigweed and lambsquarters control improved when thifensulfuron&tribenuron was tank-mixed with bromoxynil&MCPA.

General broadleaf control in durum, Minot. (Jenks, Markle, and Willoughby) 'Ben' durum wheat was seeded May 24 at 100 lb/A into 6 inch rows in a conventional tillage system. Treatments were applied to 4 to 5 leaf wheat and 2 to 4 inch kochia on June 23 with 74° F, 44% RH, and soil temperature of 80° F. Treatments were applied with a CO_2 pressurized bicycle sprayer delivering 10 gpa at 40 psi through XR8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with three replicates. Kochia density was 1 to 2 plants/ft^2.

Treatment	Rate	6/20 Kocz	8/21 Kocz	Yield
		%	%	bu/A
Fluroxypyr	0.25	74	78	42
Fluroxypyr	0.5	87	94	39
Fluroxypyr	1.0	96	100	43
Fluroxypyr	1.5	99	100	40
Fluroxypyr	2.0	100	100	49
Thif&trib+trox&MCPA	0.22+8	100	100	42
Fluroxypyr&MCPA	8	98	100	41
Dicamba-dga	2	63	50	40
Dicamba-dga+MCPA	1.5+4	98	100	43
Bromoxynil&MCPA	12	100	100	43
Carfentrazone+Act90+UAN	0.128+0.25%+4%	98	93	37
Carf+dicamba-dga+Activator 90+UAN	0.128+1.5+0.25%+4%	100	100	39
Carf+Flox&2,4-D+Activator 90+UAN	0.128+7.5+0.25%+4%	100	100	43
Carf+thif&trib+Act 90+UAN	0.128+0.22+0.25%+4%	95	91	39
Untreated	0	0	0	42
C.V. %		4.82	7.33	1.3
LSD 5%		7	11	NS
# OF REPS		3	3	3

We compared several rates of fluroxypyr and other herbicides for kochia control in durum wheat. Fluroxypyr at 0.5 oz ai or higher provided good to excellent kochia control. All other treatments except for dicamba-dga alone also controlled kochia. Carfentrazone caused the typical speckling on the wheat leaves when applied alone or in combination with dicamba-dga or fluroxypyr plus 2,4-D. However, the leaf speckling was not observed when combined with thifensulfuron&tribenuron.

General Broadleaf Control in durum, Carrington. (Hendrickson) 'Montrail' durum wheat was seeded April 25. Treatments were applied to 6 leaf tillering durum, flowering mustard, 3 inch flax and redroot pigweed, 1 inch kochia, and 1 leaf wild buckwheat on June 2 with 46° F, 89% RH, 20 % cloud cover, 10 mph wind and soil temperature of 53° F. Treatments were applied broadcast with a CO_2-hand-boom sprayer delivering 8.5 gpa at 18 psi through XR 8002 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually estimated.

		6/16				7/19			
Treatment	Rate	Wht	Wimu	Flax	Rrpw	KOCZ	Rrpw	Wimu	Wibw
	oz/A	%							
Fluroxypyr	0.25	0	28	23	0	17	8	5	5
Fluroxypyr	0.5	3	28	23	0	43	13	18	15
Fluroxypyr	1.0	0	43	70	0	80	21	31	23
Fluroxypyr	1.5	3	45	92	0	93	35	60	68
Fluroxypyr	2.0	5	55	94	0	93	54	69	78
Thifensulfuron&trib+brox&MCPA	0.22+8	14	99	86	91	79	93	97	94
Flox&MCPA	8	5	86	70	89	94	81	94	85
Dicamba-dga	2	6	40	10	84	85	84	67	92
Dica-dga+MCPA	1.5+4	13	88	18	86	87	86	97	84
Bromoxynil&MCPA	12	8	99	15	89	93	90	97	35
Carfentrazone+Act90+UAN	0.128+0.25%+4%	8	91	28	95	94	85	84	45
Carf+dica-dga+Act90+UAN	0.128+1.5+0.25%+4%	14	94	33	93	95	90	93	86
Carf+flox&2,4-D+Act90+UAN	0.128+7.5+0.25%+4%	13	99	91	93	96	94	99	94
Carf+thif&tribenuron+Act90+UAN	0.128+0.22+0.25%+4%	6	98	28	99	87	95	95	93
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		97	12	32	8	8	12	13	16
LSD 5%		9	11	21	7	9	11	12	14
# OF REPS		4	4	4	4	4	4	4	4

Initial wheat injury diminished through the season and was not detected on 7/19. Fluroxypyr at 1.5 oz/A provided over 90% kochia and flax control but poor redroot pigweed and wild mustard control. Carfentrazone provided 94% kochia control. Carfentrazone tank-mixes gave better wild buckwheat control than carfentrazone alone. Carfentrazone+fluroxypy&2,4-D gave the best full season control, greater than 90%, across all weeds, including difficult to control flax and wild buckwheat.

Broadleaf weed control in durum wheat, Williston 2000. (Riveland) This experiment was conducted to evaluate weed control and durum wheat response to broadleaf herbicides. 'Maier' durum wheat was planted on fallow in 7 inch rows at 80 lb/A on May 22. Treatments were applied on June 22 to 5.5-leaf wheat, 1 to 2 inch Russian thistle and 0.5 to 3 inch red root pigweed with 70 F, 45% RH, clear sky, and less than 5mph SSE wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gpa at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations were about 3 plants/ft^2 for Russian thistle and redroot pigweed. Plots were evaluated on July 21. Wheat was machine harvested on August 29.

		7/21			8/29	
Treatment	Rate	Wheat injury	Rrpw	Ruth	Test weight	Yield
	oz/a ai		%		lb/bu	bu/A
Fluroxypyr	0.25	0	30	18	58	28
Fluroxypyr	0.5	0	26	18	57	24
Fluroxypyr	1.0	0	40	63	58	23
Fluroxypyr	1.5	0	50	34	57	23
Fluroxypyr	2.0	0	81	90	57	29
Thifensulfuron+trib+brox&MCPA	0.22+8	7	99	99	57	19
Flox&MCPA	8	0	94	85	57	20
Dicamba-dga	2	9	96	94	57	21
Dicamba-dga+MCPA	1.5+4	10	97	96	57	21
Bromoxynil&MCPA	12	2	96	97	57	20
Carfentrazone+Act90+UAN	0.128+0.25%+4%	1	98	96	57	25
Carf+dica-dga+Act90+UAN	0.128+1.5+0.25%+4%	6	94	92	57	20
Carf+flox&2,4D+Act90+UAN	0.128+7.5+0.25%+4%	11	98	95	58	22
Carf+thf&trbenuron+A90+UAN	0.128+0.22+0.25%+4%	9	97	97	58	21
Untreated	0	0	0	0	57	20
C.V. %		80	13	10	1	20
LSD 5%		4	14	10	NS	6
# OF REPS		4	4	4	2	4

[a]Act90 = Activator 90 nonionic surfactant from Loveland.

Treatments other than rates of fluroxypyr alone or fluroxypyr&MCPA provided more than 91% control of redroot pigweed and Russian thistle. Fluroxypyr alone gave better weed control than expected because of crop competition. Fluroxypyr treatments tended to increase yield compared to other treatments, even though weed control was generally much lower than other treatments.

Volunteer flax response to fluroxypyr. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to evaluate the efficacy of fluroxypyr on volunteer flax which is an increasing problem in North Dakota cereal grains. 'Neche' flax was seeded May 15. Treatments were applied to 3 inch to 4 inch flax on June 6 with 69° F, 49% relative humidity, 30% cloud cover, 12 mph wind, and dry topsoil with damp subsoil at 61° F. Treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Flax density was 75 plants/ft^2. Sethoxydim and MCPA were applied to the entire study area to control extraneous weeds. Flax control was visually estimated. .

Treatment	Rate	6/28 Flax control	7/31 Flax control
	(oz/A)	(%)	(%)
Fluroxypyr	0.25	34	8
Fluroxypyr	0.5	68	50
Fluroxypyr	0.75	79	69
Fluroxypyr	1.0	86	84
Fluroxypyr	1.5	94	94
Untreated	0	0	0
C.V. %		10	27
LSD 5%		9	21
# OF REPS		4	4

Flax stand was greatly reduced by 1 oz/A fluroxypyr or more, while the control score at lower rates primarily reflects injured plants. Very little regrowth was observed at the two higher rates of fluroxypyr, but without crop competition, plants that remained on June 28 were still present on July 31. Flax treated with less than 0.75 oz/A fluroxypyr produced substantial regrowth.

Sulfonylurea tank mix partners for ALS-resistant kochia control (Exp. 1). (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 5 leaf wheat, 2 to 6 leaf redroot pigweed and wild mustard, 2 to 4 leaf common lambsquarters, and 1 to 2 inch kochia on June 7 with 64° F, 64% RH, 10% cloud cover, 6 to 8 mph wind and dry topsoil with damp subsoil at 58° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were redroot pigweed at 20 plants/ft^2 and wild mustard 10 plants/ft^2.

Treatment	Rate	6/27	
		Rrpw	Colq
	oz/A	%	
R6447	0.8	78	20
Thifensulfuron+R6447+NIS	0.375+0.2+0.125%	89	90
Tribenuron+R6447+NIS	0.125+0.2+0.125%	80	89
Thifensulfuron&tribenuron+R6447+NIS	0.3+0.2+0.125%	94	97
Thifensulfuron&tribenuron+R6447+fluroxypyr+NIS	0.3+0.2+1+0.125%	89	93
Thifensulfuron+fluroxypyr+NIS	0.375+1+0.125%	81	75
Tribenuron+fluroxypyr+NIS	0.125+1+0.125%	78	81
Thifensulfuron&tribenuron+fluroxypyr+NIS	0.3+1+0.125%	80	84
Thifensulfuron+bromoxynil&MCPA+NIS	0.375+6+0.125%	97	99
Tribenuron+bromoxynil&MCPA+NIS	0.125+6+0.125%	83	89
Thifensulfuron&tribenuron+bromoxynil&MCPA+NIS	0.3+6+0.125%	90	93
Bromoxynil&MCPA	6	74	86
R6447	0.2	59	28
Fluroxypyr	1	8	5
Untreated	0	0	0
C.V. %		10	7
LSD 5%		11	7
# OF REPS		4	4

No wheat injury was observed (data not shown). R6447 applied POST at 0.2 oz/A provided less than 60% control of redroot pigweed and common lambsquarters and fluroxypyr at 1 oz/A provided less than 10% control of these weeds. Sulfonylureas included in tank-mixes with R6447 or fluroxypyr were largely responsible for weed control obtained. A vigorous wheat crop greatly aided weed control. Aggressively growing wheat eliminated weed pressure in the entire study area by the second evaluation.

Sulfonylurea tank mix partners for ALS-resistant kochia control, Oriska (Exp 2). (Howatt, Roach, and Davidson-Harrington) 'Pioneer 2375' hard red spring wheat was seeded May 1. Treatments were applied to 3 to 5 leaf wheat, 0.25 to 4 inch kochia, 1 to 4 leaf redroot pigweed, and cotyledon to 6 leaf common lambsquarters on June 2 with 64° F, 37% RH, 0% cloud cover, 0 to 2 mph wind, and dry topsoil with damp subsoil at 62° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually estimated.

		6/19			7/07		
	Rate	KOCZ	Rrpw	Colq	KOCZ	Rrpw	Colq
	oz/A	%					
R6447	0.8	64	93	73	68	88	80
Thif+R6447+NIS	0.375+0.2+0.125%	79	94	84	60	88	66
Trib+R6447+NIS	0.125+0.2+0.125%	86	88	86	60	94	93
Thif&trib+R6447+NIS	0.3+0.2+0.125%	79	91	81	48	93	89
Thif&trib+R6447+flox+NIS	0.3+0.2+1+0.125%	96	96	97	91	96	94
Thif+flox+NIS	0.375+1+0.125%	88	92	84	83	71	76
Trib+flox+NIS	0.125+1+0.125%	88	89	90	87	91	86
Thif&trib+flox+NIS	0.3+1+0.125%	86	91	85	85	93	90
Thif+brox&MCPA+NIS	0.375+6+0.125%	89	95	96	80	73	81
Trib+brox&MCPA+NIS	0.125+6+0.125%	94	94	96	85	91	90
Thif&trib+brox&MCPA+NIS	0.3+6+0.125%	97	98	98	88	92	91
Bromoxynil&MCPA	6	89	96	94	86	71	63
R6447	0.2	51	85	39	25	83	13
Fluroxypyr	1	85	16	10	83	20	10
Untreated	0	0	0	0	0	0	0
C.V. %		7	6	11	17	16	24
LSD 5%		8	7	12	17	17	23
# OF REPS		4	4	4	4	4	4

No wheat injury was observed (data not shown). This site had a high percentage of ALS-resistant kochia. R6447 applied POST provided less than 70% kochia control. Weed control was improved by adding fluroxypyr or bromoxynil&MCPA to the tank-mix. Treatments that included 1 oz/A fluroxypyr provided at least 83% kochia control on 7/07. Treatments that included 6 oz/A bromoxynil&MCPA provided at least 80% kochia control. Thifensulfuron&tribenuron+R6447+fluroxypyr gave high and consistent control of all weeds through the season, but this tank-mix was not statistically different from many other non-R6447 treatments because of within treatment variation.

Broadleaf weed control in wheat with bromoxynil&MCPA tank-mixes, (Exp. 1). (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to evaluate broadleaf weed control with bromoxynil&MCPA tank-mixes. 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 5 leaf wheat, 2 to 6 leaf redroot pigweed and 2 to 4 leaf common lambsquarters on June 7 with 88° F, 39% RH, 10% cloud cover, 10 to 15 mph wind and dry topsoil with damp subsoil at 80° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were redroot pigweed 20 plants/ft^2 and scattered common lambsquarters.

Treatment	Rate	6/27	
		Rrpw	Colq
	oz/A	%	
Bromoxynil&MCPA	12	99	99
Bromoxynil&MCPA+2,4-Dester	8+3.8	99	99
Bromoxynil&MCPA+fluroxypyr	8+0.75	99	99
Bromoxynil&MCPA+tribenuron	8+0.06	99	99
Bromoxynil&MCPA+thifensulfuron	6+0.25	99	99
Fluroxypyr&MCPA	10.65	99	99
Thifensulfuron&tribenuron	0.22	81	86
Untreated	0	0	0
C.V. %		2	2
LSD 5%		3	3
# OF REPS		4	4

No wheat injury was observed (data not shown). Given the weed spectrum present in this wheat field, MCPA alone would have provided exceptional weed control. This was evident because fluroxypyr&MCPA gave nearly complete control even though fluroxypyr does not control these weeds. A vigorous wheat crop greatly aided weed control. By the second evaluation, weed pressure, even in untreated plots, was completely removed by aggressively growing wheat. Lower control ratings for thifensulfuron&tribenuron were the result of slower acting herbicides not resistant plants.

Broadleaf weed control in wheat with bromoxynil&MCPA tank-mixes, (Exp 2). (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to evaluate the efficacy of bromoxynil&MCPA tank-mixes on ALS-resistant kochia. 'Pioneer 2375' hard red spring wheat was seeded at 110 lb/A near Oriska, North Dakota, on May 1. Treatments were applied to 3 to 5 leaf tillering wheat, 0.25 to 4 inch kochia, 1 to 4 leaf redroot pigweed, and cotyledon to 6 leaf common lambsquarters on June 2 with 63° F, 40% RH, 0% cloud cover, 6 mph wind, and dry topsoil with damp subsoil at 62° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually evaluated.

		6/19			7/07		
Treatment	Rate	KOCZ	Rrpw	Colq	KOCZ	Rrpw	Colq
	oz/A				%		
Bromoxynil&MCPA	12	93	97	98	88	80	81
Brox&MCPA+24-Dester	8+3.8	91	93	97	81	86	88
Brox&MCPA+flox	8+0.75	94	97	99	85	78	65
Brox&MCPA+trib	8+0.06	93	99	97	89	94	84
Brox&MCPA+thif	6+0.25	66	99	90	38	43	40
Fluroxypyr&MCPA	10.65	85	94	90	87	87	86
Thifensulfuron&tribenuron	0.22	10	13	8	3	95	88
Untreated	0	0	0	0	0	0	0
C.V. %		9	4	8	12	16	23
LSD 5%		9	5	9	11	16	22
# OF REPS		4	4	4	4	4	4

No wheat injury was observed (data not shown). Environmental and edaphic factors resulted in poor wheat vigor and heavy weed pressure in much of the study area. While this provided a very rigorous test of the treatments, lack of canopy closure enabled a post-treatment flush of redroot pigweed and common lambsquarters. The site had a high population of ALS-resistant kochia, which was evident by the ineffectiveness of thifensulfuron&tribenuron. Bromoxynil&MCPA at 8 oz/A and 12 oz/A and fluroxypyr&MCPA provided over 80% kochia control. Bromoxynil&MCPA at 6 oz/A only gave 38% kochia control on 7/07. Tribenuron controlled late emerging redroot pigweed and common lambsquarters better than thifensulfuron.

Broadleaf weed control in hard red spring wheat using auxinic herbicides, Fargo. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 26. Treatments were applied to 5 leaf wheat, 2 to 6 leaf redroot pigweed and wild mustard, 2 to 4 leaf common lambsquarters, and 1 to 2 inch kochia on June 7 with 63° F, 64% RH, 10% cloud cover, 5 to 8 mph wind and dry topsoil with damp subsoil at 58° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were redroot pigweed 20 plants/ft^2 and wild mustard 10 plants/ft^2.

Treatment[a]	Rate	6/27 Rrpw
	oz/A	%
Bromoxynil&MCPAe	8	76
Dicamba-dma+MCPA-SWB	1+7.4	95
Dicamba-dma+MCPA-SWB+Class Act II	1+7.4+2.5%	93
Carfentrazone+dicamba-dma+MCPA-SWB+Class Act II	0.132+1+3.7+2.5%	97
Carfentrazone+dicamba-dma+Class Act II	0.132+1+2.5%	97
Thifensulfuron&tribenuron+MCPA-SWB+Class Act II	0.22+3.7+0.25%	81
Carfentrazone+2,4-D+Class ActII	0.132+3.8+2.5%	98
Carfentrazone+2,4-D-SWB+Class Act II	0.132+3.8+2.5%	94
Carfentrazone+2,4-D-SWB+Class Act II	0.132+7.6+2.5%	98
Fluroxypyr+MCPAester	1.5+8	61
C.V. %		4
LSD 5%		5
# OF REPS		4

[a] SWB were Agriliance formulations.

No wheat injury was observed (data not shown). Treatments containing carfentrazone or dicamba elicited more rapid plant death than treatments containing bromoxynil or fluroxypyr. A vigorous wheat crop greatly aided weed control. Aggressively growing wheat eliminated weed pressure in the entire study area by the second evaluation.

Broadleaf weed control in hard red spring wheat using auxinic herbicides, Oriska. (Howatt, Roach, and Davidson-Harrington) 'Pioneer 2375' hard red spring wheat was seeded May 1. Treatments were applied to 3 to 5 leaf tillering wheat, 0.25 to 4 inch kochia and 1 to 4 leaf redroot pigweed on June 2 with 64° F, 37% RH, 0% cloud cover, 0 to 2 mph wind, and dry topsoil with damp subsoil at 65° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually evaluated.

		6/19		7/07	
Treatment[a]	Rate	KOCZ	Rrpw	KOCZ	Rrpw
	oz/A	%			
Brox&MCPAe	8	26	86	18	83
Dica-dma+MCPA-SWB	1+7.4	80	95	85	85
Dica-dma+MCPA-SWB+ClassActII	1+7.4+2.5%	85	96	86	84
Carf+dica-dma+MCPA-SWB+ClActII	0.132+1+3.7+2.5%	96	97	93	66
Carf+dica-dma+ClassActII	0.132+1+2.5%	96	96	92	79
Thif&trib+MCPA-SWB+ClassActII	0.22+3.7+0.25%	15	93	10	96
Carf+2,4-D+ClassActII	0.132+3.8+2.5%	98	94	84	69
Carf+2,4-D-SWB+ClassActII	0.132+3.8+2.5%	97	98	85	88
Carf+2,4-D-SWB+ClassActII	0.132+7.6+2.5%	97	98	88	82
Flox+MCPAester	1.5+8	76	88	78	85
C.V. %		10	7	10	12
LSD 5%		11	NS	10	15
# OF REPS		4	4	4	4

[a] SWB was a formulation from Agriliance.

No wheat injury was observed (data not shown). This site had a high population of ALS-resistant kochia. Carfentrazone tank-mixes provided better kochia control than bromoxynil, thifensulfuron&tribenuron, or fluroxypyr tank-mixes with MCPA. Carfentrazone did not increase weed control by dicamba and actually decreased redroot pigweed control when tank-mixed with dicamba+MCPA. The SWB formulation of 2, 4-D did not improve kochia control, but it did improve redroot pigweed control.

Wild buckwheat control with premix and tank-mix fluroxypyr options. (Howatt, Manthey, Roach, and Davidson-Harrington) 'Ben' durum wheat was seeded April 27. The entire plot was sprayed with Fenoxaprop-P&S for grass control May 22. Treatments were applied to 3 to 4 leaf tillering wheat, 1 to 3 leaf wild buckwheat, cotyledon to 6 leaf wild mustard and 4 to 7 diameter (rosette) Canada thistle on May 25 with 71° F, 35% RH, 25% cloud cover, 0 to 5 mph wind, and dry topsoil with moist subsoil at 76° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild buckwheat 2 plants/ft^2, wild mustard 15 plants/ft^2, and Canada thistle variable. Wheat injury and weed control were visually estimated. Harvest for yield was on August 18. Durum grain samples were submitted to the Cereals Testing Lab for protein, gluten, and ash analysis.

Treatment	Rate	6/23			7/17			8/18	
		Wimu	Wibw	Cath	Cath	Wimu	Wibw	Yield	Dock
	oz/A			%				bu/A	%
Fluroxypyr+ Activator 90	1.5+ 0.25%	34	38	3	7	40	33	20	20
Flox+Act90	2+0.25%	76	69	13	17	78	65	24	11
Flox&24-D+Act90	10+0.25%	98	88	59	71	98	86	21	6
Flox&24-D+Act90	7.5+0.25%	96	75	45	44	94	73	23	8
Flox&24-D+Act90	5+0.25%	93	81	43	46	91	79	26	6
Flox&MCPA+Act90	10+0.25%	97	86	65	74	97	83	30	3
Flox&MCPA+Act90	8.36+0.25%	98	85	45	58	98	85	24	5
Flox&2,4-Ddma+LI700	10+0.25%	98	70	55	57	99	65	28	19
Flox&2,4-Ddma+LI700	7.5+0.25%	94	73	33	50	94	83	23	14
Flox&2,4-D+ thif&trib+Act90	5+ 0.22+0.25%	99	94	73	74	98	93	27	3
Flox&2,4-D+thif+Act90	5+0.19+0.25%	93	85	51	65	93	84	24	6
Thif&trib+24-D+NIS	0.22+4+0.25%	98	88	58	64	97	88	28	3
24-D-Salvo	6	96	39	58	69	96	36	26	20
Brox&MCPA	8	92	75	48	50	90	73	25	11
Brox&MCPA+flox+ Act90	8+1.5+ 0.25%	96	86	43	51	94	85	20	6
Carf+Quad7	0.13+1%	25	36	0	3	30	43	29	25
Carf+2,4-D-S+ thif+Quad7	0.13+6+ 0.19+1%	94	88	43	54	91	85	28	4
Dicamba+MCPA	1+4	97	79	40	54	97	78	26	16
Untreated	0	0	0	0	0	0	0	24	36
C.V. %		8	15	28	24	9	13	20	57
LSD 5%		9	15	16	16	11	13	NS	11
# OF REPS		4	4	4	4	4	4	3	3

No wheat injury was observed (data not shown). Treatments containing 2, 4-D or MCPA provided over 90% control of wild mustard. Fluroxypyr&MCPA provided more consistent control of wild buckwheat than other fluroxypyr pre-mixes for the rates examined while fluroxypyr&2, 4-D provided more consistent control of Canada thistle than other fluroxypyr pre-mixes. Fluroxypyr did not enhance the activity of bromoxynil&MCPA. Fluroxypyr&2,4-D+thifensulfuron&tribenuron provided the best full season control of Canada thistle at 73%. Standing water severely affected replication one of this study. Replication one was therefore eliminated from yield analysis. Saturated soil in lower areas of the study also may have inflated within treatment error for yield and reduced the sensitivity of analysis. Yield, test weight, kernel size, protein and ash, semolina protein, gluten index, wet gluten, and ash were not affected by treatments (data not shown). Wheat dockage due to wild buckwheat contamination varied from 3 to 36% and was not well correlated to vegetation control rating.

Broadleaf weed control with carfentrazone tank-mixes in durum. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to evaluate weed control and durum response to carfentrazone tank-mixes. 'Ben' durum was seeded April 27. The entire plot area was treated with 1.33 oz/A fenoxaprop for grass weed control on May 22. Treatments were applied to 3 to 4 leaf wheat, 1 to 3 leaf wild buckwheat, and cotyledon to 6 leaf wild mustard on May 25 with 64° F, 46% relative humidity, 0% cloud cover, 0 to 1 mph wind and dry topsoil with moist subsoil at 66° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild buckwheat 2 plants/ft^2 and wild mustard 15 plants/ft^2. Durum injury and weed control were visually estimated. Harvest for yield was on August 18.

		6/09			6/23		8/18
Treatment	Rate	Wimu	Wibw	Cath	Wimu	Wibw	Yield
	oz/A			%			bu/A
Carf+2,4-Ddma+NIS+UAN	0.128+6+0.25%+4%	96	88	50	97	80	32
Carf+2,4-Ddma+NIS+AMS	0.128+6+0.25%+24	99	94	75	97	76	33
Carf+2,4-Dioe+NIS+UAN	0.128+6+0.25%+4%	97	82	85	96	74	30
Carf+MCPAdma+NIS+UAN	0.128+6+0.25%+4%	97	96	30	96	81	32
Carf+2,4De+dica+NIS+UAN	0.128+4+1.4+0.25%+4%	97	98	60	99	90	34
Carf+flox+NIS+UAN	0.128+1+0.25%+4%	80	91	10	78	69	30
Carf+flox+NIS+UAN	0.128+1.5+0.25%+4%	95	94	20	87	79	33
Carf+flox&2,4-D+NIS+UAN	0.128+5+0.25%+4%	97	96	NA	94	84	34
Carf+thif&trib+NIS+UAN	0.128+0.22+0.25%+4%	98	94	10	96	83	29
Flox&2,4-D+thif&trib	7.5+0.22	99	97	80	95	84	30
Carf+NIS+UAN	0.128+0.25%+4%	74	78	0	44	40	29
Fluroxypyr	2	83	79	NA	89	70	31
Untreated	0	0	0	0	0	0	25
C.V %		11	14		7	9	12
LSD 5%		13	16		8	9	NS
# OF REPS		4	4	1	4	4	3

No visible injury from any herbicide treatment was detected on durum (data not shown). Carfentrazone alone provided poor wild mustard and wild buckwheat control. MCPA and 2, 4-D generally were better tank-mix partners with carfentrazone than fluroxypyr for this weed spectrum. Formulation of 2, 4-D did not influence weed control. Wild buckwheat control with carfentrazone and 1 oz/A fluroxypyr was lower than tank-mixes containing thifensulfuron&tribenuron. Other carfentrazone tank-mixes provided wild buckwheat control similar to thifensulfuron&tribenuron tank-mixes. Standing water severely affected replication one of this study. Replication one was therefore eliminated from yield analysis. Saturated soil in lower areas of the study also may have inflated within treatment error for yield and reduced the sensitivity of analysis. There were no differences in yield, but all herbicide treatments tended to increase yield compared to untreated control.

Broadleaf weed control with carfentrazone tank-mixes in barley. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to evaluate weed control and barley response with carfentrazone tank-mixes. 'Foster' barley was seeded April 28. Treatments were applied to 3 to 4 leaf barley, cotyledon to 6 leaf wild mustard, and cotyledon to 2 leaf redroot pigweed on May 25 with 71° F, 34% RH, 5% cloud cover, 0 to 2 mph wind, moist subsoil, and soil temperature of 76° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild mustard 20 plants/ft^2 and redroot pigweed 35 plants/ft^2. Barley injury and weed control were visually estimated. Harvest for yield was on August 3.

Treatment[a]	Rate	6/5			6/15			8/03
		Barley	Wimu	Rrpw	Barley	Wimu	Rrpw	Yield
	(oz/A)	%			%			bu/A
Carf+2,4-Ddma+NIS+UAN	0.128+6+0.25%+4%	5	98	99	6	99	99	67
Carf+2,4-Ddma+NIS+AMS	0.128+6+0.25%+24	5	98	99	5	99	99	73
Carf+2,4-Dioe+NIS+UAN	0.128+6+0.25%+4%	6	98	99	5	98	97	69
Carf+MCPAdma+NIS+UAN	0.128+6+0.25%+4%	5	98	98	3	99	99	74
Carf+2,4-Dioe+dica+NIS+UAN	0.128+4+1.4+0.25%+4%	5	97	98	5	99	99	71
Carf+flox+NIS+UAN	0.128+1+0.25%+4%	4	94	97	3	99	99	73
Carf+flox+NIS+UAN	0.128+2.5+0.25%+4%	6	93	99	4	96	98	72
Carf+flox&2,4-Dioe+NIS+UAN	0.128+5+0.25%+4%	6	98	99	4	99	99	70
Carf+thif&trib+NIS+UAN	0.128+0.22+0.25%+4%	3	98	99	2	99	99	72
Flox&2,4-Dioe+thif&trib	7.5+0.22	3	91	96	2	99	99	76
Carf+NIS+UAN	0.128+0.25%+4%	3	88	96	2	92	97	72
Fluroxypyr	2	0	53	13	0	80	33	72
Untreated	0	0	0	0	0	0	0	70
C.V. %		40	3	3	60	3	3	6
LSD 5%		2	4	3	3	4	4	NS
# OF REPS		4	4	4	4	4	4	4

[a] NIS is Activator 90 from Loveland Industries.

Initial barley injury was leaf bleaching and scattered necrotic lesions approximately 1 mm to 2 mm in diameter. New tissue showed no symptoms, but plants treated with carfentrazone remained stunted through much of the growing season. Degree of stunting in late season ranged from 10% to 20%. Tillering did not appear to be affected. All treatments except fluroxypyr alone provided 92% control or greater of wild mustard and redroot pigweed. Vigorous barley was an exceptional competitor under plentiful moisture and minimized weed effects. Wheat injury did not affect yield.

Broadleaf control with quinclorac tank-mixes. (Howatt, Roach, and Davidson-Harrington) 'Pioneer 2375' hard red spring wheat was seeded May 1 in Oriska, North Dakota. Treatments were applied to 3 to 5 leaf wheat, 0.25 to 4 inch kochia and 1 to 4 leaf redroot pigweed on June 2 with 65° F. 30% RH, and 4 mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually evaluated.

		6/19		
Treatment	Rate	Wheat injury	KOCZ	Rrpw
	oz/A		%	
Quinclorac+MSO	2.24+0.19G	0	69	66
Quinclorac+MSO	3+0.19G	0	83	69
Quinclorac+brox&MCPA+MSO	2.3+8+0.19G	0	93	95
Quinclorac+brox&MCPA+MSO	3+8+0.19G	0	95	97
Quinclorac+thif&trib+MSO	2.3+0.3+0.19G	0	77	93
Quinclorac+thif&trib+MSO	3+0.3+0.19G	0	83	94
Quinclorac+thif&trib+flox+MSO	2.3+0.3+1.5+0.19G	0	95	96
Quinclorac+thif&trib+flox+MSO	3+0.3+1.5+0.19G	0	96	97
Brox&MCPA+MSO	8+0.19G	0	91	94
Thif&trib+MSO	0.3+0.19G	0	50	93
Thif&trib+flox+MSO	0.3+1.5+0.19G	0	90	95
Fenx+brox&MCPA+flox	1.7+8+1.5	0	97	95
Untreated	0	0	0	0
C.V. %			7	9
LSD 5%		NS	8	11
# OF REPS		4	4	4

No wheat injury was observed. The site had a high population of ALS-resistant kochia, which was evident by the ineffectiveness of thifensulfuron&tribenuron. Quinclorac at 3 oz/A provided 83% kochia control and 69% redroot pigweed control. Bromoxynil&MCPA or fluroxypyr improved kochia control by 10 to 13%. Bromoxynil&MCPA or thifensulfuron&tribenuron improved pigweed control by 14 to 18%.

Hard red spring wheat response to tralkoxydim applied with fungicide. (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to determine whether adjuvants formulated with liquid fungicides, broadleaf herbicides, or tralkoxydim influence the response of wheat to tralkoxydim. Soil is silty clay with organic matter of 4.5 to 6.0 and pH of 7.5. Nitrogen Fertilizer was fall applied at 120 lbs/A. The preceding crop was hard red spring wheat. 'Oxen' hard red spring wheat was seeded April 26 in 7 inch rows using a Haybuster drill. Treatments were applied to 4 to 5 leaf wheat on June 6 with 62° F, 61% RH, 30% cloud cover, 11-15 mph wind, and dry topsoil with damp subsoil at 58° F. No rainfall was recorded in the 24 hours following treatment application. Treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles spaced at 20 inches to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury was visually estimated. Harvest for yield was on August 7.

Treatment[a]	Rate	6/09 Wheat injury	6/12 Wheat injury	6/28 Wheat injury	8/07 Wheat yield
	(oz/A)	%	%	%	bu/A
Tralkoxydim-SC+Supercharge	2.9+0.5%	1	0	0	45
Tral-SC+Supercharge+brox&MCPA	2.9+0.5%+8	3	1	0	48
Tral-SC+Supercharge+brox&MCPA+ propiconazole	2.9+0.5%+8+ 1.8	3	1	0	48
Tral-SC+Supercharge+brox&MCPA+ tebuconazole	2.9+0.5%+8+ 1.8	8	4	0	53
Tral-SC+Supercharge+brox&MCPA+ azoxystrobin	2.9+0.5%+8+ 2.08	4	2	0	56
Tralkoxydim+Supercharge	2.9+0.5%	1	0	0	47
Tralkoxydim+Supercharge+brox&MCPA	2.9+0.5%+8	2	1	0	54
Tral+Supercharge+brox&MCPA+ propiconazole	2.9+0.5%+8+ 1.8	2	2	0	56
Tral+Supercharge+brox&MCPA+ tebuconazole	2.9+0.5%+8+ 1.8	3	4	0	53
Tral+Supercharge+brox&MCPA+ azoxystrobin	2.9+0.5%+8+ 2.08	3	1	0	50
Untreated	0	0	0	0	43
C.V. %		3	88	0	88
LSD 5%		2	2	NS	6
# OF REPS		4	4	4	4

[a]AMS at 15 g was included in all herbicide treatments, SC designates a liquid formulation of tralkoxydim, propiconazole was Tilt, tebuconazole was Folicur, and azoxystrobin was Quadris.

Wheat response, manifested as chlorotic tissue on leaf tips and in mid-blade bands, was observed. Treatments that included liquid formulated tralkoxydim were more prone to this injury than dry flowable formulation tralkoxydim treatments. Injury was more severe and persisted longer when the fungicide tebuconazole was included, but this did not affect yield. Wheat showed no injury on 6/28. Liquid tralkoxydim resulted in lower yield than dry tralkoxydim when included in a tank-mix with bromoxynil&MCPA+propiconazole. Comparisons between other similar tank-mixes showed no differences between liquid and dry formulations.

Hard red spring wheat response to tralkoxydim applied with fungicide (Exp 2). (Howatt, Roach, and Davidson-Harrington) The objective of this experiment was to determine whether adjuvants formulated with liquid fungicides, broadleaf herbicides, or tralkoxydim influence the response of wheat to tralkoxydim. The experiment was established at Prosper, ND. Soil has a loam texture with organic matter of 4 and pH of 7.2. The area is fertilized by test. The preceding crop was sunflower. 'Oxen' hard red spring wheat was seeded May 3 in 6 inch rows using a Kirschman drill. Treatments were applied to 4 to 4.5 leaf wheat on June 5 with 65° F, 51% RH, 30%, 46% dew pt., 30% cloud cover, 5 to 9 mph wind, and a soil temperature of 55° F. No rainfall was recorded in the 24 hours after application of treatments. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles spaced at 20 inches to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design. Wheat injury was visually estimated.

Treatment[a]	Rate	6/09 Wheat injury	6/19 Wheat injury
	oz/A	%	
Tralkoxydim-SC+Supercharge	2.9+0.5%	0	0
Tral-SC+Supercharge+bromoxynil&MCPA	2.9+0.5%+8	3	0
Tral-SC+Supercharge+bromoxynil&MCPA+ propiconazole	2.9+0.5%+8+ 1.8	4	0
Tral-SC+Supercharge+bromoxynil&MCPA+tebuconazole	2.9+0.5%+8+1.8	14	3
Tral-SC+Supercharge+bromoxynil&MCPA+azoxystrobin	2.9+0.5%+8+2.08	3	0
Tralkoxydim+Supercharge	2.9+0.5%	0	0
Tralkoxydim+Supercharge+bromoxynil&MCPA	2.9+0.5%+8	3	0
Tralkoxydim+Supercharge+brox&MCPA+propiconazole	2.9+0.5%+8+1.8	3	0
Tralkoxydim+Supercharge+brox&MCPA+tebuconazole	2.9+0.5%+8+1.8	15	2
Tralkoxydim+Supercharge+brox&MCPA+azoxystrobin	2.9+0.5%+8+2.08	3	0
Untreated	0	0	0
C.V. %		47	49
LSD 5%		3	0
# OF REPS		4	4

[a]AMS at 15 g was included in all herbicide treatments, SC designates a liquid formulation of tralkoxydim, propiconazole was Tilt, tebuconazole was Folicur, and azoxystrobin was Quadris.

Wheat injury, manifested as chlorotic leaf tips and mid-blade bands, was observed. Injury occurred when tank-mix partners were included with tralkoxydim. Liquid and dry flowable tralkoxydim formulations elicited similar wheat response. Tebuconazole caused significantly more injury than other chemicals, and this injury persisted to 6/19. No injury was detected on 7/03 (data not shown). Severe lodging prevented a meaningful harvest.

Valor in spring wheat. Zollinger and Fitterer. Experiments were conducted near Valley City and Fargo, ND to evaluate weed control and crop safety from Valor applied EPP and PRE. In Valley City, EPP treatments were applied April 24, 2000 at 12:00 pm with 76 F air, 47 F soil at a depth of 2 to 4 inch, 37% relative humidity, 40% clouds, 1 to 5 mph S wind, dry soil surface, and moist subsoil. '2375' wheat was planted on May 10, 2000. PRE treatments were applied May 11, 2000 at 12:30 pm with 64 F air, 57 F soil at a depth of 2 to 4 inch, 50% relative humidity, 100% clouds, 3 to 5 mph NE wind, moist soil surface, and wet subsoil. In Fargo, EPP treatments were applied May 11, 2000 at 9:00 am with 53 F air, 53 F soil at a depth of 2 to 4 inch, 90% relative humidity, 95% clouds, 5 to 10 mph SW wind, dry soil surface, and moist subsoil. 'Oxen' wheat was planted on May 25, 2000. PRE treatments were applied May 26, 2000 at 10:00 am with 65 F air, 58 F soil at a depth of 2 to 4 inch, 48% relative humidity, 80% clouds, 8 to 11 mph NW wind, dry soil surface, and moist subsoil. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

Table 1. Flumioxazin in spring wheat – Valley City, ND.

Treatment[a]	Rate	Fxtl[b]	Ebns[c]	Rrpw[d]	Coma[e]
	lb/A	% control			
EPP					
Roundup Ultra	1 qt	57	43	60	27
Valor + RU Ultra	2 oz + 1 qt	82	99	99	88
Valor + RU Ultra	4 oz + 1 qt	94	96	95	90
PRE					
Roundup Ultra	1 qt	53	55	73	45
Valor + RU Ultra	2 oz + 1 qt	80	95	96	87
Valor + RU Ultra	4 oz + 1 qt	85	96	93	78
Valor + Herbimax	2 oz + 1 qt	72	96	96	93
Untreated		0	0	0	0
LSD (0.05)		13	12	10	14

[a]All treatments were applied with 2.5 lb/A AMS. Herbimax is a petroleum oil.
[b]Fxtl = green and yellow foxtail; [c]Ebns = Eastern black nightshade; [d]Rrpw = redroot pigweed; [e]Coma = common mallow.

Table 2. Flumioxazin in spring wheat - Fargo, ND.

		Wheat		June 8			July 6		
Treatment[a]	Rate	June 8	July 6	Fxtl[b]	Colq[c]	Dali[d]	Fxtl[b]	Rrpw[e]	Dali[d]
	lb/A	----% injury -----		---------- % control ----------					
EPP									
Roundup Ultra	1 qt	0	0	60	86	99	30	60	93
Valor + RU Ultra	2 oz + 1 qt	4	0	82	99	93	75	94	99
Valor + RU Ultra	4 oz + 1 qt	2	0	88	99	99	80	89	99
PRE									
Roundup Utra	1 qt	2	3	75	99	73	35	50	99
Valor + RU Ultra	2 oz + 1 qt	5	20	90	99	99	90	93	99
Valor + RU Ultra	4 oz + 1 qt	5	25	88	99	99	91	99	99
Valor + RU Ultra	2 oz + 1 qt	3	0	85	96	86	80	93	99
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		4	8	7	9	9	14	10	7

[a]All treatments were applied with 2.5 lb/A AMS. Herbimax is a petroleum oil.
[b]Fxtl = green and yellow foxtail; [c]Colq = common lambsquarters; [d]Dali = dandelion; [e]Rrpw = redroot pigweed.

Wheat injury was only observed at Fargo. Injury symptoms at June 8 were necrotic speckling and blotches and at July 6 were stunting and stand thinning. Valor applied with Roundup Ultra improved weed control from Roundup Ultra applied alone and generally gave greater than 80% foxtail and broadleaf weed control. At Fargo on July 6, common lambsquarters was completely controlled and the Valor and Herbimax treatment did not kill volunteer wheat which eventually out competed the seeded wheat.

Weed control in IMI-tolerant hard red spring wheat. (Howatt, Roach, and Davidson-Harrington) 'IMI' wheat was seeded May 5. Treatments were applied to 4 leaf wheat, 2 leaf green and yellow foxtail, and cotyledon to 3 leaf redroot pigweed on June 6 with 69° F, 49% RH, 40% cloud cover, 12 mph wind, and dry topsoil with moist subsoil at 61° F. Treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wheat injury and weed control were visually estimated.

		6/28				7/17			
Treatment	Rate	Wht inj	Vowh	Fota	Rrpw	Wht inj	Vowh	Fota	Rrpw
	oz/A	%							
Imazamox+28N+NIS	0.5+1.25%+.25%	0	98	95	96	1	99	98	95
Imazamox+28N+NIS	0.64+1.25%+.25%	0	99	94	92	3	96	97	95
Imazamox+28N+NIS	0.77+1.25%+.25%	0	99	97	96	3	98	98	93
Fenoxaprop+ bromoxynil&MCPA	1.7+ 8	0	0	95	79	0	0	97	94
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		0	2	3	4	83	2	2	4
LSD 5%		NS	1	4	5	2	2	3	4
# OF REPS		4	4	4	4	4	4	4	4

Wheat injury was not initially observed. Wheat response, manifested as shorter mature wheat, became apparent at head emergence. All rates of imazamox provided over 90% volunteer wheat, foxtail, and redroot pigweed control. Fenoxaprop gave foxtail control similar to imazamox but had no effect on volunteer wheat. Bromoxynil&MCPA provided only 79% redroot pigweed control on 6/28 but with crop competition control reached 94% on 7/17. The experiment was destroyed in early grain fill according to protocol.

Weed control in glyphosate-resistant spring wheat. (Howatt, Roach, and Davidson-Harrington) Roundup ready hard red spring wheat was seeded April 27. Treatments (2-3 lf) were applied to 2 to 3 leaf wheat, spike to 3 leaf wild oat, cotyledon to 4 leaf wild mustard, and 8-inch rosette Canada thistle on May 22 with 67° F, 63% RH, 5% cloud cover, 1 to 3 mph wind, and damp topsoil with wet subsoil at 63°F. Treatments (5-6 lf) were applied to 5 leaf wheat, 6 leaf wild oat , 2 to 6 leaf wild mustard, and bolting Candada thistle on June 7 with 87° F, 41% RH, 0% cloud cover, 4 to 6 mph wind, and dry topsoil with damp subsoil at 81° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oat 50 plants/ft^2, wild mustard 35 plants/ft^2, and Canada thistle was scattered. Wheat injury and weed control were visually estimated. Harvest for yield was on August 19.

Treatment[a]	Rate	6/09			6/23			7/11			8/19
		Wioa	Wimu	Cath	Wioa	Wimu	Cath	Wioa	Wimu	Cath	Yield
	oz/A	%									bu/A
1. Glyphosate-ipa	6	99	98	80	98	89	57	93	90	50	34
2. Glyphosate-ipa	9	99	98	75	99	76	58	94	68	50	33
3. Glyphosate-ipa	12	99	99	83	98	85	35	91	83	43	33
4. Glyt-ipa+dica-dma	6+0.06	99	99	83	98	92	55	90	92	50	32
5. Glyt-ipa+thif&trib	6+0.22	99	99	75	98	95	63	94	97	50	32
6. Glyt-ipa+brox	6+0.25	99	96	79	98	84	45	93	85	39	33
7. Glyphosate-TMS	10.9	99	98	88	99	89	37	91	90	40	34
8. Glyphosate-ipa	6	0	0	0	95	96	77	96	96	80	25
9. Glyphosate-ipa	9	0	0	0	95	96	86	98	98	80	26
10. Glyphosate-ipa	12	0	0	0	95	99	90	96	99	85	22
11. Glyt-ipa+2,4-Dester	6+0.25	0	0	0	94	97	75	97	99	75	25
12. Glyt-ipa/glyt-ipa	6/6	99	99	77	99	97	78	99	98	76	38
13. Glyt-ipa/glyt-ipa	12/12	99	98	83	99	97	80	99	99	75	38
14. Fenx+brox&MCPA	1.7+8	85	99	7	92	91	27	83	95	25	27
15. Fenx+brox&MCPA	1.7+8	0	0	0	60	91	53	59	89	48	19
16. Glyphosate-TMS	10.9	0	0	0	94	98	85	97	99	85	21
17. Untreated	0	0	0	0	0	0	0	0	0	0	6
C.V. %		5	3	11	4	8	19	5	7	24	13
LSD 5%		4	2	8	5	9	19	6	9	19	5
# OF REPS		4	4	3	4	4	3	4	4	4	4

[a] Treatments 1 through 7, 14, and the first application of 12 and 13 were applied at 2-3 lf stage. Treatments 8 through 11, 15, 16 and the second application of 12 and 13 were applied at 5-6 lf stage.

The variety used was not adapted to our environment, so yield comparison should not be made to other studies. Yield comparisons are valid within this study to evaluate herbicide and application timing effects. No wheat response was observed (data not shown). Glyphosate and glyphosate tank-mixes generally provided equal performance within application timing. Two applications of glyphosate at 6 or 12 oz/A provided the most effective control of early and late season wild oat, wild mustard, and Canada thistle, which resulted in a yield increase of 41% compared to the conventional treatment of early fenoxaprop+bromoxynil& MCPA application. Early applied glyphosate treatments did not provide full season Canada thistle control while late treatments did not remove early season weed competition. Early applied glyphosate treatments produced higher yield than late applied treatments but lower yield than split treatments. Isopropylamine and trimethylsulfonium glyphosate formulations provided equal performance.

Volunteer glyphosate-resistant spring wheat control in annual crops. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant (WH1), 'Grandin' (WH2), and 'Oxen' (WH3) hard red spring wheat were seeded April 27. Treatments 1 through 12 were applied to 2 to 3 leaf wheat, spike to 3 leaf wild oat, cotyledon to 4 leaf wild mustard, and 8-inch rosette Canada thistle on May 22 with 71° F, 63% RH, 0% cloud cover, no wind, and moist topsoil with wet subsoil at 61° F. Treatments 13 through 24 were applied to 5 leaf wheat, 6 leaf wild oat, 2 leaf foxtails, 2 to 6 leaf wild mustard, and bolting Canada thistle on June 7 with 87° F, 41% RH, 0% cloud cover, 3 to 5 mph wind and dry topsoil with damp subsoil at 81° F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oat 50 plants/ft^2, foxtail 20 plants/ft^2, wild mustard 35 plants/ft^2, and Canada thistle scattered. Glyphosate was isopropylamine formulation. Control was visually estimated.

Table 1. Volunteer glyphosate-resistant spring wheat control in annual crops.

Treatment[a]	Rate	6/09					
		WH1	WH2	WH3	Wioa	Wimu	Cath
	oz/A			%			
1. Glyt+AMS	9+24	0	98	97	99	96	77
2. Qufp+Scoil+AMS	0.5+1%+24	86	82	86	88	0	0
3. Qufp+Scoil+AMS	0.7+1%+24	86	85	86	89	0	3
4. Qufp+Scoil+AMS	1+1%+24	90	89	90	86	0	3
5. Glyt+qufp+Scoil+AMS	9+0.5+1%+24	97	97	96	99	95	68
6. Glyt+qufp+Scoil+AMS	9+0.7+1%+24	98	99	98	99	97	76
7. Glyt+qufp+Scoil+AMS	9+1+1%+24	99	99	98	99	97	79
8. MON-78195+Scoil+AMS	8.4+1%+24	98	98	97	98	99	63
9. MON-78195+Scoil+AMS	12.6+1%+24	99	99	99	99	99	74
10. MON-78195 +Scoil+AMS	16.8+1%+24	95	96	95	96	98	79
11. Clethodim+Scoil+AMS	1.7+1%+24	98	99	99	99	0	1
12. Seth+Scoil+AMS	6+1%+24	97	98	96	99	0	1
13. Glyt+AMS	9+24	0	0	0	0	0	0
14. Qufp+Scoil+AMS	0.5+1%+24	0	0	0	0	0	0
15. Qufp+Scoil+AMS	0.7+1%+24	0	0	0	0	0	0
16. Qufp+Scoil+AMS	1+1%+24	0	0	0	0	0	0
17. Glyt+qufp+Scoil+AMS	9+0.5+1%+2%	0	0	0	0	0	0
18. Glyt+qufp+Scoil+AMS	9+0.7+1%+24	0	0	0	0	0	0
19. Glyt+qufp+Scoil+AMS	9+1+1%+24	0	0	0	0	0	0
20. MON-78195+Scoil+AMS	8+1%+24	0	0	0	0	0	0
21. MON-78195 +Scoil+AMS	12.6+1%+24	0	0	0	0	0	0
22. MON-78195+Scoil+AMS	16.8+1%+24	0	0	0	0	0	0
23. Cleth+Scoil+AMS	1.7+1%+24	0	0	0	0	0	0
24. Seth+Scoil+AMS	6+1%+24	0	0	0	0	0	0
25. Untreated	0	0	0	0	0	0	0
C.V. %		9	9	8	8	5	26
LSD 5%		5	6	5	5	2	8
# OF REPS		4	4	4	4	4	4

Glyphosate alone did not affect glyphosate-resistant wheat but provided nearly complete control of emerged conventional varieties, wild oat and wild mustard. Clethodim and sethoxydim provided 95 to 99% glyphosate-resistant wheat control which was higher than control with quizalofop. Larger plants at the later application were as susceptible as smaller plants at the early application to treatments. Quizalofop efficacy was slower to develop than other treatments. Wild oat control with quizalofop was lower than all other herbicide treatments. No antagonism was observed with glyphosate+quizalofop. Early application of glyphosate or MON-78195 provided over 95% wild mustard control and 63 to 79% Canada thistle control, but late emerging plants escaped treatment and resulted in much lower ratings on 7/03. Late applications of glyphosate or MON-78195 provided the best control over all species on 6/23 and 7/03.

Table 2. Volunteer glyphosate-resistant spring wheat control in annual crops. (continued)

Treatment	Rate	6/23						
		Wh1	Wh2	Wh3	Wioa	Fxtl	Wimu	Cath
	oz/A				%			
1. Glyt+AMS	9+24	0	91	91	96	0	83	62
2. Qufp+Scoil+AMS	0.5+1%+24	83	76	81	71	0	0	0
3. Qufp+Scoil+AMS	0.7+1%+24	83	80	83	90	0	0	0
4. Qufp+Scoil+AMS	1+1%+24	90	89	91	83	0	0	0
5. Glyt+Qufp+Scoil+AMS	9+0.5+1%+24	96	95	94	97	0	84	70
6. Glyt+Qufp+Scoil+AMS	9+0.7+1%+24	94	93	94	97	0	79	63
7. Glyt+Qufp+Scoil+AMS	9+1+1%+24	95	94	93	98	0	79	62
8. MON-78195 +Scoil+AMS	8.4+1%+24	92	94	92	98	0	80	70
9. MON-78195+Scoil+AMS	12.6+1%+24	93	94	95	98	0	81	64
10. MON-78195 +Scoil+AMS	16.8+1%+24	95	97	93	98	0	81	70
11. Clethodim+Scoil+AMS	1.7+1%+24	96	97	96	98	0	0	0
12. Seth+Scoil+AMS	6+1%+24	95	98	95	98	0	0	0
13. Glyt+AMS	9+24	0	99	99	99	97	99	93
14. Qufp+Scoil+AMS	0.5+1%+24	74	76	75	71	70	0	0
15. Qufp+Scoil+AMS	0.7+1%+24	84	83	81	84	89	0	0
16. Qufp+Scoil+AMS	1+1%+24	83	84	81	81	81	0	0
17. Glyt+Qufp+Scoil+AMS	9+0.5+1%+2%	99	99	99	99	97	99	94
18. Glyt+Qufp+Scoil+AMS	9+0.7+1%+24	99	99	99	99	98	99	94
19. Glyt+Qufp+Scoil+AMS	9+1+1%+24	99	99	99	99	97	99	93
20. MON-78195+Scoil+AMS	8+1%+24	99	99	99	99	95	99	92
21. MON-78195 +Scoil+AMS	12.6+1%+24	99	99	99	99	97	99	91
22. MON-78195+Scoil+AMS	16.8+1%+24	99	99	99	99	99	99	95
23. Cleth+Scoil+AMS	1.7+1%+24	99	99	99	98	97	0	0
24. Seth+Scoil+AMS	6+1%+24	95	95	96	95	93	0	0
C.V. %		6	6	5	8	11	8	10
LSD 5%		6	7	6	10	7	6	6

Table 3. Volunteer glyphosate-resistant spring wheat control in annual crops. (continued)

Treatment	Rate	7/03					
		Wh1	Wh2	Wh3	Wioa	Wimu	Cath
	oz/A				%		
1. Glyt+AMS	9+24	0	96	97	92	65	33
2. Qufp+Scoil+AMS	0.5+1%+24	93	94	96	76	0	0
3. Qufp+Scoil+AMS	0.7+1%+24	92	94	94	75	0	0
4. Qufp+Scoil+AMS	1+1%+24	95	95	96	84	0	0
5. Glyt+Qufp+Scoil+AMS	9+0.5+1%+24	94	94	95	83	53	36
6. Glyt+Qufp+Scoil+AMS	9+0.7+1%+24	93	92	94	85	60	35
7. Glyt+Qufp+Scoil+AMS	9+1+1%+24	96	95	96	86	59	34
8. MON-78195 +Scoil+AMS	8.4+1%+24	93	94	95	86	65	36
9. MON-78195+Scoil+AMS	12.6+1%+24	95	95	97	83	65	23
10. MON-78195 +Scoil+AMS	16.8+1%+24	96	96	96	87	78	44
11. Clethodim+Scoil+AMS	1.7+1%+24	98	99	98	96	0	0
12. Seth+Scoil+AMS	6+1%+24	96	98	99	97	0	0
13. Glyt+AMS	9+24	0	98	98	98	99	86
14. Qufp+Scoil+AMS	0.5+1%+24	91	94	92	62	0	0
15. Qufp+Scoil+AMS	0.7+1%+24	93	93	94	73	0	0
16. Qufp+Scoil+AMS	1+1%+24	97	97	96	79	0	0
17. Glyt+Qufp+Scoil+AMS	9+0.5+1%+2%	99	99	99	97	99	87
18. Glyt+Qufp+Scoil+AMS	9+0.7+1%+24	99	99	99	97	99	88
19. Glyt+Qufp+Scoil+AMS	9+1+1%+24	98	99	98	98	99	83
20. MON-78195+Scoil+AMS	8+1%+24	99	99	99	98	99	84
21. MON-78195 +Scoil+AMS	12.6+1%+24	98	99	99	98	98	82
22. MON-78195+Scoil+AMS	16.8+1%+24	99	99	99	97	99	87
23. Cleth+Scoil+AMS	1.7+1%+24	99	99	99	98	0	1
24. Seth+Scoil+AMS	6+1%+24	99	99	99	99	0	0
C.V. %		3	2	2	8	17	34
LSD 5%		3	3	3	10	11	16

Preharvest weed control with glyphosate tank-mixes. (Wehking and Howatt) An experiment was established in fallow to assess pre-harvest weed control. Treatments were applied on August 8 with 74° F, 71% RH, 65% cloud cover, 5 to 10 mph wind and soil at 75° F. Treatments were applied at 8.5 gpa with an all-terrain vehicle equipped with four 8001 flat fan nozzles, at 3 mph with a 20 inch spacing offset boom. Redroot pigweed was 24- to 36-inch and foxtails were 20- to 30-inch. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	8/11		8/14		8/18	
		Rrpw	Fota	Rrpw	Fota	Rrpw	Fota
	oz/A	%					
Glyphosate	9	9	0	68	46	81	74
Glyt+AMS(liquid)	9+2.5%	15	0	79	54	76	66
Glyt+CL9804(liquid)	9+2.5%	11	0	68	33	74	51
Glyt&AMADS+Act90	75.6+0.5%	14	1	75	50	83	64
Glyt&AMADS+CL9804	75.6+2.5%	16	0	84	39	74	54
Glyt+Carf+AMS	9+0.132+2.5%	35	3	61	46	70	50
Glyt+Carf+CL9804	9+0.132+2.5%	39	6	73	45	71	44
Glyt&AMADS+Carf+CL9804	75.6+0.132+2.5%	38	6	85	61	88	80
Carfentrazone+CL9804	0.132+2.5%	14	1	25	0	4	0
Paraquat+Act90	6+0.25%	59	56	70	64	75	75
Untreated	0	0	0	0	0	0	0
C.V. %		27	33	17	27	7	15
LSD 5%		9	3	15	15	6	11
# OF REPS		4	4	4	4	4	4

Field conditions at the time of application were dry and remained dry during the evaluation period. Glyphosate&AMADS (Engame) + carfentrazone + CL9804 provided the best control the weed spectrum present. Adjuvant selection had little effect on speed of glyphosate action. Carfentrazone increased initial control of redroot pigweed when applied with glyphosate, but carfentrazone alone did not control redroot pigweed or foxtails. Paraquat produced rapid injury in redroot pigweed and foxtails, but large plants were not killed because they were not adequately covered with spray.

Durum variety tolerance to preharvest burndown treatments and timing. (Dick, Howatt, Roach, and Davidson-Harrington) Four varieties of durum wheat were seeded at 90 lb/A at 7 inch row spacing on May 2. Fenoxaprop+MCPA ester at 1.32+4 oz ai/A, respectively, was applied to the entire experiment on June 5. Soft dough (50% moisture) treatments were applied July 28 with 74° F, 73% RH, and clear sky. Hard dough (30% moisture) treatments were applied August 4 with 68° F, 75% RH, and partly cloudy sky. All treatments were applied at 8.5 gpa with an all-terrain vehicle at 3 mph with an offset boom equipped with 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Visible weed control and machine harvest were on August 15. Durum grain samples were submitted to Cereals Testing Lab for evaluation of grain and semolina quality.

Treatment	Variety	Rate	8/15			8/15
			Fota	Cath	Wibw	Yield
		oz/A		%		bu/A
Glyphosate-ipa	(Ben 50%)	12	88	50	33	29
Paraquat+NIS	(Ben 50%)	6+0.25%	94	92	35	30
Mets+2,4-Dioe	(Ben 50%)	0.06+17	0	18	55	36
Untreated	(Ben 50%)	0	0	0	0	37
Glyphosate-ipa	(Renville 50%)	12	94	NA	47	28
Paraquat+NIS	(Renville 50%)	6+0.25%	91	NA	65	32
Mets+2,4-Dioe	(Renville 50%)	0.06+17	0	NA	41	29
Untreated	(Renville 50%)	0	0	NA	0	34
Glyphosate-ipa	(Maier 50%)	12	95	67	40	32
Paraquat+NIS	(Maier 50%)	6+0.25%	93	78	78	33
Mets+2,4-Dioe	(Maier 50%)	0.06+17	0	35	73	36
Untreated	(Maier 50%)	0	0	0	0	33
Glyphosate-ipa	(Lebsock 50%)	12	87	NA	71	27
Paraquat+NIS	(Lebsock 50%)	6+0.25%	93	NA	57	33
Mets+2,4-Dioe	(Lebsock 50%)	0.06+17	0	NA	67	36
Untreated	(Lebsock 50%)	0	0	NA	0	39
Glyphosate-ipa	(Ben 30%)	12	89	72	53	37
Paraquat+NIS	(Ben 30%)	6+0.25%	90	77	48	36
Mets+2,4-Dioe	(Ben 30%)	0.06+17	0	NA	57	38
Untreated	(Ben 30%)	0	0	0	0	38
Glyphosate-ipa	(Renville 30%)	12	78	NA	47	31
Paraquat+NIS	(Renville 30%)	6+0.25%	92	NA	60	31
Mets+2,4-Dioe	(Renville 30%)	0.06+17	0	NA	73	30
Untreated	(Renville 30%)	0	0	0	0	31
Glyphosate-ipa	(Maier 30%)	12	61	35	57	31
Paraquat+NIS	(Maier 30%)	6+0.25%	91	82	81	30
Mets+2,4-Dioe	(Maier 30%)	0.06+17	0	27	72	29
Untreated	(Maier 30%)	0	0	0	0	29
Glyphosate-ipa	(Lebsock 30%)	12	81	NA	52	32
Paraquat+NIS	(Lebsock 30%)	6+0.25%	92	NA	66	37
Mets+2,4-Dioe	(Lebsock 30%)	0.06+17	0	NA	80	30
Untreated	(Lebsock 30%)	0	0	NA	0	36
C.V. %			12	41	32	19
LSD 5%			8	27	23	NS
# OF REPS			4	3	3	4

Paraquat provided 90 to 95% foxtail control while glyphosate control ranged from 61 to 94% control. Foxtail control with glyphosate applied at 30% moisture was lower than control when applied at 50% moisture. Canada thistle was very patchy in the study area. Only treatments that had three plots for evaluation were included in the analysis. Paraquat provided better and more consistent Canada thistle control than other herbicides. There was no consistent trend in wild buckwheat control. Treatments did not affect final yield. Laboratory analyses are not completed.

Durum response to preharvest burndown treatments and timing. (Dick, Howatt, Roach, and Davidson-Harrington). 'Ben' durum was seeded at 90 lb/A at 7 inch row spacing on May 2. Fenoxaprop+MCPA ester at 1.32+4 oz ai/A, respectively, was applied to the entire experiment on June 5. Treatment applications were as follows:

Timing	50% Moisture	30% moisture/7-9 DBH	3-5 DBH
Date	July 28	August 4	August 9
Temperature (F)	74°	68°	62°
Relative humidity	73%	75%	81%
Sky	clear	partly cloudy	clear

All treatments were applied at 8.5 gpa with an all-terrain vehicle at 3 mph with an offset boom equipped with 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Visible weed control and machine harvest were on August 15. Durum grain samples were submitted to Cereals Testing Lab for evaluation of grain and semolina quality.

		8/15				8/15
Treatment	Rate	Fota	Cath	Wibu	Rrpw	Yield
	oz/A	%				bu/A
Glyphosate-ipa (50%)	12	87	45	51	83	40
Glyphosate-tms (50%)	8.4	86	60	68	94	34
Glyphosate-ipa&2,4-D (50%)	32.5	88	80	78	94	34
Glyphosate-ipa+dica (50%)	12+4	94	58	76	94	32
Metsulfuron+2,4-Dioe (50%)	0.06+18	0	35	50	70	37
Paraquat+NIS (50%)	6+0.25%	94	88	59	90	34
Paraquat+NIS (7-9 DBH)	4+0.25%	95	84	71	85	38
Paraquat+NIS (7-9 DBH)	6+0.25%	91	88	73	90	38
Paraquat+NIS (7-9 DBH)	8+0.25%	95	92	75	92	39
Metsulfuron+2,4-Dioe (30%)	1+18	0	20	45	40	40
Glyphosate-ipa (30%)	12	74	32	50	70	40
Glyphosate-tms+NIS (30%)	8.4+0.25%	65	50	58	65	39
Glyphosate-ipa&2,4-D (30%)	32.5	77	76	70	80	37
Glyphosate-ipa+dica (30%)	12+4	80	40	71	85	38
Paraquat+NIS (3-5 DBH)	4+0.25%	92	63	60	75	37
Paraquat+NIS (3-5 DBH)	6+0.25%	92	94	74	90	39
Paraquat+NIS (3-5 DBH)	8+0.25%	94	90	79	93	40
Untreated	0	0	0	0	0	35
C.V. %		10	28	18	8	10
LSD 5%		11	36	16	14	NS
# OF REPS		4	2	4	2	4

Metsulfuron+2, 4-D provided less total burndown than other treatments. Application timing did not result in differences between similar herbicide treatments. Paraquat applied three to five days before harvest provided control equal to or better than other herbicides and timings. Treatments did not affect final yield. Laboratory analyses are not completed.

Sulfosulfuron with adjuvants for wild oats control in wheat, Fargo, 2000. (Woznica, Messersmith, and Nalewaja) 'Oxen' wheat was seeded April 23. Treatments were applied to 5-leaf wheat and 3- to 5-leaf wild oat on May 17 with 71 F, 46% RH, partly cloudy sky, a 10- to 15-mph wind, and dry soil surface. The treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 7 by 24 ft and the experiment was a randomized complete block design with four replicates. Wild oats density was 20 to 30 plants/ft^2.

Treatment	Rate	6/2/00		7/19/00	
		Wht	Wioa	Wht	Wioa
	oz/A				
Sulfosulfuron + R-11	0.125+0.5%	0	39	0	75
Sulfosulfuron + L-68a	0.125+1%	0	44	0	79
Sulfosulfuron + R-11	0.25+0.5%	0	65	0	86
Sulfosulfuron + L-68a	0.25+1%	0	76	0	89
Sulfosulfuron + R-11	0.375+0.5%	0	73	0	83
Sulfosulfuron + L-68a	0.375+1%	0	84	0	96
Sulfosulfuron + R-11	0.5+0.5%	0	85	0	90
Sulfosulfuron + L-68a	0.5+1%	0	93	0	93
Untreated	0	0	0	0	0
C.V. %		0	8	0	9
LSD 5%		NS	7	NS	10

[a]R-11=nonionic surfactant; L-68a=experimental adjuvant; Wht=wheat; Wioa=wild oats.

None of the sulfosulfuron treatments caused injury to wheat. Sulfosulfuron was at the recommended and intentionally lower that recommended rates to help detect differences between adjuvants. Regardless of sulfosulfuron rate, experimental adjuvant L-68a showed greater enhancement of sulfosulfuron efficacy then the commercial surfactant R-11, however the differences were not always statistically significant.

Sulfosulfuron plus thifensulfuron or MCPA with adjuvants for wild oats control in wheat, Fargo, 2000. Woznica, Messersmith, and Nalewaja) 'Oxen' hard red wheat was seeded April 23. Treatments were applied to 5-leaf wheat and 3- to 5-leaf wild oat on May 17 with 71 F, 46% RH, partly cloudy sky, a 10- to 15-mph wind, and dry soil surface. The treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 7 by 24 ft and the experiment was a randomized complete block design with four replicates. Wild oats density was 20 to 30 plants/ft^2.

Treatment[a]	Rate	6/2/2000		7/19/2000	
		Wht	Wioa	Wht	Wioa
	oz/A	%			
Sulfosulfuron+R-11	0.25+0.5%	0	63	0	81
Sulfosulfuron+ND-72	0.25+1%	0	80	0	90
Sulfosulfuron+L-53	0.25+1%	0	78	0	86
Sulfosulfuron+L-68a	0.25+1%	0	82	0	86
Sulfosulfuron+Thifensulf+R-11	0.25+0.2+0.5%	0	74	0	85
Sulfosulfuron+Thifensulf+ND-72	0.25+0.2+1%	0	85	0	90
Sulfosulfuron+Thifensulf+L-53	0.25+0.2+1%	0	81	0	88
Sulfosulfuron+Thifensulf+L-68a	0.25+0.2+1%	0	81	0	79
Sulfosulfuron+MCPA-dma+R-11	0.25+8+0.5%	0	51	0	70
Sulfosulfuron+MCPA-dma+ND-72	0.25+8+1%	0	55	0	75
Sulfosulfuron+MCPA-dma+L-53	0.25+8+1%	0	51	0	70
Sulfosulfuron+MCPA-dma+L-68a	0.25+8+1%	0	53	0	69
Untreated	0	0	0	0	69
C.V. %		0	10	0	9
LSD 5%		NS	10	NS	9

[a]Thifensulf=Thifensulfuron; R-11=nonionic surfactant; ND-72, L-53, and L-68a=experimental adjuvants; Wht=wheat; Wioa=Wild oats.

Wheat was not injured by any of sulfosulfuron treatment. Sulfosulfuron rate was intentionally applied at lower than recommended to help detect differences among adjuvants. Wild oat control was enhanced from 63 to 78-82% when applied with experimental adjuvants ND-72, L-53, and L-68a compared to commercial surfactant R-11. At the 7/19 evaluation the differences among adjuvants were less evident. Mixture of sulfosulfuron with thifensulfuron gave better wild oats control then sulfosulfuron alone. Again, experimental adjuvants provided better efficacy of sulfosulfuron+thifensulfuron then surfactant R-11. MCPA-dma was highly antagonistic to wild oat control from sulfosulfuron regardless of adjuvants.

Sulfosulfuron with adjuvants for wild oats control in wheat, Fargo, 2000. (Woznica, Messersmith, and Nalewaja) 'Oxen' hard red wheat was seeded April 23. Treatments were applied to 5-leaf wheat and 3- to 5-leaf wild oat on May 17 with 71 F, 46% RH, partly cloudy sky, a 10- to 15-mph wind, and dry soil surface. The treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 7 by 24 ft and the experiment was a randomized complete block design with four replicates. Wild oats density was 20 to 30 plants/ft^2.

Treatment[a]	Rate	6/2/2000		7/19/2000	
		Wht[a]	Wioa[a]	Wht	Wioa
	oz/A	%			
Sulfosulfuron+R-11 (F)	0.25+0.5%	0	73	0	84
Sulfosulfuron+R-11+28N (F)	0.25+0.5%+1%	0	78	0	90
Sulfosulfuron+R-11+$Ca(NO_3)_2$(pH-) (F)	0.25+0.5%+1%	0	71	0	87
Sulfosulfuron+R-11+$Ca(NO_3)_2$(pH+) (F)	0.25+0.5%+1%	0	76	0	89
Sulfosulfuron+ND-72 (F)	0.25+1%	0	86	0	89
Sulfosulfuron+L-53 (F)	0.25+1%	0	88	0	89
Sulfosulfuron+L-68a (F)	0.25+1%	0	86	0	88
Sulfosulfuron+R-11 (SB 1.8 g/L)	0.25+0.5%	0	76	0	86
Sulfosulfuron+R-11+28N (SB 1.8 g/L)	0.25+0.5%+1%	0	85	0	85
Sulfosulfuron+R-11+$Ca(NO_3)_2$(pH-)(SB 1.8 g/L)	0.25+0.5%+1%	0	78	0	92
Sulfosulfuron+R-11+$Ca(NO_3)_2$(pH+)(SB 1.8 g/L)	0.25+0.5%+1%	0	81	0	89
Sulfosulfuron+ND-72 (SB 1.8 g/L)	0.25+1%	0	88	0	89
Sulfosulfuron+L-53 (SB 1.8 g/L)	0.25+1%	0	85	0	88
Sulfosulfuron+L-68a (SB 1.8 g/L)	0.25+1%	0	85	0	82
Untreated	0	0	0	0	0
C.V. %		0	9	0	7
LSD 5%		NS	10	NS	9

[a] F=Fargo tap water; SB=sodium bicarbonate in spray carrier; R-11=nonionic surfactant; ND-72, L-53, and L-68a =experimental adjuvants; 28N=28% N urea/ammonium nitrate liquid fertilizer; Wht=wheat; Wioa=Wild oats.

Sulfosulfuron, regardless of accompanying adjuvant, did not injure wheat. Rate of herbicide was intentionally lower that recommended to help detect differences among adjuvants. Sodium bicarbonate did not antagonized sulfosulfuron efficacy on wild oats. Addition of 28% N fertilizer or calcium nitrate to nonionic surfactant (R-11) occasionally improved sulfosulfuron efficacy. Also high pH of spray mixtures generally did not affect sulfosulfuron efficacy. Early evaluation (6/2) showed that experimental adjuvants ND-72, L-53, and L-68a enhanced sulfosulfuron efficacy more then nonionic surfactant R-11 applied alone (without 28% N fertilizer or calcium nitrate). The differences among adjuvants were much less at the preeharvest evaluation (7/19).

Sulfosulfuron (MON 37500) with adjuvants for green foxtail control in wheat, Fargo, 2000. (Woznica, Messersmith, and Nalewaja) 'Oxen' hard red wheat was seeded May 27. Treatments were applied to 4- to 5-leaf wheat and 1- to 3-leaf green foxtail, 2- to 4-leaf redroot pigweed, and 2- to 4-leaf wild mustard on June 5 with 72 F, 35% RH, partly cloudy sky, a 10 mph wind, and dry soil surface. The treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 7 by 24 ft and the experiment was a randomized complete block design with four replicates. Green foxtail density was 5 to 10, redroot pigweed 1 to 2, and wild mustard 1 to 2 plants/ft^2.

Treatment[a]	Rate	6/12[a]				6/19[a]			
		Wht	Grft	Rrpw	Wimu	Wht	Grft	Rrpw	Wimu
	oz/A	%							
Sulfosulfuron+R-11 (F)	0.25+0.5%	1	76	86	88	0	70	72	100
Sulfosulfuron+R-11+28N (F)	0.25+0.5%+1%	1	83	81	89	0	84	84	100
Sulfosulfuron+R-11+$Ca(NO_3)_2$ (pH-)(F)	0.25+0.5%+1%	0	85	88	90	0	84	88	100
Sulfosulfuron+R-11+$Ca(NO_3)_2$ (pH+)(F)	0.25+0.5%+1%	0	90	93	93	0	88	85	100
Sulfosulfuron+ND-72 (F)	0.25+1%	0	88	94	90	0	83	89	100
Sulfosulfuron+L-53 (F)	0.25+1%	0	91	93	93	0	86	86	100
Sulfosulfuron+L-68a (F)	0.25+1%	0	74	80	83	0	68	73	100
Sulfosulf+R-11 (SB 1.8g/L)	0.25+0.5%	0	71	84	84	0	74	78	100
Sulfosulf+R-11+28N (SB 1.8g/L)	0.25+0.5%+1%	0	84	81	89	0	84	86	100
Sulfosulf+R-11+$Ca(NO_3)_2$ (pH-)(SB 1.8g/L)	0.25+0.5%+1%	0	81	86	85	0	80	76	100
Sulfosulf+R-11+$Ca(NO_3)_2$ (pH+)(SB 1.8g/L)	0.25+0.5%+1%	0	90	93	93	0	84	88	100
Sulfosulfuron+ND-72 (SB 1.8g/L)	0.25+1%	0	90	90	93	0	89	88	100
Sulfosulfuron+L-53 (SB 1.8g/L)	0.25+1%	0	91	94	94	0	86	88	100
Sulfosulfuron+L-68a (SB 1.8g/L)	0.25+1%	0	88	90	91	0	90	91	100
Sulfosulfuron+L-88	0.25+1%	3	93	89	95	0	94	92	100
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		358	7	7	6	0	9	7	14
LSD 5%		NS	8	8	8	NS	9	8	18

[a] F=Fargo tap water; SB=sodium bicarbonate in spray carrier; R-11=nonionic surfactant; ND-72, L-53, L-68a, and L-88=experimental adjuvants; 28N=28% N urea/ammonium nitrate liquid fertilizer; Wht=wheat; Grft=green foxtail; Rrpw=redroot pigweed; Wimu=wild mustard.

Sulfosulfuron, regardless of accompanying adjuvant, did not injure wheat. Sulfosulfuron rate was intentionally lower than recommended to help detect differences among adjuvants. Sodium bicarbonate slightly antagonized sulfosulfuron efficacy on foxtails, redroot pigweed, and wild mustard but the antagonism occurred only short after herbicide application. Later evaluation (6/19) indicated that 28% N fertilizer or calcium nitrate with nonionic surfactant (R-11) significantly improved sulfosulfuron phytotoxicity to green foxtail and redroot pigweed. High pH of spray mixtures generally did not affect sulfosulfuron efficacy. Experimental adjuvants ND-72, L-53, L-68a, and L-88 enhanced sulfosulfuron efficacy more then nonionic surfactant alone. Among experimental adjuvants L-88 tended to be better then the others. Preeharvest evaluations were impossible due to severe crop and weed damage caused by float.

Clodinafop: adjuvants for wild oat control, Fargo. (Ramsdale and Messersmith) The experiment was conducted over a dense infestation of wild oat in which no crop was seeded. All treatments were applied on May 22, 2000, at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Experimental design was a randomized complete block with four replicates, and plot size was 10 by 30 ft. Conditions at treatment were 70 F, 40% RH, wind SW at 8 mph, and sky mostly cloudy. Wild oat was 3- to 4-leaf with 1-2 tillers and 3- to 6-inch tall.

Treatment[a]	Rate	Wild oat control	
		June 5	June 12
	oz ai/A	%	
Clodinafop + Score	0.4 + 0.4%	82	99
Clodinafop + Score	0.4 + 1%	82	99
Clodinafop + Scoil	0.4 + 1%	84	99
Clodinafop + Quad 7	0.4 + 1%	84	99
Clodinafop + Herbimax	0.4 + 1%	86	99
Clodinafop + Score + Scoil	0.4 + 0.4% + 1%	84	99
Clodinafop + Score + Quad 7	0.4 + 0.4% + 1%	85	99
Clodinafop + Score + Herbimax	0.4 + 0.4% + 1%	84	99
CV		3	2
LSD (5%)		NS	NS

[a] Score = petroleum oil concentrate; Scoil = methylated vegetable oil; Quad 7 = basic blend; Herbimax = petroleum oil concentrate.

Clodinafop is sold pre-packaged with the petroleum-based-adjuvant Score. If, clodinafop is to be applied at reduced rates, it would require either applying a reduced rate of Score adjuvant or applying some of the clodinafop with a different adjuvant. This experiment was conducted to examine the influence of different adjuvants applied with clodinafop for wild oat control. Clodinafop efficacy was similar for all adjuvant combinations tested, whether a petroleum-oil-based, methylated vegetable-oil-based, or basic blend adjuvant.

Clethodim: spray volume-herbicide rate study, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on August 3, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on September 8 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 70 F, 60% RH, wind S at 10 mph, and sky clear. Oat was 6- to 8-inch (4- to 5-leaf), foxtail millet 3- to 5-inch (4- to 5-leaf), and proso millet 2- to 4-inch (4- to 5-leaf). Experimental design was a randomized complete block with four replicates.

Treatment[a]	Volume[b]	Rate	September 18			October 3
			Oat	Fomi	Prmi	Oat
	gpa	oz ai/A	%			
Clethodim + Herbimax	2.5	0.8 + 1.5 pt	83	93	97	100
Clethodim + Herbimax	5	0.8 + 1.5 pt	83	96	98	100
Clethodim + Herbimax	10	0.8 + 1.5 pt	81	92	97	100
Clethodim + Scoil	2.5	0.8 + 1.5 pt	86	95	99	100
Clethodim + Scoil	5	0.8 + 1.5 pt	87	96	99	100
Clethodim + Scoil	10	0.8 + 1.5 pt	84	94	98	100
Clethodim + Herbimax	2.5	0.4 + 1.5 pt	76	85	88	100
Clethodim + Herbimax	5	0.4 + 1.5 pt	73	84	88	99
Clethodim + Herbimax	10	0.4 + 1.5 pt	64	86	88	94
Clethodim + Scoil	2.5	0.4 + 1.5 pt	78	88	91	99
Clethodim + Scoil	5	0.4 + 1.5 pt	76	90	93	99
Clethodim + Scoil	10	0.4 + 1.5 pt	81	88	92	99
Clethodim + Herbimax	2.5	0.2 + 1.5 pt	55	76	78	87
Clethodim + Herbimax	5	0.2 + 1.5 pt	61	83	80	87
Clethodim + Herbimax	10	0.2 + 1.5 pt	50	78	78	73
Clethodim + Scoil	2.5	0.2 + 1.5 pt	63	79	82	93
Clethodim + Scoil	5	0.2 + 1.5 pt	70	86	87	96
Clethodim + Scoil	10	0.2 + 1.5 pt	68	79	81	90
CV			7	5	5	3
LSD (5%)			7	7	6	4

[a] Herbimax = petroleum oil concentrate; Scoil = methylated vegetable oil.
[b] All treatments were applied with XR8001 tips at 28 psi and volume was change by application speed.

Species response to fall treatments was slow due to cool fall temperatures. A hard frost on September 24 killed the warm season millets, thus preventing an October 3 evaluation. Discussion will focus on oat control 25 days after treatment. Clethodim applied with Scoil provided similar control at all spray volumes, regardless of herbicide rate. Clethodim at 0.4 oz/A with Herbimax applied in 2.5 or 5 gpa spray volume provided similar control to clethodim at 0.8 oz/A with Herbimax at all three spray volumes. However, clethodim efficacy at 0.4 oz/A with Herbimax applied in 10 gpa spray volume was slightly less than clethodim at 0.8 oz/A with Herbimax. Similarly, clethodim at 0.2 oz/A with Herbimax applied in 10 gpa provided 13% less control than when applied in 2.5 or 5 gpa spray volume. Clethodim at reduced rates provided effective oat control when application was at 2.5 or 5 gpa spray volume or with Scoil adjuvant.

Fenoxaprop-P: spray volume and adjuvants for wild oat control, Fargo.
(Ramsdale and Messersmith) The experiment was conducted over a dense infestation of wild oat in which no crop was seeded. Treatments were applied at 4:30 pm on May 25, 2000, with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 70 F, 32% RH, wind E at 6 mph, and the sky was clear. Wild oat was 4- to 6-leaf with up to 2 tillers and 4- to 6-inch tall. Experimental design was a randomized complete block with three replicates. Fenoxaprop-P was applied at a reduced rate to best differentiate between treatments.

Treatment[a]	Rate	Volume[b]	Wild oat control	
			June 8	June 19
	oz ai/A	gpa	%	
Fenoxaprop-P	0.8	2.5	81	92
Fenx-P + Herbimax	0.8 + 1.5 pt	2.5	81	93
Fenoxaprop-P	0.8	5	80	95
Fenx-P + Herbimax	0.8 + 1.5 pt	5	84	95
Fenoxaprop-P	0.8	10	75	95
Fenx-P + Herbimax	0.8 + 1.5 pt	10	86	95
CV			4	3
LSD (5%)			5	NS

[a] Fenoxaprop-P = Puma formulation which includes a safener; Herbimax = petroleum oil concentrate.
[b] Treatments applied with XR8001 tip at 28 psi and volume changed by altering application speed.

Fenoxaprop-P control of wild oat was not influenced by adjuvant or spray volume at the late evaluation. At the June 8 evaluation, fenoxaprop-P without additional adjuvant was generally more effective when applied at 2.5 or 5 gpa than at 10 gpa spray volume. However, fenoxaprop-P applied at 10 gpa with Herbimax enhanced wild oat control over fenoxaprop-P alone and provided control similar to fenoxaprop-P applied at 2.5 or 5 gpa.

Flucarbazone: spray volume and adjuvants, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on August 3, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on September 8 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 70 F, 60% RH, wind S at 10 mph, and sky clear. Oat was 6- to 8-inch (4- to 5-leaf), proso millet 2- to 4-inch (4- to 5-leaf), and foxtail millet 3- to 5-inch (4- to 5-leaf). Experimental design was a randomized complete block with four replicates. Flucarbazone was applied at a reduced rate to best differentiate between treatments.

Treatment[a]	Rate	Volume[b]	September 18			Sept 25
			Oat	Prmi	Fomi	Oat
	oz ai/A		% control			
Flucarbazone + Act90	0.1 + 0.25%	2.5	49	19	45	63
Flucarbazone + Act90	0.1 + 1%	2.5	50	29	55	69
Flucarbazone + Quad 7	0.1 + 1%	2.5	56	43	61	76
Flucarbazone + Quad 7	0.1 + 4%	2.5	55	46	66	75
Flucarbazone + Act90	0.1 + 0.25%	5	50	19	45	69
Flucarbazone + Act90	0.1 + 0.5%	5	49	26	53	68
Flucarbazone + Quad 7	0.1 + 1%	5	60	48	65	78
Flucarbazone + Quad 7	0.1 + 2%	5	60	49	71	73
Flucarbazone + Act90	0.1 + 0.25%	10	44	19	39	61
Flucarbazone + Quad 7	0.1 + 1%	10	54	51	68	76
CV			9	16	9	5
LSD (5%)			7	8	8	5

[a] Act90 = Activator 90 nonionic surfactant by Loveland Industries; Quad 7 = basic blend adjuvant by AGSCO Inc.

[b] Treatments applied with XR8001 tips and volume changed by altering application speed.

Flucarbazone was more effective when applied with Quad 7 basic blend adjuvant than Activator 90 nonionic surfactant regardless of spray volume or adjuvant concentration. Flucarbazone applied with 0.25% v/v Activator 90 provided similar grass species control at 2.5, 5, and 10 gpa spray volume. However, when the same total amount of Activator 90 per acre was applied, e.g. 1% at 2.5 gpa versus 0.5% at 5 gpa versus 0.25% at 10 gpa, flucarbazone efficacy generally increased as spray volume decreased from 10 to 2.5 gpa. These data indicate that flucarbazone can be effectively applied in 2.5 gpa spray volume with nonionic surfactant if the nonionic surfactant is applied on an area basis or with a basic blend adjuvant independent of adjuvant concentration.

Imazamethabenz: spray volume and adjuvants, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on May 24, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 3 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 69 F, 78% RH, wind was calm, and sky cloudy. Oat was 12- to 15-inch and jointing. Experimental design was a randomized complete block with four replicates. Data represent visual estimates of control taken on July 24.

Treatment[a]	Rate	Volume[b]	Speed	Oat
	oz ai/A	gpa	mph	%
Immb + X-77	1 + 0.25%	2.5	10	16
Immb + X-77	2.5 + 0.25%	2.5	10	36
Immb + X-77	5 + 0.25%	2.5	10	41
Immb + Sunit-II	1 + 1.5 pt	2.5	10	44
Immb + Sunit-II	2.5 + 1.5 pt	2.5	10	55
Immb + Sunit-II	5 + 1.5 pt	2.5	10	66
Immb + X-77	1 + 0.25%	5	5	34
Immb + X-77	2.5 + 0.25%	5	5	36
Immb + X-77	5 + 0.25%	5	5	50
Immb + Sunit-II	1 + 1.5 pt	5	5	40
Immb + Sunit-II	2.5 + 1.5 pt	5	5	51
Immb + Sunit-II	5 + 1.5 pt	5	5	62
Immb + X-77	1 + 0.25%	10	2.5	25
Immb + X-77	2.5 + 0.25%	10	2.5	36
Immb + X-77	5 + 0.25%	10	2.5	53
Immb + Sunit-II	1 + 1.5 pt	10	2.5	35
Immb + Sunit-II	2.5 + 1.5 pt	10	2.5	49
Immb + Sunit-II	5 + 1.5 pt	10	2.5	58
CV				10
LSD (5%)				6

[a] X77 = nonionic surfactant; Sunit-II = methylated vegetable oil.
[b] All treatments were applied at 28 psi and with XR8001 tips.

Efficacy of imazamethabenz with Sunit-II methylated vegetable oil generally decreased as spray volume increased. Conversely, efficacy of imazamethabenz applied with 0.25% X-77 nonionic surfactant tended to decrease as spray volume decreased. Imazamethabenz at 1 oz/A with Sunit-II provided similar oat control compared to imazamethabenz at 2.5 oz/A with X-77. Oat control was also similar for imazamethabenz at 2.5 oz/A with Sunit-II and imazamethabenz at 5 oz/A with X-77. These data suggest that imazamethabenz is most effective when applied in low spray volume with 1.5 pt/A Sunit-II methylated vegetable oil.

Quizalofop-P: spray volume and adjuvants, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on May 24, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 3 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 69 F, 78% RH, wind was calm, and sky cloudy. Oat was 12- to 15-inch, proso millet 6- to 8-inch, and foxtail millet 8- to 10-inch, and all species were tillering. Experimental design was a randomized complete block with four replicates. Quizalofop was applied at a reduced rate to best differentiate between treatments.

					July 17			July 24
Treatment[a]	Rate	Volume	Tip[b]	Speed	Oat	Prmi	Fomi	Oat
	oz ae/A	gpa		mph	% control			
Quiz-P + Herbimax	0.3 + 1%	2.5	8001	10	41	92	81	54
Quiz-P + Herbimax	0.3 + 1.5 pt	2.5	8001	10	49	97	89	61
Quiz-P + Quad 7	0.3 + 1%	2.5	8001	10	55	97	85	69
Quiz-P + Herbimax	0.3 + 1%	5	8002	10	40	90	78	49
Quiz-P + Herbimax	0.3 + 1.5 pt	5	8002	10	51	95	81	63
Quiz-P + Quad 7	0.3 + 1%	5	8002	10	55	95	86	70
Quiz-P + Herbimax	0.3 + 1%	10	8001	2.5	45	94	86	54
Quiz-P + Herbimax	0.3 + 1.5 pt	10	8001	2.5	48	98	90	60
Quiz-P + Quad 7	0.3 + 1%	10	8001	2.5	59	97	89	76
Quiz-P + Herbimax	0.3 + 1%	10	8004	10	35	94	83	34
Quiz-P + Herbimax	0.3 + 1.5 pt	10	8004	10	49	94	87	51
Quiz-P + Quad 7	0.3 + 1%	10	8004	10	52	93	85	71
CV					9	4	5	10
LSD (5%)					6	5	6	9

[a] Herbimax = petroleum oil concentrate; Quad 7 = basic blend adjuvant.
[b] All treatments were applied with XR tips at 28 psi.

Control of proso and foxtail millet by quizalofop-P was excellent, so differences between treatments was minimal. However, quizalofop-P was generally most effective when applied with Quad 7 basic blend adjuvant, regardless of spray volume. Quizalofop-P with 1.5 pt/A Herbimax provided greater oat control than quizalofop-P with 1% v/v Herbimax whether applied at 2.5, 5, and 10 gpa spray volume. Efficacy of quizalofop-P when applied with 1.5 pt/A Herbimax was similar among spray volumes. Conversely, quizalofop-P with 1% Herbimax applied at 10 gpa with 8004 nozzles was less effective than quizalofop-P with 1% Herbimax at 2.5 or 5 gpa or at 10 gpa with 8001 nozzles. The large spray droplets produced by 8004 nozzles were likely poorly retained by oat when quizalofop-P was applied with 1% Herbimax.

Sethoxydim: spray volume-herbicide rate study, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on August 3, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on September 11 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 64 F, 40% RH, wind NW at 8-10 mph, and sky clear. Oat was 6- to 8-inch (tillering), foxtail millet 3- to 5-inch (4- to 5-leaf), and proso millet 2- to 4-inch (4- to 5-leaf). Experimental design was a randomized complete block with four replicates.

Treatment[a]	Volume[b]	Rate	Oat control	
			September 26	October 3
	gpa	oz ai/A	%	
Sethoxydim + Herbimax	2.5	1.5 + 1.5 pt	76	92
Sethoxydim + Herbimax	5	1.5 + 1.5 pt	78	89
Sethoxydim + Herbimax	10	1.5 + 1.5 pt	71	88
Sethoxydim + Scoil	2.5	1.5 + 1.5 pt	70	89
Sethoxydim + Scoil	5	1.5 + 1.5 pt	74	87
Sethoxydim + Scoil	10	1.5 + 1.5 pt	73	89
Sethoxydim + Herbimax	2.5	1 + 1.5 pt	74	87
Sethoxydim + Herbimax	5	1 + 1.5 pt	71	86
Sethoxydim + Herbimax	10	1 + 1.5 pt	61	79
Sethoxydim + Scoil	2.5	1 + 1.5 pt	72	88
Sethoxydim + Scoil	5	1 + 1.5 pt	69	84
Sethoxydim + Scoil	10	1 + 1.5 pt	71	86
Sethoxydim + Herbimax	2.5	0.5 + 1.5 pt	59	77
Sethoxydim + Herbimax	5	0.5 + 1.5 pt	51	70
Sethoxydim + Herbimax	10	0.5 + 1.5 pt	53	56
Sethoxydim + Scoil	2.5	0.5 + 1.5 pt	59	75
Sethoxydim + Scoil	5	0.5 + 1.5 pt	60	74
Sethoxydim + Scoil	10	0.5 + 1.5 pt	55	70
CV			7	6
LSD (5%)			7	6

[a] Herbimax = petroleum oil concentrate; Scoil = methylated vegetable oil.
[b] All treatments were applied with XR8001 tips at 28 psi and volume was change by application speed.

Species response to fall treatments was slow due to cool fall temperatures. A hard frost on September 24 killed the warm season millets, thus preventing evaluation. Discussion will focus on the October 3 evaluation of oat control. Sethoxydim efficacy with Scoil was similar at all spray volumes with each herbicide rate. Sethoxydim at 1 oz/A with Scoil provided similar oat control to sethoxydim at 1.5 oz/A with Scoil, while oat control by sethoxydim at 0.5 oz/A with Scoil was approximately 10% less. Sethoxydim at 1 oz/A with Herbimax applied in 2.5 or 5 gpa spray volume provided similar oat control to sethoxydim at 1.5 oz/A with Herbimax applied in 10 gpa. Likewise, sethoxydim at 0.5 oz/A with Herbimax applied in 2.5 gpa provided similar oat control to sethoxydim at 1 oz/A with Herbimax applied in 10 gpa spray volume. Oat control by sethoxydim at 0.5 oz/A with Herbimax applied in 10 gpa was 21% less than when applied in 2.5 gpa. These data illustrate the potential to reduce sethoxydim rate by applying in 2.5 gpa spray volume and/or using a more effective adjuvant.

Tralkoxydim: spray volume and adjuvants for wild oat control, Fargo. (Ramsdale and Messersmith) The experiment was conducted over a dense infestation of wild oat in which no crop was seeded. Treatments were applied at 5:00 pm on May 25, 2000, with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 70 F, 32% RH, wind E at 6 mph, and the sky was clear. Wild oat was 4- to 6-leaf with up to 2 tillers and 4- to 6-inch tall. Experimental design was a randomized complete block with four replicates. Tralkoxydim was applied at a reduced rate to best differentiate between treatments.

Treatment[a]	Rate	Tip[b]	Volume	Speed	Wild oat control	
					June 8	June 19
	oz ai/A		gpa	mph	%	
Tral + Supercharge	2 + 0.5%	8001	2.5	10	58	55
Tral + Scoil	2 + 1%	8001	2.5	10	61	54
Tral + Scoil	2 + 1.5 pt	8001	2.5	10	90	94
Tral + Supercharge	2 + 0.5%	8001	5	5	74	80
Tral + Scoil	2 + 1%	8001	5	5	73	76
Tral + Scoil	2 + 1.5 pt	8001	5	5	91	92
Tral + Supercharge	2 + 0.5%	8002	5	10	70	68
Tral + Scoil	2 + 1%	8002	5	10	77	79
Tral + Scoil	2 + 1.5 pt	8002	5	10	90	90
Tral + Supercharge	2 + 0.5%	8004	10	10	76	77
Tral + Scoil	2 + 1%	8004	10	10	84	83
Tral + Scoil	2 + 1.5 pt	8004	10	10	87	89
CV					4	5
LSD (5%)					5	6

[a] Supercharge = methylated vegetable oil plus pH buffers; Scoil = methylated vegetable oil.
[b] All treatments were applied XR tips at 28 psi.

Tralkoxydim was most effective when applied with Scoil at 1.5 pt/A and was equally effective at 2.5, 5, or 10 gpa spray volume with this adjuvant. However, tralkoxydim efficacy decreased as spray volume decreased when tralkoxydim was applied with Supercharge at 0.5% or Scoil at 1%. The amount of adjuvant in the spray deposit at 2.5 or 5 gpa was likely insufficient to maximize tralkoxydim absorption. Tralkoxydim applied with Supercharge at 5 gpa was generally more effective using 8001 than 8002 nozzles. Tralkoxydim efficacy with either 1% or 1.5 pt/A Scoil applied at 5 gpa was not influenced by droplet size. These data suggest that having a greater amount of adjuvant applied per acre is beneficial for tralkoxydim efficacy. Tralkoxydim can be effectively applied at 2.5 gpa spray volume if the adjuvant is applied on an area basis.

Tralkoxydim: adjuvants for wild oat control in sodium bicarbonate water, Fargo. (Ramsdale and Messersmith) The experiment was conducted over a dense infestation of wild oat in which no crop was seeded. The spray water used contained sodium bicarbonate at 1.8 g/L, which is an antagonist that occurs at similar concentrations in a significant portion of water supplies in North Dakota. All treatments were applied on May 22, 2000, at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Experimental design was a randomized complete block with 4 replicates, and plot size was 10 by 30 ft. Conditions at treatment were 73 F, 40% RH, wind SW at 8-10 mph, and sky mostly cloudy. Wild oat was 3- to 4-leaf with 1-2 tillers and 3- to 6-inch tall.

Treatment[a]	Rate	Wild oat control	
		June 5	June 12
	oz ai/A	%	
Tral + Supercharge	0.2 + 0.5%	65	58
Tral + Supercharge + AMS	0.2 + 0.5% + 1%	79	83
Tral + Supercharge + AMS	0.2 + 1% + 1%	81	85
Tral + Supercharge + Scoil	0.2 + 0.5% + 1.5 pt	78	81
Tral + Supercharge + Scoil + AMS	0.2 + 0.5% + 1.5 pt + 1%	85	96
Tral + Supercharge + Scoil + AMS	0.2 + 0.5% + 1% + 1%	83	87
Tral + Supercharge + Herbimax + AMS	0.2 + 0.5% + 2 pt + 1%	84	91
Tral + Supercharge + Surfate	0.2 + 0.5% + 1%	76	81
Tral + Supercharge + Quad 7	0.2 + 0.5% + 1%	80	84
Tral + Scoil + AMS	0.2 + 1.5 pt + 1%	82	89
Tral + Scoil	0.2 + 1.5 pt	75	76
Tral + Quad 7	0.2 + 1%	70	55
Tral + Surfate	0.2 + 1%	31	30
CV		6	6
LSD (5%)		7	7

[a] Supercharge = methylated vegetable oil plus pH buffers; Scoil = methylated vegetable oil; Herbimax = petroleum oil concentrate; Surfate = surfactant plus ammonium sulfate fertilizer; Quad 7 = basic blend; AMS = spray grade ammonium sulfate.

Tralkoxydim is sold pre-packaged with Supercharge adjuvant. If tralkoxydim is to be applied at reduced rates, it would require either applying a reduced rate of Supercharge adjuvant or applying some of the tralkoxydim with a different adjuvant. This experiment was conducted to examine the influence of different adjuvants applied with tralkoxydim for wild oat control when an antagonistic water carrier was used. Tralkoxydim spray mixtures that included an oil adjuvant and nitrogen fertilizer provided the best wild oat control. The nitrogen fertilizer was necessary to overcome sodium bicarbonate antagonism. However, surfactant-fertilizer combinations, such as Quad 7 or Surfate, did not maximize tralkoxydim efficacy. An oil adjuvant such as Supercharge, Herbimax, or Scoil was necessary to ensure proper tralkoxydim absorption.

Drift-reducing nozzles at low spray volume, Prosper. (Ramsdale and Messersmith) 'Jud' oat, 'Oxen' hard red spring wheat, and 'Sunrise' white proso millet were planted as strips side-by-side on May 31, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on June 29 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 80 F, 45% RH, wind S at 5 mph, and sky clear. Oat was 8- to 10-inch (tillering), wheat 6- to 8-inch (tillering), and proso millet 4- to 6-inch (5- to 6-leaf). Experimental design was a randomized complete block with four replicates. Treatments included glyphosate (Roundup Ultra) at 1 oz ae/A, quizalofop-P at 3 oz ae/A with 1.5 pt/A Herbimax, imazethapyr at 0.37 oz ai/A with 1.5 pt/A Scoil, and sethoxydim at 1 oz ai/A with 1 pt/A Scoil. Visual estimates of percent control were made on July 10.

				Glyphosate			Quizalofop-P			Imazethapyr			Sethoxydim		
Nozzle[a]	Volume	Speed	Pressure	Proso millet	Oat	Wheat	Proso millet	Oat	Wheat	Proso millet	Oat	Wheat	Proso millet	Oat	Wheat
	(gpa)	(mph)	(psi)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
XR 11001	2.5	10	28	81	84	86	93	82	87	76	69	61	87	83	82
TD 11001	2.5	12	40	71	85	82	96	86	90	79	71	69	86	84	82
LM 11002	2.5	14	15	78	86	87	94	84	90	81	74	69	91	88	81
TT 11001	2.5	7	15	75	85	88	96	87	92	80	73	69	90	86	86
TT 11002	2.5	14	15	73	81	81	95	86	91	79	73	65	89	85	79
XR 11001	10	2.5	28	50	74	56	98	85	90	79	68	59	88	82	80
TD 11001	10	3	40	41	76	58	98	86	91	79	71	66	86	79	77
LM 11002	10	3.5	15	54	71	63	97	81	86	80	70	62	91	83	78
TT 11002	10	3.5	15	45	71	60	97	82	91	76	69	60	87	78	76
CV				13	6	9	4	6	5	3	6	6	5	4	4
LSD (5%)				12	6	9	NS	NS	NS	NS	NS	6	NS	4	5

[a] TD = TurboDrop air-induction nozzle by Greenleaf Technologies Inc., Covington, LA; LM = Lurmark Ultra-Lo-Drift air-induction nozzle by Precision Fluid Control Products, Farmington, MN; TT = Turbo TeeJet flooding flat-fan nozzle and XR = Extended Range nozzle by Spraying Systems Co., Wheaton, IL.

Overall, herbicides applied through drift-reducing nozzles provided similar grass species control compared to application through standard extended-range (XR) sprayer nozzles, whether applied at 2.5 or 10 gpa spray volume. North Dakota State University research has consistently demonstrated that efficacy of many translocated herbicides in 2.5 or 5 gpa spray volume is equal or greater than when applied in higher spray volumes. Standard low-output nozzles produce fine spray droplets that are susceptible to spray drift. However, drift-reducing nozzles that produce large spray droplets can be used to apply herbicides in low spray volumes. These data suggest that herbicides applied in 2.5 gpa spray volume with drift-reducing nozzles can provide similar control to application with standard XR flat-fan nozzles.

Drift-reducing nozzles at low spray volume, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Oxen' hard red spring wheat, and 'Sunrise' white proso millet were planted as strips side-by-side on August 3, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on September 11 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 61 F, 60% RH, wind N at 10-15 mph, and sky clear. Oat was 6- to 8-inch (tillering), wheat 5- to 7-inch (tillering), and proso millet 2- to 4-inch (4- to 5-leaf). Experimental design was a randomized complete block with four replicates. Treatments included glyphosate (Roundup Ultra) at 1 oz ae/A, quizalofop-P at 3 oz ae/A with 1.5 pt/A Herbimax, imazethapyr at 0.37 oz ai/A with 1.5 pt/A Scoil, and sethoxydim at 1 oz ai/A with 1 pt/A Scoil. Visual estimates of percent control were made on October 3.

Nozzle[a]	Volume	Speed	Pressure	Glyphosate		Quizalofop-P		Imazethapyr		Sethoxydim	
				Oat	Wheat	Oat	Wheat	Oat	Wheat	Oat	Wheat
	(gpa)	(mph)	(psi)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
XR 11001	2.5	10	28	97	91	79	88	74	71	77	74
TD 11001	2.5	12	40	98	93	79	87	78	74	78	71
LM 11002	2.5	14	15	98	93	76	85	76	72	80	75
TT 11001	2.5	7	15	91	88	73	82	72	63	72	71
TT 11002	2.5	14	15	91	88	73	84	74	69	73	69
XR 11001	10	2.5	28	88	76	78	88	77	70	74	70
TD 11001	10	3	40	87	79	76	85	74	69	76	72
LM 11002	10	3.5	15	82	69	70	83	69	65	74	69
TT 11002	10	3.5	15	78	63	74	84	69	65	73	71
CV				4	5	5	3	6	8	5	6
LSD (5%)				5	6	5	NS	NS	NS	NS	NS

[a] TD = TurboDrop air-induction nozzle by Greenleaf Technologies Inc., Covington, LA; LM = Lurmark Ultra-Lo-Drift air-induction nozzle by Precision Fluid Control Products, Farmington, MN; TT = Turbo TeeJet flooding flat-fan nozzle and XR = Extended Range nozzle by Spraying Systems Co., Wheaton, IL.

Oat control at Fargo by glyphosate and quizalofop-P applied at 2.5 gpa was significantly less with Turbo TeeJet 11001 or 11002 nozzles than with standard XR 11001 nozzles, but differences were less than 10 percentage points. North Dakota State University research has consistently demonstrated that efficacy of many translocated herbicides in 2.5 or 5 gpa spray volume is equal or greater than when applied in higher spray volumes. Standard low-output nozzles produce fine spray droplets that are susceptible to spray drift. However, drift-reducing nozzles that produce large spray droplets can be used to apply herbicides in low spray volumes. These data suggest that herbicides applied in 2.5 gpa spray volume with drift-reducing nozzles can provide similar control to application with standard XR flat-fan nozzles.

Accent with adjuvants. Zollinger and Fitterer. An experiment was conducted in Wyndmere, ND to evaluate weed control from herbicides applied POST. Pioneer '37H24" corn was planted on April 23, 2000. POST treatments were applied May 29, 2000 at 11:30 am with 71 F air, 83 F soil surface, 50% relative humidity, 95% clouds, 2 to 3 mph N wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 5 to 6 inch, 2 collar. Weed species present were: 1 to 4 inch (20 to 30/ft^2) foxtail; 1 to 4 inch (10 to 20/ft^2) common lambsquarters; and 2 to 5 inch (10 to 15/ft^2) common ragweed. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		June 11			June 26		
Treatment [a]	Rate	Fxtl	Colq	Corw	Fxtl	Colq	Corw
	Product/A	%	%	%	%	%	%
Accent+Sterling Plus+Destiny+AMS	0.67oz+1pt+1% v/v+1lb	87	93	92	75	99	99
Accent+Sterling Plus+Destiny+AMS	0.33oz+1pt+1% v/v+1lb	80	85	85	70	99	99
Accent+Sterling Plus+Prime Oil+AMS	0.33oz+1pt+1% v/v+1lb	37	90	90	20	99	99
Accent+Sterling Plus+Hi-Per-Oil+AMS	0.33oz+1pt+0.5% v/v+1lb	43	90	90	20	99	99
Accent+Sterling Plus+CL 9605+AMS	0.33oz+1pt+0.5% v/v+1lb	47	90	90	25	99	99
Accent+Sterling Plus+AG0001+AMS	0.33oz+1pt+0.5% v/v+1lb	55	87	90	20	99	99
Accent+Sterling Plus+AG0005+AMS	0.33oz+1pt+0.5% v/v+1lb	23	77	77	0	99	99
Accent+Sterling Plus+Newtone+AMS	0.33oz+1pt+1% v/v+1lb	47	83	83	20	99	92
Accent+Sterling Plus+FirstMate+AMS	0.33oz+1pt+1% v/v+1lb	67	77	70	40	99	95
Accent+Sterling Plus+AgriStay	0.33oz+1pt+1% v/v	30	87	80	13	99	95
Accent+Dispatch 2N	0.33oz+2.5qt	63	10	10	50	0	0
Accent+Dispatch 111	0.33oz+1% v/v	50	17	17	32	28	0
Accent+Clarity+Atrazine+Scoil	0.33oz+4fl oz+0.375lb+1.5pt	70	80	80	45	99	99
Accent+Distinct+Atrazine+Scoil	0.33oz+2oz+0.375lb+1.5pt	70	90	90	45	99	99
Accent Gold+Sterling+Destiny	2.9oz+3fl oz+1% v/v	83	90	90	70	99	96
Accent Gold+Sterling+Hi-Per-Oil	1.6oz+3fl oz+0.5% v/v	53	57	57	22	99	99
Accent Gold+Dispatch 2N	1.6oz+2.5qt	73	40	40	43	50	56
Accent Gold+Dispatch 111	1.6oz+1% v/v	82	73	73	47	80	67
Celebrity Plus+Premier 90+28 %	4.67oz+0.25%+2qt	73	70	70	73	96	99
Celebrity Plus+Premium COC+28 %	4.67oz+1%+2qt	70	67	67	78	93	93
Celebrity Plus+WC001+28 %	4.67oz+0.5%+2qt	77	85	85	67	99	99
Celebrity Plus+Linkage+28 %	4.67oz+1%+2qt	88	92	92	83	99	99
Celebrity Plus+WC002+28 %	4.67oz+1%+2qt	92	92	92	90	99	99
Celebrity Plus+Soy-Stick+28 %	4.67oz+1%+2qt	93	92	92	91	99	99
LSD (0.05)		10	8	7	9	6	7

[a]AMS = ammonium sulfate; Refer to adjuvant glossary for adjuvant types.

No injury occurred. The experiment contained a higher proportion of yellow foxtail than green foxtail. Grass and broadleaf weeds were drought stressed prior to and after application. Generally, treatments with greatest grass control contained an MSO type adjuvant. Most treatments controlled common lambsquarters and common ragweed. No explanation for poor weed control from Accent plus Dispatch 2N and Dispatch 111.

Low-rate split application of herbicides for weed control in soybean, Casselton. (Ramsdale and Messersmith) Experiments were conducted to examine the potential of reducing herbicide rates in soybean by split application. 'AG 0901' soybean was planted in 30-inch rows on May 18, 2000, near Casselton, ND. All treatments were applied with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Plots were 10 by 30 ft and arranged in a randomized complete block design with four replicates. All herbicide rates were lower than labeled rates and either were applied in one single application or two applications each at half the single rate. Data presented represents visual evaluations taken on July 27. Soybean were harvested on October 12, 2000.

Date Treatment	June 7 1st Split	June 17 Single	July 1 2nd Split
Sprayer			
gpa	8.5	8.5	8.5
psi	35	35	35
Air temperature (F)	75	60	85
Relative humidity (%)	55	60	55
Wind (mph)	5	8	5
Sky	clear	cloudy	cloudy
Soybean	unifoliolate	1 trifoliolate	2-3 trifoliolate
Common cocklebur			
leaf no.	cotyledon-2	2-6	-
height (inch)	1-3	2-5	-
Yellow foxtail			
leaf no.	1-2	2-5	-
height (inch)	1-3	2-4	-

Yellow foxtail and common cocklebur control by imazethapyr at 0.25 or 0.38 oz/A applied once was approximately 30 and 10 percentage points less than by imazethapyr at 0.75 oz/A applied once. However, imazethapyr at 0.25 or 0.38 oz/A in two 0.125 or 0.19 oz/A treatments provided similar control to imazethapyr at 0.75 oz/A applied once. Similarly, imazamox at 0.15 or 0.25 oz/A in two 0.075 or 0.125 oz/A treatment provided comparable yellow foxtail control to imazamox at 0.5 oz/A applied once. Also, imazamox at 0.25 oz/A in two 0.125 oz/A treatments provided common cocklebur control similar to imazamox at 0.5 oz/A applied once. Yellow foxtail and common cocklebur control by imazamox applied once decreased by approximately 20 and 50 percentage points as the rate was reduced from 0.5 oz/A to 0.25 or 0.15 oz/A, respectively. Thus, imazethapyr at one-third rate applied twice resulted in similar weed control to the full rate applied once, which should provide enough savings in herbicide cost to pay for the second application. However, imazamox applied twice required one-half rate to provide common cocklebur control similar to imazamox at the full rate applied once. Both herbicides applied with any one the three adjuvant types, i.e., nonionic surfactant plus 28% N, basic blend, or methylated vegetable oil, generally resulted in similar weed control, except each herbicide at the lowest (one-third) rate applied once generally provided the least control when applied with the basic blend adjuvant. Overall, soybean yields were low and generally did not relate to visual estimates of weed control. Standing water was present in much of the experimental area due to heavy rains in June. As a result, soybean maturity was delayed and yields were variable.

Treatment[a]	Rate	Yellow foxtail		Common cocklebur		Soybean yield	
		Single	Split	Single	Split	Single	Split
	oz ai/A	% control				bu/A	
Imazethapyr experiment							
Imazethapyr + Act90 + 28%N	0.75 + 0.25% + 4.0%	95	-	87	-	24	-
Imazethapyr + Quad 7	0.75 + 1.0%	81	-	79	-	21	-
Imazethapyr + Scoil	0.75 + 2.0%	95	-	83	-	26	-
Imazethapyr + Act90 + 28%N	0.38 + 0.25% + 4.0%	70	85	61	72	20	20
Imazethapyr + Quad 7	0.38 + 1.0%	83	85	73	76	17	22
Imazethapyr + Scoil	0.38 + 2.0%	82	94	71	84	20	20
Imazethapyr + Act90 + 28%N	0.25 + 0.25% + 4.0%	67	82	65	71	21	22
Imazethapyr + Quad 7	0.25 + 1.0%	38	87	38	66	18	25
Imazethapyr + Scoil	0.25 + 2.0%	66	78	56	74	15	19
Untreated						12	
CV		9		11		26	
LSD (5%)		10		11		NS	
Imazamox experiment							
Imazamox + Act90 + 28%N	0.5 + 0.25% + 4.0%	92	-	79	-	19	-
Imazamox + Quad 7	0.5 + 1.0%	83	-	71	-	22	-
Imazamox + Scoil	0.5 + 2.0%	96	-	78	-	16	-
Imazamox + Act90 + 28%N	0.25 + 0.25% + 4.0%	64	86	54	72	12	17
Imazamox + Quad 7	0.25 + 1.0%	60	89	54	70	13	17
Imazamox + Scoil	0.25 + 2.0%	74	88	60	71	16	18
Imazamox + Act90 + 28%N	0.15 + 0.25% + 4.0%	35	85	35	59	15	16
Imazamox + Quad 7	0.15 + 1.0%	24	80	25	56	12	16
Imazamox + Scoil	0.15 + 2.0%	36	83	34	56	17	16
Untreated						11	
CV		8		10		24	
LSD (5%)		9		8		5	

[a] Act90 = Activator 90 nonionic surfactant; 28%N = 28% N as urea-ammonium nitrate fertilizer; Quad 7 = basic blend adjuvant, Scoil = methylated vegetable oil.

Imazamox: spray volume and adjuvants, Fargo. (Ramsdale and Messersmith) 'Jud' oat, 'Red Siberian' foxtail millet, and 'Sunrise' white proso millet were planted as strips side-by-side on May 24, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 3 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 69 F, 78% RH, wind was calm, and sky partly cloudy. Oat was 12- to 15-inch, proso millet 6- to 8-inch, and foxtail millet 8- to 10-inch, and all species were tillering. Experimental design was a randomized complete block with four replicates. Imazamox was applied at a reduced rate to best differentiate between treatments.

Treatment[a]	Rate	Volume[b]	July 17			July 24			
			Oat	Prmi	Fomi	Oat	Prmi	Fomi	mean
	oz ai/A	gpa				%			
Immx + Scoil	0.25 + 1.5 pt	2.5	61	81	79	83	87	82	79
Immx + Scoil	0.25 + 1%	2.5	58	68	74	70	73	78	70
Immx + Scoil	0.25 + 1.5 pt	5	58	79	76	76	85	81	76
Immx + Scoil	0.25 + 1%	5	58	69	73	66	72	76	69
Immx + Scoil	0.25 + 1.5 pt	10	52	70	73	56	70	76	66
Immx + Scoil	0.25 + 1%	10	41	58	65	51	58	66	56
Immx + Act 90 + UAN	0.25 + 0.25% + 0.25G	2.5	50	64	67	61	61	69	62
Immx + Act 90 + UAN	0.25 + 1% + 0.25G	2.5	60	71	70	70	71	74	69
Immx + Act 90 + UAN	0.25 + 0.25% + 0.25G	5	54	65	69	70	60	69	64
Immx + Act 90 + UAN	0.25 + 0.5% + 0.25G	5	56	67	70	71	68	73	67
Immx + Act 90 + UAN	0.25 + 0.25% + 0.25G	10	50	58	63	61	55	69	59
Immx + Act 90	0.25 + 0.25%	2.5	41	44	60	47	36	63	49
Immx + Act 90	0.25 + 1%	2.5	48	60	64	54	54	66	58
Immx + Act 90	0.25 + 0.25%	5	40	34	62	49	29	66	47
Immx + Act 90	0.25 + 0.5%	5	46	48	64	52	46	66	54
Immx + Act 90	0.25 + 0.25%	10	36	33	54	45	26	56	42
CV			9	9	9	8	11	8	9
LSD (5%)			6	8	8	7	9	8	8

[a] Scoil = methylated vegetable oil; Act 90 = Activator 90 nonionic surfactant; UAN = 28% N as urea ammonium nitrate.

[b] All treatments were applied with XR8001 tips at 28 psi and volume was changed by application speed.

Imazamox efficacy was greater with 1.5 pt/A Scoil compared to 1% v/v Scoil at all spray volumes. Imazamox with either 1% or 1.5 pt/A Scoil provided similar grass species control when at 2.5 and 5 gpa spray volume. However, imazamox efficacy with Scoil was generally less when applied at 10 gpa than at 2.5 or 5 gpa. Imazamox applied with NIS plus UAN was generally more effective than imazamox with NIS alone, regardless of NIS concentration. Efficacy was similar among spray volumes when imazamox was applied with 0.25% NIS with or without UAN. However, grass species control increased as spray volume decreased when imazamox was applied with an equal amount of surfactant per acre (e.g., 1% at 2.5 gpa, 0.5% at 5 gpa, and 0.25% at 10 gpa).

Raptor with adjuvants. Zollinger and Fitterer. Experiments were conducted in Casselton and Hillsboro, ND to evaluate weed control from Raptor with various adjuvants. In Casselton, Navigator navy beans were planted on May 18, 2000. POST treatments were applied June 19, 2000 at 9:00 am with 67 F air, 63 F soil surface, 69% relative humidity, 75% clouds, 10 to 15 mph NW wind, moist soil surface, and moist subsoil. Weed species present were: 3 to 4 inch (15 to 20/ft^2) foxtail; and 2 to 4 inch (5 to 10/ft^2) common cocklebur. In Hillsboro, Roundup Ready soybeans were planted on May 12, 2000. POST treatments were applied June 29, 2000 at 12:00 am with 81 F air, 95 F soil surface, 40% relative humidity, 40% clouds, 1 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, crop stage was 2 to 3 trifoliate. Weed species present were: 4 to 10 inch (5 to 20/ft^2) foxtail; 6 inch to bloom (2 to 4/ft^2) wild mustard; and 4 to 10 inch (5 to 10/ft^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

When comparing treatments, observe that some Raptor treatments were applied at 2 fl oz/A and some at 5 fl oz/A.

At Casselton, water was still standing on some areas of the experiment June 26 from the flood that occurred on June 19. With the exception of Raptor and Flexstar treatment, dry bean injury could not be separated from effect of standing water. The Raptor + Flexstar treatment caused 50% crop injury and was recorded as burning, stunting, and stand loss. On July 3, standing water had rescinded but dry beans in some areas of reps 2 and 3 still exhibited damage from standing. The dry bean exhibited stunted growth from stress conditions the entire season.

At Hillsboro, there was no soybean injury with any treatment, and at July 16 wild mustard, redroot pigweed, and common lambsquarters was completely controlled.

Table 1. Raptor with adjuvants in dry bean - Casselton.

Treatment [a]	Rate	June 26	July 3		July 17	
		Cocb	Fxtl	Cocb	Fxtl	Cocb
	fl oz/A	%	%	%	%	%
Raptor+Destiny+AMS	4+1% v/v+1lb	43	75	62	92	75
Raptor+Destiny+AMS	2+1% v/v+1lb	40	63	40	73	67
Raptor+Hi-Per-Oil+AMS	2+0.5% v/v+1lb	40	57	20	60	62
Raptor+AG0001+AMS	2+0.5% v/v+1lb	40	30	13	60	60
Raptor+FirstMate	2+1% v/v	38	40	13	65	57
Raptor+Prime Oil+AMS	2+1% v/v+1lb	33	40	22	72	65
Raptor+Newtone	2+1% v/v	37	40	23	63	63
Raptor+CL 9605+AMS	2+0.5% v/v+1lb	47	40	45	67	68
Raptor+Flexstar+Scoil	2+0.5pt+1lb	99	82	87	62	80
Raptor+Dispatch 2N	2+2.5qt	50	30	30	58	57
Raptor+Dispatch 111	2+1% v/v	40	23	22	50	50
Raptor+Premier 90	5+0.25% v/v+1qt	47	30	28	80	85
Raptor+Premium COC+28%	5+1% v/v+1qt	47	30	30	85	82
Raptor+Soy-Stick+28%	5+1% v/v+1qt	50	50	50	93	87
Raptor+WC001+28%	5+0.5% v/v+1qt	47	83	72	92	88
Raptor+WC002+28%	5+1% v/v+1qt	50	82	73	95	92
Raptor+Linkage	5+1% v/v	47	82	72	90	85
Raptor+AG0005+AMS	2+0.5% v/v+llb	37	50	53	50	60
LSD (0.05)		8	4	4	9	9

[a]AMS = ammonium sulfate; Refer to adjuvant glossary for adjuvant types.

Table 2. Raptor with adjuvants in soybean - Hillsboro.

Treatment [a]	Rate	June 5					July 11		July 26	
		Fxtl	V. Wht	Wimu	Colq	Cocb	Fxtl	Cocb	Fxtl	Cocb
	fl oz/A	%	%	%	%	%	%	%	%	%
Raptor+Destiny+AMS	4+1% v/v+1lb	43	43	57	23	37	88	80	99	95
Raptor+Destiny+AMS	2+1% v/v+1lb	23	23	40	20	20	43	43	96	83
Raptor+Hi-Per-Oil+AMS	2+0.5% v/v+1lb	23	23	37	20	23	30	70	96	80
Raptor+AG0001+AMS	2+0.5% v/v+1lb	20	20	30	20	20	32	27	93	78
Raptor+FirstMate	2+1% v/v	23	23	43	23	17	30	37	80	75
Raptor+Prime Oil+AMS	2+1% v/v+1lb	23	23	37	23	13	38	37	93	77
Raptor+Newtone	2+1% v/v	13	13	43	23	27	27	33	83	75
Raptor+CL 9605+AMS	2+0.5% v/v+1lb	13	13	30	23	30	20	40	89	82
Raptor+Flexstar+Scoil	2+0.5pt+1lb	27	23	96	23	85	32	50	77	87
Raptor+Dispatch 2N	2+2.5qt	20	20	30	20	10	50	75	86	75
Raptor+Dispatch 111	2+1% v/v	13	13	23	20	20	30	33	73	75
Raptor+Premier 90	5+0.25% v/v+1qt	20	20	37	20	27	88	57	98	85
Raptor+Premium COC+28%	5+1% v/v+1qt	30	30	50	20	43	78	55	99	95
Raptor+Soy-Stick+28%	5+1% v/v+1qt	23	20	30	20	30	50	80	96	88
Raptor+WC001+28%	5+0.5% v/v+1qt	20	20	37	20	43	50	73	96	85
Raptor+WC002+28%	5+1% v/v+1qt	20	20	30	20	23	50	47	96	88
Raptor+Linkage	5+1% v/v	20	20	37	20	23	50	57	99	83
Raptor+AG0005+AMS	2+0.5% v/v+llb	20	20	33	20	20	50	60	98	86
LSD (0.05)		9	9	11	5	9	7	10	10	9

[a]AMS = ammonium sulfate; Refer to adjuvant glossary for adjuvant types.

Glyphosate: formulation, spray volume, and AMS, Prosper. (Ramsdale and Messersmith) 'Jud' oat, 'Oxen' hard red spring wheat, and 'Sunrise' white proso millet were planted as strips side-by-side on May 31, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on June 29 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 72 F, 60% RH, wind S at 5 mph, and sky clear. Oat was 8- to 10-inch (tillering), wheat 6- to 8-inch (tillering), and proso millet 4- to 6-inch (5- to 6-leaf). Experimental design was a randomized complete block with four replicates. Glyphosate was applied at a reduced rate to better detect treatment effects on glyphosate efficacy. Nonionic surfactant was added as recommended by the herbicide label for each formulation.

Treatment	Volume[a]	Rate[b]	July 10		
			Proso millet	Oat	Wheat
	gpa	oz ae/A	% control		
Roundup Ultra	2.5	1	90	92	91
Roundup Original + NIS	2.5	1 + 0.5%	80	93	94
Roundup Custom + NIS	2.5	1 + 1%	75	89	82
Touchdown + NIS	2.5	1 + 0.5%	74	86	80
Roundup Ultra Dry	2.5	1	90	94	93
RU-Ultra + AMS	2.5	1 + 2%	97	97	97
RU-Original + NIS + AMS	2.5	1 + 0.5% + 2%	88	98	98
RU-Custom + NIS + AMS	2.5	1 + 1% + 2%	83	94	93
Touchdown + NIS + AMS	2.5	1 + 0.5% + 2%	83	89	88
RU-Ultra Dry + AMS	2.5	1 + 2%	94	95	96
Roundup Ultra	10	1	77	82	77
Roundup Original + NIS	10	1 + 0.5%	74	92	88
Roundup Custom + NIS	10	1 + 1%	78	89	84
Touchdown + NIS	10	1 + 0.5%	66	82	75
Roundup Ultra Dry	10	1	78	81	71
RU-Ultra + AMS	10	1 + 2%	93	93	94
RU-Original + NIS + AMS	10	1 + 0.5% + 2%	88	94	94
RU-Custom + NIS + AMS	10	1 + 1% + 2%	89	96	96
Touchdown + NIS + AMS	10	1 + 0.5% + 2%	85	92	88
RU-Ultra Dry + AMS	10	1 + 2%	87	88	86
CV			5	4	6
LSD (5%)			6	5	7

[a] Roundup Ultra = isopropyl amine salt with full adjuvant load, Roundup Original = isopropyl amine salt with partial adjuvant load, Roundup Custom = isopropyl amine salt, Roundup Ultra Dry = ammonium salt with full adjuvant load; Touchdown =trimethyl sulfonium salt with partial adjuvant load; NIS = Activator 90 nonionic surfactant; AMS = spray grade ammonium sulfate (% w/v).

[b] All treatments were applied with XR8001 tips at 28 psi and volume was change by application speed.

Roundup Ultra and Roundup Ultra Dry without ammonium sulfate were more effective when applied in 2.5 than 10 gpa spray volume. The Roundup Ultra and Roundup Ultra Dry labels do not require additional adjuvant. However, Roundup Ultra or Roundup Ultra Dry applied at a reduced rate in 10 gpa contained insufficient adjuvant to maximize efficacy. Roundup Ultra applied with ammonium sulfate at 2.5 and 10 gpa spray volume provided similar grass control, but Roundup Ultra Dry applied with ammonium sulfate was still more effective at 2.5 versus 10 gpa. Spray volume did not influence glyphosate efficacy when applied as Roundup Original, Roundup Custom, or Touchdown formulations and with or without ammonium sulfate, but these formulations required additional adjuvant. Ammonium sulfate generally enhanced glyphosate efficacy independent of formulation or spray volume, except for Roundup Ultra Dry applied at 2.5 gpa spray volume. Averaged over glyphosate formulation and grass species, ammonium sulfate increased glyphosate efficacy 6 and 11% when applied at 2.5 and 10 gpa, respectively.

Glyphosate: spray volume-herbicide rate study, Prosper. (Ramsdale and Messersmith) The Roundup Ultra formulation of glyphosate at labeled rates contains a full adjuvant load, but reduced rates decreases the amount of adjuvant applied per acre and at high application volumes decreases the surfactant concentration per unit volume. The experiment was conducted to examine the influence of spray volume and nonionic surfactant on efficacy of glyphosate (Roundup Ultra) applied at reduced rates. 'Jud' oat, 'Oxen' hard red spring wheat, and 'Sunrise' white proso millet were planted as strips side-by-side on May 31, 2000. Plots 11 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on June 29 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. Conditions at treatment were 72 F, 60% RH, wind S at 5 mph, and sky clear. Oat was 8- to 10-inch (tillering), wheat 6- to 8-inch (tillering), and proso millet 4- to 6-inch (5- to 6-leaf). Experimental design was a randomized complete block with four replicates.

Treatment[a]	Volume[b]	Rate	July 10		
			Proso millet	Oat	Wheat
	gpa	oz ai/A	% control		
Glyphosate	2.5	2	99	100	100
Glyphosate	5	2	99	100	100
Glyphosate	10	2	96	98	99
Glyphosate + NIS	2.5	2 + 0.5%	100	100	100
Glyphosate + NIS	5	2 + 0.5%	98	99	100
Glyphosate + NIS	10	2 + 0.5%	94	97	98
Glyphosate	2.5	1	95	98	98
Glyphosate	5	1	93	97	97
Glyphosate	10	1	77	86	77
Glyphosate + NIS	2.5	1 + 0.5%	88	95	93
Glyphosate + NIS	5	1 + 0.5%	83	96	91
Glyphosate + NIS	10	1 + 0.5%	74	83	78
Glyphosate	2.5	0.5	79	84	78
Glyphosate	5	0.5	60	72	62
Glyphosate	10	0.5	18	37	33
Glyphosate + NIS	2.5	0.5 + 0.5%	65	78	68
Glyphosate + NIS	5	0.5 + 0.5%	63	76	68
Glyphosate + NIS	10	0.5 + 0.5%	58	67	57
CV			7	4	5
LSD (5%)			9	6	7

[a] NIS = Activator 90 nonionic surfactant.
[b] All treatments were applied with XR8001 tips at 28 psi and volume was change by application speed.

Glyphosate at 0.2 oz/A provided 94 to 100% control of grass species, regardless of spray volume or surfactant. Glyphosate at 1 oz/A applied in 2.5 or 5 gpa spray volume without additional surfactant provided greater than 90% grass species control and was similar to glyphosate at 2 oz/A. However, grass control decreased by 12 to 20% when glyphosate at 1 oz/A was applied in 10 gpa spray volume. When applied at 10 gpa, adding 0.5% v/v nonionic surfactant to glyphosate at 1 oz/A did not enhance grass control over glyphosate alone. Therefore, the reduced efficacy observed for glyphosate applied at 1 oz/A in 10 gpa spray volume was most likely due to the decreased glyphosate concentration in the spray deposit. Glyphosate at 0.5 oz/A applied in 2.5 gpa spray volume provided grass control similar to glyphosate at 1 oz/A in 10 gpa. Grass control by glyphosate at 0.5 oz/A decreased approximately 12 and 50% as spray volume was increased from 2.5 gpa to 5 and 10 gpa, respectively. When applied at 10 gpa, glyphosate at 0.5 oz/A plus nonionic surfactant significantly increased grass control over glyphosate alone, which indicates insufficient adjuvant in the formulation when glyphosate at 0.5 oz/A was applied in 10 gpa.

Glyphosate with adjuvants-Wahpeton. Oltmans and Zollinger. An experiment was conducted near Wahpeton, ND to evaluate weed control from Roundup formulations and Touchdown applied with adjuvants. Asgrow '0901' soybean was planted May 6, 2000. POST treatments were applied June 16, 2000 at 1:30 to 3:00 pm with 58 F air, 64 F soil at a 2 to 4 inch depth, 64% relative humidity, 90% clouds, 4 to 8 mph NW wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to 2 to 3 trifoliolate soybean. Weed species present were: 2 to 5 inch, (5-10 plants/m^2) redroot pigweed; 3 to 6 inch, (20-30 plants/ft^2) common lambsquarters; 2 to 6 inch, (10-15 plants/m^2) common cocklebur; 2 to 5 inch, (30-40 plants/ft^2) common ragweed; and 4 to 6 inch, (20-30 plants/ft^2) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

Treatments were developed according to the adjuvant load in glyphosate formulations. Roundup Ultra and Roundup UltraDry do not require additional surfactant, Roundup Original and Touchdown require some additional surfactant, and Roundup Custom has no surfactant in the formulation. Treatments were applied at reduced rates to detect differences in herbicide enhancement by adjuvants. On June 28, all treatments had greater than 97% foxtail, common cocklebur, and redroot pigweed control (not shown). Common lambsquarters control decreased when either AMS or Corral AMS was applied with the Roundup formulations, while the opposite was true for common ragweed where there was enhanced control. NIS enhanced common ragweed control when applied with either Roundup Custom or Touchdown. Adjuvants CL9804 and CL9913 generally did not enhance common lambsquarters and common ragweed control; however, control was enhanced when CL9804 was added with the drift retardant Placement. On July 11, weed control generally decreased due to new flushes of weeds. Common cocklebur control was greater than 92% for all treatments (not shown). Two treatments, Roundup Original+NIS and Touchdown+NIS+AMS, had greater than 90% foxtail control. All treatments had less than 90% common ragweed control. Common lambsquarters and redroot pigweed control varied between treatments, formulation, and adjuvant. When combined among formulations, Roundup Custom and Touchdown provided greater common lambsquarters control, and Touchdown provided greater redroot pigweed control. When combined among adjuvants, NIS generally enhanced common lambsquarters and redroot pigweed control.

Treatment[a]	Rate	June 28		July 11			
		Colq	Corw	Fxtl[b]	Colq	Corw	Rrpw
	(oz prod/A)	(% control)					
Roundup Ultra	8	99	95	82	93	76	91
Roundup Ultra+AMS	4	69	98	61	68	64	75
Roundup Ultra+Class Act	4+2.5% v/v	98	96	82	85	69	81
Roundup Ultra+Corral AMS	4+2.5% v/v	87	95	82	82	67	90
Roundup UltraDry	4.6	92	96	85	85	86	92
Roundup UltraDry+AMS	2.3	72	94	78	63	73	81
Roundup UltraDry+Class Act	2.3+2.5% v/v	94	98	76	73	61	89
Roundup UltraDry+Corral AMS	2.3+2.5% v/v	68	97	76	59	70	90
Roundup Original+NIS	8+0.5% v/v	98	89	93	92	89	95
Roundup Original+NIS+AMS	4+0.5% v/v	94	92	85	84	79	86
Roundup Original+Class Act	4+2.5% v/v	99	69	77	86	60	86
Roundup Original+NIS+Corral AMS	4+0.5% v/v+2.5% v/v	92	87	84	83	73	88
Touchdown+NIS	7+0.5% v/v	98	99	85	89	83	92
Touchdown+NIS+AMS	3.5+0.5% v/v	96	83	90	91	76	92
Touchdown+Class Act	3.5+2.5% v/v	98	92	82	91	69	88
Touchdown+NIS+Corral AMS	3.5+0.5% v/v+2.5% v/v	91	97	78	91	72	94
Roundup Custom+NIS	6+1% v/v	95	97	85	93	76	91
Roundup Custom+NIS+AMS	3+1% v/v	99	72	86	96	76	96
Roundup Custom+Class Act	3+2.5% v/v	98	88	77	90	72	91
Roundup Custom+Surfate	3+1% v/v	97	83	78	81	72	88
Roundup Custom+CL9804	3+2.5% v/v	88	79	76	82	62	87
Roundup Original+CL9913	3+2.5% v/v	88	79	78	73	61	83
Roundup Custom+NIS+Corral AMS	3+0.5% v/v+2.5% v/v	98	82	74	87	59	83
Roundup Original+Placement+CL9804	3+6+2.5% v/v	96	94	74	89	63	89
Untreated		0	0	0	0	0	0
LSD (0.05)		15	17	18	17	18	16

[a]AMS = ammonium sulfate at 8.5lb/100gal; Class Act = nonionic surfactant+ammonium sulfate; Corral AMS = ammonium sulfate+drift retardant; NIS = nonionic surfactant; Surfate = nonionic surfactant+ammonium sulfate; CL9804 = nonionic surfactant+ammonium sulfate; CL9913 = nonionic surfactant+ammonium sulfate; Placement = drift retardant

[b]Fxtl = Grft and Yeft

Glyphosate with adjuvants-Wendell, MN. Oltmans and Zollinger. An experiment was conducted near Wendell, MN to evaluate weed control from Roundup formulations and Touchdown applied with adjuvants. Asgrow '0901' soybean was planted May 25, 2000. POST treatments were applied June 2, 2000 at 12:00 to 1:30 pm with 73 F air, 65 F soil at a 2 to 4 inch depth, 40% relative humidity, 0% clouds, 3 to 5 mph NW wind, moist soil surface, moist subsoil, fair crop vigor, and no dew present to second trifoliolate soybean. Weed species present were: 1 to 3 inch, (10-20 plants/ft^2) redroot pigweed; 2 to 5 inch, (1-5 plants/ft^2) common lambsquarters; 1 to 5 inch, (15-25 plants/plot) maple-leaved goosefoot; 1 to 5 inch, (1-5 plants/m^2) common cocklebur; and 1 to 4 inch, (1-5 plants/m^2) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer equipped with a wind shield delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

Treatments were developed according to the adjuvant load in glyphosate formulations. Roundup Ultra and Roundup UltraDry do not require additional surfactant, Roundup Original and Touchdown require some additional surfactant, and Roundup Custom has no surfactant in the formulation. Treatments were applied at reduced rates to detect differences in herbicide enhancement by adjuvants. On July 5, foxtail control was generally greater when Roundup Ultra was applied with AMS, Class Act, or Corral AMS. Combined across formulations, foxtail control was generally enhanced when using Class Act, Surfate, or CL9804. CL9804 enhanced control of common lambsquarters, maple-leaved goosefoot, and common cocklebur. Common lambsquarters and maple-leaved goosefoot contol was reduced with AMS, Corral AMS, NIS+AMS, or NIS+Corral AMS. For redroot pigweed, all treatments had greater than 92% control, with the exception of the combination CL9804+Placement. On July 22, all adjuvants had between 86 and 91% foxtail control. In general, weed control decreased due to new flushes. Common lambsquarters and maple-leaved goosefoot control decreased, with Class Act, Surfate, and CL9804 having the greatest control. Common cocklebur control was similar to control reported on July 6. Redroot pigweed control decreased, with Class Act, Corral AMS, and CL9804 generally having the greatest control. Adjuvants that generally enhanced weed control were Class Act, Surfate, and CL9804.

Treatment[a]	Rate	July 5					July 22				
	(oz prod/A)	Fxtl[b]	Colq	Gsft	Cocb	Rrpw	Fxtl	Colq	Gsft	Cocb	Rrpw
		(% control)									
Roundup Ultra	8	90	75	76	78	97	91	75	73	59	71
Roundup Ultra+AMS	4	95	59	61	79	93	91	43	43	78	68
Roundup Ultra+Class Act	4+2.5% v/v	95	81	87	72	92	92	74	69	76	83
Roundup Ultra+Corral AMS	4+2.5% v/v	95	61	64	83	93	88	41	45	68	84
Roundup UltraDry	4.6	92	60	62	70	89	88	43	43	61	68
Roundup UltraDry+AMS	2.3	85	34	34	67	91	89	16	19	68	73
Roundup UltraDry+Class Act	2.3+2.5% v/v	94	60	78	82	96	86	55	53	69	71
Roundup UltraDry+Corral AMS	2.3+2.5% v/v	89	50	54	83	94	89	29	28	81	66
Roundup Original+NIS	8+0.5% v/v	91	71	73	86	93	89	62	58	71	70
Roundup Original+NIS+AMS	4+0.5% v/v	89	41	48	84	96	86	8	8	79	65
Roundup Original+Class Act	4+2.5% v/v	94	82	84	90	89	93	78	74	94	81
Roundup Original+NIS+Corral AMS	4+0.5% v/v+2.5% v/v	75	55	53	89	96	89	43	43	90	88
Touchdown+NIS	7+0.5% v/v	92	71	76	88	97	90	60	64	85	74
Touchdown+NIS+AMS	3.5+0.5% v/v	94	75	75	91	94	90	63	60	88	85
Touchdown+Class Act	3.5+2.5% v/v	88	86	85	88	95	89	85	75	93	84
Touchdown+NIS+Corral AMS	3.5+0.5% v/v+2.5%v/v	97	64	77	93	96	91	56	54	88	74
Roundup Custom+NIS	6+1% v/v	83	72	75	88	87	86	58	59	81	69
Roundup Custom+NIS+AMS	3+1% v/v	89	59	66	79	91	84	53	51	83	73
Roundup Custom+Class Act	3+2.5% v/v	96	82	85	90	89	68	74	68	93	69
Roundup Custom+Surfate	3+1% v/v	95	77	80	89	93	90	68	65	86	68
Roundup Custom+CL9804	3+2.5% v/v	97	89	91	94	94	91	83	74	84	88
Roundup Original+CL9913	3+2.5% v/v	92	67	70	90	93	88	53	48	91	72
Roundup Custom+NIS+Corral AMS	3+0.5% v/v+2.5% v/v	92	48	57	85	93	88	31	31	88	76
Roundup Original+Placement+CL9804	3+6+2.5% v/v	91	66	68	89	70	89	59	55	89	60
Untreated		0	0	0	0	0	0	0	0	0	0
LSD (0.05)		13	23	21	18	15	13	24	24	24	16

[a]AMS = ammonium sulfate at 8.5lb/100gal; Class Act = nonionic surfactant+ammonium sulfate; Corral AMS = ammonium sulfate+drift retardant; NIS = nonionic surfactant; Surfate = nonionic surfactant+ammonium sulfate; CL9804 = nonionic surfactant+ammonium sulfate; CL9913 = nonionic surfactant+ammonium sulfate; Placement = drift retardant

[b]Fxtl = Grft and Yeft; Gsft = maple-leaved goosefoot

Liberty with adjuvants. Zollinger and Fitterer. An experiment was conducted in Wyndmere, ND to evaluate weed control from herbicides Liberty with various adjuvants. Pioneer '37H24' corn was planted on April 23, 2000. POST treatments were applied May 29, 2000 at 1:00 pm with 71 F air, 83 F soil surface, 50% relative humidity, 95% clouds, 2 to 3 mph N wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 5 to 6 inch, 2 collar. Weed species present were: 2 to 4 inch (20 to 30/ft^2) foxtail; 2 to 5 inch (15 to 25/ft^2) common lambsquarters; and 1 to 2 inch (5 to 10/ft^2) redroot pigweed. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		June 12			June 26			
Treatment [a]	Rate	Fxtl	Colq	Rrpw	Fxtl	V. corn	Rrpw	Colq
	fl oz/A	%	%	%	%	%	%	%
Liberty	22	80	70	80	40	50	47	30
Liberty+AMS	22+2.5% v/v	78	80	92	70	98	43	33
Liberty+AMS	11+2.5% v/v	67	67	77	40	60	40	30
Liberty+Class Act	11+2.5% v/v	73	50	75	47	67	37	27
Liberty+Class Act II	11+2.5% v/v	77	50	80	35	55	50	30
Liberty+CL 9913	11+2.5% v/v	70	57	75	37	62	33	20
Liberty+CL 9804	11+2.5% v/v	77	53	63	40	53	37	27
Liberty+AG0006	11+2.5% v/v	85	73	87	40	60	37	20
Liberty+CL 9804	22+2.5% v/v	90	90	92	45	77	43	33
Liberty ATZ	24	55	30	33	20	27	30	10
Liberty+Placement ProPak	11+1% v/v	80	30	50	40	43	30	20
Liberty+Dispatch 111	11+2	70	30	50	35	55	40	25
Liberty+Dryve	11+17lb/100gal	80	57	80	37	63	40	20
Untreated		0	0	0	0	0	0	0
LSD (0.05)		16	14	11	12	14	10	8

[a]AMS = ammonium sulfate; Refer to adjuvant glossary for adjuvant types.

No corn injury was observed. Weeds were drought stressed prior to, at, and after application. Few differences occurred between adjuvants at respective rates. No reduce rate treatment controlled foxtail, volunteer corn, redroot pigweed, or common lambsquarters at June 26.

ZA1296 (mesotrione) plus nicosulfuron and adjuvants for weed control in corn, Casselton, 2000. (Woznica, Messersmith, and Nalewaja) 'Asgrow AG 0901' corn was seeded May 7. Treatments were applied to 3- to 4-leaf corn, 2- to 4-leaf common cocklebur, and 2- to 4-leaf yellow foxtail on June 6 with 75 F, 40% RH, partly cloudy sky, a 5- to 10-mph wind, and dry soil surface. Treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 10 by 40 feet and the experiment was a randomized complete block design with four replicates. Weed densities were: foxtail (95% yellow) 3- to 5-plants/ft^2 and common cocklebur 1- to 3-plants/ft^2.

Treatment[a]	Rate	6/15/00			6/27/00		
		Corn	Cocb[a]	Yeft[a]	Corn	Cocb	Yeft
	oz/A	%					
ZA1296 + Herbimax	1.5+1%	0	88	83	0	89	71
ZA1296 + Herbimax	0.375+1%	0	78	61	0	80	68
ZA1296 + Quad7	0.375+1%	0	91	91	0	85	79
ZA1296 + Herbimax	0.75+1%	0	80	70	0	84	74
ZA1296 + Quad7	0.75+1%	0	91	91	0	93	83
Nicosulfuron + Herbimax	0.18+1%	0	20	50	0	15	80
Nicosulfuron + Quad7	0.18+1%	0	29	53	0	15	84
Nicosulfuron + Herbimax	0.37+1%	0	25	63	0	24	84
Nicosulfuron + Quad7	0.37+1%	0	35	64	0	23	86
ZA1296+Nicosulfuron + Herbimax	0.375+0.18+1%	0	79	84	0	89	85
ZA1296+Nicosulfuron + Quad7	0.375+0.18+1%	0	86	90	0	94	92
ZA1296+Nicosulfuron + Herbimax	0.375+0.37+1%	0	83	86	0	84	93
ZA1296+Nicosulfuron + Quad7	0.375+0.37+1%	0	84	90	0	89	96
ZA1296+Nicosulfuron + Herbimax	0.75+0.18+1%	0	84	81	0	85	70
ZA1296+Nicosulfuron + Quad7	0.75+0.18+1%	0	91	89	0	97	96
ZA1296+Nicosulfuron + Herbimax	0.75+0.37+1%	0	86	84	0	86	88
ZA1296+Nicosulfuron + Quad7	0.75+0.37+1%	0	89	90	0	95	96
Untreated	0	0	0	0	0	0	0
C.V. %		0	11	13	0	6	11
LSD 5%		NS	11	14	NS	6	13

[a] Herbimax=petroleum oil; Quad7=basic blend adjuvant; Cocb=common cocklebur; Yeft=yellow foxtail.

None of the treatments caused injury to corn 1 and 3 weeks after herbicide application. ZA 1296 applied in reduced rates (0.375 and 0.75 oz/A) with Herbimax (petrolum oil adjuvant) gave less common cocklebur and yellow foxtail control then when applied in full rate of 1.5 oz/A. However, more effective basic blend adjuvant Quad7 provided equal or higher weed control with the reduced rates of ZA 1296 then Herbimax with full rate of ZA 1296. Reduced rate of ZA 1296 with reduced rates of nicosulfuron provided better control of yellow foxtail. Quad7 was generally more efficacious adjuvant then Herbimax with the herbicide mixtures. Further evaluations were impossible due to severe floating.

Adjuvants with ZA1296 (mesotrione) for weed control in corn, Casselton, 2000. (Woznica, Messersmith, and Nalewaja) 'Asgrow AG 0901' corn was seeded May 7. Treatments were applied to 3- to 4-leaf corn, 2- to 4-leaf common cocklebur, and 2- to 3-leaf yellow foxtail on June 6 with 75 F, 46% RH, partly cloudy sky, a 5- to 10-mph wind, and dry soil surface. Treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 10 by 40 feet and the experiment was a randomized complete block design with four replicates. Weed densities were: foxtail (95% yellow) 3- to 5-plants/ft^2 and common cocklebur 1- to 3-plants/ft^2.

		6/15			6/27		
Treatment[a]	Rate	Corn	Cocb[a]	Yeft[a]	Corn	Cocb	Yeft
	oz ai/A			%			
ZA1296 + Herbimax	0.75+1%	0	74	56	0	85	55
ZA1296 + Herbimax+AMS	0.75+1%+2%	0	80	73	0	85	64
ZA1296 + Quad7	0.75+1%	0	86	85	0	94	80
ZA1296 + ND-72	0.75+1%	0	83	80	0	89	78
ZA1296 + L-34	0.75+1%	0	89	88	0	92	85
ZA1296 + L-64	0.75+1%	0	88	89	0	89	84
ZA1296 + Herbimax	1.5+1%	0	84	78	0	90	69
ZA1296 + Herbimax + AMS	1.5+1%+2%	0	85	86	0	90	70
ZA1296 + Quad7	1.5+1%	0	93	93	0	93	76
ZA1296 + ND-72	1.5+1%	0	90	91	0	93	80
ZA1296 + L-34	1.5+1%	0	91	91	0	92	83
ZA1296 + L-64	1.5+1%	0	98	98	0	95	89
ZA1296 + Herbimax + SB	0.75+1%+1.8 g/L	0	74	58	0	79	61
ZA1296 + Herbimax + AMS+SB	0.75+1%+2%+1.8 g/L	0	80	76	0	91	69
ZA1296 + Quad7 + SB	0.75+1%+1.8 g/L	0	83	79	0	90	71
ZA1296 + ND-72 + SB	0.75+1%+1.8 g/L	0	86	85	0	93	74
ZA1296 + L-34 + SB	0.75+1%+1.8 g/L	0	84	86	0	89	70
ZA1296 + L-64 + SB	0.75+1%+1.8 g/L	0	85	81	0	92	73
ZA1296 + Herbimax + SB	1.5+1%+1.8 g/L	0	79	76	0	88	54
ZA1296 + Herbimax + AMS+SB	1.5+1%+2%+1.8 g/L	0	88	88	0	91	71
ZA1296 + Quad7 + SB	1.5+1%+1.8 g/L	0	85	89	0	93	80
ZA1296 + ND-72 + SB	1.5+1%+1.8 g/L	0	89	91	0	91	76
ZA1296 + L-34 + SB	1.5+1%+1.8 g/L	0	86	89	0	90	76
ZA1296 + L-64 + SB	1.5+1%+1.8 g/L	0	88	89	0	94	75
Untreated	0	0	0	0	0	0	0
C.V. %		0	6	7	0	5	11
LSD 5%		NS	7	8	NS	6	11

[a] SB= sodium bicarbonate in spray carrier at 1.8 g/L=400 ppm of Na^+; AMS=ammonium sulfate; Herbimax=petroleum oil; Quad7=basic blend adjuvant; ND-72, L-64, and L-64=experimental adjuvants; Cocb=common cocklebur; Yeft=yellow foxtail.

ZA 1296 did not cause any injury to corn 1 and 3 weeks after treatment. Sodium bicarbonate in spray carrier only slightly antagonized efficacy of ZA1296. In most cases treatments containing basic blend adjuvant Quad7 and experimental adjuvants (ND-72, L-34, and particularly L-64) provided better weed control with ZA 1296 than Herbimax (petroleum oil) or Herbimax + ammonium sulfate. Further evaluations were impossible due to severe floating.

PRE and POST weed control in corn. Zollinger and Fitterer. An experiment was conducted near Colfax, ND to evaluate weed control from herbicides applied PRE and POST. Wensman '357' corn was planted on April 25, 2000. PRE treatments were applied April 26, 2000 at 12:00 with 68 F air, 53 F soil at a depth of 2 to 4 inch, 41 % relative humidity, 100% clouds, 3 to 7 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied May 29, 2000 at 9:30 am with 64 F air, 73 F soil surface, 70% relative humidity, 50% clouds, 2 to 4 mph S wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 5 inch (2 collar). Weed species present were: 1 to 4 inch (5 to10/ft^2) green and yellow foxtail; 1 to 4 inch (5 to 10/ft^2) common lambsquarters; 1 to 4 inch (7 to 10/ft^2) wild buckwheat; 1 to 4 inch (5 to10/ft^2) Pennsylvania smartweed; 1 to 5 inch (10 to15/ft^2) marshelder; and 1 to 3 inch (1 to 3/ft^2) redroot pigweed. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel- type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		May 30		June 12		Jume 26		July 10		
Treatment[1]	Rate	Wibw	Mael	Fxtl	Wibw	Fxtl	Wibw	Fxtl	Wibw	Mael
	Product/A	%	%	%	%	%	%	%	%	%
PRE										
Epic	11oz	7	91	86	30	99	0	52	13	80
Epic+atrazine	11oz+0.5lb	38	95	98	67	96	43	57	7	99
Epic+atrazine	9oz+0.5lb	18	88	95	53	96	10	47	13	72
TopNotch&Mesotrione	4.5pt	50	96	90	33	98	37	43	47	75
TopNotch&Mesotrione	5pt	45	98	80	53	93	30	43	43	87
PRE/POST										
Surpass/Mesotrione+Herbimax+28%	2pt/0.188pt	20	53	99	86	90	81	67	80	99
Surpass/Mesotrione+atrazine+ Herbimax+28%	2pt/0.188pt+ 0.55lb	33	53	98	94	99	99	99	99	99
Frontier/Marksman+Herbimax	1.88pt/3.5pt	10	58	99	86	93	99	73	99	99
Dual II Magnum/ NorthStar+ Herbimax+28%	1.67pt/5oz	30	68	99	66	93	89	99	99	99
POST										
Mesotrione+Herbimax+28%	0.188pt	-	-	60	50	37	43	7	38	99
Mesotrione+Scoil	0.188pt	-	-	83	60	40	60	7	60	99
Mesotrione+atrazine+Scoil	0.188pt+0.55lb	-	-	90	93	86	94	37	85	99
Mesotrione+Clarity+Scoil	0.188pt+4fl oz	-	-	70	90	40	99	13	85	99
Mesotrione+Distinct+Scoil	0.188pt+2oz	-	-	85	95	47	99	43	99	99
Mesotrione+Clarity+atrazine+Scoil	0.188pt+4fl oz+0.42lb	-	-	98	99	83	96	50	99	99
Mesotrione+Distinct+atrazine+Scoil	0.188pt+2oz+ 0.42lb	-	-	91	93	63	76	72	99	99
LSD (0.05)		15	10	6	9	7	15	11	10	8

[1]Herbimax = petroleum oil at 1% v/v; 28-0-0 at 2.5% v/v; and Scoil = methylated seed oil at 1.5 pt/A.
[2]Fxtl = green foxtail and yellow foxtail.

Timely rains occurred soon after PRE applications. Excellent growing conditions existed throughout the growing season. Injury ratings taken on June 2 indicated slight stalk bending on corn plants from all treatments containing Clarity, especially Marksman. No injury was observed on June 12 except stunting and prolonged stalk bending with Marksman. All treatments gave complete redroot pigweed and common lambsquarters control. Green and yellow foxtail was controlled at May 30. Marshelder was controlled at June 12 and June 26. All treatments controlled Pennsylvania smartweed except PRE/POST treatments at May 30 but was controlled at all later evaluations. Treatments containing atrazine and/or Clarity generally gave greater weed control than those treatments without the herbicides. Epic and Mesotrione did not control wild buckwheat. Marshelder control began to break from most PRE treatments by July 10.

Weed control in corn with nicosulfuron tank mixtures, Wishek, 2000. (Endres and Schneider) The experiment was conducted to evaluate weed control in corn with selected nicosulfuron rates and tank mixtures. The experiment was conducted on a medium/fine textured soil with 6.3 pH and 3.0% organic matter at the Tri-county trial site near Wishek. The experiment was a randomized complete block design with four replicates. 'DK493RR' field corn was planted on May 18 in 28-inch rows. Herbicide treatments were applied to the center 5 ft of 7.5 by 22 ft plots with a hand-boom plot sprayer at 10.5 gal/A at 35 psi through 8001 flat fan nozzles. Treatments were applied on June 26 during weather conditions of 66 F, 48% RH, 40% cloudy sky, and 14 mph wind to 8- to 12-inch tall corn, 1- to 6-inch tall yellow and green foxtail, 1- to 5-inch tall redroot pigweed, and 2- to 8-inch wide prostrate pigweed.

		July 10		July 25	
Treatment[a]	Rate	Fota[b]	Piwe[c]	Fota	Piwe
	(oz ai/A)	------	(% control)		-------
Nico+dica +NIS+UAN	0.5 + 4 +0.25% + 2 pt	72	80	73	88
Nico+dica +atrazine+MSO	0.25 + 2 + 0.38 lb + 1.5 pt	75	79	75	85
Nico+BAS 662 +NIS+UAN	0.5 + (2+0.8) + 0.25% + 2 pt	75	88	77	95
Nico+dica +Quad 7	0.25 + 1 + 1%	71	79	74	87
C.V. %		6	4	4	3
LSD (0.05)		NS	6	NS	5

[a]NIS=Preference;MSO=Scoil.
[b]Fota=Yellow and green foxtail.
[c]Piwe=Redroot and prostrate pigweed.

Corn injury was not detected with herbicide treatments. Yellow foxtail was only suppressed due to growth stage when treatments were applied. The reduced rate of nicosulfuron (Accent) performed as well as the labeled rate in suppressing foxtail. Nicosulfuron +BAS 662 (Distinct) provided the highest pigweed control (88-95%). Quad 7 added to the reduced rates of nicosulfuron + dicamba (Banvel) provided similar weed control as full rates of nicosulfuron + dicamba + NIS + UAN.

POST weed control in corn. Zollinger and Fitterer. An experiment was conducted in Carrington, ND to evaluate weed control from herbicides applied POST. Pioneer '39D81' corn was planted on May 18, 2000. POST treatments were applied June 23, 2000 at 1:00 pm with 77 F air, 86 F soil surface, 73% relative humidity, 50% clouds, 1 to 3 mph NW wind, moist soil surface, moist subsoil, good crop vigor, no dew present, and crop was 6 to 10 inch, 3 to 4 collar. Weed species present were: 1 to 4 inch (20 to 30/ft^2) foxtail; 1 to 3 inch (2 to 4/ft^2) common lambsquarters; 1 to 3 inch (1 to 3/ft^2) redroot pigweed; and 2 to 5 inch (2 to 4/ft^2) wild buckwheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		July 7				July 21	Aug 18	
Treatment [a]	Rate	Fxtl	Rrpw	Colq	Prpw	Fxtl	Fxtl	Wibw
	Product/A	%	%	%	%	%	%	%
Basis Gold+Distinct+NIS+AMS	14oz+1oz	68	99	99	99	57	57	99
Basis Gold+Distinct+NIS+AMS	14oz+2oz	75	96	96	96	63	65	99
Basis Gold+Distinct+NIS+AMS	14oz+4oz	62	99	99	99	70	72	99
Basis Gold+Distinct+PO+AMS	14oz+1oz	63	98	98	98	53	52	99
Basis Gold+Distinct+PO+AMS	14oz+2oz	67	99	99	99	63	68	99
Basis Gold+Distinct+PO+AMS	14oz+4oz	70	99	99	99	70	68	99
Basis Gold+Clarity+PO+AMS	14oz+4 fl oz	62	99	99	99	57	60	99
Accent Gold+Distinct+NIS+AMS	2.9oz+1oz	62	78	78	78	43	43	99
Accent Gold+Distinct+NIS+AMS	2.9oz+2oz	67	78	78	78	57	57	99
Accent Gold+Distinct+NIS+AMS	2.9oz+4oz	75	88	88	88	68	69	99
Accent Gold+Distinct+PO+AMS	2.9oz+1oz	65	67	67	67	60	60	99
Accent Gold+Distinct+PO+AMS	2.9oz+2oz	67	80	77	80	63	63	99
Accent Gold+Distinct+PO+AMS	2.9oz+4oz	67	88	88	88	63	65	99
Accent Gold+Clarity+PO+AMS	2.9oz+4 fl oz	65	75	75	75	55	53	99
Accent+Distinct+NIS+AMS	0.67oz+2oz	50	50	50	50	50	52	99
Accent+Distinct+Atrazine+NIS+AMS	0.67oz+2oz	68	68	68	68	73	72	99
Accent+Distinct+NIS+AMS	0.67oz+4oz	60	53	53	53	57	55	79
Accent+Distinct+PO+AMS	0.67oz+2oz	70	80	80	80	63	65	99
Accent+Distinct+Atrazine+PO+AMS	0.67oz+2oz+0.55lb	62	57	57	57	60	62	99
Accent+Distinct+PO+AMS	0.67oz+4oz	68	78	77	77	75	78	99
Accent+Clarity+NIS+AMS	0.67oz+8fl oz	63	60	63	60	58	65	99
LSD (0.05)		14	13	12	12	13	12	6

[a]AMS = ammonium sulfate and was applied at 2 lb/A; NIS = Activator 90 and was applied at 0.25% v/v; PO = Herbimax and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

At July 21 and August 18, redroot pigweed, prostrate pigweed, and common lambsquarters were completed controlled. Generally, weed control as Distinct rates increased. Replacing Distinct with Clarity generally resulted in less weed control. Oil adjuvants gave enhanced weed control more that other adjuvant combinations.

DPX 79406 in corn. Zollinger and Fitterer. Experiments were conducted near Casselton and Wyndmere, ND to evaluate weed control in corn from herbicides applied EPOST and POST. In Casselton, NK 'N2555BT'corn was planted in each plot on May 18, 2000. EPOST treatments were applied June 6, 2000 at 9:00 am with 62 F air, 56 F soil surface, 61 % relative humidity, 70% clouds, 7 to 12 mph S wind, moist soil surface, moist subsoil, no dew present, and crop stage was 3 to 4 inch (1 collar). Weed species present were: 1 to 2 inch (5 to 10/ft^2) green and yellow foxtail; 1 to 2 inch (3 to10/ft^2) redroot pigweed; 2 to 3 inch (8 to 10/ft2) wild mustard; and 1 to 2 inch (5 to 8/ft2) common cocklebur. POST treatments were applied June 19, 2000 at 8:00 am with 63 F air, 62 F soil surface, 69% relative humidity, 80% clouds, 8 to 12 mph NW winds, moist soil surface, and moist subsoil, no dew present, and crop stage was 5 to 6 inch (2 collar). Weed species present were: 2 to 4 inch (5 to 10/ft^2) foxtail; 2 to 4 inch (3 to 5/ft^2) redroot pigweed; 3 to 4 inch (8 to 10/ft^2) wild mustard; 1 to 3 inch (3 to 5/ft^2) Venice mallow; and 3 to 4 inch (5 to 8/ft^2) common cocklebur.

In Wyndmere, Pioneer '37H24' corn was planted in each plot on April 13, 2000. EPOST treatments were applied on May 23, 2000 at 1:00 pm with 83 F air, 76 F soil surface, 24% relative humidity, 85% clouds, 5 to 9 mph W wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 4 to 5 inch (1 collar). Weed species present were: 1 to 3 inch (10 to 25/ft^2) foxtail and 1 to 4 inch (15 to 50/ft^2) common lambsquarters. POST treatments were applied on May 29, 2000 at 12:30 pm with 71 F air, 83 F soil surface, 50% relative humidity, 95% clouds, 2 to 3 mph N wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 5 to 6 inch, 2 collar. Weed species present were: 2 to 4 inch (10 to 25/ft^2) foxtail and 2 to 5 inch (15 to 50/ft^2) common lambsquarters.

Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

DPX 79406 is a 1:1 ratio or 37.5DF nicosulfuron (Accent) + 37.5DF rimsulfuron (Matrix) product.

At Casselton, adequate rain through the growing season provided good growing conditions. No corn injury was observed through all evaluations. Weed control 15 days after application (July 3) was variable with few herbicide treatments giving greater than 90% weed control. EPOST treatments plus DPX- 79406+Distinct+ atrazine+Scoil gave greater than 90% control of most weeds. At July 17, wild mustard was completely controlled and EPOST treatments and treatments containing DPX-79406 generally gave adequate weed control.

At Wyndmere, drought stress existed through evaluation and no corn injury was observed. Drought stress caused less overall weed control. Accent+Clarity+atrazine+Scoil provided the greatest control of both foxtail and common lambsquarters.

Table 1. Post emergence weed control in corn - Casselton.

Treatment[1]	Rate	July 3					July 17			
		Fxtl[2]	Rrpw	Wimu	Cocb	Vema	Fxtl	Rrpw	Colq	Cocb
	Product/A	%	%	%	%	%	%	%	%	%
EPOST										
Basis Gold+Surpass+Herbimax+AMS	14oz+1.5pt	95	99	99	83	99	99	99	99	88
Basis Gold+Surpass+Herbimax+AMS	7oz+1.5pt	95	96	99	72	99	99	99	99	73
POST										
DPX 79406+Hornet+Scoil	0.5oz+2.4oz	53	53	63	53	70	90	95	90	92
DPX 79406+Clarity+Scoil	0.5oz+4fl oz	75	77	78	65	86	95	95	95	93
DPX 79406+Clarity+atrazine+Scoil	0.5oz+4fl oz+0.375lb	75	77	83	53	88	93	93	93	93
DPX 79406+Distinct+atrazine+Scoil	0.5oz+0.375lb	62	99	99	62	99	92	92	88	93
DPX 79406+Distinct+Scoil	0.5oz+4oz	70	89	83	82	86	95	95	95	93
DPX 79406+Hornet+Scoil	0.5oz+4oz	62	70	70	63	73	93	92	92	92
DPX 79406+Clarity+Scoil	0.023+4fl oz	80	77	77	67	77	99	99	99	99
DPX 79406+Clarity+atrazine+Scoil	0.023+4fl oz+0.375lb	70	86	86	57	86	99	99	99	99
DPX 79406+Distinct+Scoil	0.023+4oz	60	72	83	83	86	97	95	97	98
Basis Gold+Herbimax+AMS	7oz	15	17	97	10	17	47	97	87	47
Basis Gold+Accent+Herbimax+AMS	7oz+0.33oz	27	50	93	20	58	48	88	75	50
Basis Gold+Accent+Herbimax+AMS	7oz+0.167oz	23	13	50	8	13	50	48	48	48
Accent+Clarity+atrazine+Scoil	0.031+4fl oz+0.375lb	65	83	70	47	83	90	98	93	92
Accent+Clarity+atrazine+Scoil	0.33oz+4fl oz+0.375lb	47	63	68	42	70	68	88	88	80
LSD (0.05)		9	14	7	8	16	7	6	6	7

[1]Scoil = methylated seed oil at 1.5 pt/A; Herbimax = petroleum oil at 1%v/v; and AMS = ammonium sulfate at 17 lb/100 gal.
[2]Fxtl = green foxtail and yellow foxtail.

Table 2. Post emergence weed control in corn - Wyndmere.

Treatment[1]	Rate	July 12		June 26	
		Fxtl[2]	Colq	Fxtl	Colq
	Product/A	%	%	%	%
EPOST					
Basis Gold+Surpass+Herbimax+AMS	14oz+1.5pt	93	96	65	99
Basis Gold+Surpass+Herbimax+AMS	7oz+1.5pt	67	95	53	99
POST					
DPX 79406+Hornet+Scoil	0.5oz+2.4oz	88	73	77	77
DPX 79406+Clarity+Scoil	0.5oz+4fl oz	68	43	75	85
DPX 79406+Clarity+atrazine+Scoil	0.5oz+4fl oz+0.375lb	70	88	53	99
DPX 79406+Distinct+atrazine+Scoil	0.5oz+0.375lb	68	85	44	83
DPX 79406+Distinct+Scoil	0.5oz+4oz	76	69	68	98
DPX 79406+Hornet+Scoil	0.5oz+4oz	80	60	75	68
DPX 79406+Clarity+Scoil	0.023+4fl oz	77	65	72	93
DPX 79406+Clarity+atrazine+Scoil	0.023+4fl oz+0.375lb	83	88	57	93
DPX 79406+Distinct+Scoil	0.023+4oz	73	67	63	91
Basis Gold+Herbimax+AMS	7oz	47	43	33	27
Basis Gold+Accent+Herbimax+AMS	7oz+0.33oz	60	83	47	83
Basis Gold+Accent+Herbimax+AMS	7oz+0.167oz	63	60	50	53
Accent+Clarity+atrazine+Scoil	0.031+4fl oz+0.375lb	85	92	88	98
Accent+Clarity+atrazine+Scoil	0.33oz+4fl oz+0.375lb	79	86	73	96
LSD (0.05)		10	12	9	16

[1]Scoil = methylated seed oil at 1.5 pt/A; Herbimax = petroleum oil at 1%v/v; and AMS = ammonium sulfate at 17 lb/100 gal.
[2]Fxtl = green foxtail and yellow foxtail.

Aim in corn. Zollinger and Fitterer. An experiment was conducted in Casselton, ND to evaluate weed control in corn from Aim applied POST. NK 'N2555BT' corn was planted on May 18, 2000. POST treatments were applied June 6, 2000 at 11:00 am with 69 F air, 57 F soil surface, 49% relative humidity, 50% clouds, 8 to 12 mph S wind, moist soil surface, and moist subsoil. Weed species present were: 1 to 2 inch (5 to 10/ft^2) foxtail; 1 to 2 inch (3 to 5/ft^2) redroot pigweed; 2 to 3 inch (8 to 10/ft^2) wild mustard; and 1 to 2 inch (5 to 8/ft^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		June 21				July 3			
Treatment [a]	Rate	Fxtl	Cocb	Vema	Rrpw	Fxtl	Cocb	Vema	Rrpw
	Product/A	%	%	%	%	%	%	%	%
Aim+Atrazine+NIS	0.33oz+0.42lb+0.25% v/v	53	58	82	99	35	70	89	99
Aim+Clarity+NIS	0.33oz+0.5pt+0.25% v/v	35	67	80	99	10	73	83	99
Aim+Basis Gold+PO+28%	0.33oz+14oz+1% v/v+2qt	95	70	96	99	97	77	96	99
Aim+Accent Gold+PO+28%	0.33oz+2.9oz+1% v/v+2qt	96	85	93	99	96	82	93	93
Aim+Hornet+NIS	0.33oz+2.4oz+0.25% v/v	37	72	85	99	35	80	86	86
Aim+NorthStar+NIS	0.33oz+5oz+0.25% v/v	87	75	85	99	83	78	80	86
Aim+Sterling+Class Act II	0.33oz+4fl oz+2.5% v/v	23	82	87	93	20	72	77	83
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		11	11	13	7	17	10	12	9

[a]28% = 28% liquid nitrogen fertilizer and was applied 2 qt/A; NIS = nonionic surfactant = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil = Herbimax = and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

At July 3, only treatments containing Basis Gold or Accent Gold controlled foxtail. Cocklebur control was less than 83%. Venice mallow control ranged between 77 and 96% control. Most treatments control redroot pigweed.

Starane in corn. Zollinger and Fitterer. An experiment was conducted in Casselton, ND to evaluate corn tolerance to Starane applied POST. NK 'N2555BT' corn was planted on May 18, 2000. POST treatments were applied June 6, 2000 at 10:30 am with 66 F air, 56 F soil surface, 55% relative humidity, 65% clouds, 7 to 11 mph NE wind, moist soil surface, and moist subsoil. Weed species present were: 1 to 2 inch (5 to 10/ft^2) foxtail; 1 to 2 inch (3 to 5/ft^2) redroot pigweed; 2 to 3 inch (8 to 10/ft^2) wild mustard; and 1 to 2 inch (5 to 8/ft^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Treatment [a]	Rate	June 21			July 3		
		Fxtl	Cocb	Rrpw	Fxtl	Cocb	Rrpw
	Product/A	%	%	%	%	%	%
Starane+Activator 90	0.5pt+0.25% v/v	0	78	13	0	70	80
Starane+Activator 90	0.67pt+0.25% v/v	0	82	30	0	73	93
Starane+Atrazine+Activator 90	0.5pt+0.5lb+0.25% v/v	27	85	99	17	78	99
Starane&Salvo+Activator 90	1.3pt+0.25% v/v	0	87	99	0	73	99
Starane&Saber+LI 700	2pt+0.25% v/v	0	80	99	2	70	99
PCC196+LI 700	2pt+0.25% v/v	45	82	99	37	77	99
Starane+Aim+LI 700	0.5pt+0.33oz+0.25% v/v	40	77	98	17	67	99
Starane+Accent+LI 700+28%	0.5pt+0.5oz+0.25% v/v+2qt	80	60	93	55	65	99
Starane+Basis Gold+LI 700+28%	0.5pt+10oz+0.25% v/v+2qt	98	75	99	93	70	99
Starane+Distinct+LI 700+28%	0.5pt+4oz+0.25% v/v+2qt	58	73	98	52	72	99
Starane+Hornet+LI 700+28%	0.5pt+2.4oz+0.25 v/v+2qt	50	77	86	12	85	99
Shotgun	2pt	53	78	99	32	68	99
Shotgun	3pt	73	85	99	48	78	99
Untreated		0	0	0	0	0	0
LSD (0.05)		14	14	13	11	11	10

[a]Activator 90 and LI 700 are nonionic adjuvant; 28% = 28% liquid nitrogen fertilizer. Refer to adjuvant glossary for adjuvant types.

No corn injury occurred. At June 21 and July 3, wild mustard and Venice mallow were completely controlled. Only Starane + Basis Gold controlled green and yellow foxtail. only Starane + Hornet gave greater than 80% common cocklebur control. Except for crop competition, there is no explanation for greater than 80% redroot pigweed control Starane treatments alone without an additional broadleaf herbicide.

AE Fl 30360 in corn. Zollinger and Fitterer. Experiments were conducted near Colfax and Carrington, ND to evaluate weed control from AE F130360. In Colfax, Wensman '357' corn was planted in each plot on April 25, 2000. PRE treatments were applied April 26, 2000 at 12:00 with 68 F air, 53 F soil at a depth of 2 to 4 inches, 41 % relative humidity, 100% clouds, 3 to 7 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied May 29, 2000 at 9:30 am with 64 F air, 73 F soil surface, 70% relative humidity, 50% clouds, 2 to 4 mph S wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 5 inch (2 collar). Weed species present were: 1 to 4 inch (5 to 10/ft^2) green and yellow foxtail; 1 to 4 inch (5 to 10/ft^2) common lambsquarters; 1 to 4 inch (7 to 10/ft^2) wild buckwheat; 1 to 4 inch (5 to 10/ft^2) Pennsylvania smartweed; 1 to 5 inch (10 to 15/ft^2) marshelder; and 1 to 3 inch (1 to 3/ft^2) redroot pigweed.

In Carrington, Pioneer '39D81' corn was planted in each plot on May 18, 2000. PRE treatments were applied May 24, 2000 at 10:30 am with 64 F air, 58 F soil at a depth of 2 to 4 inch, 35% relative humidity, 0% clouds, 8 to 15 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied June 23, 2000 at 12:00 pm with 78 F air, 89 F soil surface, 75% relative humidity, 50% clouds, 5 to 10 mph NW wind, moist soil surface, moist subsoil, good crop vigor no dew present, and crop stage was 6 to 10 inch (3 to 4 collar). Weed species present were: 1 to 4 inch (3 to 5/ft^2) green and yellow foxtail; 1 to 3 inch (2 to 4/ft^2) common lambsquarters; 1 to 3 inch (5 to 10/ft^2) redroot pigweed; and 2 to 5 inch (1 to 2/ft^2) wild buckwheat.

Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer, using a wind shield, delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Both locations exhibited very good growing conditions for the crop and weeds. Weeds were not drought stressed or stressed from any other conditions through the evaluation period. At Colfax, no corn injury was observed except at May 24 when injury in the form of slight necrosis and chlorosis was observed with Balance Pro+atrazine/AE F130360 01+Scoil+28-0-0 PRE/POST and AE F130360 02+Activator 90+28-0-0. All herbicides controlled redroot pigweed, marshelder, and Pennsylvania smartweed. All herbicides controlled common lambsquarters except Accent+Herbimax+28-0-0 (60 to 70% control). Both PRE/POST treatments controlled green and yellow foxtail. Most POST treatments did not control foxtail species or wild buckwheat.

At Carrington, no corn injury occurred. At July 7, most POST treatments did not control redroot pigweed, prostrate pigweed, and common lambsquarters but the weeds were controlled at all later evaluations. Most treatments gave adequate green and yellow foxtail control. The only treatment that controlled wild buckwheat was AE Fl 30360 01+ Distinct + Scoil + 28-0-0 applied POST at the higher rate.

Table 1. Weed control on corn - Colfax.

Treatment[1]	Rate	June 12		June 26		July 10	
		Fxtl[2]	Wibw	Fxtl	Wibw	Fxtl	Wibw
	Product/A	%	%	%	%	%	%
PRE/POST							
Balance Pro+atrazine/AE F130360 01+Scoil+28-0-0	1.88fl oz+0.5lb/1.25oz	99	67	99	43	99	0
Balance Pro/AE F130360 02+Scoil+28-0-0	1.88fl oz/1.25oz	99	60	96	17	99	0
POST							
AE F130360 01+Scoil+28-0-0	1.25oz	88	60	80	20	83	28
Accent+Herbimax+28-0-0	0.67oz	90	47	70	50	50	43
AE F130360 02+Scoil+28-0-0	1.25oz	95	77	70	57	40	50
AE F130360 02+Scoil	1.25oz	95	73	85	50	50	30
AE F130360 02+Herbimax+28-0-0	1.25oz	80	70	63	40	43	30
AE F130360 02+Activator 90+28-0-0	1.25oz	85	67	73	20	53	13
AE F130360 01+Distinct+Scoil+28-0-0	1.25oz+4oz	99	99	96	99	72	72
AE F130360 02+Distinct+Scoil+28-0-0	1.25oz+4oz	98	96	93	99	83	87
Accent+Distinct+Herbimax+28-0-0	0.67oz+4oz	90	90	80	99	72	82
Untreated		0	0	0	0	0	0
LSD (0.05)		7	7	10	10	4	7

[1]Scoil = methylated seed oil at 1.5 pt/A; 28-0-0 at 2 qt/A; Herbimax = petroleum oil at 1.5 pt/A and Activator 90 = non ionic surfactant at 0.5% v/v.
[2]Fxtl = green foxtail and yellow foxtail.

Table 2. Weed control on corn - Carrington.

Treatment[1]	Rate	July 7					July 21		August 18	
		Fxtl[2]	Rrpw	Prpw	Col q	Wibw	Fxtl	Wibw	Fxtl	Wibw
	Product/A	%	%	%	%	%	%	%	%	%
PRE/POST										
Balance Pro+atrazine/AE F130360 01+Scoil+28-0-0	1.88fl oz+0.5lb/1.25oz	92	93	93	93	33	93	60	95	61
Balance Pro/AE F130360 02+Scoil+28-0-0	1.88fl oz/1.25oz	92	96	96	96	37	96	50	97	52
POST										
AE F130360 01+Scoil+28-0-0	1.25oz	88	67	67	67	13	90	30	93	35
Accent+Herbimax+28-0-0	0.67oz	83	67	60	60	17	91	32	95	38
AE F130360 02+Scoil+28-0-0	1.25oz	88	77	77	77	23	91	43	94	48
AE F130360 02+Scoil	1.25oz	82	80	80	80	27	90	47	92	52
AE F130360 02+Herbimax+28-0-0	1.25oz	85	70	70	70	27	82	50	84	52
AE F130360 02+Activator 90+28-0-0	1.25oz	90	70	70	70	27	92	70	92	75
AE F130360 01+Distinct+Scoil+28-0-0	1.25oz+4oz	87	70	70	70	30	95	95	95	95
AE F130360 02+Distinct+Scoil+28-0-0	1.25oz+4oz	87	80	80	80	27	95	81	93	81
Accent+Distinct+Herbimax+28-0-0	0.67oz+4oz	87	70	70	70	30	95	63	97	60
Untreated		0	0	0	0	0	0	0	0	0
LSD (0.05)		7	13	11	11	16	10	13	8	13

[1]Scoil = methylated seed oil at 1.5 pt/A; 28-0-0 at 2 qt/A; Herbimax = petroleum oil at 1.5 pt/A and Activator 90 = non ionic surfactant at 0.5% v/v.
[2]Fxtl = green foxtail and yellow foxtail.

Wild buckwheat control with AE FI 30360. Zollinger and Fitterer. An experiment was conducted near Carrington, ND to evaluate weed control from herbicides applied POST. Pioneer '39DSI' corn was planted on May 18, 2000. POST treatments were applied June 23, 2000 at 12:30 pm with 77 F air, 87 F soil surface, 73% relative humidity, 50% cloud, 1 to 3 mph NW wind, moist soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 6 to 10 inch, (3 to 4 collar). Weed species present were: 1 to 4 inch (3 to 5/ft^2) green and yellow foxtail; 3 to 5 inch (3 to 5/ft^2) common lambsquarters; 1 to 3 inch (5 to 10/ft^2) redroot pigweed; 1 to 3 inch (5 to 10/ft^2) prostrate pigweed; and 2 to 5 inch (1 to 2/ft^2) wild buckwheat. Treatments were applied to the center 6.67 feet of the 1 0 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		July 7				July 12		August 18	
Treatment[1]	Rate	Fxtl[2]	Rrpw	Colq	Prpw	Fxtl	Wibw	Fxtl	Wibw
	Product/A	%	%	%	%	%	%	%	%
AE F30360 01+Scoil+28-0-0	1.25oz	82	67	67	67	85	40	89	38
AE F30360 02+Scoil+28-0-0	1.25oz	85	85	85	85	80	30	84	35
AE F30360 01+Clarity+Scoil+28-0-0	1.25oz+4fl oz	82	75	72	75	87	99	89	99
AE F30360 02+Clarity+Scoil+28-0-0	1.25oz+4fl oz	85	78	78	78	88	99	90	99
AE F30360 01+Clarity+Scoil+28-0-0	1.25oz+8fl oz	82	70	70	70	85	99	88	99
AE F30360 02+Clarity+Scoil+28-0-0	1.25oz+8fl oz	75	70	70	70	85	99	86	99
AE F30360 01+Connect+Scoil+28-0-0	1.25oz+8fl oz	75	73	73	73	85	73	88	70
AE F30360 02+Connect+Scoil+28-0-0	1.25oz+8fl oz	75	77	77	77	85	43	87	48
Accent+Scoil+28-0-0	0.67oz	70	72	72	72	90	63	90	68
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		8	8	7	8	11	11	12	10

[1]Scoil = methylated seed oil at 1.5 pt/A and 28-0-0 at 2 qt/A.
[2]Fxtl = green foxtail and yellow foxtail.

The target weed for control was wild buckwheat. Slight corn injury was observed only at June 29 and was less than 3%. Weed control at July 7 was variable and generally ranged between 70 and 85% and control of wild buckwheat was not more than 30% from any treatment (data not shown). Redroot pigweed, prostrate pigweed, and common lambsquarters were controlled at July 12 and August 18 (data not shown). Only treatments containing dicamba controlled wild buckwheat.

AE F130360 (foramsulfuron) with adjuvants in corn, Casselton, 2000. (Woznica, Messersmith, and Nalewaja) 'Asgrow AG 0901' corn was seeded May 7. Treatments were applied to 3- to 4-leaf corn, 2- to 4-leaf common cocklebur, and 2- to 3-leaf yellow foxtail on June 6 with 75 F, 46% RH, partly cloudy sky, a 5- to 10-mph wind, and dry soil surface. Treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gal/A at 35 psi through 8001 flat fan nozzles. Plot size was 10 by 40 feet and the experiment was a randomized complete block design with four replicates. Weed densities were: foxtail (95% yellow) 3- to 5-plants/ft^2 and common cocklebur 1- to 3-plants/ft^2.

Treatment[a]	Rate	6/15/00			6/27/00		
		Corn	Cocb[a]	Yeft[a]	Corn	Cocb	Yeft
	oz/A			%			
AE F130360 + Scoil	0.75+0.19G	0	64	83	0	78	80
AE F130360 + Quad7	0.75+1%	0	74	91	0	80	83
AE F130360 + L-34	0.75+1%	0	75	91	0	83	81
AE F130360 + L-64	0.75+1%	0	75	95	0	84	85
AE F130360 + Scoil	1.25+0.19G	0	69	85	0	79	88
AE F130360 + Quad7	1.25+1%	0	73	94	0	86	88
AE F130360 + L-34	1.25+1%	0	70	95	0	81	86
AE F130360 + L-64	1.25+1%	0	78	95	0	91	89
Untreated	0	0	0	0	0	0	0
C.V. %		0	7	3	0	6	7
LSD 5%		NS	7	4	NS	6	8

[a] Scoil=methylated seed oil; Quad7=basic blend adjuvant; L-64, and L-64=experimental adjuvants; Cocb=common cocklebur; Yeft=yellow foxtail.

None of the herbicide treatments caused injury to corn 1 and 3 weeks after treatment. A rate reduction of AE F130360 by 50% had no significant influence on common cocklebur and yellow foxtail control. Efficacy of AE F130360 with Scoil tended to be lower than with basic blend adjuvant Quad7 and experimental adjuvants L-34, and L-64. AE F130360 phytotoxicity to common cocklebur was enhanced more by L-64 then the other adjuvants, at the high rate. Further evaluations were impossible due to severe floating.

Liberty resistant corn. Zollinger and Fitterer. An experiment was conducted in Casselton, ND to evaluate weed control in Liberty resistant corn from herbicides applied PRE, EPOST, and POST. NK N2555BT corn was planted on May 18, 2000. PRE treatments were applied May 19, 2000 at 9:00 am with 55 F air, 49 F soil at a depth of 2 to 4 inch, 35% relative humidity, 70% clouds, 8 to 12 mph N wind, dry soil surface, and moist subsoil. EPOST treatments were applied May 31, 2000 at 3:00 pm with 62 F air, 61 F soil surface, 49% relative humidity, 90% clouds, 6 to 9 mph S wind, moist soil surface and moist subsoil. Weed species present were: 1 to 2 inch (5 to 10/ft^2) foxtail; 1 to 2 inch (3 to 5/ft^2) redroot pigweed; 2 to 3 inch (8 to 10/ft^2) wild mustard; 1 to 2 inch (5 to 8/ft^2) common cocklebur. POST treatments were applied June 6, 2000 at 10:00 am with 66 F air, 56 F soil surface, 55% relative humidity, 65% clouds, 7 to 11 mph S wind, moist soil surface, and moist subsoil. Weed species present were: 2 to 4 inch (5 to 10/ft^2) foxtail; 2 to 4 inch (3 to 5/ft^2) redroot pigweed; 3 to 4 inch (8 to 10/ft^2) wild mustard; and 3 to 4 inch (5 to 8/ft^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8002 flat fan nozzles for EPOST and POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		July 3			August 7		
Treatment [a]	Rate	Fxtl	Cocb	Vema	Fxtl	Cocb	Yield
	Product/A	%	%	%	%	%	bu/A
PRE							
Surpass+Atrazine	2.5pt+0.5lb	95	15	99	95	17	-
Balance Pro+Surpass+Atrazine	1.88fl oz+1pt+0.5lb	96	57	89	95	45	41
Balance+Surpass+Atrazine	1.25oz+1pt+0.5lb	96	52	99	98	50	47
PRE/POST							
Axiom/Liberty+AMS	11oz/20fl oz	90	65	93	88	43	30
Axiom/Liberty+AMS	1.5lb/20fl oz	93	63	99	93	43	49
Axiom/Distinct+NIS+28% v/v	21oz/4oz	93	72	99	91	33	47
Axiom/Accent Gold+Clarity+NIS+28%	11oz/2.9oz+2fl oz	98	82	99	95	75	65
Balance Pro/Liberty+Atrazine+AMS	2.25fl oz/28fl oz+0.5lb	98	73	99	98	57	33
Balance/Liberty+Atrazine+AMS	1.5oz/28fl oz+0.5lb	99	77	99	99	53	28
Surpass/Liberty+Atrazine+AMS	2.5pt/28fl oz+0.5lb	95	80	99	95	55	28
Surpass/Aim+Liberty+AMS	2pt/0.33oz+20fl oz	95	63	99	93	35	31
Surpass/NorthStar+PO+28%	2.5pt/5oz	96	80	66	99	53	24
POST							
Liberty+Atrazine+AMS	34fl oz+0.5lb	95	73	99	95	58	62
Accent Gold+Clarity+PO+28%	2.9fl oz+4fl oz	68	77	93	80	75	66
Untreated		0	0	0	0	0	9
LSD (0.05)		7	11	7	8	11	13

[a]AMS - ammonium sulfate and was applied at 3 lb/A; 28% = 28% liquid nitrogen fertilizer and was applied 2 qt/A; NIS = nonionic surfactant = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil = Herbimax = and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

No corn injury was observed. At June 3, a new flush of common cocklebur had emerged, At August 7, a new flush of common cocklebur had emerged and a new flush of green and yellow foxtail and common cocklebur had emerged in some plots. Most treatments gave greater than 80% foxtail control. However cocklebur control was reduced substantially by the new flush. Atrazine at 0.5 lb/A is not enough to prevent new cocklebur flushes. Only treatments containing Accent Gold gave greater than 70% cocklebur control, presumable from residual clopyralid (Stinger).

Volunteer RUR wheat control in RUR corn-Carrington. Oltmans and Zollinger. An experiment was conducted near Carrington, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. Dekalb '493RR' corn was planted May 24, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 24, 2000. EPOST treatments were applied June 20, 2000 at 12:00 to 12:30 pm with 66 F air, 62 F soil at a 2 to 4 inch depth, 75% relative humidity, 100% clouds, 12 to 16 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 3 to 5 collar corn. Weed species present were: 4 to 7 inch, (1-5 plants/ft^2) wild mustard; 2 to 4 inch, (1-5 plants/ft^2) redroot pigweed; 2 to 4 inch, (15-25 plants/ft^2) common lambsquarters; 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat; and 2 to 4 inch, (10-15 plants/ft^2) foxtail. POST treatments were applied June 26, 2000 at 9:00 to 9:15 am with 56 F air, 54 F soil at a 2 to 4 inch depth, 17% relative humidity, 5% clouds, 5 to 10 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to 6 to 8 collar corn. Weed species present were: 1 to 5 inch, (15-20 plants/plot) wild mustard; 1 to 3 inch, (20-30 plants/plot) foxtail; and 5 to 7 inch, (20-30 plants/plot) volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type sprayer equipped with a wind shield. The experiment had a randomized complete block design with for replicates per treatment.

At 7 days after application (DAA), most treatments had corn injury. At 30 DAA, injury was minimal in most treatments. Treatments with Basis or Basis Gold generally had the greatest corn injury. DK '493RR' has a relative maturity of 99 days, which may have contributed to crop injury. At 14 DAA, all treatments, except Accent+Banvel treatments, had greater than 94% foxtail and redroot pigweed control. Accent+Banvel treatments were not applied with surfactant, which may explain poor weed control. Most treatments had greater than 90% common lambsquarters and wild mustard control. All treatments at 28 DAA and July 24 had greater than 98% wild mustard and common lambsquarters control (not shown), and greater than 86% redroot pigweed control. On July 24, foxtail control decreased due to new flushes. All treatments, except Atrazine at 0.42 lb/A, had 99% volunteer wheat control. Atrazine at 0.42 lb/A was not effective in controlling volunteer wheat. The addition of oil may increase weed control. Higher rates of Atrazine are not recommended due to carry-over problems.

Treatment	Rate[a]	Application Stage[b]	Corn		14 DAA					28 DAA			July 24		
			7 DAA	30 DAA	Fxtl[c]	Vwht	Rrpw	Colq	Wimu	Fxtl	Vwht	Rrpw	Fxtl	Vwht	Rrpw
	(product/A)		% injury		% control										
Roundup Ultra+AMS+Atrazine/ Roundup Ultra+AMS	1qt+0.42lb/1qt	E/P	6	1	99	9	99	99	98	92	9	95	92	9	96
Roundup Ultra+AMS+Accent/ Roundup Ultra+AMS	1qt+0.33oz/1qt	E/P	3	0	98	99	99	99	99	76	99	90	73	99	92
Roundup Ultra+AMS+Accent/ Roundup Ultra+AMS	1qt+0.50oz/1qt	E/P	15	3	99	99	99	99	99	73	99	96	73	99	96
Roundup Ultra+AMS+Basis	1qt+0.33oz	E	11	4	98	66	99	99	99	61	99	94	64	99	95
Roundup Ultra+AMS+Basis Gold+MSO	1qt+14oz+1.5pt	E	4	1	99	98	99	99	99	78	99	93	82	99	89
Roundup Ultra+AMS+Basis Gold+MSO	1qt+10oz+1.5pt	E	20	6	94	86	97	99	99	72	99	87	63	99	87
Roundup Ultra+AMS+Basis Gold+MSO	1qt+7oz+1.5pt	E	1	4	98	93	98	99	99	71	99	86	71	99	88
Accent+Banvel	0.66oz+4floz	E	3	3	46	67	78	90	98	28	99	95	30	99	92
Accent+Banvel	0.50oz+4floz	E	0	1	15	56	66	76	85	40	99	95	26	99	92
Untreated			0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			15	6	16	11	10	8	5	22	2	10	16	1	11

[a]AMS = ammonium sulfate at 8.5lb/100gal
[b]E = EPOST; P = POST
[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

Volunteer RUR wheat control in RUR corn-Prosper. Oltmans and Zollinger. An experiment was conducted near Prosper, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. Dekalb '493RR' corn was planted May 17, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 17, 2000. EPOST treatments were applied June 11 at 9:30 to 10:30 am with 62 F air, 61 F soil at a 2 to 4 inch depth, 65% relative humidity, 0% clouds, 2 to 4 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 2 to 4 collar corn. Weed species present were: 2 to 4 inch, (5-10 plants/ft^2) common cocklebur; 2 to 4 inch, (40-50 plants/ft^2) foxtail; 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat; 2 to 4 inch, (10-15 plants/ft^2) common lambsquarters; 2 to 4 inch, (20-30 plants/ft^2) redroot pigweed; 2 to 5 inch, (1-5 plants/m^2) wild mustard; and 2 to 4 inch, (5-10 plants/m^2) common ragweed. POST treatments were applied June 29, 2000 at 2:00 to 2:15 pm with 78 F air, 66 F soil at a 2 to 4 inch depth, 44% relative humidity, 20% clouds, 5 to 11 mph NE wind, moist soil surface, moist subsoil, fair crop vigor, and no dew present to 6 to 8 collar corn. Weed species present were: 2 to 5 inch, (15-25 plants/plot) common cocklebur; and 1 to 3 inch, (20-30 plants/plot) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

At 7 days after application (DAA), all treatments had greater than 7% corn injury. At 30 DAA, injury decreased, with Basis and Basis Gold treatments generally having the greatest corn injury. DK '493RR' has a relative maturity of 99 days, which may have contributed to crop injury. All treatments had greater than 90% wild mustard, redroot pigweed, common lambsquarters, and common ragweed control throughout the growing season (not shown). At 14 DAA, all treatments, except Accent+Banvel treatments, had greater than 84% foxtail and common cocklebur control. Accent+Banvel treatments were not applied with surfactant, which may explain poor weed control. At 28 DAA, most treatments had 99% volunteer wheat control. On July 22, foxtail and common cocklebur control decreased due to new flushes of weeds. Volunteer wheat control was similar to 28 DAA; however, control increased with Accent+Banvel at 0.5 oz/A+4 floz/A from 29% 14 DAA to 73% 28 DAA to 94%. Increased control was mostly likely from plant stress due to herbicide injury, and plant death from crop competition throughout the growing season. Volunteer wheat was not controlled with Atrazine at 0.42 lb/A. The addition of oil may increase weed control. Higher rates of Atrazine are not recommended due to carry-over problems.

Treatment	Rate[a]	Application Stage[b]	Corn		14 DAA			28 DAA			July 22		
			7 DAA	30 DAA	Fxtl[c]	Vwht	Cocb	Fxtl	Vwht	Cocb	Fxtl	Vwht	Cocb
	(product/A)		% injury		% control								
Roundup Ultra+AMS+Atrazine/ Roundup Ultra+AMS	1qt+0.42lb/1qt	E/P	13	0	99	13	93	99	13	92	99	13	92
Roundup Ultra+AMS+Accent/ Roundup Ultra+AMS	1qt+0.33oz/1qt	E/P	10	3	84	99	84	89	99	79	89	99	79
Roundup Ultra+AMS+Accent/ Roundup Ultra+AMS	1qt+0.50oz/1qt	E/P	7	3	88	99	86	89	99	88	89	99	88
Roundup Ultra+AMS+Basis	1qt+0.33oz	E	28	1	99	98	98	84	99	85	77	99	55
Roundup Ultra+AMS+Basis Gold+MSO	1qt+14oz+1.5pt	E	21	8	99	99	99	96	99	88	87	99	74
Roundup Ultra+AMS+Basis Gold+MSO	1qt+10oz+1.5pt	E	23	3	99	80	97	82	99	75	78	99	57
Roundup Ultra+AMS+Basis Gold+MSO	1qt+7oz+1.5pt	E	29	10	99	91	94	90	99	85	87	99	60
Accent+Banvel	0.66oz+4floz	E	9	6	58	59	59	75	99	71	33	99	55
Accent+Banvel	0.50oz+4floz	E	9	0	65	29	64	65	73	71	28	95	53
Untreated			0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			10	6	22	19	26	19	7	15	26	3	20

[a]AMS = ammonium sulfate at 8.5lb/100gal
[b]E = EPOST; P = POST
[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

Flexstar in soybean - Colfax. Zollinger and Fitterer. An experiment was conducted near Colfax, ND to evaluate weed control from Flexstar applied alone or with thifensulfuron. Asgrow 'AGO901' soybean was planted in each plot on April 26, 2000. PRE treatments were applied April 26, 2000 at 1:00 pm with 68 F air, 53 F soil at a depth of 2 to 4 inches, 41% relative humidity, 100% clouds, 5 to 8 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied May 29, 2000 at 10:30 with 66 F air, 75 F soil surface, 70% relative humidity, 10% clouds, 2 to 3 mph S wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was first trifoliate. Weed species present were: 1 to 4 inch (5 to 10/ft^2) common lambsquarters; 2 to 5 inch (3 to 7/ft^2) marshelder and 1 to 3 inch (2 to 7/ft^2) redroot pigweed. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Treatment[1]	Rate	June 12	June 26	
		Soybean injury	Rrpw	Colq
	Product/A	%	%	%
POST				
Flexstar+Activator 90	0.5pt	7	70	50
Flexstar+Activator 90	0.75pt	5	99	80
Flexstar+Activator 90	1pt	5	99	99
Flexstar+Herbimax	0.5pt	3	99	99
Flexstar+Herbimax	0.75pt	3	99	99
Flexstar+Herbimax	1pt	3	99	99
Flexstar+Scoil	0.5pt	3	99	99
Flexstar+Scoil	0.75pt	2	99	99
Flexstar+Scoil	1pt	2	99	99
Flexstar+Harmony GT+Herbimax	0.5pt+0.083oz	2	99	99
Flexstar+Harmony GT+Herbimax	0.75pt+0.083oz	3	99	99
Flexstar+Harmony GT+Herbimax	1pt+0.083oz	7	99	99
POST/LPOST				
Flexstar+Scoil/Flexstar+Scoil	0.25pt/0.25pt	2	99	99
Flexstar+Scoil/Flexstar+Scoil	0.375pt/0.375pt	3	99	99
Flexstar+Scoil/Flexstar+Scoil	0.5pt/0.5pt	3	99	99
LSD (0.05)		5	5	6

[1]Activator 90 = non ionic surfactants at 0.25% v/v; Herbimax = petroleum oil at 1 qt/A with Flexstar and 1% v/v with Harmony GT; and Scoil = methylated seed oil at 1.5 pt/A.

The experiment was established at a site heavily infested with marshelder and common lambsquarters. Soybean injury symptoms were observed only on June 12 and expressed as slight chlorosis and stunting. The greatest soybean injury was from Flexstar plus Harmony GT at the highest rates applied with oil adjuvant. Flexstar at 0.5pt/A represents a half rate for North Dakota. Marshelder was completely controlled. Redroot pigweed and common lambsquarters were controlled on June 12. Flexstar applied at 0.5pt/A with nonionic surfactant did not control redroot pigweed or common lambsquarters. Oil adjuvants were superior to non ionic surfactants in enhancing weed control from Flexstar.

Flexstar in soybean - Hillsboro. Zollinger and Fitterer. An experiment was conducted in Hillsboro, ND to evaluate weed control from Flexstar applied POST with adjuvants, in sequential application at reduced rates, and in tank-mix combinations. Pioneer '9071' soybeans were planted on May 13, 2000. POST treatments were applied June 27, 2000 at 11:00 am with 70 F air, 84 F soil surface, 56% relative humidity, 50% clouds, 1 to 3 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 2 to 4 trifoliate. Weed species present were: 4 to 8 inch (2 to 5/ft^2) redroot pigweed; 5 to 9 inch (1 to 3/ft^2) common lambsquarters; and 6 to 8 inch (1 to 2/ft^2) kochia. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		July 11	July 11		July 26	
Treatment [a]	Rate	Soybean injury	Rrpw	Colq	Rrpw	Colq
	(Product/A)	%	%	%	%	%
Flexstar+NIS	0.5pt	6	99	53	73	73
Flexstar+NIS	0.75pt	10	99	70	90	80
Flexstar+NIS	1pt	7	99	85	90	80
Flexstar+PO	0.5pt	7	96	57	93	80
Flexstar+PO	0.75pt	9	99	66	99	83
Flexstar+PO	1pt	19	99	95	96	89
Flexstar+Scoil	0.5pt	11	99	70	93	80
Flexstar+Scoil	0.75pt	6	99	57	94	83
Flexstar+Scoil	1pt	14	99	63	96	93
Flexstar+Scoil/Flexstar+Scoil	0.25pt/0.25pt	5	99	47	76	76
Flexstar+Scoil/Flexstar+Scoil	0.375pt/0.375pt	10	99	67	86	85
Flexstar+Scoil/Flexstar+Scoil	0.5pt/0.5pt	9	99	77	99	91
Flexstar+Harmony GT+PO	0.5pt+1/12oz	72	99	99	99	99
Flexstar+Harmony GT+PO	0.75pt+1/12oz	72	99	99	99	99
Flexstar+Harmony GT+PO	0.1pt+1/12oz	68	99	99	99	99
LSD (0.05)		7	3	12	9	10

[a]NIS = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil and was applied at 1qt/A; Scoil = methylated seed oil adjuvant and was applied at 1.5 pt/A. Refer to adjuvant glossary for adjuvant types.

Kochia was the intended weed species for study. However, kochia population was light and inconsistent for evaluation. ALS resistant kochia occurs in much of North Dakota which requires use of a non-ALS herbicide for control. Slight soybean injury occurred from Flexstar applied with adjuvants or in sequential applications. However, severe soybean injury occurred from Flexstar + Harmony GT + PO treatments. Injury was severe leaf and stem desiccation and loss of soybean plant stand. The oil adjuvant with Harmony GT is suspected to be the cause of severe soybean injury. All treatments gave near complete foxtail control. Oil adjuvants increased weed control. Addition of Harmony GT enhanced broadleaf weed control.

Kochia control with Flexstar/Reflex. Zollinger and Fitterer. An experiment was conducted near Perley, MN to evaluate kochia control from fomesafen at different formulations, spray volumes, application timings, and adjuvants. Soybean was planted in early May. EPOST treatments were applied June 7, 2000 at 4 pm with 88 F air, 108 F soil surface, 43% relative humidity, 0% clouds, 1 to 5 mph W wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was unifoliate. Weed species present were: 1 to 3 inch (1 to 5/ft^2) kochia; and 3 inch (25 to 40/ft^2) kochia. POST treatments were applied June 12, 2000 at 5 pm with 70 F air, 85 F soil surface, 46% relative humidity, 50% clouds, 10 to 15 mph W wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was first trifoliate. Weed species present were: medium density 3 to 5 inch (1 to 5/ft^2) kochia; and a solid mat of high-density 4 to 5 inch (25 to 40/ft^2) kochia. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles or 17 gpa at 40 psi through 8002 flat fan nozzles, using a wind shield. The experiment had a randomized complete block design with three replicates per treatment.

Reflex at 0.75 pt/A is the label use rate for North Dakota. Flexstar is registered only on soybean and Reflex is registered for use on dry edible beans in North Dakota through Section 18 registration. Most treatments gave slight soybean injury (3 to 12%). Moderate soybean injury usually occurred only from those treatments where Reflex was applied at higher rates, with oil adjuvants and in sequential application timings. Injury was confined to leaf speckling or burning of leaves that intercepted herbicide spray. Trifoliate leaves that emerged after application were not affected. Substituting a petroleum oil adjuvant with a methylated seed oil adjuvant generally did not increase soybean leaf phytotoxicity. The Flexstar formulation generally caused more soybean injury than the Reflex formulation. Spray volume or application timing had little effect on soybean injury. Generally, greater kochia control resulted from use of the Flexstar formulation, especially at low or medium rates, at 17 gpa, with oil adjuvants and at EPOST applications to smaller kochia plants. A higher water volume was generally an advantage with EPOST applications of Flexstar. No differences in kochia control were observed between water volumes for POST applications with Flexstar. However, Reflex gave better kochia control at 17 gpa than 8.5 gpa. Greater kochia control resulted when Reflex was applied with methylated seed oil rather than petroleum oil or surfactant. Sequential EPOST/POST applications generally provided excellent control by controlling small plants and successive flushes that germinated after the first application. The study was lost due to flooding and standing water for several days from eight inches of rain that occurred on June 19. At June 16, kochia regrowth was evident in plots with poor to good initial control. It is suspected that significant regrowth would have occurred in most plots with less than 80 to 99% kochia control, especially in plots sprayed at the POST timing. This study demonstrates the importance of maximum coverage with high spray volume, treatment of small plants, and use of oil adjuvants with this contact type herbicide.

Table 1. Kochia control with Flexstar at two spray volumes.

		June 16			
		8.5 gpa		17 gpa	
Treatment[1]	Rate	Soybean injury	Kocz	Soybean injury	Kocz
	(Product/A)	(%)	(%)	(%)	(%)
EPOST					
Flexstar+Activator 90	0.5pt	7	20	8	40
Flexstar+Activator 90	0.75pt	7	23	12	50
Flexstar+Activator 90	1pt	7	43	12	57
Flexstar+Herbimax	0.5pt	7	58	7	60
Flexstar+Herbimax	0.75pt	10	60	12	65
Flexstar+Herbimax	1pt	17	75	17	86
Flexstar+Scoil	0.5pt	8	75	8	80
Flexstar+Scoil	0.75pt	8	78	10	96
Flexstar+Scoil	1pt	12	93	10	96
POST					
Flexstar+Activator 90	0.5pt	7	30	7	45
Flexstar+Activator 90	0.75pt	10	30	10	47
Flexstar+Activator 90	1pt	10	37	12	53
Flexstar+Herbimax	0.5pt	8	52	8	45
Flexstar+Herbimax	0.75pt	10	73	10	58
Flexstar+Herbimax	1pt	18	85	12	75
Flexstar+Scoil	0.5pt	7	65	7	62
Flexstar+Scoil	0.75pt	10	80	8	78
Flexstar+Scoil	1pt	12	92	13	90
EPOST/POST					
Flexstar+Scoil/Flexstar+Scoil	0.25pt/0.25pt	15	96	15	94
Flexstar+Scoil/Flexstar+Scoil	0.375pt/0.375pt	15	97	15	95
Flexstar+Scoil/Flexstar+Scoil	0.5pt/0.5pt	23	99	25	98
LSD (0.05)		11	12	6	8

Table 2. Kochia control with Reflex at two spray volumes.

		June 16			
		8.5 gpa		17 gpa	
Treatment[1]	Rate	Soybean injury	Kocz	Soybean injury	Kocz
EPOST	(Product/A)	(%)	(%)	(%)	(%)
Reflex+Activator 90	0.5pt	3	20	2	32
Reflex+Activator 90	0.75 pt	3	23	5	40
Reflex+Activator 90	1pt	5	22	10	42
Reflex+Herbimax	0.5pt	3	23	5	53
Reflex+Herbimax	0.75pt	8	52	7	55
Reflex+Herbimax	1pt	8	70	7	68
Reflex+Scoil	0.5pt	5	70	5	57
Reflex+Scoil	0.75pt	8	78	8	82
Reflex+Scoil	1pt	10	87	8	87
POST					
Reflex+Activator 90	0.5pt	2	15	0	20
Reflex+Activator 90	0.75pt	3	18	2	23
Reflex+Activator 90	1pt	5	22	3	28
Reflex+Herbimax	0.5pt	0	23	2	32
Reflex+Herbimax	0.75pt	5	40	3	53
Reflex+Herbimax	1pt	8	54	3	70
Reflex+Scoil	0.5pt	7	45	3	35
Reflex+Scoil	0.75pt	8	47	7	75
Reflex+Scoil	1pt	15	47	10	80
EPOST/POST					
Reflex+Scoil/Reflex+Scoil	0.25/0.25pt	8	48	12	73
Reflex+Scoil/Reflex+Scoil	0.375/0.375pt	15	89	15	95
Reflex+Scoil/Reflex+Scoil	0.5/0.5ptpt	17	92	18	98
LSD (0.05)		10	14	5	8

Harmony GT in soybeans. Zollinger and Fitterer. An experiment was conducted in Hillsboro, ND to evaluate soybean tolerance to Harmony GT in a weed-free environment. Asgrow RR 'AG0801' soybeans were planted on May 12, 2000. Treatments were applied July 11, 2000 at 12:00 pm with 75 F air, 92 F soil surface, 69% relative humidity, 100% clouds, 1 to 3 mph NW wind, dry soil surface, moist subsoil, good crop vigor, dew present, and crop stage was fourth trifoliate. No weed species were present. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		Soybean injury		
Treatment [a]	Rate	July 13	July 21	July 26
	Product/A	%	%	%
Harmony GT+NIS	1/12 oz+0.25% v/v	1	0	2
Harmony GT+NIS	1/6 oz+0.25% v/v	2	0	0
Harmony GT+NIS	0.3 oz+0.25% v/v	4	6	7
Harmony GT+NIS	½ oz+0.25% v/v	7	13	10
Harmony GT+PO	1/12 oz+1qt	0	0	0
Harmony GT+PO	1/6 oz+1qt	4	3	3
Harmony GT+PO	0.3oz+1qt	4	10	8
Harmony GT+PO	½ oz+1qt	4	12	12
LSD (0.05)		3	4	6

[a]NIS = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil and was applied 1 qt/A. Refer to adjuvant glossary for adjuvant types.

Experiment was conducted in a weed-free area. Two crop rate ranges exist, Harmony GT at 0.3 to 0.6 oz 75DF/A for small grains and 1/12 oz 75DF/A for soybean. Harmony GT at 0.3 to 0.6 oz 75DF/A provides excellent control of wild buckwheat and other broadleaf weed s. Products for wild buckwheat control in soybean are limited.

Soybean injury at July 13 was slight yellowing and chlorosis. Soybean injury at July 21was was slight stunting. It has been proposed that early maturing soybean varieties may have increase tolerance to Harmony GT than later maturing varieties grown further south in the mid-west. Additional studies should be conducted with many conventional and glyphosate resistant varieties adapted to North Dakota to determine tolerance to high rates of Harmony GT.

Common ragweed control in soybean. Zollinger and Fitterer. Experiments were conducted in Wahpeton and Wyndmere, ND to evaluate weed control from herbicides applied PRE. In Wahpeton, Asgrow 'AG0901' soybeans were planted on May 6, 2000. PRE treatments were applied May 6, 2000 at 10:00 am with 71 F air, 60 F soil at a depth of 2 to 4 inch, 40% relative humidity, 80% clouds, 5 to 8 mph SW wind, dry soil surface, and moist subsoil. In Wyndmere, Pioneer '90B93' soybeans were planted on May 6, 2000. PRE treatments were applied May 23, 2000 at 12:00 pm with 71 F air, 59 F soil at a depth of 2 to 4 inch, 24% relative humidity, 100% clouds, 7 to 12 mph SW wind, dry soil surface, and moist subsoil. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer, equipped with a wind shield, delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table 1. Weed control in soybeans, Wahpeton, ND.

		June 2				June 30				
Treatment	Rate	Fxtl	Colq	Corw	Cocb	Fxtl	Rrpw	Colq	Corw	Cocb
	Product/A	%	%	%	%	%	%	%	%	%
Authority+Lorox	3oz+0.75lb	53	99	30	20	64	93	99	13	13
Authority+Lorox	3oz+1lb	50	99	30	10	67	99	99	20	23
Authority+Lorox	3oz+1.25lb	47	99	27	20	50	99	75	15	20
Authority+Lorox	4oz+0.75lb	60	99	40	20	70	99	99	27	25
Authority+Lorox	4oz+1lb	50	99	37	20	66	99	99	33	25
Authority+Lorox	4oz+1.25lb	47	99	30	17	75	99	99	33	32
Authority+Lorox	4oz+1.5lb	57	99	40	7	73	99	99	33	27
Authority+Lorox	5oz+0.75lb	57	99	33	10	66	99	99	32	27
Authority+Lorox	5oz+1lb	62	99	47	17	75	99	99	37	0
Authority+Lorox	5oz+1.25lb	75	99	50	37	77	99	96	47	37
Lorox	1lb	53	96	30	0	43	76	63	10	10
Lorox	1.5lb	70	95	63	22	40	52	33	13	13
Pursuit Plus	2.5pt	75	99	67	27	98	99	99	77	72
Untreated		0	0	0	0	0	0	0	0	0
LSD (0.05)		8	3	9	9	11	9	8	15	9

Table 2. Weed control in soybeans, Wyndmere, ND.

		June 21			
Treatment	Rate	Fxtl	Colq	Wibw	Rrpw
	Product/A	%	%	%	%
Authority+Lorox	3oz+0.75lb	43	95	95	95
Authority+Lorox	3oz+1lb	55	95	95	95
Authority+Lorox	3oz+1.25lb	33	95	95	95
Authority+Lorox	4oz+0.75lb	67	95	95	95
Authority+Lorox	4oz+1lb	73	95	95	95
Authority+Lorox	4oz+1.25lb	70	95	95	95
Authority+Lorox	4oz+1.5lb	70	95	95	95
Authority+Lorox	5oz+0.75lb	77	95	95	95
Authority+Lorox	5oz+1lb	70	95	95	95
Authority+Lorox	5oz+1.25lb	75	95	95	95
Lorox	1lb	40	95	95	95
Lorox	1.5lb	55	95	95	95
Pursuit Plus	2.5pt	86	96	96	96
Untreated		0	0	0	0
LSD (0.05)		16	1	1	1

No common ragweed emerged at Wyndmere. At Wahpeton, no rain occurred within the first 2 to 3 weeks after planting. At Wahpeton, very high common ragweed density, high organic matter soil, which greatly adsorbs and inactivates Lorox and lack of rain fall reduced common ragweed control.

Soybean iron chlorosis-Arthur, ND. O'Barr, Zollinger, and Franzen. An experiment was conducted at Arthur, ND to evaluate iron chlorosis herbicide interactions at the POST stage. POST treatments were applied on June 28, 2000 at 10:40am with 68 F air, 64 F soil surface, 53% RH, 5-10 N wind, 10% clouds, moist soil surface, wet subsoil, crop was 30% uniformly chlorotic, light dew present, and the crop stage was 2nd -3rd trifoliate. Treatments were applied to the entire area of each 10 by 20 ft plots with a bicycle wheel-type sprayer equipped with drift cones delivering 8.5 gpa at 40 psi through 8001 flat-fan nozzles. The experiment had a randomized complete block design with six replicates per treatment. A 5 ft border strip between blocks and a 5 ft border around the entire plot were used to buffer cooperator herbicides from drifting into treatment areas.

Treatment	Rate	July 12			July 26			Yield
		Yellow	Burn	Stunt	Yellow	Burn	Stunt	
	Product/A	----------%----------						bu/A
Basagran+Herbimax	2pt+2pt	12	5	10	2	0	10	25
Blazer+Activator 90	1.5pt+0.25%	9	10	9	0	5	12	27
Galaxy+Herbimax	2pt+2pt	10	5	6	0	7	5	26
Storm+Herbimax	1.5pt+2pt	21	10	22	5	5	18	24
Cobra+Herbimax	10oz+1.5pt	10	5	15	0	6	15	22
Flexstar+Herbimax	0.75pt+2pt	8	9	5	5	0	5	26
Pinnacle+Activator90	0.25oz+0.25%	5	0	0	0	1	0	28
FirstRate+Activator90 + 28% UAN	0.3oz+0.125%+ 2.5%	5	2	0	0	0	1	30
Pursuit+Herbimax+ 28% UAN	3oz+2pt+ 2.5%	16	5	15	11	5	13	22
Raptor+Herbimax+ 28% UAN	4oz+2pt 2.5%	23	5	10	5	5	8	29
Untreated		5	0	5	0	0	0	28
LSD (0.05)		8	6	10	NS	NS	7	4

This study was established at a location planted to soybean exhibiting chlorosis at time of herbicide application. All visual evaluations were taken at 14 and 28 days after herbicide application. Evaluations were performed without knowing treatment number or herbicide used. Visible injury ratings were difficult to determine because stunting and chlorosis caused by iron deficiency, in many plots, could not be differentiated from soybean response to herbicides. In other words, some injury ratings may be due to the iron deficiency and not due to herbicide application alone. In some cases, symptoms of iron chlorosis did not observe plot borders, which caused injury ratings to be taken from herbicide treatments that do not normally cause injury. An effort was made to select fields as uniformly chlorotic as possible to minimize these differences. Plots were hand weeded as needed to assure yield differences were due to herbicide treatment and not weed competition. Soil samples were collected from each plot and analyzed for soluble salts (Electrical conductivity or EC), and EC ranged .16 to .34 mmhos/cm.

A few conclusions were consistent throughout the three sites in 2000. Injury ratings decreased at the second evaluation compared to the first. Cobra and other contact herbicides caused burning and stunting, which tended to increase injury and decrease yield. Iron chlorosis stress in addition to herbicide applications may induce greater injury symptoms.

Soybean iron chlorosis/Fe amendment-Arthur, ND. O'Barr, Zollinger, and Franzen. An experiment was conducted at Arthur, ND to evaluate iron chlorosis herbicide interactions at the POST stage with the addition of an iron amendment. Iron added to POST treatments were applied on June 28, 2000 at 11:00am with 70 F air, 65 F soil surface, 55% RH, 5-10 N wind, 12% clouds, moist soil surface, wet subsoil, crop was 20% uniformly chlorotic, light dew present, and the crop stage was 2nd -3rd trifoliate. Treatments were applied to the entire area of each 10 by 20 ft plots with a bicycle wheel-type sprayer equipped with drift cones delivering 8.5 gpa at 40 psi through 8001 flat-fan nozzles. The experiment had a randomized complete block design with a split plot arrangement and four replicates per treatment. A 5 ft border strip between blocks and a 5 ft border around the entire plot were used to buffer cooperator herbicides from drifting into treatment areas.

		July 12			July 26			
Treatment	Rate	Yellow	Burn	Stunt	Yellow	Burn	Stunt	Yield
	Product/A	----------%----------						bu/A
Blazer+Activator 90	1.5pt+0.25%	6	11	6	3	0	5	31
Blazer+Activator 90+ Fe-HEDTA 4.5%	1.5pt+0.25%+ 2pt	9	8	8	0	0	4	29
Cobra+Herbimax	10oz+1.5pt	7	10	11	0	0	7	30
Cobra+Herbimax+ Fe-HEDTA 4.5%	10oz+1.5pt+ 2pt	6	7	9	0	0	8	29
Raptor+Herbimax+ 28% UAN	4oz+2pt+ 2.5%	7	7	9	3	0	9	30
Raptor+Herbimax+ 28% UAN+ Fe-HEDTA 4.5%	4oz+2pt+ 2.5%+ 2pt	9	6	10	0	0	4	29
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS

This study was established at a location planted to soybean exhibiting chlorosis at time of herbicide application. All visual evaluations were taken at 14 and 28 days after herbicide application. Evaluations were performed without knowing treatment number or herbicide/iron amendment used. Visible injury ratings were difficult to determine because stunting, burning and chlorosis caused by iron deficiency, in many plots, could not be differentiated from soybean response to herbicides. In other words, some injury ratings may be due to the iron deficiency and not due to herbicide/amendment application alone. In some cases, symptoms of iron chlorosis did not observe plot borders, which caused injury ratings to be taken from herbicide treatments that do not normally cause injury. An effort was made to select fields as uniformly chlorotic as possible to minimize these differences. Plots were hand weeded as needed to assure yield differences were due to herbicide treatment and not weed competition. Soil samples were collected from each plot and analyzed for soluble salts (Electrical Conductivity or EC), and EC ranged .16 to .21 mmhos/cm.

Addition of a foliar iron amendment with herbicide treatments did not reduce crop injury or increase yield compared to treatments where herbicide alone was applied. Injury ratings decreased at the second evaluation compared to the first. In the Raptor+Iron treatment, a reduction of weed control was observed, whereas the treatment with Raptor alone had excellent weed control (data not shown).

Soybean iron chlorosis-Colfax, ND. O'Barr, Zollinger, and Franzen. An experiment was conducted at Colfax, ND to evaluate iron chlorosis herbicide interactions at the POST stage. POST treatments were applied on June 27, 2000 at 10:00am with 66 F air, 71 F soil surface, 60% RH, 0-5 SW wind, 0% clouds, moist soil surface, wet subsoil, crop was 15% uniformly chlorotic, light dew present, and the crop stage was 2nd -3rd trifoliate. Treatments were applied to the entire area of each 10 by 20 ft plots with a bicycle wheel-type sprayer equipped with drift cones delivering 8.5 gpa at 40 psi through 8001 flat-fan nozzles. The experiment had a randomized complete block design with six replicates per treatment. A 5 ft border strip between blocks and a 5 ft border around the entire plot were used to buffer cooperator herbicides from drifting into treatment areas.

Treatment	Rate	July 11			July 25			Yield
		Yellow	Burn	Stunt	Yellow	Burn	Stunt	
	Product/A	----------%----------						bu/A
Basagran+Herbimax	2pt+2pt	10	0	0	2	0	0	32
Blazer+Activator 90	1.5pt+0.25%	16	5	15	3	0	5	31
Galaxy+Herbimax	2pt+2pt	19	3	10	5	0	5	32
Storm+Herbimax	1.5pt+2pt	15	12	8	5	0	5	31
Cobra+Herbimax	10oz+1.5pt	18	15	15	5	2	12	23
Flexstar+Herbimax	0.75pt+2pt	10	10	5	0	0	5	30
Pinnacle+Activator90	0.25oz+0.25%	5	5	5	0	0	0	33
FirstRate+Activator90 + 28% UAN	0.3oz+0.125%+ 2.5%	0	0	0	3	0	0	32
Pursuit+Herbimax+ 28% UAN	3oz+2pt+ 2.5%	5	0	5	9	0	0	31
Raptor+Herbimax+ 28% UAN	4oz+2pt 2.5%	14	5	10	5	0	5	32
Roundup Ultra+AMS	2pt+2.5lb	15	0	5	3	0	5	32
Untreated		5	0	0	0	0	0	31
LSD (0.05)		11	8	9	NS	NS	7	3

This study was established at a location planted to soybean exhibiting chlorosis at time of herbicide application. All visual evaluations were taken at 14 and 28 days after herbicide application. Evaluations were performed without knowing treatment number or herbicide used. Visible injury ratings were difficult to determine because stunting and chlorosis caused by iron deficiency, in many plots, could not be differentiated from soybean response to herbicides. In other words, some injury ratings may be due to the iron deficiency and not due to herbicide application alone. In some cases, symptoms of iron chlorosis did not observe plot borders, which caused injury ratings to be taken from herbicide treatments that do not normally cause injury. An effort was made to select fields as uniformly chlorotic as possible to minimize these differences. Plots were hand weeded as needed to assure yield differences were due to herbicide treatment and not weed competition. Soil samples were collected from each plot and analyzed for soluble salts (Electrical conductivity or EC), and EC ranged .30 to .45 mmhos/cm.

A few conclusions were consistent throughout the three sites in 2000. Injury ratings decreased at the second evaluation compared to the first. Cobra and other contact herbicides caused burning and stunting, which tended to increase injury and decrease yield. Iron chlorosis stress in addition to herbicide applications may induce greater injury symptoms.

Soybean iron chlorosis-Kent, MN. O'Barr, Zollinger, and Franzen. An experiment was conducted at Kent, MN to evaluate iron chlorosis herbicide interactions at the POST stage. POST treatments were applied on June 27, 2000 at 11:45am with 70 F air, 82 F soil surface, 74% RH, 5-10 SW wind, 30% clouds, dry soil surface, wet subsoil, crop was 25% uniformly chlorotic, no dew present, and the crop stage was 2nd -3rd trifoliate. Treatments were applied to the entire area of each 10 by 20 ft plots with a bicycle wheel-type sprayer equipped with drift cones delivering 8.5 gpa at 40 psi through 8001 flat-fan nozzles. The experiment had a randomized complete block design with six replicates per treatment. A 5 ft border strip between blocks and a 5 ft border around the entire plot were used to buffer cooperator herbicides from drifting into treatment areas.

		July 11			July 25			
Treatment	Rate	Yellow	Burn	Stunt	Yellow	Burn	Stunt	Yield
	Product/A	----------%----------						bu/A
Basagran+Herbimax	2pt+2pt	5	0	0	0	0	0	22
Blazer+Activator 90	1.5pt+0.25%	9	11	21	0	10	18	21
Galaxy+Herbimax	2pt+2pt	22	15	20	5	10	15	22
Storm+Herbimax	1.5pt+2pt	20	16	25	14	15	20	19
Cobra+Herbimax	10oz+1.5pt	34	25	33	16	20	37	16
Flexstar+Herbimax	0.75pt+2pt	20	15	14	5	8	9	23
Pinnacle+Activator90	0.25oz+0.25%	11	6	12	0	5	13	24
FirstRate+Activator90 + 28% UAN	0.3oz+0.125%+ 2.5%	20	5	7	0	0	5	24
Pursuit+Herbimax+ 28% UAN	3oz+2pt+ 2.5%	10	0	5	0	0	0	26
Raptor+Herbimax+ 28% UAN	4oz+2pt 2.5%	20	6	16	3	0	11	23
Roundup Ultra+AMS	2pt+2.5lb	24	0	5	0	0	10	25
Untreated		5	0	0	0	0	0	24
LSD (0.05)		11	14	10	7	5	16	4

This study was established at a location planted to soybean exhibiting chlorosis at time of herbicide application. All visual evaluations were taken at 14 and 28 days after herbicide application. Evaluations were performed without knowing treatment number or herbicide used. Visible injury ratings were difficult to determine because stunting and chlorosis caused by iron deficiency, in many plots, could not be differentiated from soybean response to herbicides. In other words, some injury ratings may be due to the iron deficiency and not due to herbicide application alone. In some cases, symptoms of iron chlorosis did not observe plot borders, which caused injury ratings to be taken from herbicide treatments that do not normally cause injury. An effort was made to select fields as uniformly chlorotic as possible to minimize these differences. Plots were hand weeded as needed to assure yield differences were due to herbicide treatment and not weed competition. Soil samples were collected from each plot and analyzed for soluble salts (Electrical conductivity or EC), and EC ranged .4 to 1.3 mmhos/cm.

A few conclusions were consistent throughout the three sites in 2000. Injury ratings decreased at the second evaluation compared to the first. Cobra and other contact herbicides caused burning and stunting, which tended to increase injury and decrease yield. Iron chlorosis stress in addition to herbicide applications may induce greater injury symptoms.

Roundup Ready soybeans - Carrington. Zollinger and Fitterer. An experiment was conducted in Carrington, ND to evaluate weed control from herbicides applied PRE and POST. Pioneer '90B31' soybeans were planted on May 24, 2000. PRE treatments were applied May 24, 2000 at 11:30 am with 66 F air, 58 F soil at a depth of 2 to 4 inch, 35% relative humidity, 0% clouds, 10 to 15 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied June 23, 2000 at 11:00 am with 76 F air, 90 F soil surface, 73% relative humidity, 95% clouds, 3 to 6 mph NW wind, moist soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 1 to 2 trifoliate. Weed species present were: 1 to 4 inch (10 to 15/ft^2) foxtail; 1 to 3 inch (10 to 15/ft^2) redroot pigweed; and 1 to 3 inch (1 to 5/ft^2) wild mustard. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. A wind shield was used for both PRE and POST treatment applications. The experiment had a randomized complete block design with three replicates per treatment.

Treatment [a]	Rate	Soybean injury			Soybean
		June 15	June 23	June 29	Yield
	Product/A	%	%	%	bu/A
PPI/POST					
Boundry/Roundup Ultra+AMS	1.25pt/1.5pt+2lb	0	0	0	34
Boundry/Touchdown+AMS	1.25pt/2.65pt+2lb	0	0	0	32
PRE					
Authority	4oz	0	0	0	34
PRE/POST					
Domain/Roundup Ultra+AMS	11oz/1.5pt+8.5lb/100gal	0	0	0	38
Domain/Roundup Ultra+AMS	9oz/1.5pt+8.5lb/100gal	0	0	0	36
Sencor+Authority/Pursuit+Quad 7	5oz+2oz/3fl oz+1% v/v	0	0	0	32
Sencor+Authority/Roundup Ultra+AMS	3oz+3oz/1pt+8.5lb/100gal	0	0	0	38
Domain/Pursuit+Quad 7	9oz/3fl oz+1% v/v	0	0	0	33
Sencor+Authority/Raptor+Quad 7	3oz+3oz/3fl oz+1% v/v	0	0	0	36
Authority/Assure II+PO	4oz/8fl oz+1% v/v	0	0	0	35
Authority+Lorox DF/Assure II+PO	4oz+8oz/8fl oz+1% v/v	0	0	0	35
Authority/Harmony GT+Assure II+PO	4oz+0.083oz/8fl oz+1% v/v	0	0	0	37
Authority/Roundup Ultra	4oz/1pt	0	0	0	38
Valor/Roundup Ultra	2oz/1qt	0	13	0	36
Valor/Roundup Ultra	3oz/1qt	0	38	0	38
POST					
Roundup Ultra+AMS	1.5pt+2lb	0	0	0	35
Roundup Ultra+AMS	1qt+2lb	0	0	0	36
Untreated		0	0	0	17
LSD (0.05)		NS	5	NS	7

[a]AMS = ammonium sulfate and was applied at 2 lb/A, Quad 7 = basic blend adjuvant and was applied at % v/v, PO = petroleum oil = Herbimax and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

Soybean injury on June 23 was from Valor treatment and was leaf crinkling and cupping. All treatments gave complete green and yellow foxtail, wild mustard, redroot pigweed, prostrate pigweed, and common lambsquarters control at May 31, July 7, and August 18.

Roundup Ready soybean - Casselton. Zollinger and Fitterer. An experiment was conducted in Casselton, ND to evaluate weed control from herbicides applied POST. Asgrow '0901' soybeans were planted on May 18, 2000. POST treatments were applied July 19, 2000 with 59 F air, 93 F soil surface, 46% relative humidity, 46% clouds, 1 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was third trifoliate. Weed species present were: 3 to 8 inch (50/ft^2) foxtail; 6 to 10 inch (5 to 7/ft^2) cocklebur; 12 inch flowering (1 to 2/ft^2) wild mustard; and 3 to 6 inch (3 to 5/ft^2) venice mallow. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Treatment [a]	Rate	August 29 Cocb	Soybean Yield
	Product/A	%	bu/A
PRE/POST			
Micro-Tech/Roundup Ultra	2qt/1qt	98	34
Pendimax/Roundup Ultra+AMS	2.25pt/1qt+2% v/v	97	32
FirstRate/Roundup Ultra+AMS	0.3oz/1qt+2% v/v	94	35
FirstRate/Roundup Ultra+AMS	0.6oz/2pt+2% v/v	99	34
FirstRate/Glyphomax Plus+AMS	0.3oz/1qt+2% v/v	94	33
Prowl/Extreme+NIS+AMS	2.25pt/3pt+0.125% v/v+1.5% w/w	97	35
Boundry/Roundup Ultra+NIS+AMS	1.25pt/1.5pt+0.5% v/v+2% v/v	92	33
Domain/Roundup Ultra+NIS+AMS	10oz/1.5pt+0.5% v/v+2% v/v	95	35
Authority/Roundup Ultra+NIS+AMS	4.2oz/1.5pt+0.5% v/v+2% w/w	97	29
POST			
Roundup Ultra+AMS	1qt+2% v/v	97	30
Roundup Ultra+AMS	1.62pt+2% v/v	98	37
Roundup Ultra+Flexstar+NIS+AMS	1.5pt/0.75pt+0.5% v/v+2% v/v	94	34
Extreme+NIS+AMS	3pt+0.125%+1.5% w/w	97	27
Roundup Ultra+Flexstar+Scoil	1.5pt/0.75pt+1.5pt	98	26
POST/LPOST			
Roundup Ultra+AMS/Roundup Ultra+AMS	1qt+2% v/v/1qt+2% v/v	99	32
LSD (0.05)		7	9

[a]AMS = ammonium sulfate and was applied at 2% v/v, NIS = nonionic surfactant = Activator 90 and was applied at 0.25% v/v; Scoil = methylated seed oil and was applied at 1.5 pt/A. Refer to adjuvant glossary for adjuvant types.

At July 31and August 15, all treatments gave complete foxtail, common lambsquarters, wild mustard, and common cocklebur control. At August 29, all treatments gave complete foxtail, common lambsquarters, and wild mustard control. Crop was at canopy closure at August 29. At September 13, treatments with only Roundup, Extreme, and Roundup + Flexstar had a new flush of foxtail at harvest.

Roundup Ready soybeans - Colfax. Zollinger and Fitterer. An experiment was conducted near Colfax, ND to evaluate weed control in glyphosate resistant soybeans from herbicides applied PRE and POST. Asgrow 'AGO901' soybean was planted in each plot on April 26, 2000. PRE treatments were applied April 26, 2000 at 1:00 pm with 68 F air, 53 F soil at a depth of 2 to 4 inches, 41 % relative humidity, 100% clouds, 5 to 8 mph NW wind, dry soil surface, and moist subsoil. POST treatments were applied May 29, 2000 at 10:30 with 66 F air, 75 F soil surface, 70% relative humidity, 10% clouds, 2 to 3 mph S wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was first trifoliate. Weed species present were: 1 to 4 inch (1 to 5/ft^2) foxtail; 1 to 4 inch to (5 to 10/ft^2) common lambsquarters; 2 to 5 inch (3 to 7/ft^2) marshelder and 1 to 3 inch (2 to 7/ft^2) redroot pigweed. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel- type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Treatment[1]	Rate	May 24	June 12	June 23	July 10			
		Soybean injury	Mael	Mael	Fxtl[2]	Rrpw	Colq	Mael
	Product/A	%	%	%	%	%	%	%
PRE								
Sencor+Authority	4oz+4oz	0	73	99	99	99	99	83
PRE/POST								
Boundry/Touchdown+AMS	1.25pt/2.65pt+2lb	0	99	99	99	96	99	96
Authority/Pursuit+Quad 7	3oz/0.72oz+1% v/v	0	73	86	86	99	89	57
Authority/Raptor+Quad 7	3oz/2fl oz+1% v/v	0	73	96	96	99	99	77
Authority/Roundup Ultra+Quad 7	3oz/1pt+1% v/v	0	99	99	99	99	99	95
Valor/Roundup Ultra+AMS	2oz/1pt+2lb	0	99	93	93	96	99	96
FirstRate/Roundup Ultra+AMS	0.3oz/1pt+2lb	0	99	99	98	99	99	99
Authority/Harmony GT+Assure II+PO	4oz/0.083oz+8fl oz+1% v/v	0	99	99	94	99	99	99
POST								
Roundup Ultra+AMS	1.5pt+2lb	0	99	99	99	86	83	93
Roundup Ultra+AMS	2pt+2lb	0	99	99	99	87	91	90
Flexstar+Select+PO	1pt+6fl oz+1% v/v	5	99	99	99	90	86	99
Flexstar+Harmony GT+Select+PO	1pt+0.083oz+6fl oz+1% v/v	13	99	99	96	96	96	96
Roundup Ultra+Flexstar+PO+AMS	1pt+0.75pt+1% v/v+2lb	3	99	99	86	99	96	99
Roundup Ultra+Pursuit+Quad 7	1pt+0.72oz+1% v/v	3	77	80	96	95	99	67
Extreme+NIS+AMS	2.25pt+0.25% v/v+2lb	2	99	96	99	99	96	96
LSD (0.05)		10	13	11	12	11	10	16

[1]AMS=ammonium sulfate; Quad 7=basic blend; PO= petroleum oil=Herbimax; and NIS=non ionic surfactant=Activator 90.
[2]Fxtl=green foxtail and yellow foxtail.

The experiment was established at a site heavily infested with marshelder and common lambsquarters. Soybean injury symptoms were observed only on May 24 and expressed as chlorosis and leaf distortion. Plant injury was due to oil adjuvant with fomesafen plus thifensulfuron components of the tankmix. Redroot pigweed, common lambsquarters, and foxtail species were controlled on June 12 and June 23. Most treatments gave at least 86% weed control on July 10. Some treatments containing imazethapyr did not control common cocklebur. However, imazethapyr&glyphosate at 0.047 and 0.42 lb/A, respectively gave 96% control.

Roundup Ready soybeans - Hillsboro. Zollinger and Fitterer. An experiment was conducted in Hillsboro, ND to evaluate weed control from herbicides applied PRE and POST. PRE treatments were applied May 15, 2000 at 1:30 with 68 F air, 50 F soil at a depth of 2 to 4 inch, 40% relative humidity, 95% clouds, 2 to 5 mph SE wind, dry soil surface, and moist subsoil. POST treatments were applied June 27, 2000 at 10:30 am with 70 F air, 84 F soil surface, 56% relative humidity, 50% clouds, 1 to 3 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 2 to 4 foliate. Weed species present were: 3 to 10 inch (5 to 10/ft^2) foxtail; 4 to 6 inch (1 to 5/ft^2) redroot pigweed; and 5 to 7 inch (1 to 3/ft^2) common lambsquarters. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		July 26		
Treatment	Rate	Fxtl	Rrpw	Colq
	Product/A	%	%	%
PRE				
Sencor+Authority	4oz+4oz	28	66	73
PRE/POST				
Boundry+Touchdown+AMS	1.25pt/1.6pt+2lb	99	99	99
Authority/Pursuit+Quad 7	3oz/0.72oz+1% v/v	93	98	96
Authority/Raptor+Quad 7	3oz/2fl oz+1% v/v	93	99	93
Authority/Roundup Ultra+AMS	3oz/1pt+2lb	98	99	99
Valor/Roundup Ultra+AMS	2oz/1pt+2lb	99	99	99
FirstRate/Roundup Ultra+AMS	0.3oz/1pt+2lb	99	99	99
Authority/Harmony GT+Assure II+PO	4oz/0.083oz+8fl oz+1% v/v	83	99	99
POST				
Roundup Ultra+AMS	1.5pt+2lb	99	99	99
Roundup Ultra+AMS	2pt+2lb	99	99	99
Flexstar+Select+PO	1pt+6fl oz+1% v/v	98	99	99
Flexstar+Harmony GT+Select+PO	1pt+0.083oz+6fl oz+1% v/v	83	99	96
Roundup Ultra+Flexstar+PO+AMS	1pt+0.75pt+1% v/v+2lb	85	99	99
Roundup Ultra+Pursuit+Quad 7	1pt+0.72oz+1% v/v	99	99	99
Extreme+NIS+AMS	2.25pt+0.25% v/v+2lb	99	99	99
LSD (0.05)		14	12	14

[a]AMS = ammonium sulfate and was applied at 2 lb/A, Quad 7 = basic blend adjuvant and and was applied at % v/v, PO = petroleum oil = Herbimax and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

No injury occurred from PRE treatments. Soybean injury only occurred from Flexstar + Select + PO (15%) and from Flexstar + Harmony GT + Select + PO (50%). Most PRE/POST treatment controlled foxtail, redroot pigweed, and common lambsquarters.

Touchdown in glyphosate resistant soybean. Zollinger and Fitterer. An experiment was conducted in Hillsboro, ND to evaluate weed control from herbicides applied POST. Asgrow RR 'AG0801' soybeans were planted on May 12, 2000. POST treatments were applied June 29, 2000 at 11:30 am with 81 F air, 93 F soil surface, 40% relative humidity, 40% clouds, 1 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 2 to 3 trifoliate. Weed species present were: 4 to 10 inch (5 to 20/ft^2) foxtail; 6 inch to bloom (2 to 4/ft^2) wild mustard; and 4 to 10 inch (5 to 10/ft^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Treatment [a]	Rate	Soybean injury		July 5		July 11		July 26	
		July 5	July 11	Colq	Cocb	Colq	Cocb	Colq	Cocb
	Product/A	%	%	%	%	%	%	%	%
Touchdown+AMS	2pt	0	0	99	99	99	99	99	99
Touchdown+AMS	2.65pt	0	0	99	99	99	99	99	99
Touchdown+AMS	5.4pt	0	0	99	99	99	99	99	99
Touchdown+Flexstar+AMS	2pt+0.75pt	8	2	99	99	93	86	99	99
Touchdown+Flexstar+AMS	2.65pt+0.75pt	15	10	99	99	99	99	99	99
Touchdown+FirstRate+AMS	2pt+0.3oz	0	0	99	99	99	99	99	99
Touchdown+FirstRate+AMS	2.65pt+0.3oz	0	0	99	99	99	99	99	99
Touchdown+Pursuit+AMS	2pt+4fl oz	3	0	99	99	99	99	99	99
Touchdown+Pursuit+AMS	2.65pt+4fl oz	0	0	99	99	99	99	99	99
Cobra+AMS	6fl oz	18	3	20	53	7	23	7	7
V10084+AMS	6fl oz	12	10	20	42	20	30	0	0
V10085+AMS	6fl oz	15	10	20	55	37	37	0	0
V10086+AMS	6fl oz	8	12	22	45	7	20	0	0
LSD (0.05)		7	9	1	13	11	10	4	4

[a]AMS - ammonium sulfate and was applied at 8.5 lb/100 gal water with Touchdown and at 2 lb/A with Corba and V100XX treatments. Refer to adjuvant glossary for adjuvant types.

All Touchdown treatments controlled green and yellow foxtail, volunteer wheat, and wild mustard and near complete control of common lambsquarters or common cocklebur applied alone or in tank-mix combination.

Volunteer RUR wheat control in RUR soybean-Carrington. Oltmans and Zollinger. An experiment was conducted near Carrington, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. Dekalb 'B03-51' soybean was planted May 24, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 24, 2000. EPOST treatments were applied June 20, 2000 at 11:00 to 11:30 am with 67 F air, 60 F soil at a 2 to 4 inch depth, 68% relative humidity, 50% clouds, 12 to 16 mph SE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to first triofoliolate soybean. Weed species present were: 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat; 5 to 7 inch, (1-5 plants/ft^2) wild mustard; 2 to 4 inch, (10-15 plants/ft^2) foxtail; 2 to 4 inch, (15-25 plants/ft^2) redroot pigweed; and 2 to 4 inch, (1-5 plants/m^2) wild buckwheat. MPOST treatments were applied July 6, 2000 at 10:00 to 10:15 am with 70 F air, 67 F soil at a 2 to 4 inch depth, 90% relative humidity, 100% clouds, 7 to 10 mph S wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to third trifoliolate soybean. Weed species present were: 1 to 3 inch, (1-5 plants/ft^2) foxtail; cotyledon to 2 leaf, (1-5 plants/ft^2) redroot pigweed; 6 to 8 inch, (5-25 plants/plot) volunteer wheat; and 1 to 4 inch, (1-5 plants/m^2) wild buckwheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

At 14 days after application (DAA), all treatments had excellent wild mustard (not shown), and volunteer wheat control. Most treatments had greater than 93% foxtail and redroot pigweed control. Wild buckwheat control ranged from 19 to 98%. Only 5 treatments had greater than 89% wild buckwheat control, the remaining had less than 71% control. Roundup Ultra tank-mixes provided the greatest wild buckwheat control. At 28 DAA, all treatments had greater than 97% wild mustard (not shown) and volunteer wheat control. Split-applied treatments had greater than 97% foxtail, redroot pigweed, and wild buckwheat control. On July 31, all treatments had greater than 97% wild mustard (not shown) and volunteer wheat control. Treatments with one herbicide application had reduced foxtail control due to new flushes. Flexstar+Fusion was the only treatment with less than 89% redroot pigweed control. Decreased weed control from Flexstar+Fusion may have resulted from no oil being applied with the herbicides. Split-applied treatments were the only effective treatments for wild buckwheat and foxtail control. Generally, two herbicide applications are needed for control of new weed flushes.

Treatment	Rate[a]	Application Stage[b]	14 DAA				28 DAA				July 31			
			Fxtl[c]	Vwht	Rrpw	Wibw	Fxtl	Vwht	Rrpw	Wibw	Fxtl	Vwht	Rrpw	Wibw
	(product/A)		% control											
Roundup Ultra+AMS+Assure II	1qt+8floz	E	99	99	99	98	71	98	90	81	61	99	88	60
Roundup Ultra+AMS+Assure II	1qt+6floz	E	99	99	99	71	78	99	89	79	76	99	90	82
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1qt+4floz/ 1qt+4floz	E	98	99	99	90	97	99	99	97	97	99	99	97
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1qt+3floz/ 1qt+3floz	E/M	93	99	98	93	97	99	99	97	97	99	99	97
Roundup Ultra+AMS+Select	1qt+6floz	E/M	99	99	99	89	79	99	95	66	75	99	92	69
Roundup Ultra+AMS+Select	1qt+4floz	E	99	98	99	94	80	99	93	84	77	99	90	80
Raptor+Quad 7	4floz	E	96	91	98	19	79	99	96	24	72	99	97	0
Raptor+Cobra+Quad 7	4floz+4floz	E	67	95	99	26	31	99	95	21	36	99	94	0
Flexstar+Fusion	0.75pt+8floz	E	61	98	46	25	55	99	63	36	48	99	68	30
Untreated			0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			19	3	22	36	14	2	12	29	17	0	10	28

[a]AMS = ammonium sulfate at 8.5lb/100gal; Quad 7 = basic blend at 1% v/v

[b]E = EPOST; M = MPOST

[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

Volunteer RUR wheat control in RUR soybean-Prosper. Oltmans and Zollinger. An experiment was conducted near Prosper, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. Asgrow '0901' soybean was planted May 17, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 17, 2000. EPOST treatments were applied June 11, 2000 at 7:30 to 8:00 am with 57 F air, 60 F soil at a 2 to 4 inch depth, 77% relative humidity, 0% clouds, 2 to 4 mph N wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to first trifoliolate soybean. Weed species present were: 2 to 4 inch, (1-5 plants/m^2) common cocklebur; 2 to 4 inch, (40-50 plants/ft^2) foxtail; 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat; 4 to 6 leaf, (5-10 plants/ft^2) wild mustard; 1 to 3 inch, (1-5 plants/ft^2) common lambsquarters; 2 to 4 inch, (10-15 plants/ft^2) redroot pigweed; and 1 to 3 inch, (1-5 plants/m^2) common ragweed. MPOST treatments were applied June 29, 2000 at 2:00 to 2:15 pm with 78 F air, 66 F soil at a 2 to 4 inch depth, 44% relative humidity, 20% clouds, 5 to 11 mph NE wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to third trifoliolate soybean. Weeds species present were: 2 to 4 inch, (15-25 plants/plot) foxtail; and 6 to 8 inch, (15-20 plants/plot) volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer. The experiment had a randomized complete block design with four replicates per treatment.

		Applic.	28 DAA				July 22			
Treatment	Rate[a]	Stage[b]	Fxtl[c]	Vwht	Rrpw	Colq	Fxtl	Vwht	Rrpw	Colq
	(product/A)		% control							
Roundup Ultra+AMS+Assure II	1qt+8floz	E	78	99	85	93	77	99	88	93
Roundup Ultra+AMS+Assure II	1qt+6floz	E	77	99	88	91	69	99	83	86
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1qt+4floz/ 1qt+4floz	E	99	99	99	99	98	99	99	99
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1qt+3floz/ 1qt+3floz	E/M	96	99	99	99	96	99	99	99
Roundup Ultra+AMS+Select	1qt+6floz	E/M	95	99	92	92	88	99	91	93
Roundup Ultra+AMS+Select	1qt+4floz	E	89	99	91	94	80	99	87	95
Raptor+Quad 7	4floz	E	88	99	97	95	77	99	97	94
Raptor+Cobra+Quad 7	4floz+4floz	E	83	99	98	98	88	99	96	99
Flexstar+Fusion	0.75pt+8floz	E	83	99	92	84	88	99	95	81
Untreated			0	0	0	0	0	0	0	0
LSD (0.05)			11	1	10	8	13	0	13	15

[a]AMS = ammonium sulfate at 8.5lb/100gal; Quad 7 = basic blend at 1% v/v
[b]E = EPOST; M = MPOST
[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

At 14 days after application (DAA), all treatments had greater than 91% common cocklebur, foxtail, wild mustard, common lambsquarters, redroot pigweed, common ragweed, and volunteer wheat control (not shown). At 28 DAA, all treatments had greater than 91% wild mustard, common ragweed, common cocklebur, and volunteer wheat control (not shown). All treatments had greater than 84% redroot pigweed and common lambsquarters control. On July 22, all treatments had greater than 99% wild mustard and volunteer wheat control, and greater than 87% common ragweed and common cocklebur control (not shown). Foxtail control varied between treatments, with split-applied treatments providing control of new flushes.

Timing of Roundup application-Felton, MN. Oltmans and Zollinger. An experiment was conducted near Felton, MN to evaluate weed control from PRE and POST herbicides. Asgrow '0901' soybean was planted May 6, 2000. PRE treatments were applied May 6, 2000 at 2:00 to 3:00 pm with 70 F air, 65 F soil at a 2 to 4 inch depth, 41% relative humidity, 100% clouds, 5 to 8 mph NW wind, dry soil surface, and moist subsoil. EPOST treatments were applied May 31, 2000 at 1:30 to 1:45 pm with 64 F air, 68 F soil at a 2 to 4 inch depth, 42% relative humidity, 100% clouds, 3 to 5 mph N wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to unifoliolate soybean. Weed species present were: 1 to 3 inch, (15-20 plants/ft^2) common lambsquarters; 1 to 2 inch, (40-50 plants/ft^2) redroot pigweed; 1 to 2 inch, (10-20 plants/m^2) foxtail; and 1 to 2 inch, (5-15 plants/m^2) kochia. MPOST treatments were applied June 8, 2000 at 5:30 to 6:30 pm with 85 F air, 84 F soil at a 2 to 4 inch depth, 43% relative humidity, 0% clouds, 10 to 15 mph E wind, dry soil surface, dry subsoil, excellent crop vigor, and no dew present to first trifoliolate soybean. Weed species present were: 1 to 3 inch, (40-50 plants/ft^2) redroot pigweed; 2 to 4 inch, (15-20 plants/ft^2) common lambsquarters; 2 to 4 inch, (10-15 plants/m^2) foxtail; and 2 to 4 inch, (5-15 plants/m^2) kochia. POST treatments were applied June 15, 2000 at 10:00 to 10:30 am with 72 F air, 63 F soil at a 2 to 4 inch depth, 58% relative humidity, 100% clouds, 2 to 4 mph SE wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to second trifoliolate soybean. Weed species present were: 1 to 4 inch, (40-50 plants/ft^2) redroot pigweed; 1 to 4 inch, (10-15 plants/ft^2) common lambsquarters; 1 to 4 inch, (5-10 plants/m^2) kochia; and 1 to 4 inch, (10-15 plants/m^2) foxtail. LPOST treatments were applied June 30, 2000 at 8:30 to 9:00 am with 68 F air, 68 F soil at a 2 to 4 inch depth, 78% relative humidity, 60% clouds, 7 to 10 mph S wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 5 inch, (20-30 plants/ft^2) redroot pigweed; 1 to 6 inch, (10-15 plants/ft^2) common lambsquarters; 1 to 5 inch, (5-10 plants/m^2) kochia; and 1 to 6 inch, (10-15 plants/m^2) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield for MPOST treatments, and a backpack sprayer for EPOST, POST, and LPOST treatments. The experiment had a randomized complete block design with four replicates per treatment.

At 14 days after application (DAA), all treatments had greater than 96% foxtail control, and greater than 84% redroot pigweed control (not shown). Most treatments had greater than 82% common lambsquarters and kochia control. ALS treatments did not control kochia, which was expected with ALS resistant kochia. At 28 DAA, all treatments had greater than 90% foxtail control, with the exception of Raptor applied at 3 floz/A. Most treatments had greater than 84% common lambsquarters, redroot pigweed, and kochia control. Extreme at 2.25 pt/A and Roundup Ultra+Raptor at 1 pt/A+3 floz/A did not control kochia. Felton received 9 inches of rain June 18 and 19, which caused a new flush of weeds to emerge in EPOST, MPOST and POST treatments. On July 28, weed control was generally greater than 90% in treatments with a PRE application or a LPOST application. PRE herbicides provided residual weed control, and split-applied treatments with a LPOST application controlled new flushes of weeds.

Treatment[a]	Rate (product/A)	Application Stage[b]	14 DAA		28 DAA				July 28			
			Colq[c]	Kocz	Fxtl	Colq	Kocz	Rrpw	Fxtl	Colq	Kocz	Rrpw
			% control									
Authority/Roundup Ultra+AMS	3oz/1qt	PRE/M	99	99	98	97	99	87	91	95	97	79
Authority/Roundup Ultra+AMS	3oz/1pt	PRE/M	99	99	99	97	99	87	90	97	98	78
Authority/Roundup Ultra+AMS	3oz/0.5pt	PRE/M	99	99	95	99	99	86	84	97	98	80
Roundup Ultra+AMS	1qt	E	99	99	99	99	95	84	81	82	78	41
Roundup Ultra+AMS	1qt	M	82	96	94	86	95	71	83	79	89	49
Roundup Ultra+AMS	1qt	P	99	99	98	96	93	75	92	94	94	71
Roundup Ultra+AMS	1qt	L	99	99	99	99	99	99	99	99	99	99
Roundup Ultra+AMS/ Roundup Ultra +AMS	1pt/1pt	M/L	98	99	99	99	99	99	99	99	99	98
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.75pt/0.75pt	M/L	99	99	99	98	99	98	99	98	99	98
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.50pt/0.50pt	M/L	84	98	97	91	97	96	97	91	97	96
Roundup Ultra+AMS/ Roundup Ultra+AMS/ Roundup Ultra+AMS	0.50pt/0.50pt/ 0.50pt	M/P/L	91	99	98	97	99	94	98	97	99	94
Extreme+Quad 7	2.25pt	M	91	61	95	84	61	89	91	79	60	83
Roundup Ultra+AMS+Raptor	1pt+3floz	M	68	43	96	74	42	72	76	58	42	70
Roundup Ultra+AMS+Flexstar	1pt+0.75pt	M	91	86	96	79	87	86	77	63	89	73
Pursuit+Quad 7	3floz	M	58	0	90	53	0	89	89	49	0	88
Raptor+Quad 7	4floz	M	60	0	91	86	0	88	90	85	0	86
Raptor+Quad 7	3floz	M	85	0	82	91	0	83	81	91	0	78
Valor/Roundup Ultra+AMS	1.5oz/1.5pt	PRE/M	98	99	99	97	99	97	93	92	97	90
Valor/Roundup Ultra+AMS	2oz/1.5pt	PRE/M	98	99	97	97	99	97	92	87	94	88
Untreated			0	0	0	0	0	0	0	0	0	0
LSD (0.05)			18	12	8	20	10	14	11	16	12	15

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/100gal

[b]E = EPOST; M = MPOST; P = POST; L = LPOST

[c]Fxtl = Grft and Yeft

Timing of Roundup application-Oriska. Oltmans and Zollinger. An experiment was conducted near Oriska, ND to evaluate weed control from PRE and POST herbicides. Asgrow '0901' soybean was planted May 13, 2000. PRE treatments were applied May 13, 2000 at 10:00 to 11:30 am with 68 F air, 50 F soil at a 2 to 4 inch depth, 37% relative humidity, 50% clouds, 2 to 4 mph E wind, dry soil surface, and moist subsoil. EPOST treatments were applied June 7, 2000 at 1:30 to 1:45 pm with 89 F air, 68 F soil at a 2 to 4 inch depth, 50% relative humidity, 5% clouds, 5 to 10 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to unifoliolate soybean. Weed species present were: 1 to 3 inch, (40-50 plants/ft^2) foxtail; and 4 to 6 leaf, (1-5 plants/m^2) wild mustard. MPOST treatments were applied June 17, 2000 at 9:30 to 10:30 am with 58 F air, 58 F soil at a 2 to 4 inch depth, 66% relative humidity, 90% clouds, 2 to 4 mph W wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to second trifoliolate soybean. Weed species present were: 2 to 4 inch, (40-50 plants/ft^2) foxtail; and 2 to 7 inch, (1-5 plants/m^2) wild mustard. POST treatments were applied June 23, 2000 at 12:00 to 12:30 pm with 75 F air, 68 F soil at a 2 to 4 inch depth, 17% relative humidity, 20% clouds, 4 to 6 mph N wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to 2 to 3 trifoliolate soybean. Weed species present were: 1 to 6 inch, (20-50 plants/ft^2) foxtail; and 2 to 12 inch, (1-5 plants/m^2) wild mustard. LPOST treatments were applied June 29, 2000 at 9:00 to 9:30 am with 70 F air, 60 F soil at a 2 to 4 inch depth, 56% relative humidity, 0% clouds, 6 to 10 mph W wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 7 inch, (20-40 plants/ft^2) foxtail; and 2 to 14 inch, (1-5 plants/m^2) wild mustard. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer equipped with a wind shield delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

Treatment[a]	Rate	Applic. Stage[b]	28 DAA		July 24	
			Fxtl[c]	Wimu	Fxtl	Wimu
	(product/A)		% control			
Authority/Roundup Ultra+AMS	3oz/1qt	PRE/M	95	98	87	99
Authority/Roundup Ultra+AMS	3oz/1pt	PRE/M	94	97	94	96
Authority/Roundup Ultra+AMS	3oz/0.5pt	PRE/M	91	99	75	99
Roundup Ultra+AMS	1qt	E	61	98	49	99
Roundup Ultra+AMS	1qt	M	84	99	78	99
Roundup Ultra+AMS	1qt	P	96	99	96	99
Roundup Ultra+AMS	1qt	L	95	99	95	99
Roundup Ultra+AMS/Roundup Ultra +AMS	1pt/1pt	M/L	97	99	97	99
Roundup Ultra+AMS/Roundup Ultra+AMS	0.75pt/0.75pt	M/L	91	99	91	99
Roundup Ultra+AMS/Roundup Ultra+AMS	0.50pt/0.50pt	M/L	88	99	88	99
Roundup Ultra+AMS/Roundup Ultra+AMS/ Roundup Ultra+AMS	0.50pt/0.50pt/ 0.50pt	M/P/L	97	99	97	99
Extreme+Quad 7	2.25pt	M	98	99	98	99
Roundup Ultra+AMS+Raptor	1pt+3floz	M	93	99	93	99
Roundup Ultra+AMS+Flexstar	1pt+0.75pt	M	98	99	98	97
Pursuit+Quad 7	3floz	M	95	99	93	99
Raptor+Quad 7	4floz	M	94	99	93	99
Raptor+Quad 7	3floz	M	93	99	88	99
Valor/Roundup Ultra+AMS	1.5oz/1.5pt	PRE/M	97	99	91	99
Valor/Roundup Ultra+AMS	2oz/1.5pt	PRE/M	99	99	97	99
Untreated			0	0	0	0
LSD (0.05)			13	2	13	2

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/99gal
[b]E = EPOST; M = MPOST; P = POST; L = LPOST
[c]Fxtl = Grft and Yeft

At 14 days after application (DAA), all treatments had greater than 91% foxtail control, and 97% wild mustard control. At 28 DAA, most treatments had greater than 91% foxtail control. All treatments 28 DAA and July 24 had greater than 97% wild mustard control. On July 24, most treatments had greater than 91% foxtail control. Foxtail control decreased in some treatments due to new flushes.

Timing of Roundup application-Wahpeton. Oltmans and Zollinger. An experiment was conducted near Wahpeton, ND to evaluate weed control from PRE and POST herbicides. Asgrow '0901' soybean was planted May 6, 2000. PRE treatments were applied May 6, 2000 at 9:00 to 11:00 am with 71 F air, 60 F soil at a 2 to 4 inch depth, 40% relative humidity, 80% clouds, 5 to 8 mph SW wind, dry soil surface, and moist subsoil. EPOST treatments were applied May 31, 2000 at 6:15 to 6:30 pm with 58 F air, 60 F soil at a 2 to 4 inch depth, 65% relative humidity, 100% clouds, 5 to 9 mph N wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to unifoliolate soybean. Weed species present were: 2 to 4 inch, (20-30 plants/ft^2) common lambsquarters; 2 to 4 inch, (40-50 plants/ft^2) common ragweed; 1 to 3 inch, (40-50 plants/ft^2) foxtail; and 1 to 3 inch, (1-5 plants/ft^2) common cocklebur. MPOST treatments were applied June 7, 2000 at 10:00 to 11:00 am with 83 F air, 65 F soil at a 2 to 4 inch depth, 49% relative humidity, 0% clouds, 10 to 15 mph NE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to first trifoliolate soybean. Weed species present were: 2 to 4 inch, (20-30 plants/ft^2) common lambsquarters; 2 to 5 inch, (40-50 plants/ft^2) common ragweed; 2 to 4 inch, (40-50 plants/ft^2) foxtail; and 3 to 5 inch, (1-5 plants/ft^2) common cocklebur. POST treatments were applied June 16, 2000 at 1:30 to 2:00 pm with 58 F air, 61 F soil at a 2 to 4 inch depth, 64% relative humidity, 80% clouds, 4 to 8 mph N wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to second trifoliolate soybean. Weed species present were: 1 to 6 inch, (10-30 plants/m^2) common lambsquarters; 1 to 5 inch, (15-30 plants/ft^2) common ragweed; 1 to 6 inch, (10-40 plants/ft^2) foxtail; and 1 to 6 inch, (1-5 plants/ft^2) common cocklebur. LPOST treatments were applied June 22, 2000 at 5:00 to 5:30 pm with 80 F air, 71 F soil at a 2 to 4 inch depth, 17% relative humidity, 0% clouds, 2 to 4 mph E wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 4 inch, (5-10 plants/m^2) common lambsquarters; 1 to 2 inch, (5-10 plants/m^2) common ragweed; 1 to 2 inch, (20-40 plants/plot) foxtail; and 1 to 3 inch, (20-30 plants/plot) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

At 14 days after application (DAA), all treatments had greater than 96% foxtail and common cocklebur control (not shown). Most treatments had greater than 92% common lambsquarters and common ragweed control (not shown). At 28 DAA, most treatments had greater than 90% weed control. On July 22, weed control was generally greater than 91% in treatments with a PRE application or a LPOST application. PRE herbicides provided residual weed control, and split-applied treatments with a LPOST application controlled new flushes of weeds.

Treatment[a]	Rate	Applic. Stage[b]	28 DAA				July 22			
			Fxtl[b]	Colq	Corw	Cocb	Fxtl	Colq	Corw	Cocb
	(product/A)		% control							
Authority/Roundup Ultra+AMS	3oz/1qt	PRE/M	85	99	97	89	87	99	98	86
Authority/Roundup Ultra+AMS	3oz/1pt	PRE/M	87	99	95	91	87	97	89	88
Authority/Roundup Ultra+AMS	3oz/0.5pt	PRE/M	92	98	95	85	85	96	91	83
Roundup Ultra+AMS	1qt	E	83	96	77	98	63	82	55	75
Roundup Ultra+AMS	1qt	M	78	99	97	98	68	94	84	90
Roundup Ultra+AMS	1qt	P	89	98	83	98	91	99	84	99
Roundup Ultra+AMS	1qt	L	97	99	97	97	97	99	97	97
Roundup Ultra+AMS/ Roundup Ultra +AMS	1pt/1pt	M/L	99	99	99	98	94	99	94	98
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.75pt/0.75pt	M/L	96	99	98	93	96	99	98	93
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.50pt/0.50pt	M/L	96	91	95	97	96	91	95	97
Roundup Ultra+AMS/ Roundup Ultra+AMS/ Roundup Ultra+AMS	0.50pt/0.50pt 0.50pt	M/P/L	97	99	97	98	97	99	97	98
Extreme+Quad 7	2.25pt	M	97	99	94	84	86	96	84	79
Roundup Ultra+AMS+Raptor	1pt+3floz	M	96	99	96	94	77	97	82	84
Roundup Ultra+AMS+Flexstar	1pt+0.75pt	M	91	96	87	91	76	96	80	73
Pursuit+Quad 7	3floz	M	95	73	79	92	86	74	59	83
Raptor+Quad 7	4floz	M	94	93	91	94	82	94	74	79
Raptor+Quad 7	3floz	M	98	93	76	81	94	98	67	83
Valor/Roundup Ultra+AMS	1.5oz/1.5pt	PRE/M	98	99	99	94	98	99	98	96
Valor/Roundup Ultra+AMS	2oz/1.5pt	PRE/M	95	99	99	89	91	98	94	82
Untreated			0	0	0	0	0	0	0	0
LSD (0.05)			11	15	12	19	16	11	14	21

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/100gal
[b]E = EPOST; M = MPOST; P = POST; L = LPOST
[c]Fxtl = Grft and Yeft

Soybean population effects on weed control-Felton, MN. Oltmans and Zollinger. An experiment was conducted near Felton, MN to evaluate weed control from PRE and POST herbicides applied to soybean planted in 7.5 inch, (225,000 plants/A) and 30 inch, (175,000 plants/A) rows. Asgrow '0901' soybean was planted May 6, 2000. PRE treatments were applied May 6, 2000 at 2:00 to 3:00 pm with 70 F air, 65 F soil at a 2 to 4 inch depth, 41% relative humidity, 100% clouds, 5 to 8 mph NW wind, dry soil surface, and moist subsoil. MPOST treatments were applied June 8, 2000 at 6:30 to 7:30 pm with 82 F air, 84 F soil at a 2 to 4 inch depth, 42% relative humidity, 0% clouds, 5 to 10 mph E wind, dry soil surface, dry subsoil, excellent crop vigor, and no dew present to first trifoliolate soybean. Weed species present were: 1 to 3 inch, (40-50 plants/ft^2) redroot pigweed; 2 to 4 inch, (15-20 plants/ft^2) common lambsquarters; 2 to 4 inch, (10-15 plants/ft^2) foxtail; and 2 to 4 inch, (5-10 plants/m^2) kochia. LPOST treatments were applied June 30, 2000 at 8:30 to 9:00 am with 65 F air, 67 F soil at a 2 to 4 inch depth, 82% relative humidity, 60% clouds, 7 to 10 mph S wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 5 inch, (1-5 plants/ft^2) redroot pigweed; 1 to 6 inch, (5-10 plants/ft^2) common lambsquarters; 1 to 5 inch, (1-5 plants/m^2) kochia; and 1 to 6 inch, (1-5 plants/m^2) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield for MPOST treatments, and a backpack sprayer for LPOST treatments. The experiment had a randomized complete block design with four replicates per treatment.

At 28 days after application (DAA), all treatments had greater than 83% foxtail control. Authority PRE followed by Roundup Ultra and Roundup Ultra split-applied had greater than 96% common lamsquarters, kochia, and redroot pigweed control in wide rows. Felton received 9 inches of rain June 18 and 19, which caused a new flush of weeds to emerge in MPOST treatments. On July 28, Roundup Ultra split-applied had greater than 93% weed control in wide rows. In narrow rows, Authority PRE followed by Roundup Ultra had between 88 and 97% weed control. Raptor at 4 floz/A was not an effective treatment, because there was no control of ALS-resistant kochia. Reducing the rate of Roundup Ultra with multiple applications was successful in controlling weeds throughout the season in both wide and narrow row soybeans.

Treatment[a]	Rate	Application Stage[b]	14 DAA				28 DAA				July 28			
			Fxtl[c]	Colq	Kocz	Rrpw	Fxtl	Colq	Kocz	Rrpw	Fxtl	Colq	Kocz	Rrpw
	(product/A)		% control											
30" row/175,000 seeds/A														
Roundup Ultra+AMS	1qt	M	99	89	94	81	93	69	92	58	83	73	87	60
Roundup Ultra+AMS	1pt	M	98	63	86	66	83	76	99	54	70	76	89	55
Roundup Ultra+AMS	0.5pt	M	99	28	68	28	86	41	81	41	72	38	64	15
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	99	85	97	98	99	96	99	96	99	96	99	93
Authority/ Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	99	99	98	99	99	97	82	97	98	89
Raptor+Quad 7	4floz	M	99	99	60	96	87	92	51	71	68	67	0	57
Untreated			0	0	0	0	0	0	0	0	0	0	0	0
7.5" row/225,000 seeds/A														
Roundup Ultra+AMS	1qt	M	99	83	97	80	91	86	82	79	80	88	83	81
Roundup Ultra+AMS	1pt	M	99	69	88	75	93	77	87	74	64	76	91	77
Roundup Ultra+AMS	0.5pt	M	93	28	68	33	91	53	86	48	77	50	87	48
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	99	90	96	93	89	76	91	84	89	76	91	84
Authority/ Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	99	99	97	99	99	86	88	95	97	89
Raptor+Quad 7	4floz	M	99	75	51	84	96	90	51	66	64	50	10	56
Untreated			0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			5	20	27	21	11	24	21	21	22	26	21	23

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/100gal
[b]M = MPOST; L = LPOST
[c]Fxtl = Grft and Yeft

Soybean population effects on weed control-Oriska. Oltmans and Zollinger. An experiment was conducted near Oriska, ND to evaluate weed control from PRE and POST herbicides applied to soybean planted in 7.5 inch, (225,000 plants/A) and 30 inch, (175,000 plants/A) rows. Asgrow '0901' soybean was planted May 13, 2000. PRE treatments were applied May 13, 2000 at 9:30 to 10:00 am with 68 F air, 50 F soil at a 2 to 4 inch depth, 37% relative humidity, 50% clouds, 2 to 4 mph E wind, dry soil surface, and moist subsoil. MPOST treatments were applied June 17, 2000 at 8:30 to 9:30 am with 56 F air, 56 F soil at a 2 to 4 inch depth, 71% relative humidity, 90% clouds, 2 to 4 mph W wind, moist soil surface, moist subsoil, good crop vigor, and dew present to second trifoliolate soybean. Weed species present were: 2 to 4 inch, (10-20 plants/ft^2) foxtail; and 3 to 5 inch, (1-5 plants/ft^2) marshelder. LPOST treatments were applied June 29, 2000 at 8:30 to 9:00 am with 70 F air, 60 F soil at a 2 to 4 inch depth, 56% relative humidity, 0% clouds, 6 to 10 mph W wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 3 inch, (20-30 plants/plot) foxtail; and 3 to 6 inch, (15-25 plants/plot) marshelder. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer equipped with a wind shield delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

Treatment[a]	Rate	Application Stage[b]	14 DAA		28 DAA		July 24	
			Fxtl[c]	Mael	Fxtl	Mael	Fxtl	Mael
	(product/A)		% control					
30" row/175,000 seeds/A								
Roundup Ultra+AMS	1qt	M	99	99	89	99	81	78
Roundup Ultra+AMS	1pt	M	99	99	90	98	80	79
Roundup Ultra+AMS	0.5pt	M	99	94	84	95	76	72
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	98	98	96	94	96	94
Authority/Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	95	97	80	88
Raptor+Quad 7	4floz	M	96	93	95	93	91	79
Untreated			0	0	0	0	0	0
7.5" row/225,000 seeds/A								
Roundup Ultra+AMS	1qt	M	99	99	89	98	80	95
Roundup Ultra+AMS	1pt	M	99	99	85	98	84	93
Roundup Ultra+AMS	0.5pt	M	98	99	94	98	88	97
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	98	99	95	99	95	99
Authority/Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	96	98	85	98
Raptor+Quad 7	4floz	M	94	99	93	98	91	91
Untreated			0	0	0	0	0	0
LSD (0.05)			3	6	10	5	15	17

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/100gal
[b]M = MPOST; L = LPOST
[c]Fxtl = Grft and Yeft; Mael = Marshelder

At 14 days after application (DAA), all treatments had greater than 93% foxtail and marshelder control. At 28 DAA, all treatments had greater than 84% foxtail control, and greater than 93% marshelder control. On July 24, weed control was greater in 7.5" rows with 225,000 plants than 30" rows with 175,000 plants, because of light penetration for continuous germination in wide rows. Roundup Ultra split-applied at the reduce rate of 0.5 pt/A had the best season-long weed control across populations. In narrow rows, Raptor at 4 floz/A also had season-long weed control.

Glyphosate with adjuvants-Oriska. Oltmans and Zollinger. An experiment was conducted near Oriska, ND to evaluate weed control from Roundup formulations and Touchdown applied with adjuvants. Asgrow '0901' soybean was planted May 13, 2000. POST treatments were applied June 23, 2000 at 9:30 to 11:30 am with 75 F air, 68 F soil at a 2 to 4 inch depth, 17% relative humidity, 20% clouds, 4 to 6 mph NW wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to 2 to 3 trifoliolate soybean. Weed species present were: 2 to 12 inch, (1-5 plants/m^2) wild mustard; and 1 to 6 inch, (40-50 plants/ft^2) foxtail. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

Treatment[a]	Rate	July 6		July 24	
		Fxtl[b]	Wimu	Fxtl	Wimu
	(oz prod/A)	(% control)			
Roundup Ultra	8	99	83	94	89
Roundup Ultra+AMS	4	98	95	83	83
Roundup Ultra+Class Act	4+2.5% v/v	99	78	88	71
Roundup Ultra+Corral AMS	4+2.5% v/v	98	79	80	75
Roundup UltraDry	4.6	95	92	89	97
Roundup UltraDry+AMS	2.3	99	89	89	79
Roundup UltraDry+Class Act	2.3+2.5% v/v	97	84	76	74
Roundup UltraDry+Corral AMS	2.3+2.5% v/v	98	86	88	81
Roundup Original+NIS	8+0.5% v/v	98	94	90	91
Roundup Original+NIS+AMS	4+0.5% v/v	99	79	77	82
Roundup Original+Class Act	4+2.5% v/v	98	91	95	85
Roundup Original+NIS+Corral AMS	4+0.5% v/v+2.5% v/v	95	83	90	89
Touchdown+NIS	7+0.5% v/v	98	97	84	88
Touchdown+NIS+AMS	3.5+0.5% v/v	99	96	89	95
Touchdown+Class Act	3.5+2.5% v/v	97	80	95	82
Touchdown+NIS+Corral AMS	3.5+0.5% v/v+2.5%v/v	98	91	91	89
Roundup Custom+NIS	6+1% v/v	99	96	86	94
Roundup Custom+NIS+AMS	3+1% v/v	98	84	80	78
Roundup Custom+Class Act	3+2.5% v/v	96	85	85	80
Roundup Custom+Surfate	3+1% v/v	96	88	78	83
Roundup Custom+CL9804	3+2.5% v/v	99	90	87	86
Roundup Original+CL9913	3+2.5% v/v	98	78	83	83
Roundup Custom+NIS+Corral AMS	3+0.5% v/v+2.5% v/v	97	90	85	86
Roundup Original+Placement+CL9804	3+6+2.5% v/v	95	80	78	77
Untreated		0	0	0	0
LSD (0.05)		4	11	14	14

[a]AMS = ammonium sulfate at 8.5lb/100 gal; Class Act = nonionic surfactant+ammonium sulfate; Corral AMS = ammonium sulfate+drift retardant; NIS = nonionic surfactant; Surfate = nonionic surfactant+ammonium sulfate; CL9804 = nonionic surfactant+ammonium sulfate; CL9913 = nonionic surfactant+ammonium sulfate; Placement = drift retardant

[b]Fxtl = Grft and Yeft

Treatments were developed according to the adjuvant load in glyphosate formulations. Roundup Ultra and Roundup UltraDry do not require additional surfactant, Roundup Original and Touchdown require some additional surfactant, and Roundup Custom has no surfactant in the formulation. Treatments were applied at reduced rates to detect differences in herbicide enhancement by adjuvants. On July 6, all treatments had greater than 95% foxtail control. Wild mustard control was greater when AMS or NIS was added to glyphosate, with the exception of Roundup UltraDry. Adjuvants that generally provided less enhancement of wild mustard control were CL9913, Corral AMS, Class Act, and the combination of CL9804+placement. On July 24, weed control decreased; however, treatments with AMS or NIS generally had better foxtail and wild mustard control.

Soybean population effects on weed control-Wahpeton. Oltmans and Zollinger. An experiment was conducted near Wahpeton, ND to evaluate weed control from PRE and POST herbicides applied in soybean planted in 7.5 inch, (225,000 plants/A) and 30 inch, (175,000 plants/A) rows. Asgrow '0901' soybean was planted May 6, 2000. PRE treatments were applied May 6, 2000 at 9:00 to 11:00 am with 71 F air, 60 F soil at a 2 to 4 inch depth, 40% relative humidity, 80% clouds, 5 to 8 mph SW wind, dry soil surface, and moist subsoil. MPOST treatments were applied June 8, 2000 at 10:30 to 11:30 am with 87 F air, 67 F soil at a 2 to 4 inch depth, 44% relative humidity, 0% clouds, 10 to 15 mph NE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to first trifoliolate soybean. Weed species present were: 2 to 4 inch, (5-10 plants/m^2) common lambsquarters; 2 to 5 inch, (40-50 plants/ft^2) common ragweed; 2 to 4 inch, (20-30 plants/ft^2) foxtail; 2 to 4 inch, (20-30 plants/ft^2) redroot pigweed; and 3 to 5 inch, (1-5 plants/ft^2) common cocklebur. LPOST treatments were applied June 22, 2000 at 5:30 to 6:00 pm with 80 F air, 71 F soil at a 2 to 4 inch depth, 17% relative humidity, 0% clouds, 2 to 4 mph E wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to 3 to 4 trifoliolate soybean. Weed species present were: 1 to 5 inch, (10-20 plants/ft^2) common lambsquarters; 1 to 5 inch, (1-5 plants/ft^2) common ragweed; 1 to 2 inch, (15-25 plants/plot) foxtail; and 1 to 3 inch, (15-25 plants/plot) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. PRE treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. MPOST treatments were applied with a bicycle-wheel-type plot sprayer equipped with a wind shield and the LPOST treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

At 14 days after application (DAA), all treatments had greater than 96% foxtail, common cocklebur and redroot pigweed control. Weed control with single applications of Roundup Ultra at 0.5 pt/A or 1 pt/A generally provided weed control similar to Roundup Ultra at 1 qt/A. On July 22, weed control generally decreased due to new weed flushes. Reducing the rate of Roundup Ultra with multiple applications was successful in controlling weeds throughout the season in both wide and narrow row soybeans.

Treatment[a]	Rate	Application Stage[b]	14 DAA					28 DAA					July 22				
			Fxtl[c]	Colq	Corw	Cocb	Rrpw	Fxtl	Colq	Corw	Cocb	Rrpw	Fxtl	Colq	Corw	Cocb	Rrpw
	(product/A)		% control														
30" row/175,000 seeds/A																	
Roundup Ultra+AMS	1qt	M	99	99	99	99	99	72	96	93	87	75	74	87	83	72	77
Roundup Ultra+AMS	1pt	M	99	83	96	99	99	75	90	91	78	94	73	87	60	51	89
Roundup Ultra+AMS	0.5pt	M	99	61	88	99	99	87	82	81	50	80	85	79	68	41	75
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	96	93	97	96	99	96	97	96	93	98	94	97	97	92	97
Authority/ Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	99	99	99	81	98	95	82	96	73	94	73	60	89
Raptor+Quad 7	4floz	M	96	53	19	96	99	75	95	53	70	95	75	87	53	66	89
Untreated			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5" row/225,000 seeds/A																	
Roundup Ultra+AMS	1qt	M	99	99	99	99	99	87	97	93	93	96	80	92	78	65	95
Roundup Ultra+AMS	1pt	M	99	78	98	99	99	92	98	91	94	97	92	96	88	84	98
Roundup Ultra+AMS	0.5pt	M	99	39	49	99	99	88	70	82	91	98	80	75	71	82	94
Roundup Ultra+AMS/ Roundup Ultra+AMS	0.5pt/0.5pt	M/L	99	76	97	97	99	95	97	91	89	98	95	97	91	89	97
Authority/ Roundup Ultra+AMS	4oz/1pt	PRE/M	99	99	99	99	99	96	99	97	81	99	93	96	78	72	96
Raptor+Quad 7	4floz	M	96	9	10	99	99	85	77	58	97	98	87	80	64	81	85
Untreated			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			4	25	15	4	0	20	14	13	20	11	13	17	22	26	14

[a]Quad 7 = basic blend at 1% v/v; AMS = ammonium sulfate at 8.5lb/100gal
[b]M = MPOST; L = LPOST
[c]Fxtl = Grft and Yeft

Evaluation of injury to imidazolinone-tolerant canola seeded into sulfonylurea-treated soil.
Brian Jenks, Denise Markle, and Gary Willoughby, and Kent McKay (NCREC, Minot). Herbicide treatments were applied May 21, 1999. One year later, imidazolinone-tolerant canola (46A76) was seeded May 17,2000 at 700,000 pls/A into 6-inch rows under a conventional tillage system. Individual plots were 10 by 60 ft and replicated three times. Canola was harvested August 22, 2000.

		Canola	
Treatment	Rate	Yield	Tst Wt
		lb/A	lb/bu
Untreated		1637	50.6
Peak	0.25 oz	1662	50.8
Amber	0.28 oz	1662	50.7
Rave	2 oz	1601	50.8
Finesse	0.25 oz	1658	50.8
Ally	0.1 oz	1812	50.7
LSD		NS	NS
CV		8	0.3

The plot area was not tilled in fall 1999. We disked the plot area twice in spring 2000 prior to seeding. Raptor (4 fl oz) was applied postemergence over the entire plot. The only visible injury was a slight yellowing on one end of the study which was on a steeper slope. The pH and OM on the slope were 8.2 and 2.4%, respectively. The pH and OM for the rest of the plot area was 7.7 and 3.0%, respectively. Canola yields in the treated plots were not significantly different from the untreated.

Volunteer RUR wheat control in RUR canola-Carrington. Oltmans and Zollinger. An experiment was conducted near Carrington, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. 'Rider' canola was planted May 24, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 24, 2000. EPOST treatments were applied June 13, 2000 at 11:30 to 11:45 am with 51 F air, 64 F soil at a 2 to 4 inch soil depth, 90% relative humidity, 100% clouds, 6 to 9 mph S wind, moist soil surface, moist subsoil, excellent crop vigor, and no dew present to cotyledon to 2 leaf canola. Weed species present were: 1 to 2 inch, (10-15 plants/ft^2) foxtail; cotyledon to 2 leaf, (10-15 plants/ft^2) redroot pigweed; 6 to 8 leaf, (1-5 plants/m^2) wild mustard; and 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat. MPOST treatments were applied June 20, 2000 at 11:00 to 11:30 am with 97 F air, 60 F soil at a 2 to 4 inch depth, 68% relative humidity, 75% clouds, 12 to 16 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 3 to 4 leaf canola. Weed species present were: 3 to 5 inch, (15-25 plants/ft^2) foxtail; 2 to 4 inch, (15-25 plants/ft^2) redroot pigweed; 5 to 7 inch, (1-5 plants/ft^2) wild mustard; and 5 to 7 inch, (10-15 plants/ft^2) volunteer wheat. POST treatments were applied June 26, 2000 at 9:15 to 9:30 am with 56 F air, 54 F soil at a 2 to 4 inch depth, 17% relative humidity, 5% clouds, 5 to 10 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, and dew present to 5 to 6 leaf canola. Weed species present were: 1 to 3 inch, (30-50 plants/plot) foxtail, 1 to 5 inch, (15-25 plants/plot) wild mustard; and 7 to 9 inch, (10-15 plants/plot) volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

Treatment	Rate[a]	Growth Stage	14 DAA			28 DAA		
			Wimu[b]	Vwht	Rrpw	Wimu	Vwht	Rrpw
	(product/A)	(leaf)	% control					
Roundup Ultra+AMS+Assure II	1pt+8floz	3-4	91	99	99	99	100	97
Roundup Ultra+AMS+Assure II	1pt+6floz	3-4	93	98	99	99	100	97
Roundup Ultra+AMS+Assure II	1pt+4floz	3-4	96	98	99	99	100	98
Roundup Ultra+AMS+Select	1pt+6floz	3-4	96	95	97	99	99	98
Roundup Ultra+AMS+Select	1pt+4floz	3-4	83	85	98	99	100	97
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1pt+3floz/ 1pt+3floz	cot-2/ 5-6	95	99	98	96	99	99
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1pt+2floz/ 1pt+2floz	cot-2/ 5-6	95	97	95	98	99	99
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS	1pt+6floz/1pt	cot-2/ 5-6	93	87	99	98	99	99
Stinger+Assure II	0.33pt+8floz	3-4	38	88	98	71	99	92
Untreated			0	0	0	0	0	0
LSD (0.05)			15	15	3	11	1	2

[a]AMS = ammonium sulfate at 8.5lb/100gal
[b]Vwht = volunteer wheat

At 14 days after application (DAA), all treatments had greater than 95% foxtail (not shown) and redroot pigweed control, and greater than 85% volunteer wheat control. Two treatments (i.e., Stinger+Assure II and Roundup Ultra+AMS+Select at 1 pt/A+4 floz/A) had less than 91% wild mustard control. At 28 DAA, all treatments had greater than 90% foxtail (not shown), volunteer wheat, and redroot pigweed control. The only treatment with lower than 96% wild mustard control was Stinger+Assure II, with 71% control.

Volunteer RUR wheat control in RUR canola-Prosper. Oltmans and Zollinger. An experiment was conducted near Prosper, ND to evaluate weed control from POST applied herbicides. 'Rider' canola was planted May 17, 2000. Monsanto '33512' wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 17, 2000. EPOST treatments were applied May 31, 2000 at 11:30 to 11:45 am with 62 F air, 55 F soil at 2 to 4 inch depth, 43% relative humidity, 100% clouds, 2 to 5 mph NE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to cotyledon to 2 leaf canola. Weed species present were: 1 to 2 inch, (5-15 plants/ft^2) foxtail: cotyledon to 2 leaf, (5-15 plants/ft^2) redroot pigweed; 1 to 2 inch, (5-15 plants/ft^2) kochia; 1 to 2 inch, (5-10 plants/ft^2) common lambsquarters; cotyledon to 2 leaf, (1-5 plants/m^2) common cocklebur; 2 to 4 leaf, (1-5 plants/m^2) wild mustard; and 2 to 4 inch, (10-15 plants/ft^2) volunteer wheat. MPOST treatments were applied June 11, 2000 at 10:00 to 10:30 am with 62 F air, 61 F soil at a 2 to 4 inch depth, 65% relative humidity, 0% clouds, 2 to 4 mph NE wind, dry soil surface, dry subsoil, excellent crop vigor, and no dew present to 3 to 4 leaf canola. Weed species present were: 2 to 5 inch, (1-5 plants/m^2) wild mustard; 1 to 3 inch, (10-15 plants/ft^2) redroot pigweed; 1 to 3 inch, (5-10 plants/ft^2) common lambsquarters; 2 to 4 leaf, (1-5 plants/m^2) common cocklebur; 2 to 5 inch, (10-20 plants/ft^2) foxtail; and 4 to 6 inch, (10-15 plants/ft^2) volunteer wheat. POST treatments were applied June 17 at 12:30 to 12:45 pm with 60 F air, 56 F soil at a 2 to 4 inch depth, 43% relative humidity, 70% clouds, moist soil surface, moist subsoil, good crop vigor, and no dew present to 5 to 6 leaf canola. Weed species present were: 1 to 2 inch, (1-5 plants/ft^2) foxtail; cotyledon to 2 leaf, (1-5 plants/ft^2) redroot pigweed; 1 to 2 inch, (1-5 plants/m^2) common lambsquarters; 2 to 4 leaf, (1-5 plants/m^2) common cocklebur, and cotyledon to 2 leaf, (1-5 plants/m^2) wild mustard. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a backpack sprayer for EPOST and POST treatments, and a bicycle-wheel-type plot sprayer equipped with a wind shield for MPOST treatments. The experiment had a randomized complete block design with four replicates per treatment.

Treatment	Rate	Growth Stage[a]	14 DAA		28 DAA	
			Wimu[b]	Vwht	Wimu	Vwht
	(product/A)	(leaf)	% control			
Roundup Ultra+AMS+Assure II	1pt+8floz	3-4	96	96	88	99
Roundup Ultra+AMS+Assure II	1pt+6floz	3-4	98	88	99	99
Roundup Ultra+AMS+Assure II	1pt+4floz	3-4	96	88	97	99
Roundup Ultra+AMS+Select	1pt+6floz	3-4	95	87	88	98
Roundup Ultra+AMS+Select	1pt4floz	3-4	96	89	91	98
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1pt+3floz/ 1pt+3floz	cot-2/ 5-6	99	96	99	99
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS+Assure II	1pt+2floz/ 1pt+2floz	cot-2/ 5-6	96	99	98	99
Roundup Ultra+AMS+Assure II/ Roundup Ultra+AMS	1pt+6floz/1pt	cot-2/ 5-6	99	90	98	99
Stinger+Assure II	0.33pt+8floz	3-4	47	68	98	99
Untreated			0	0	0	0
LSD (0.05)			26	11	8	2

[a]AMS = ammonium sulfate at 8.5lb/100gal
[b]Vwht = volunteer wheat

At 14 days after application (DAA), all treatments had greater than 93% foxtail, redroot pigweed, common lambsquarters, and common cocklebur control (not shown). All treatments, except Stinger+Assure II , had greater than 95% wild mustard control. All treatments, except Stinger+Assure II had greater than 87% volunteer wheat control; however, all treatments 28 DAA had 98% volunteer wheat control. At 28 DAA, all treatments had greater than 93% foxtail, redroot pigweed, common lambsquarters, and common cocklebur control (not shown), and greater than 88% wild mustard control.

Roundup-resistant canola herbicide trial, Carrington, 2000. (Endres, Henson, and Schneider) The experiment was conducted on a minimum-till field with a Heimdahl-Emrick loam soil with 6.2 pH and 3.3% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. Herbicide treatments were applied to 5 by 25 ft plots with a hand-boom plot sprayer. The PPI treatment was applied at 18.4 gal/A at 35 psi through 8002 flat fan nozzles on May 1 with 68 F, 24% RH, 90% clear sky, and 8 mph wind on a dry soil surface and incorporated with a roto-tiller at a 3- to 4-inch depth. 'Hyola 357RR' canola was planted at 700,000 PLS/A on May 3 in 7-inch rows at a 0.5- to 1-inch depth. POST treatments were applied at 9.2 gal/A at 35 psi through 8001 flat fan nozzles. POSTA treatments were applied on May 25 with 57 F, 55% RH, clear sky, and 9 mph wind to 1- to 2-leaf canola, 1- to 2-inch tall yellow and green foxtail, 1- to 5-inch tall common lambsquarters, 0.5-inch tall redroot and prostrate pigweed, and 1.5- to 4-inch tall wild buckwheat. POSTB treatments were applied on June 2 with 50 F, 77% RH, clear sky, and 8 mph wind to 3- to 4-leaf canola, 3- to 4-leaf foxtail, 1- to 5-inch tall common lambsquarters, 4- to 6-inch tall horseweed, 0.5- to 1-inch tall pigweed, and 2- to 6-inch tall wild buckwheat. POSTC treatments were applied on June 8 with 66 F, 69% RH, 80% cloudy sky, and 11 mph wind to 5- to 6-leaf canola, 5- to 6-leaf foxtail, 1- to 9-inch tall common lambsquarters, ≤12-inch tall horseweed, 1- to 2-inch tall pigweed, and 6- to 12-inch vine wild buckwheat. The trial was harvested with a plot combine on August 15.

	Herbicide		Weed control									Canola seed
			8-July					31-July				
Treatment[1]	Rate	Timing	Fota[2]	Colq	Howe	Piwe[3]	Wibw	Fota	Colq	Howe	Wibw	yield
	lb/A		%									lb/A
Glyt	0.375	POSTA	94	99	99	97	81	90	96	94	76	1104.6
Glyt	0.56	POSTA	98	98	92	98	86	89	94	99	89	1283.4
Glyt	0.375	POSTB	98	99	68	98	75	96	98	98	67	1175.2
Glyt	0.56	POSTB	99	99	94	99	75	96	94	98	82	1149.1
Glyt	0.75	POSTB	97	99	92	98	84	90	89	99	85	1257.3
Glyt	0.375	POSTC	99	82	99	97	68	94	87	98	73	1334.9
Glyt	0.56	POSTC	99	81	92	98	77	91	95	91	75	894.6
Glyt/Glyt	0.375/0.375	POSTA/C	95	99	99	99	85	91	99	99	86	1099.2
Glyt/Glyt	0.560/0.375	POSTA/C	99	99	99	99	96	97	99	99	96	1379.4
Glyt/Glyt	0.560/0.560	POSTA/C	98	99	99	99	92	96	99	99	95	1077.0
Glyt+Clpy	0.375+0.094	POSTB	98	99	99	99	86	93	98	99	78	1152.8
Trif/Qufp-P	0.75/0.068	PPI/POSTB	99	89	99	95	81	98	76	99	88	1351.4
untreated			0	0	0	0	0	0	0	0	0	797.9
LSD (0.05)			5	9	2	14	11	10	9	11	6	NS

[1]Glyphosate (Roundup Ultra) treatments include AMS at 1% v/v; Quizalofop treatment includes COC (Herbimax) at 1% v/v.
[2]Fota=yellow and green foxtail.
[3]Piwe=Redroot and prostrate pigweed.

Green and yellow foxtail, horseweed, and redroot and prostrate pigweed control was ≥ 90% with glyphosate at 0.38 lb/A among application timings . Common lambsquarters control with trifluralin was less than with POST treatments on July 31. Common lambsquarters control was highest (96-99%) with glyphosate at 0.38 lb/A applied 22 or 30 days after planting compared to the late application. Wild buckwheat control on July 31 was highest (95-96%) with sequential applications of glyphosate at 0.560/0.375 and 0.560/0.560 lb/A. Canola injury was not detected with any treatment. Although not statistically significant, canola yield tended to improve with herbicide treatments compared to the untreated check.

Liberty-resistant canola herbicide trial, Carrington, 2000. (Henson, Endres, and Schneider) The experiment was conducted on a minimum-till field and Heimdahl-Emrick loam soil with 6.2 pH and 3.3% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. Herbicide treatments were applied to 5 by 25 ft plots with a hand-boom or hooded bicycle–wheel plot sprayer. PPI treatments were applied at 18.4 gal/A at 35 psi through 8002 flat fan nozzles on May 1 with 69 F, 23% RH, 90% clear sky, and 8 mph wind on a dry soil surface and incorporated with a roto-tiller at a 3- to 4-inch depth. 'InVigor 2573' canola was planted at 700,000 PLS/A on May 3 in 7-inch rows at a 0.5- to 1-inch depth. POST treatments were applied at 9.2 gal/A at 35 psi through 8001 flat fan nozzles. POSTA treatments were applied on June 2 with 50 F, 77% RH, clear sky, and 8 mph wind to 3-leaf canola, 3- to 4-leaf foxtail, 1-inch tall to flowering wild mustard, and other annual broadleaf weeds were 1- to 3-inches tall. POSTB treatments were applied on June 16 with 51 F, 74% RH, 95% cloudy sky, and 11 mph wind to 6- to 8-leaf canola, 3- to 6-inch tall yellow and green foxtail, 6- to 15-inch tall common lambsquarters, 10- to 15-inch tall horseweed, 12-inch tall kochia, 1- to 4-inch tall redroot and prostrate pigweed, 6-inch tall Russian thistle, 2- to 15-inch tall wild buckwheat, and flowering wild mustard.

Visual crop injury was absent or negligible with all herbicide treatments (data not shown). Few differences in weed control were evident among herbicide treatments with the first and second visual evaluations (Table).

The third evaluation (canola at physiological maturity) indicated that control of all weed species present was good to excellent (84 to 99%) with treatments that included trifluralin (Table). Weed control generally was similar between application timings of glufosinate, but an advantage existed with early application of glufosinate for Russian thistle control. Sequential applications of glufosinate generally provided similar weed control as single applications. Glufosinate at 0.44 lb/A generally did not improve weed control compared to glufosinate at 0.36 lb/A.

Treatment[1]	Herbicide Rate	Herbicide Timing	Weed control Fota[2]	Colq	Howe	KOCZ	Piwe[3]	Ruth	Wibw	Wimu
	lb/A		%							
Evaluation 1 (10 to 12 d after last POST herbicide application):										
Untreated			0	0	0	0	0	0	0	0
Trif/Gluf	0.75/0.36	PPI/POSTA	99	99	99	99	99	99	99	97
Gluf/Gluf	0.26/0.26	POSTA/B	99	79	75	99	99	98	76	99
Qufp-P+Gluf	0.04+0.36	POSTA	83	75	91	91	95	90	81	90
Gluf	0.44	POSTB	93	73	75	99	99	93	81	99
Qufp-P+Gluf	0.03+0.36	POSTB	98	96	88	98	99	91	94	99
Seth+Gluf	0.04+0.36	POSTB	66	50	73	96	99	62	63	99
Trif/Seth	0.75/0.36	PPI/POSTA	91	97	98	98	99	95	99	57
Seth+Clpy	0.10+0.19	POSTB	96	35	88	98	98	0	68	98
LSD (0.05)			*34*	*38*	*37*	*8*	*3*	*14*	*36*	*10*
Evaluation 2 (26 to 28 d after last POST herbicide application):										
Untreated			0	0	0	0	0	0	0	0
Trif/Gluf	0.75/0.36	PPI/POSTA	99	99	99	99	99	99	99	99
Gluf/Gluf	0.26/0.26	POSTA/B	99	79	75	99	99	98	76	99
Qufp-P+Gluf	0.04+0.36	POSTA	86	95	77	98	99	94	77	96
Gluf	0.44	POSTB	88	76	76	99	96	96	66	99
Qufp-P+Gluf	0.03+0.36	POSTB	96	91	86	86	98	94	88	99
Seth+Gluf	0.04+0.36	POSTB	89	40	60	79	99	79	62	99
Trif/Seth	0.75/0.36	PPI/POSTA	98	96	99	99	99	96	99	55
Seth+Clpy	0.10+0.19	POSTB	88	48	86	88	96	61	57	99
LSD (0.05)			*18*	*31*	*34*	*26*	*4*	*23*	*31*	*29*
Evaluation 3 (canola at physiological maturity):										
Untreated			0	0	0	0	0	0	0	
Trif/Gluf	0.75/0.36	PPI/POSTA	98	95	99	99	99	99	89	
Gluf/Gluf	0.26/0.26	POSTA/B	85	83	72	89	95	92	68	
Qufp-P+Gluf	0.04+0.36	POSTA	70	80	76	88	95	99	72	
Gluf	0.44	POSTB	84	73	77	88	93	78	66	
Qufp-P+Gluf	0.03+0.36	POSTB	84	94	92	99	94	84	80	
Seth+Gluf	0.04+0.36	POSTB	79	66	55	77	97	67	58	
Trif/Seth	0.75/0.36	PPI/POSTA	99	87	99	99	97	88	84	
Seth+Clpy	0.10+0.19	POSTB	81	65	98	72	92	71	78	
LSD (0.05)			*13*	*13*	*32*	*18*	*8*	*11*	*13*	

[1]Glufosinate treatments include AMS at 3 lb/A; Sethoxydim treatments include MSO (Scoil) at 2.5% v/v.

[2]Fota=yellow and green foxtail.

[3]Piwe=Redroot and prostrate pigweed.

Liberty for Weed Control in Canola. (Terry D. Gregoire, 2000) Devils Lake

Treatments were applied to Canola with a CO_2 pressured back pack sprayer using 8001 nozzles at 40 psi delivering 8.5 gpa. Conditions at various spray dates are included in Table 1. Canola seedling establishment was initially very poor due to a dry seedbed. Subsequent rains allowed germination and a satisfactory stand was established but crop growth stage was variable. Wild oat growth was more advanced than canola. Wild Oat density was greater than 10 plants per square foot and wild mustard was less than 2 plants per foot. The broadleaf weeds were low in numbers and scattered throughout the plots. The NIS used was Induce.

Table 1

	Spray Date	Canola Leaf Stage	Wild Oat Leaf Stage	Wild Mustard	Temperature	Sunlight	Time	Relative Humidity
EPO	June 7	1-4	3	2-4	69° F	Sunny	9:30pa.m	86%
MPO	June 14	2-5	4 ½	4-5	58° F	P.C.	10:15 p.m.	85%
LPO	June 18	3-6	5 ½	5-6	55° F	Sunny.	9 a.m.	78%

				June28 % control		July 27 % control
Trt No.	Treatment Name	Rate Rate Unit	Growth Stage	Wild Oat	Broadleaf	Wild Oat
1	untreated			0.0	0.0	0.0
2	Liberty	1.25 pt/a	EPO	90.0	100.0	89.8
2	Ams	3.0 lb/a				
2	Liberty	1.25 pt/a	LPO			
2	Ams	3 lb/A				
3	Assure II	.4 pt/a	EPO	97.8	100.0	80.0
3	nis	.25% v/v				
3	Liberty	1.7 pt/a	LPO			
3	Ams	3 lb/A				
4	Liberty	2.1 pt/a	MPO	70.0	100.0	87.0
4	Ams	3 lb/a				
5	Assure II	.3 pt/a	MPO	87.0	100.0	94.8
5	Liberty	1.7 pt/a	MPO			
5	Ams	3 lb/a				
6	Liberty	1.7pt/a	LPO	91.5	100.0	94.5
6	Poast	.4 pt/a	LPO			
6	Ams	3 lb/a				
7	Poast	1 pt/a	LPO	85.0	100.0	97.0
7	Stinger	.5 pt/a	LPO			
7	Dash	2.4% v/v				
LSD (P=.05)				13.01	0.00	8.15
Standard Deviation				8.76	0.00	5.48
CV				11.76	0.0	7.07

Summary

Crop injury was evident in treatment three. Injury symptoms indicated a contaminant caused the injury and not the intended treatments. No injury was noted in other treatments. Crop competition was reduced in treatment three and I believe affected wild oat control as control decreased from first evaluation to the second evaluation. Rainfall in June allowed additional wild oat germination and subsequent growth that the late post treatment did not control. Liberty at 2.1 pt had significantly less wild oat control than any other treatment at the first evaluation. Broadleaf weed control was excellent with all treatments. The second evaluation data one month later indicated reduced wild oat control in treatment three due to reasons explained previously.

Herbicide-tolerant and Conventional Canola Production Systems Comparison. Johnson, B., R. Zollinger, B. Hanson, E. Eriksmoen, N. Riveland, R. Henson, and B. Jenks

Evaluation of conventional and herbicide-tolerant (HT) canola performance was performed in a systems comparison study conducted at Carrington, Prosper, Langdon, Hettinger, Minot, and Williston, ND during the 2000 growing season. The study was abandoned at Minot and Prosper due to stand establishment problems and flooding, respectively. Cultivar type and corresponding herbicide compliment (Table 1) identified 16 canola production systems. Open-pollinated (OP) and hybrid cultivars were selected from commercial conventional and HT varieties. Herbicide compliment for conventional cultivars was PPI trifluralin alone and with post application of quizalofop and ethametsulfuron. Herbicide-tolerant cultivars were Roundup, Liberty, or Clearfield types. Replicated studies were solid seeded at 5 lb/A live seed in mid-May. Data collected included seed yield, seed weight, seed oil concentration, flowering date, weed species and intensity, plant lodging, and plant height. This report will focus on seed yield and crop value, and production costs associated with seed for planting and herbicides for weed control.

System costs reflect a nearly four-fold range from lowest, System 1, to highest System14 (Table 1). Contributing to system cost were seed and herbicide components. Hybrid seed cost was approximately twice that of OP cultivars. Conventional System 2 and 4 herbicide cost was similar to the Liberty and two application Roundup systems. Cost for single Roundup and Clearfield systems were similar. Herbicide costs were lowest for Systems 1 and 3 where PPI trifluralin alone provided chemical weed control.

System yield differences emphasize the cultivar component more than the herbicide factor since weed competition was moderate and weed control was good. System yield comparisons at Carrington indicate similar performance for conventional (Systems 1, 2, 3, and 4), Roundup (Systems 5, 6, 7, 8, 9, 10, 11, and 12), and Liberty hybrid System 14 (Table 2). Liberty OP System 13 and OP Clearfield Systems 15 and 16 generally produced lower yield than the other systems. Net returns (NR) for these systems were the lowest at Carrington. Conventional Systems 1 and 3 produced higher NR than Roundup Systems 9 and 10 and comparable NR to Roundup Systems 6, 11, and 12. The highest NR's were noted for the OP Roundup Systems 5, 7, and 8.

Systems in the high group for yield, at Hettinger, were conventional hybrid Systems 3 and 4, OP Roundup System 8 and hybrid Systems 11 and 12, Liberty hybrid System14, and Clearfield OP System16 (Table 2). The OP conventional and HT systems were generally in the low yield group with the exception of System 9 which was in both high and low yield groups. Net return was the highest for conventional hybrid System 3. High NR's were also observed for conventional hybrid System 4, Roundup hybrid Systems 11 and 12, and OP Clearfield System 14. Net returns among the other systems varied from $137 to $160/A.

Better canola adaptation to growing conditions at Langdon resulted in the highest yield and NR's at this site. Seven of the 16 systems produced in the high yield group at Langdon with six of these systems also producing in the high NR group (Table 2). High NR's were noted for conventional (System 3), Roundup (Systems 7, 8, and 11), and Clearfield System 16. The highest NR was exhibited by the hybrid Liberty System 14. The lowest NR was for the lower yielding OP conventional System 2 with PPI trifluralin and post emergence herbicides. The additional cost of the post herbicides substantially reduced NR compared to System 1 where post herbicides were not applied.

Five systems at Williston were in the high yield group and produced NR's near or greater than $100/A (Table 2). Conventional hybrid System 4 and OP Roundup Systems 7 and 8 produced NR's of $98, $97, and $97/A, respectively. Better weed control is indicated by greater yield from System 4 than System 3. These are both conventional PPI trifluralin systems with System 4 also having post herbicide application. Higher yield for System 4 compensated for greater herbicide costs and increased NR considerably compared to System 3. Hybrid Roundup Systems 11 and 12 produced NR's of $114 and $108/A, respectively.

Of the 16 systems evaluated eight were associated with HT Roundup cultivars, four with conventional cultivars, two with Liberty cultivars, and two with Clearfield cultivars. System NR's averaged across all sites indicated three of the four highest system NR's for Roundup systems and the fourth high net return for the conventional hybrid System 3 with PPI trifluralin and no post herbicides. Averaged across three sites Clearfield OP System 16 and hybrid Liberty System 14 produced high NR. Both cultivar site adaptation and weed species should be considered with seed and herbicide costs when selecting the best canola production system for an area.

Table 1. Seed and herbicide costs associated with conventional and herbicide-tolerant canola production systems.

System	Cultivar †	Type ‡	Seed Cost/A §	Herbicide	Rate (ai/A)	Adjuvant	Herbicide Cost/A ¶	Total Cost/A
1	Hudson	OP	$ 8.00	Trifluralin	1.0 lb		$ 6.50	$14.50
2	Hudson	OP	$ 8.00	Trifluralin Quizalofop Ethametsulfuron	1.0 lb 1.0 oz. 0.23 oz	NIS 0.25% v/v	$24.00	$32.00
3	Hyola 401	HYB	$17.00	Trifluralin	1.0 lb		$ 6.50	$23.50
4	Hyola 401	HYB	$17.00	Trifluralin Quizalofop Ethametsulfuron	1.0 lb 1.0 oz. 0.23 oz	NIS 0.25% v/v	$24.00	$41.00
5	LG3295	OP	$10.50	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$16.00	$26.50
6	LG3295	OP	$10.50	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$21.50	$32.00
7	Minot	OP	$11.50	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$16.00	$27.00
8	Minot	OP	$11.50	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$21.50	$33.00
9	SW Rider	SYN	$15.00	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$16.00	$31.00
10	SW Rider	SYN	$15.00	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$21.50	$36.50
11	Hyola 357	HYB	$20.00	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$16.00	$36.00
12	Hyola 357	HYB	$20.00	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$21.50	$41.50
13	Phoenix	OB	$ 8.00	Glufosinate	0.44 lb	AMS 3 lb / A	$27.50	$35.50
14	Invigor 2373	HYB	$20.50	Glufosinate	0.44 lb	AMS 3 lb / A	$27.50	$48.00
15	45A71	OP	$11.00	Imazamox	0.5 oz	UAN 3pt / A	$15.50	$26.50
16	45A76	OP	$12.50	Imazamox	0.5 oz	UAN 3pt / A	$15.50	$28.00

† Hudson and Hyola 401 are conventional canola cultivars.
LG3295, Minot, SW Rider, and Hyola 357 are Roundup-resistant cultivars.
Phoenix and Invigor 2373 are Liberty-resistant cultivars.
45A71 and 46A76 are Clearfield-resistant cultivars.

‡ OP = Open-Pollinated; SYN = Synthetic; HYB = Hybrid

§ Seed cost is based on average retail prices for 2000 at a 5 lb/acre seeding rate. Seed was benlate treated.

¶ Herbicide cost is based on average retail prices for 2000. Roundup Ready systems include a $15/A technology fee that includes 1 pt of glyphosate/A.

Table 2. Convention and herbicide-tolerant canola production system comparisions for yield and net return from four North Dakota Research Extension Centers for the 2000 growing season.

System	Cultivar	Type	Herbicide	Carrington		Hettinger		Langdon		Williston		Mean	Mean
				Yield	NR †	Yield	NR	Yield	NR	Yield	NR	Yield	NR
				lb/A	$/A	lb/A	$/A	lb/A	$/A	lb/A	$/A	lb/A	$/A
1	Hudson	OP	Trifluralin	1140	97	1770	158	2610	240	910	75	1610	143
2	Hudson	OP	Trifluralin Quizalofop Ethametsulfuron	1090	74	1860	150	2570	219	1160	81	1670	131
3	Hyola 401	HYB	Trifluralin	1250	99	2270	198	3050	274	1060	80	1910	163
4	Hyola 401	HYB	Trifluralin Quizalofop Ethametsulfuron	1150	71	2260	180	2960	248	1420	98	1950	149
5	LG3295	OP	Glyphosate	1350	105	1730	142	‡				1540	124
6	LG3295	OP	Glyphosate Glyphosate	1350	100	1730	137					1540	118
7	Minot	OP	Glyphosate	1350	105	1720	141	3100	275	1270	97	1860	154
8	Minot	OP	Glyphosate Glyphosate	1420	106	1970	160	3170	277	1330	97	1970	160
9	SW Rider	SYN	Glyphosate	1160	82			2710	234	1130	79	1670	132
10	SW Rider	SYN	Glyphosate Glyphosate	1270	88			2980	254	1080	69	1780	137
11	Hyola 357	HYB	Glyphosate	1350	95	2210	179	3200	275	1540	114	2080	167
12	Hyola 357	HYB	Glyphosate Glyphosate	1410	96	2310	184	3160	267	1530	108	2100	164
13	Phoenix	OB	Glufosinate	800	43	1860	146	2800	238			1820	142
14	Invigor 2373	HYB	Glufosinate	1320	81	2080	155	3480	291			2290	175
15	45A71	OP	Imazamox			1820	151						
16	45A76	OP	Imazamox	840	54	2210	187	3100	274			2050	172
LSD (0.05)				360		390		470		280			
C.V.%				21		14		12		19			

† NR = net return = $/A = (Yield @ $9.75/cwt) – (Total Cost from Table 1)
‡ System was not evaluated.

Crambe tolerance to Spartan. Zollinger and Fitterer. An experiment was conducted at NW-22, near Fargo, ND to evaluate crambe tolerance to Spartan applied PRE. The soil at NW-22 is a silty clay with a pH of 7.3 and 4.8% organic matter. 'Belenzia' crambe was planted on May 17, 2000. PRE treatments were applied May 18, 2000 at 5:00 pm with 75 F air, 59 F soil at a depth of 2 to 4 inch, 24% relative humidity, 0% clouds, 7 to 10 mph SW wind, dry soil surface, and moist subsoil. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		Crambe injury	
Treatment	Rate	May 31	June 19
	Product/A	%	%
Spartan	3	0	3
Spartan	4	0	12
Spartan	5.33	0	27
Untreated		0	0
LSD (0.05)		NS	13

The suggested Spartan rate according to soil type and organic matter was 5.33 oz/A. Crambe had not emerged on May 26. Crambe stage on May 31 was cotyledon to 1st leaf stage. Crambe stage at June 19 was three to four inches tall and injury observed was stunting and stand loss. The study was terminated due to standing water from a rain event that delivered eight inches of rain on June 19.

Weed control in Crambe. Brian Jenks, Denise Markle, Gary Willoughby, and Kent McKay. (NCREC, Minot). 'Belann' crambe was seeded at 25 lb/A on May 18 into 6-inch rows. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Preplant incorporated (PPI) and preemergence (PRE) treatments were applied on May 18. The postemerence treatments were applied on June 22 and 23. PPI and PRE treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The crambe was swathed August 15 and harvested August 28.

Treatment[a]	Rate	Crambe			Rrpw	Yield	Tst Wt
		Jun 20	Jul 1	Sep 12	Jul 1		
		—% Injury—		pl/m of row	% Control	lb/A	lb/bu
Untreated		0	0	18	0	1238	25.9
PPI							
Treflan	2 pt	2	4	20	95	1427	26.1
Sonalan	3 pt	27	43	15	99	1506	25.5
Prowl	3.6 pt	17	38	20	98	1439	25.0
PRE/4-LEAF							
Spartan / Assure II	0.125 lb ai / 8 fl oz	12	20	15	38	1250	25.9
Spartan / Assure II	0.25 lb ai / 8 fl oz	18	28	13	52	1311	25.0
Spartan / Assure II	0.5 lb ai / 8 fl oz	79	83	11	97	1317	24.5
Handweeded check[b]		3	5	14		1545	25.6
4-LEAF/4-LEAF[c]							
Assure II / Tough	8 fl oz / 1.5 pt		8	15	67	1315	25.4
Assure II / Muster	8 fl oz / 0.3 oz		7	17	63	1606	25.2
4-LEAF							
Stinger + Assure II	5.33 fl oz + 8 fl oz		4	15	7	1346	25.0
Tough + Assure II	1.5 pt + 8 fl oz		11	14	72	1321	25.8
Muster + Assure II	0.3 oz + 8 fl oz		5	18	72	1351	25.3
Liberty	10 fl oz		22	17	50	1354	26.1
Liberty	20 fl oz		59	13	60	1274	24.9
LSD		6	14	NS	41	NS	NS
CV		18	37	25	9	14	3.2

[a] Assure II was applied with 0.25% NIS. Liberty was applied with 3 lb/A AMS.
[b] Treflan was applied at 1.5 pt PPI followed by Assure II at 8 fl oz POST to aid handweeding.
[c] First application was one day prior to second application.

We evaluated several non-registered herbicides compared to the standard treatments of Treflan, Sonalan, and Assure II. All treatments caused at least slight injury to crambe. Sonalan, Prowl, and Spartan caused moderate to severe crop injury. However, crambe yield with Treflan, Sonalan, and Prowl were similar to the handweeded check. The crambe recovered slightly from the Spartan injury, but yielded 200-300 lbs lower than the handweeded check. Tough, Muster, and Stinger caused slight crop injury. We saw little difference in crop injury when applying Tough or Muster in combination with Assure II or as separate applications.

Spartan and Valor in dry beans. Zollinger and Fitterer. An experiment was conducted near Hatton, ND to evaluate weed control from Spartan and Valor applied PPI and PRE. On May 30, 2000, PPI treatments were applied and incorporated with a rototiller to a 2 inch depth at I 1:00 am followed by seeding two rows of 'Remington' pinto and 'Navigator' navy beans in each plot. Immediately after seeding, PRE treatments were applied at 2:00 pm with 65 F air, 60 F soil at a depth of 2 to 4 inches, 43% relative humidity, 100% clouds, 3 to 5 mph NW wind, dry soil surface, and moist subsoil. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table 1. Spartan and Valor applied PPI.

Treatment	Rate	Pinto bean injury		Navy bean injury	
		June 27	July 21	June 27	June 21
	Product/A	%	%	%	%
Spartan	2.67oz	0	0	0	0
Spartan	3oz	0	0	0	0
Spartan	4oz	0	0	0	0
Spartan	4.5oz	0	0	0	0
Spartan	5.33oz	0	0	0	0
Spartan	9oz	0	0	27	0
Valor	1oz	0	0	0	0
Valor	1.5oz	0	0	0	0
Valor	2oz	0	0	0	0
Valor	3oz	0	0	0	0
Valor	4oz	2	0	0	5
LSD (0.05)		1	0	13	0

Table 2. Spartan and Valor applied PRE.

Treatment	Rate	Pinto bean injury		Navy bean injury	
		June 27	July 21	June 27	June 21
	Product/A	%	%	%	%
Spartan	2.67oz	0	0	0	0
Spartan	3oz	0	0	0	0
Spartan	4oz	0	0	8	0
Spartan	4.5oz	0	0	2	0
Spartan	5.33oz	5	3	23	8
Spartan	9oz	20	9	33	9
Valor	1oz	2	0	2	0
Valor	1.5oz	3	2	7	7
Valor	2oz	43	14	38	12
Valor	3oz	57	12	53	15
Valor	4oz	85	37	86	52
LSD (0.05)		14	8	11	9

Dry bean had not emerged on June 7 and were at the unifoliate stage on July 14. No injury symptoms were expressed at July 14. Spartan rate according to soil type and organic matter is 4.5 to 5.33 oz/A. Spartan at 9 oz/A is 2X the label use rate. No significant dry bean injury was observed from any PPI treatment except on June 27 from Spartan at 9 oz/A. However, dry bean had recovered at July 21. The navy dry bean variety exhibited more injury from PRE applied Spartan than the pinto dry bean variety at the June 27 evaluation but injury was similar at July 21. Dry bean injury was greater with Valor than Spartan and dry bean did not recover from high rates of Valor as compared to high rates of Spartan.

Raptor in dry beans. Zollinger and Fitterer. An experiment was conducted in Prosper, ND to evaluate dry bean tolerance to Raptor in a weed-free environment. On June 2, 2000 Sonalan was broadcast applied at 4 pints per acre and incorporated. Two rows of Remington pinto and Navigator navy beans were planted June 2, 2000. POST treatments were applied July 10, 2000 at 2:00 pm with 82 F air, 110 F soil surface, 60% relative humidity, 5% clouds, 3 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 4 to 5 trifoliate. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		Dry bean yield	
Treatment [a]	Rate	Navy	Pinto
	Product/A	lb/A	lb/A
Raptor+NIS	4fl oz	1938	1298
Raptor+Basagran+NIS+28%	4fl oz+0.25pt	1975	1394
Raptor+Basagran+NIS+28%	4fl oz+0.5pt	2360	1634
Raptor+Basagran+NIS+28%	4fl oz+0.75pt	2198	1216
Raptor+PO	4fl oz	1842	1495
Raptor+Basagran+PO+28%	4fl oz+0.25pt	1766	1469
Raptor+Basagran+PO+28%	4fl oz+0.5pt	1876	1437
Raptor+Scoil	4fl oz	1630	1551
Raptor+Basagran+Scoil+28%	4fl oz+0.25pt	1726	1623
Raptor+Basagran+Scoil+28%	4fl oz+0.5pt	1771	1586
Untreated		1939	1689
LSD (0.05)		273	219

[a]NIS = Activator 90 and was applied at 0.25% v/v; 28% = 28% liquid nitrogen fertilizer and was applied 1% v/v; PO = petroleum oil and was applied at 1% v/v; Scoil = methylated seed oil adjuvant and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

The study was conducted in a weed-free environment. No dry bean injury occurred. Basagran had a greater safening effect when Raptor was applied with NIS as compared to petroleum or Scoil oil adjuvants. Basagran at 0.25 or 0.5 pt/A provided increasing safety of Raptor + NIS but Basagran at 0.75 pt/A did not improve safening over 0.5 pt/A. Then greatest navy bean yields were from Raptor + Basagran + NIS treatments. However, no pattern occurred with Pinto beans.

Common ragweed control in dry beans. Zollinger and Fitterer. An experiment was conducted in Wahpeton, ND to evaluate primarily common ragweed control from herbicides applied PRE and POST. Navigator navy beans were planted on May 6, 2000. PRE treatments were applied May 6, 2000 at 10:00 am with 71 F air, 60 F soil at a depth of 2 to 4 inch, 40% relative humidity, 80% clouds, 5 to 8 mph SW wind, dry soil surface, and moist subsoil. POST treatments were applied June 8, 2000 at 10:00 am with 86 F air, 98 F soil surface, 45% relative humidity, 10% clouds, 5 to 7 mph E wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was V1 to V2. Weed species present were: 1 to 3 inch (1 to 5/ft^2) foxtail; 2 to 3 inch (1/yd^2) wild proso millet; 1 to 3 inch (1 to 5/ft^2) redroot pigweed; 1 to 5 inch (1 to 10/ft^2) common lambsquarters; 2 to 4 inch (1 to 5/ft^2) common ragweed; and 3 to 5 inch (1 to 3/yd^2) common cocklebur. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment

Treatment [a]	Rate	6/21	June 30					July 6				
		inj.	Fxtl	Wipm	Colq	Corw	Cocb	Fxtl	Wipm	Colq	Corw	Cocb
	Product/A	%	%	%	%	%	%	%	%	%	%	%
PPI/POST												
Prowl/Raptor+NIS	3.6pt/4fl oz	0	99	95	87	77	88	95	83	83	70	53
POST												
Raptor+NIS	4fl oz	0	85	73	65	72	88	80	37	57	50	63
Raptor+Basagran+NIS+28%	4fl oz+0.25pt	0	98	88	82	82	90	93	83	92	73	65
Raptor+Basagran+NIS+28%	4fl oz+0.5pt	0	96	85	75	83	90	83	63	82	87	93
Raptor+Quad 7	4fl oz	0	96	90	70	62	87	92	70	70	60	63
Raptor+NIS+Zinc	4fl oz+1qt	0	98	92	62	62	93	87	63	67	63	57
Raptor+Basagran+Zinc+NIS+28%	4fl oz+0.25pt +1qt	0	98	88	75	72	90	93	77	78	60	30
Raptor+Reflex+Scoil	4fl oz+0.5pt	0	98	93	68	93	96	93	67	68	85	53
Reflex+Scoil	1pt	10	0	0	0	92	88	10	10	10	90	43
Raptor+Reflex+NIS	4fl oz+0.25pt	10	99	73	47	45	77	93	40	37	40	53
Cobra	4fl oz	5	0	0	10	37	37	0	0	10	20	23
V10084	4fl oz	5	0	0	7	28	43	0	0	27	23	23
V10085	4fl oz	5	0	0	0	62	67	0	0	30	30	20
V10086	4fl oz	5	0	0	10	66	82	0	0	23	47	43
Untreated		0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		NS	6	8	11	10	12	11	11	11	13	16

[a]NIS = Activator 90 and was applied at 0.25% v/v; 28% = 28% liquid nitrogen fertilizer and was applied 1 qt/A; Quad 7 is a basic blend adjuvant and was applied at 1% v/v; Scoil = methylated seed oil adjuvant and was applied at 1% v/v. Refer to adjuvant glossary for adjuvant types.

At June 21, dry bean injury was chlorosis/yellowing with Raptor and Reflex treatments and leaf burn with treatments containing Cobra or V100XX herbicides. At July 6, only Raptor + Basagran (0.5 pt/A), or treatments containing Reflex gave greater than 85% common ragweed control.

Biennial wormwood control in dry beans (Site 1) Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot) and George Kegode (Fargo). Dry beans (Maverick) were planted June 2 into 30-inch rows at 60 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied preplant incorporated (PPI) on May 30, preemergence (PRE) on June 6, or postemergence on July 15 (POST 1) or July 21 (POST 2) . PRE and PPI treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The primary weeds of interest were biennial wormwood (Biww) and kochia (Kocz). This site was in sunflower in 1998 and fallow 1999. Soil conditions were dry and not ideal at planting time.

Treatment[a]	Rate	Dry beans		Biww		Kocz		Yield
		Jul 19	Aug 31	Jul 19	Aug 31	Jul 19	Aug 31	
		–% Injury–		———% Control———				lb/A
Untreated		0	0	0	0	0	0	945
PPI/POST								
Handweeded check[b]		0	0	100	92	100	96	1455
Broadstrike+Dual / Assure II	2 pt / 8 oz	0	0	30	18	10	5	830
Python / Assure II	1 oz / 8 oz	0	0	50	30	10	0	1039
PRE/POST								
Spartan / Assure II	0.125 lb ai / 8 oz	2	0	100	92	100	99	1631
Spartan / Assure II	0.25 lb ai / 8 oz	0	2	100	95	100	100	1374
Spartan / Assure II	0.5 lb ai / 8 oz	5	2	100	99	100	100	1643
Sencor / Assure II	0.33 lb / 8 oz	0	1	100	100	98	94	1671
Valor / Assure II	1.5 oz ai / 8 oz	57	62	100	100	100	100	761
POST/POST 2								
Basagran + COC / Basagran + Poast	1 pt + 1 % / 1 pt + 1 pt	0	0	67	90	71	86	1424
POST								
Basagran + Poast	2 pt + 1 pt	0	0	92	84	89	82	1413
Reflex + Raptor	1 pt + 2 oz	2	1	42	38	77	58	1202
Basagran + Raptor + 28% N	1 pt + 4 oz + 1 qt	1	0	76	56	71	63	1291
LSD		4	5	17	16	9	14	454
CV		50	62	13	14	8	13	21

[a] Poast and Assure II were applied with COC at 1%, and Raptor was applied with NIS at 0.25%.
[b] Treflan at 1.5 pt (PPI) and Assure II at 8 oz (POST) were applied to aid in handweeding.

We evaluated several registered and non-registered products for controlling biennial wormwood in dry beans. Spartan, Valor, Python, Broadstrike + Dual, Reflex, and Raptor are not registered (Section 3) for use in dry beans. The pH at this site is 5.4 with 3.3% organic matter. Valor was the only product that caused significant crop injury. Broadstrike + Dual and Python did not control either biennial wormwood or kochia. Python effectively controlled biennial wormwood in a separate study in Fargo (pH 7.5), but not in this study. Python is recommended for use in soils with pH ranging from 5.9 to 7.8. Python has greater activity as soil pH increases so the lack of control by Python in this study may have been due to low soil pH. Spartan, Sencor, and Valor effectively controlled both weeds. A split application of Basagran was slightly more effective than a single application. Tankmixes of Basagran + Raptor or Reflex + Raptor provided poor control of biennial wormwood and kochia.

Biennial wormwood control in dry beans (Site 2) Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot) and George Kegode (Fargo). Dry beans (Othello) were planted June 3 into 30-inch rows at 60 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied preplant incorporated (PPI) on May 30, preemergence (PRE) on June 6, or postemergence on July 15 (POST 1) or July 21 (POST 2) . PRE and PPI treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The primary weed of interest was biennial wormwood (Biww). Kochia (Kocz), redroot pigweed (Rrpw), and common lambsquarters (Colq) were also present. This site was in wheat in 1998 and fallow 1999. Soil conditions at planting were much better than at Site 1.

Treatment[a]	Rate	Dry beans		Biww		Kocz		Rrpw		Colq		Yield
		7-20	8-30	7-20	8-30	7-20	8-30	7-20	8-30	7-20	8-30	
		% Injury		% Control								lb/A
Untreated		0	0	0	0	0	0	0	0	0	0	754
PPI/POST												
Handweeded check[b]		2	0	100	99	100	98	99	100	100	100	2094
Broadstrike + Dual / Assure II	2 pt / 8 oz	0	0	37	33	10	7	93	96	83	78	1481
Python / Assure II	1 oz / 8 oz	0	0	42	37	15	0	69	82	55	47	1534
PRE/POST												
Spartan / Assure II	0.125 lb ai / 8 oz	0	1	92	90	93	89	87	93	97	95	2258
Spartan / Assure II	0.25 lb ai / 8 oz	2	1	99	100	97	97	97	93	100	100	2434
Spartan / Assure II	0.5 lb ai / 8 oz	8	6	100	100	100	100	99	100	100	100	2322
Sencor / Assure II	0.33 lb / 8 oz	4	3	100	98	92	92	84	84	98	93	1866
Valor / Assure II	1.5 oz ai / 8 oz	69	60	100	92	99	98	98	98	99	97	1170
POST/POST 2												
Basagran / Basagran + Poast	1 pt / 1 pt + 1 pt	0	0	77	91	92	88	60	70	68	70	1833
POST												
Basagran + Poast	2 pt + 1 pt	0	0	89	80	95	89	73	60	92	73	2041
Reflex + Raptor	1 pt + 2 oz	9	3	37	17	71	32	87	80	63	50	995
Basagran + Raptor + 28% N	1 pt + 4 oz + 1 qt	0	0	79	70	89	63	89	83	88	77	1854
LSD		6	9	11	15	10	10	15	15	17	18	592
CV		48	93	9	12	8	9	11	11	12	14	20

[a] Poast and Assure II were applied with COC at 1%, and Raptor was applied with NIS at 0.25%.
[b] Treflan at 1.5 pt (PPI) and Assure II at 8 oz (POST) were applied to aid in handweeding.

We evaluated several registered and non-registered products for controlling biennial wormwood in dry beans. Spartan, Valor, Python, Broadstrike + Dual, Reflex, and Raptor are not registered (Section 3) for use in dry beans. The pH at this site is 5.5 with 4.3% organic matter. Valor was the only product that caused significant crop injury. Broadstrike + Dual and Python did not control biennial wormwood. Spartan, Sencor, and Valor effectively controlled all weeds. A split application of Basagran was slightly more effective than a single application. Basagran + Raptor provided fair control of biennial wormwood and kochia. Reflex + Raptor provided very poor biennial wormwood control.

Weed control in Dry Bean. Brian Jenks, Denise Markle, Gary Willoughby, and Kent McKay. (NCREC, Minot). Dry beans (Maverick) were planted at Underwood on May 24 into 30-inch rows at 60 lb/A in a conventional tillage system. Individual plots were 10 x 22 ft arranged in a RCBD with four replicates. Prowl, Valor, and Spartan were applied preemergence (PRE) on May 25. Postemergence (POST) treatments were applied on June 22 to 1-2 trifoliate dry beans. PRE treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The primary weeds present were wild mustard (Wimu, 2-4 lf, 1-2 per sq ft) and green/yellow foxtail (Foxtail, 1-2", 30 per sq ft).

		Dry Bean Injury			Wimu		Foxtail			
Treatment	Rate	Jun 22	Jul 12	Jul 31	Jun 22	Jul 31	Jun 22	Jul 31	Yield	Tst wt.
		——— % ———			———% Control ———				lb/A	lb/bu
Untreated			0	0		0		0	414	57.3
PRE/POST										
Prowl / Raptor + NIS	3.6 pt / 4 oz + 0.25%	5	0	0	49	100	64	92	1477	57.8
Valor / Poast + COC	1.25 oz ai / 1 pt + 1%	33	12	0	81	88	83	98	1458	58.2
Spartan / Poast + COC	0.25 lb ai / 1 pt + 1%	15	29	20	78	82	81	97	1155	59.1
POST										
Raptor + NIS	4 oz + 0.25%		0	0		95		86	1318	58.1
Raptor + NIS + Zinc	4 oz + 0.25% + 1 qt		0	0		98		91	1404	58.0
Raptor + Basagran + NIS + 28%N	4 oz + 4 oz + 0.25% + 1 qt		0	0		94		92	1325	58.5
Raptor + Quad 7	4 oz + 1%		0	0		97		93	1573	59.1
Raptor + Basagran + NIS + 28%N	4 oz + 8 oz + 0.25% + 1 qt		0	0		94		92	1522	58.4
Raptor + Reflex + MSO	4 oz + 8 oz + 1%		0	0		100		84	1285	60.0
Reflex + Poast + MSO	16 oz + 1 pt + 1%		0	0		100		97	1519	59.0
Basagran + Poast + COC	2 pt + 1 pt + 1%		0	0		62		95	1159	58.0
LSD		10	5	3	26	14	7	5	389	0.9
CV		33	116	148	21	11	5	4	21	1

We evaluated dry bean tolerance and weed control with four experimental herbicides. We observed no injury with Raptor or Reflex. Raptor provided good to excellent control of wild mustard and foxtail spp. Valor caused moderate initial injury, but the dry beans appeared to recover over time. Spartan caused significant injury throughout the season. The soil pH at Underwood is 7.5. Spartan caused almost no injury in studies at Minot where the pH is 5.5. Wild mustard control with Basagran was poorer than expected.

Volunteer glyphosate-resistant spring wheat control in summer fallow. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant wheat was seeded May 10 in a field that was set aside for summmer fallow. Treatments 1 through 12 were applied to 1 to 1.5 leaf wheat, cotyledon to 1 leaf redroot pigweed, and cotyledon to 2 leaf common lambsquarters on May 25 with 65° F, 42% RH, 5% cloud cover, 0 to 2 mph wind, and dry topsoil with damp subsoil at 69° F. Treatments 13 through 24 were applied to 5 to 6 leaf wheat and 5 to 8 leaf redroot pigweed and common lambsquarters on June 15 with 63° F, 79% RH, 20 increasing to 80% cloud cover, 8 mph wind and wet topsoil and subsoil at 62° F. All treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Glyphosate was isopropylamine formulation. Control was visually estimated.

Treatment	Rate	6/12			6/28			7/19		
		Wht	Rrpw	Colq	Wht	Rrpw	Colq	Wht	Rrpw	Colq
	oz/A					%				
1. Glyphosate+AMS	9+24	0	91	94	0	90	94	0	92	93
2. Quizalofop+Scoil+AMS	0.5+1%+24	96	0	0	97	0	0	99	0	0
3. Quizalofop+Scoil+AMS	0.7+1%+24	93	0	0	97	0	0	98	0	0
4. Quizalofop+Scoil+AMS	1+1%+24	97	0	0	96	0	0	98	0	0
5. Glyt+quiz+Scoil+AMS	9+0.5+1%+24	94	89	93	95	83	92	95	89	96
6. Glyt+quiz+Scoil+AMS	9+0.7+1%+24	96	89	94	96	89	96	96	92	95
7. Glyt+quiz+Scoil+AMS	9+1+1%+24	94	89	93	93	90	97	95	93	97
8. MON-78195+Scoil+AMS	8.4+1%+24	96	90	93	93	89	96	96	95	95
9. MON-78195+Scoil+AMS	12.6+1%+24	92	89	91	93	85	94	94	88	95
10. MON-78195+Scoil+AMS	16.8+1%+24	95	91	95	95	88	94	96	92	95
11. Clethodim+Scoil+AMS	1.7+1%+24	98	0	0	99	0	0	99	0	0
12. Sethoxydim+Scoil+AMS	6+1%+24	99	0	0	99	0	0	99	0	0
13. Glyphosate+AMS	9+24	0	0	0	0	98	97	0	98	98
14. Quizalofop+Scoil+AMS	0.5+1%+24	0	0	0	94	0	0	98	0	0
15. Quizalofop+Scoil+AMS	0.7+1%+24	0	0	0	97	0	0	99	0	0
16. Quizalofop+Scoil+AMS	1+1%+24	0	0	0	98	0	0	99	0	0
17. Glyt+quiz+Scoil+AMS	9+0.5+1%+24	0	0	0	97	99	98	99	99	99
18. Glyt+quiz+Scoil+AMS	9+0.7+1%+24	0	0	0	96	99	98	99	99	99
19. Glyt+quiz+Scoil+AMS	9+1+1%+24	0	0	0	96	98	99	99	97	99
20. MON-78195+Scoil+AMS	8.4+1%+24	0	0	0	94	98	99	99	98	99
21. MON-78195+Scoil+AMS	12.6+1%+24	0	0	0	94	99	96	98	97	97
22. MON-78195+Scoil+AMS	16.8+1%+24	0	0	0	96	98	99	98	97	99
23. Clethodim+Scoil+AMS	1.7+1%+24	0	0	0	94	0	0	99	0	0
24. Sethoxydim+Scoil+AMS	1.7+1%+24	0	0	0	88	0	0	97	0	0
25. Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		4	10	10	3	9	5	2	6	4
LSD 5%		2	3	4	4	6	4	3	4	3
# OF REPS		4	4	4	4	4	4	4	4	4

All treatments except glyphosate alone provided 94 to 99% glyphosate-resistant wheat control. Growth stage at application had a minor effect on wheat control. Later application of glyphosate or MON-78195 provided slightly better control of all species because more plants had emerged and received treatment.

Burndown in fallow. Zollinger and Fitterer. An experiment was conducted at NW-22 to evaluate weed control from herbicides applied EPOST. EPOST treatments were applied May 18, 2000 at 6:00 pm with 61 F air, 58 F soil surface, 28% relative humidity, 80% clouds, 6 to 10 mph SW wind, dry soil surface, and moist subsoil. Weed species present were: 3 to 4 inch (20 to 30/ft^2) volunteer wheat; 1 to 2 inch (5 to 15/ft^2) foxtail; 3 to 4 inch (5 to 10/ft^2) field pennycress; 2 to 3 inch (3 to 5/ft^2) wild mustard; 1 to 3 inch (2 to 4/ft^2) wild buckwheat; and 1 to 3 inch (2 to 5/ft^2) dandelion. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		June 8			June 28				
		Wibw	Cath	Dali	Fxtl	Wibw	Rrpw	Colq	Vema
Treatment [a]	Rate								
	Product/A	%	%	%	%	%	%	%	%
Aim+2,4-D ester+RU Ultra+AMS	0.33oz+4fl oz+0.75pt	65	70	90	57	57	93	96	96
Aim+2,4-D ester+RU Ultra+AMS	0.33oz+8fl oz+0.75pt	83	77	99	73	73	96	89	99
Aim+Roundup Ultra+AMS	0.17oz+1.5pt	82	72	96	73	89	57	93	99
Aim+Roundup Ultra+AMS	0.33oz+0.75pt	80	82	93	68	93	60	93	83
Aim+Roundup Ultra+AMS	0.33oz+1.5pt	83	85	99	76	93	70	93	93
Aim+Spartan+RU Ultra+AMS	0.17oz+3oz+1.5pt	92	80	99	93	99	99	99	99
Aim+Spartan+RU Ultra+AMS	0.33oz+2oz+0.75pt	87	80	93	80	96	99	99	99
Aim+Gramoxone Extra+NIS	0.33oz+2pt	90	78	93	67	93	63	93	86
FallowMaster	33fl oz	72	70	93	62	83	73	93	89
Surpass&Mesotrione+Touchdown+AMS	4pt+2pt	93	87	99	90	99	99	99	99
Surpass&Mesotrione+Touchdown+AMS	4.5pt+2pt	82	80	99	78	96	99	99	99
Surpass&Mesotrione+Touchdown+AMS	5pt+2pt	92	77	99	83	99	99	99	99
Surpass&Mesotrione+Gram. Extra+NIS	4pt+2pt	87	70	88	82	99	99	99	96
Surpass&Mesotrione+Gram. Extra+NIS	4.5pt+2pt	88	73	99	88	99	99	99	99
Surpass&Mesotrione+Gram. Extra+NIS	5pt+2pt	95	83	89	88	99	99	99	99
Fieldmaster+AMS	8pt	93	85	93	99	99	99	99	99
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		9	14	11	10	12	14	12	11

[a]RU Ultra = Roundup Ultra, Gram. Extra = Gramoxone Extra. AMS = ammonium sulfate and was applied at 17 lb/100 gal of water; NIS = Activator 90 and was applied at 0.25% v/v. Refer to adjuvant glossary for adjuvant types.

At May 31, Field pennycress was completely controlled, and volunteer wheat, foxtail, and wild mustard ranged from 90 to 95% control; wild buckwheat and Canada thistle ranged from 75 to 87% control,; and dandelion ranged from 65 to 70% control. On May 31 and June 8, field pennycress, volunteer wheat, foxtail, and wild mustard were completely controlled. Most corn was lost due to flooding on June 19.

Weed control in flax, Fargo. (Howatt, Roach, and Davidson-Harrington) This experiment was conducted to evaluate weed control and flax response to several herbicides. 'Neche' flax was seeded May 15. Treatments were applied to 3 inch flax, 2 leaf green and yellow foxtail, and cotyledon to 4 leaf redroot pigweed and wild mustard on June 6 with 69° F, 49% relative humidity, 30% cloud cover, 12 mph wind, and dry topsoil with damp subsoil at 61° F. Treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were redroot pigweed and foxtail spp. at 20 plants/ft^2 and wild mustard at 10 plants/ft^2. Flax injury and weed control was visually estimated. Harvest was on September 21. Flaxseed was stored at 58° F. Oil content was determined by Nuclear Magnetic Resonance.

		6/28				9/21	
Treatment	Rate	Flax injury	Fota	Rrpw	Wimu	Flax Oil	Flax Yield
	(oz/A)		%			(%)	(bu/A)
MCPA+clethodim+MSO	4.0+1.5+0.18G	1	90	88	99	42	19
Bromoxynil&MCPA+clet+MSO	3&3+1.5+0.18G	0	95	84	99	41	22
Brox&MCPA+clet+MSO	4&4+1.5+0.18G	1	92	79	92	44	20
Brox&MCPA+sethoxydim+MSO	4&4+3.0+0.18G	0	89	85	99	45	20
Clopyralid&MCPA+clet+MSO	1.25&7+1.5+0.18G	3	92	94	99	42	20
Clopyralid&MCPA+seth+MSO	1.25&7+3+0.18G	4	94	90	99	42	18
Thifensulfuron+Activator 90	0.25+0.25%	21	21	96	99	37	8
Thif+MCPA+clet+MSO	0.25+4+1.5+0.18G	30	88	96	98	40	15
Thif+MCPA+seth+MSO	0.25+4+3+0.18G	29	86	95	98	39	16
Untreated	0	0	0	0	0	41	9
C.V. %		49	6	6	3	8	18
LSD 5%		6	7	7	3	NS	4
# OF REPS		4	4	4	4	4	4

Clethodim did not increase flax injury compared to sethoxydim. Flax showed substantial injury from thifensulfuron treatments. Injury manifested as stunted and chlorotic plants. Newer tissue tended to be more chlorotic than older tissue. Low yield obtained from thifensulfuron alone was greatly influenced by lack of foxtail spp. control. Thifensulfuron injury also resulted in lower yield. Thifensulfuron tank-mixes that controlled foxtail spp. generally yielded less than other combinations.

Flax response to sulfentrazone. (Howatt, Roach, and Davidson-Harrington) The objective of this study was to evaluate flax response to sulfentrazone. 'Neche' flax was seeded May 15. PPI treatments were applied on May 11 with 54° F, 83% relative humidity, 1 to 3 mph wind, 100% cloudcover, moist subsoil at 56° F, and dry topsoil. Immediately following application PPI treatments were incorporated to a depth of 1.5 inches with two cultivator passes. Light rain precluded PRE treatments. PRE treatments were applied May 15 with 61° F, 45% relative humidity, 0 to 1 mph wind, 0% cloudcover, moist subsoil at 50° F, and dry topsoil. All treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa at 35 psi through 8002 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. The plot area was treated with 1.5 oz/A clethodim plus 1 qt/A MSO for grass control.

		6/08	6/09	6/30	9/21
Treatment	Rate	Stand reduction	Flax injury	Flax injury	Flax yield
	(oz/A)		%		(bu/A)
Sulfentrazone (PRE)	2	7	3	0	12
Sulfentrazone (PRE)	3	4	0	0	17
Sulfentrazone (PRE)	4	12	5	0	14
Sulfentrazone (PRE)	6	9	11	1	17
Sulfentrazone (PRE)	8	23	24	13	18
Sulfentrazone (PPI)	2	11	0	0	10
Sulfentrazone (PPI)	3	5	5	0	11
Sulfentrazone (PPI)	4	2	8	1	12
Sulfentrazone (PPI)	6	6	4	0	25
Sulfentrazone (PPI)	8	9	13	5	24
Untreated	0	--	0	0	6
C.V. %		92	122	184	21
LSD 5%		NS	11	5	5
# OF REPS		4	4	4	4

The proposed sulfentrazone rate for this soil was 3 to 4 oz ai/A. PRE treatments tended to show more injury than PPI treatments. Stand establishment was lowest in plots treated with 8 oz (2 x field rate) sulfentrazone applied PRE. While minor stand loss was measured in 4 oz PRE and 2 oz PPI sulfentrazone treatments, 6 oz PRE and 6 or 8 oz PPI had similar plant populations to the untreated. Evaluation of Flax chlorosis on 6/09 indicated no difference between the untreated and any sulfentrazone treatment. Flax was visibly stunted from 2 x rates of sulfentrazone regardless of incorporation treatment, but stunting only persisted when 8 oz sulfentrazone was applied PRE. Biomass reduction was a visual estimation that incorporated stunting and stand loss. Only 8 oz sulfentrazone treatments were different from the untreated and 8 oz PRE was significantly more injurious than 8 oz PPI. Flax appeared to recover from minor, early season responses to sulfentrazone applied at rates form 2 to 6 oz ai/A. Yield differences are likely the result of broadleaf weed competition.

Weed control in Flax. Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot). Flax (Cathay) was seeded May 18 into 6-inch rows at 50 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied preemergence (PRE) on May 18 or postemergence on June 22 (POST). PRE treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The primary weeds were redroot pigweed (Rrpw) and wild buckwheat (Wibw). Flax was harvested on September 8.

Treatment	Rate	Flax injury		Rrpw	Wibw	Yield
		Jun 20	Jul 01	Jul 01	Jul 01	
		——%——		—% Control—		bu/A
PRE						
Spartan	0.125 lb ai	0	3	53	52	23
Spartan	0.25 lb ai	1	5	72	77	25
Spartan	0.5 lb ai	5	9	95	95	25
Valor	1.5 oz ai	45	62	88	69	19
Valor	3 oz ai	80	85	100	93	13
DPX-R6447	0.8 oz ai	6	10	57	32	18
DPX-R6447	1.6 oz ai	13	22	90	58	22
POST						
Harmony GT	0.33 oz		41	90	90	18
Harmony GT + Starane	0.33 oz + 0.5 oz ai		75	90	91	8
Bronate	1 pt		15	87	89	22
Curtail M	1.75 pt		18	50	70	23
Raptor	4 fl oz		24	87	60	19
Handweeded check			5			19
Untreated		0	0	0	0	0
LSD		7	10	15	10	5
CV		20	23	12	9	15

[a] Harmony GT and Raptor treatments were applied with NIS at 0.25%. The entire experiment was treated with Poast plus COC at 1 pt plus 1%.

We evaluated several non-registered herbicides for weed control and injury to flax compared to the standard treatments. Spartan, Valor, DPX-R6447, Harmony GT, Starane, Raptor, and Curtail M are not registered (Section 3) for use in flax. All treatments caused some visible flax injury (discoloration, stunting, or stand reduction). Spartan caused only slight injury and had the highest yields. The low rate of Spartan (0.125 lb ai) is notably weaker on wild buckwheat compared to higher rates. The sunflower label would recommend 0.188 to 0.25 lb ai for our soil type. DPX-R6447 caused slight to moderate injury and Valor caused severe injury. The Harmony GT rate used here is too high and will cause unacceptable injury. Starane caused too much injury at even low rates. The untreated plots were not harvestable to due excessive weeds.

Flax Tolerance to Preemergence Herbicides, Carrington, 2000. (Hendrickson)

The study was conducted on a Heimdal silt loam soil with a 7.5 pH and 2.7% organic matter. Flax (Cathy) was seeded on May 7th at 41 lbs/A. PRE herbicides were applied immediately after planting with 56° F air, 48° F soil, 60% relative humidity, 5% clouds, and no wind. The soil surface was dry to a depth of 0.75 inches. Treatments were applied to 8-by 25-ft plots with a hand-boom calibrated to deliver 20 gpa at 20 psi through XR8003 flat fan nozzles. The trial was harvest with a plot combine on August 24, 2000. The experimental design was a randomized complete block with three replicates.

Weeds evaluated were common lambsquarters, redroot pigweed, and prostrate pigweed. Both sulfentrazone and flumioxazin provided excellent control of common lambsquarters, redroot pigweed, and prostrate pigweed. DPX-R6447 applied at 0.125 lb ia/A provided excellent common lambsquarters and redroot pigweed control, but was weak on prostrate pigweed (Table).

All treatments, except the high rate of sulfentrazone and flumioxazin, had yields greater than the untreated check. Both the high rate of sulfentrazone and flumioxazin caused significant crop injury and reduction in plant stand counts (Table).

Weed control in flax.

		Weed control					Flax				
		5/30/00		6/20/00			5/30/00	5/30/00	6/20/00	7/17/00	8/24/00
Treatment	Rate	Colq	Rrpw	Colq	Rrpw	Prpw[3]	stand counts		injury		yield
	Lb ia/A	----------		%	----------		# / 3 m of row	----------	%	----------	bu/A
sulfentrazone	0.125	98	95	94	96	83	267	17	7	0	24
sulfentrazone	0.25	100	98	99	100	95	239	33	20	0	24
sulfentrazone	0.5	100	100	100	100	100	180	70	60	33	21
flumioxazin	0.0938	95	96	92	98	93	236	30	13	0	24
flumioxazin	0.1875	98	100	98	100	100	181	53	50	33	20
DPX-R6447	0.0625	88	88	75	80	53	266	13	5	0	23
DPX-R6447	0.125	96	97	90	88	67	229	27	10	13	24
check	0	0	0	0	0	0	276	0	0	0	18
LSD (0.05)		7	5	6	4	12	57	10	12	5	3

Common Cocklebur Control in Flax (Terry D. Gregoire, 2000) Flax was sprayed June 21st near Devils Lake, North Dakota. The temperature during application was 75°, relative humidity near 55% with full sunshine. The flax was in bud stage with a few blossoms visible and common cocklebur was 2-4 lf. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in RCBD and replicated 4 times. Treatment evaluation dates were June 30th and August 23rd 2000.

Trt No.	Treatment Name	Rate Rate Unit	Growth Stage	June 30 Reduced Flax Growth %	August 23 Flax Stems Green %	August 23 Common Cocklebur Plants %	Yields gms/treatment
1	Untreated			0	0	0	188
2	Curtail M	21 oz/A	8"-10"	6	0	100	175
3	Curtail M	28 oz/A	8"-10"	4	0	100	171
4	Curtail M	32 oz/A	8"-10"	4	0.5	100	171
5	Dicamba	2 oz/ A	8"-10"	2	1.3	89	152
6	Mcpa Ester	12 oz/A	8"-10"	2	0	79	187
LDS (P=.05)				3.66	1.48	20.65	18.4
Standard Deviation				2.43	0.98	13.70	12.2

Summary

Flax tolerated all treatments with some injury. All treatments delayed flowering a few days and Curtail shortened the plants slightly. Common cocklebur control was excellent with Curtail M. Cocklebur plants remaining at harvest time in the Dicamba and MCPA treatments were 2-4 leaf indicating these plants germinated after treatment application. No treatments were different from one another for injury or percent cocklebur control. Dicamba treatment significantly lowered yields compared to other treatments. Curtail M tended to lower yields compared to the check and MCPA treatments.

Weed control in Chickpea. Brian Jenks, Denise Markle, Gary Willoughby, and Kent McKay. (NCREC, Minot). Chickpeas (Sanford) were planted April 28 into 6-inch rows at 150 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied preplant incorporated (PPI) on April 26, preemergence (PRE) on May 3, or postemergence (POST) on June 5. PRE and PPI treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. Tough was applied postemergence when chickpeas were about 5-6" tall. The primary weeds present were wild buckwheat (Wibw), kochia (Kocz), redroot pigweed (Rrpw), and yellow foxtail (Yeft).

Treatment[a]	Rate	Crop density	Crop Injury		Wibw		Kocz		Rrpw	Yeft
			May 25	Jul 15	Jul 15	Aug 21	Jul 15	Aug 21	Jul 15	Aug 21
		pl/m	——%——		——% Control——					
Untreated		5.1	0	0	0	0	0	0	0	0
PPI										
Sonalan	2 pt	3.7	3	0	67	57	79	74	100	75
Treflan	2 pt	----	5	0	60	68	70	57	98	79
Prowl	3.6 pt	----	1	0	73	80	75	65	94	85
Spartan [a]	0.125 lb ai	5.3	4	0	42	45	77	80	73	58
Spartan [a]	0.25 lb ai	4.8	3	0	83	78	93	95	85	80
Spartan [a]	0.5 lb ai	4.0	7	2	91	92	99	99	97	85
PRE										
Balance	1 oz	4.9	0	0	0	0	98	95	100	80
Balance	1.5 oz	5.5	0	0	0	0	100	99	100	84
Balance	3 oz	5.0	0	0	0	0	100	99	100	89
Spartan [a]	0.125 lb ai	3.8	0	0	48	53	84	73	83	58
Spartan [a]	0.25 lb ai	4.5	2	0	81	86	100	99	93	72
Spartan [a]	0.5 lb ai	4.4	5	3	95	92	100	100	99	88
Valor [a]	1 oz ai	3.4	12	0	28	23	97	95	98	47
Valor [a]	1.5 oz ai	3.5	18	3	48	43	92	86	97	72
Valor [a]	3 oz ai	3.9	47	3	73	62	98	94	100	70
PPI/POST										
Handweeded check[b]		3.7	3	0	95	89	100	100	100	94
Treflan / Tough + Assure II + NIS	1.5 pt / 1.5 pt + 7 fl oz + 0.25 %	----	3	0	75	77	100	96	100	95
LSD		NS	4	2	12	15	15	20	11	12
CV		21	39	196	13	17	11	14	7	10

[a] All Spartan and Valor treatments were followed by a POST application of Assure II at 7 fl oz/A.
[b] To aid handweeding, Treflan (PPI) / Tough + NIS (POST) were applied at 1.5 pt / 1.5 pt + 0.25%.

We evaluated chickpea tolerance to several new herbicides as well as weed control with these new products compared to existing products. Balance, Spartan, and Valor are not labeled for use in chickpea. Spartan at 0.25 lb ai or higher provided good to excellent control of kochia, wild buckwheat, and redroot pigweed. Spartan at 0.125 lb ai did not provide adequate weed control. Balance was effective on kochia and pigweed, but had no effect on wild buckwheat. Valor provided good to excellent kochia and pigweed control, but poor wild buckwheat control. Treflan/Tough provided excellent control of kochia and pigweed, but only fair control of wild buckwheat. Tough alone is weak on wild buckwheat. Chickpea yields are not presented due to the confounding nature of the wild buckwheat pressure and ascochyta that caused severe damage to the study. Treatments that did not effectively control wild buckwheat suffered severe or total yield loss as a result of the high wild buckwheat pressure. A fungicide treatment to control ascochyta was applied too late to prevent severe yield loss.

Kochia control in Chickpea. Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot) and George Kegode (Fargo). Chickpeas (Sanford) were planted April 28 into 6-inch rows at 150 lb/A in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Sonalan was preplant incorporated (PPI) on April 26. Spartan and Balance were applied preemergence (PRE) on May 3. Tough was applied postemergence on May 26 (EPOST), May 31 (MPOST), or June 7 (LPOST). PRE and PPI treatments were applied with a CO_2 pressurized bicycle sprayer with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. All POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. The primary weed of interest in this study was kochia (Kocz). Kochia plants were approximately 0.25, 1, and 1-3 inches, respectively, at time of application. Kochia density was light with 1-2 plants per square foot. Wild buckwheat (Wibw), redroot pigweed (Rrpw), and yellow foxtail (Yeft) were also present.

Treatment[a]	Rate	Timing	Kochia size	Jun 21			Aug 01		
				Kocz	Wibw	Yeft	Kocz	Wibw	Yeft
			inches	% control					
Sonalan	2 pt	PPI	---	83	85	89	72	79	83
Spartan / Assure II	5.33 oz / 8 oz	PRE/MPOST	---	99	99	84	100	92	60
Balance	1.25 oz	PRE	---	82	28	73	69	10	58
Sonalan / Tough	2 pt / 1.5 pt	PPI/MPOST	0.5-1	99	94	97	93	85	93
Tough + Assure II	1.5 pt + 8 oz	E POST	0.25	86	63	73	66	57	58
Tough + Assure II	1.5 pt + 8 oz	M POST	1	99	70	83	97	59	63
Tough + Assure II	1.5 pt + 8 oz	L POST	1-3	96	50	90	83	25	88
Tough / Tough + Assure II	0.75 pt / 0.75 pt + 8 oz	E POST / L POST	0.25	100	53	89	98	29	92
Handweeded									
Untreated				0	0	0	0	0	0
LSD				3	8	9	12	23	21
CV				2	7	7	9	28	18

[a] Tough and/or Assure II treatments applied with NIS at 0.25%.
[b] Treflan (PPI) at 1.5 pt and Assure II (POST) at 8 fl oz were applied to aid in handweeding.

Spartan, Sonalan/Tough, Tough applied to 1-inch kochia, and Tough/Tough provided excellent kochia control. Sonalan and Balance provided only fair kochia control. The first Tough treatment (applied to 0.25-inch kochia) controlled emerged kochia, but did not control a later flush resulting in a lower late-season rating. The last Tough treatment (applied to 1 to 3-inch kochia) was less effective on the larger kochia. Tough applied to 1-inch kochia or a split application was more effective than early or late applications alone. Pigweed control was good to excellent with all treatments.

Chickpea yields were not meaningful due to a heavy infestation of wild buckwheat that impacted yields in the Tough and Balance-treated plots. Tough provides poor control of wild buckwheat. The chickpeas were also infected with ascochyta resulting in severe yield loss.

Lentil and chickpea response to Spartan and Balance, Carrington, 2000. (Endres and Schneider) The experiment was conducted on a Heimdahl-Emrick loam soil with 6.2 pH and 3.3% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with four replicates. Herbicide treatments were applied to the center 6.67 ft of 10 by 25 ft plots with a hand-boom plot sprayer at 17.2 gal/A at 35 psi through 8002 flat fan nozzles. PPI treatments were applied on May 9 with 62 F, 33% RH, clear sky, and 8 mph wind on a dry soil surface and incorporated with a roto-tiller at a 3-inch depth. Inoculated 'CDC Richlea' lentil was planted at 500,000 PLS/A and inoculated 'Sanford' chickpea was planted at 130,700 PLS/A on May 10 in 7-inch rows at a 1.5- to 2-inch depth. PRE treatments were applied on May 10 with 67 F, 47% RH, 50-75% cloudy sky, and 7 mph wind on a dry soil surface. A total of 0.46 inches of rain occurred during the 15-d period following the application of PRE treatments.

		Weed control							Lentil			Chickpea	
Herbicide		Lentil			Chickpea				Stand	Injury		Stand	Injury
Treatment	lb ai/A	colq	pw spp[1]	wimu	colq	pw spp[1]	wibw	wimu	31-May	2-Jun	16-Jun	15-Jun	19-Ju
		%							plt/ft^2	%		plt/ft^2	%
PPI													
Snen	0.13	91	82	38	98	87	65	68	15	2	1	1.2	0
Snen	0.25	97	97	55	99	96	90	60	12	34	29	1.0	15
Snen	0.50	99	99	94	99	99	99	94	9	76	68	1.3	11
PRE													
Snen	0.13	53	44	51	48	62	20	20	14	0	0	1.2	0
Snen	0.25	74	76	46	89	71	77	53	14	0	0	1.4	0
Snen	0.50	80	87	56	96	84	88	53	13	5	4	1.2	0
Isox	0.05				95	78	0	95				1.1	0
Isox	0.07				98	92	0	91				1.0	0
Isox	0.14				99	98	13	99				1.2	0
untreated		0	0	0	0	0	0	0	14	0	0	1.4	0
LSD (0.05)		14	23	31	9	7	26	27	2	4	6	NS	NS

[1]pw spp = redroot and prostrate pigweed.

Common lambsquarters and pigweed control with PPI sulfentrazone was generally superior to PRE sulfentrazone. PPI sulfentrazone at 0.50 lb/A was required for > 90% control of wild mustard. PPI sulfentrazone at 0.25 provided 90% control of wild buckwheat. Isoxaflutole at 0.05 lb/A provided excellent control of common lambsquarters and wild mustard, and 0.07 lb/A provided excellent control of pigweed. Lentil tolerance was acceptable with PPI sulfentrazone at 0.13 lb/A and all PRE treatments. Chickpea tolerance to sulfentrazone and isoxaflutole was difficult to evaluate due to an established stand having a low and variable density.

Weed control in Lentil. Brian Jenks, Denise Markle, and Gary Willoughby, and Kent McKay (NCREC, Minot). 'CDC Richlea' lentils were seeded April 28 at 60 lb/A into 6 inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Preplant incorporated (PPI) treatments were applied April 26, preemergence (PRE) treatments were applied May 3. Postemergence treatments were applied June 2 (POST) and June 5 (POST 2). All treatments were applied with a CO_2 pressurized bicycle sprayer. PPI and PRE treatments were applied with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. Postemergence treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi.

		Lentil			Control					
		Density	Injury		Wibw		Rrpw	Yeft	Kocz	
Treatment	Rate	6-26	5-25	7-15	7-15	8-21	7-15	8-21	7-15	8-21
		pl/m					%—			
Untreated		10.7	0	0	0	0	0	0	0	0
PPI										
Sonalan	2 pt	10.8	8	2	86	87	96	91	91	91
Treflan	2 pt		13	0	75	71	95	81	83	84
Treflan + Sencor	1.5 pt + 0.25 lb ai		14	4	70	58	90	80	77	76
PRE										
Pursuit	2 fl oz		10	2	90	89	100	88	40	28
Spartan / Prowl	0.125 lb ai / 2.4 pt	6.1	70	5	55	55	93	20	90	87
PPI/POST										
Spartan / Assure II	0.125 lb ai / 7 fl oz	8.7	17	3	67	68	75	57	82	87
Spartan / Assure II	0.25 lb ai / 7 fl oz	8.2	52	9	84	77	92	75	89	91
Spartan / Assure II	0.5 lb ai / 7 fl oz	5.4	66	44	93	92	97	80	98	96
Handweeded check[a]		8.9	11	3	90	92	97	94	96	98
PPI/POST 2										
Treflan / Thistrol	1.5 pt / 0.5 pt		11	0	67	62	88	78	70	63
PRE/POST										
Spartan / Assure II	0.125 lb ai / 7 fl oz	7.3	30	3	58	50	75	27	90	95
Spartan / Assure II	0.25 lb ai / 7 fl oz	5.5	58	12	86	81	97	58	96	95
Spartan / Assure II	0.5 lb ai / 7 fl oz	4.8	66	54	92	87	97	76	100	98
Valor / Assure II	1 oz ai / 7 fl oz	7.1	53	4	47	27	78	30	72	78
Valor / Assure II	1.5 oz ai / 7 fl oz	6.8	62	12	45	37	74	25	77	83
Valor / Assure II	3 oz ai / 7 fl oz	3.1	75	27	50	37	91	27	92	91
POST 2										
Thistrol (MCPB)	1 pt		0	0	22	7	60	37	38	37
LSD		2	7	12	10	15	13	22	16	20
CV		18	13	71	9	15	9	23	13	16

[a]Treflan was applied at 1.5 pt (PPI) followed by Assure II at 7 fl oz (POST).

We evaluated lentil tolerance to different rates of Spartan and Valor applied either preplant incorporated or preemergence. All rates of Spartan and Valor caused moderate to severe crop injury early in the season. Crop stunting and stand reduction were observed in almost all Spartan and Valor treatments compared to the untreated check. The lentils recovered somewhat by mid-July, especially in lower rates of Spartan and Valor. A high density of yellow foxtail also impeded lentil growth. An adjuvant was not applied with Assure II resulting in lower foxtail control. Spartan at 0.125 lb ai generally provided less weed control compared to the higher rates. Valor controlled kochia and pigweed at the high rate only. It did not control wild buckwheat or yellow foxtail at any rate.

Field pea response to sulfentrazone (Exp. 1). (Howatt, Roach, and Davidson-Harrington) 'Alfetta' pea was seeded May 3. Preplant incorporated (PPI) treatments were applied prior to planting on May 3 with 75° F, 40% RH, 0% cloud cover, 4 to 5 mph wind, and dry topsoil with damp subsoil at 51°F. Immediately following application, PPI treatments were incorporated with two cultivator passes. Preemergence (PRE) treatments were applied after planting on May 3. Environmental conditions were the same. All treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 17 gpa at 35 psi through 8002 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Clorosis and stunting were visually evaluated and plant density and yield were measured.

		6/09		6/30	
Treatment	Rate	Chlorosis	Stunt	Stunt	Yield
	oz/A		%		lb/A
Handweeded	0	0	0	0	3000
Sulfentrazone (PRE)	2	0	0	0	3170
Sulfentrazone (PRE)	3	0	0	0	3100
Sulfentrazone (PRE)	4	0	0	4	3220
Sulfentrazone (PRE)	6	1	0	5	3400
Sulfentrazone (PRE)	8	6	6	6	3190
Sulfentrazone (PPI)	2	0	0	0	3300
Sulfentrazone (PPI)	3	0	0	0	3210
Sulfentrazone (PPI)	4	0	0	0	2800
Sulfentrazone (PPI)	6	1	1	1	3150
Sulfentrazone (PPI)	8	3	4	5	3100
Untreated	0	0	0	0	2900
C.V. %		281	377	110	14
LSD 5%		NS	NS	3	NS
# OF REPS		4	4	4	4

The proposed sulfentrazone rate on this soil was 3 to 4 oz ai/A. Injury manifested as chlorotic and necrotic lesions of varying size, shortened plants, and occasional death. There was no difference in field pea density among treatments (data not shown). Sulfentrazone at 8 oz/A resulted in slight stunting of plants on 6/30. PRE sulfentrazone treatments of 4 and 6 oz/A were more injurious than PPI treatments at the same rates. Sulfentrazone rates and incorporation did not affect yield.

Field pea response to sulfentrazone (Exp 2). (Howatt, Roach, and Davidson-Harrington) 'Alfetta' pea was planted May 11. Preplant incorporated (PPI) treatments were applied May 10 with 53° F, 83% RH, 100% cloud cover, 3 to 5 mph wind, and wet subsoil with damp topsoil at 55° F. PPI treatments were immediately incorporated with two cultivator passes. Preplant (PRE) treatments were applied on May 12 with 51° F, 69% RH, 100% cloud cover, 8 to 10 mph wind and wet subsoil with dry topsoil at 54° F. All treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 17 gpa at 35 psi through 8002 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Chlorosis and stunting were visually evaluated and field pea density was measured.

Treatment	Rate	6/12	
		Chlorosis	Stunt
	oz/A	%	
Handweeded	0	0	0
Sulfentrazone (PRE)	2	1	0
Sulfentrazone (PRE)	3	1	5
Sulfentrazone (PRE)	4	5	10
Sulfentrazone (PRE)	6	8	11
Sulfentrazone (PRE)	8	16	34
Sulfentrazone (PPI)	2	0	0
Sulfentrazone (PPI)	3	4	5
Sulfentrazone (PPI)	4	1	5
Sulfentrazone (PPI)	6	6	11
Sulfentrazone (PPI)	8	9	20
Untreated	0	0	0
C.V. %		69	63
LSD 5%		4	8
# OF REPS		4	4

The proposed sulfentrazone rate on this soil was 3 to 4 oz ai/A. Injury manifested as chlorotic and necrotic lesions of varying size, shortened plants, and occasional death. There was no difference in field pea density among treatments (data not shown). Sulfentrazone at 8 oz/A applied PRE caused the greatest degree of chlorosis and stunting. Sulfentrazone at 6 and 8 oz/A PPI and 4, 6, and 8 oz/A PRE caused injury compared to untreated plots. Standing water destroyed the experiment.

Weed control in Field Pea. Brian Jenks, Denise Markle, Gary Willoughby, and Kent McKay. (NCREC, Minot). 'Majoret' peas were seeded April 28 at 180 lb/A into 6 inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arrranged in a RCBD with three replicates. Preplant incorporated (PPI) treatments were applied April 26, preemergence (PRE) treatments were applied May 3, and postemergence (POST) treatments were applied on June 2. All treatments were applied with a CO_2 pressurized bicycle sprayer. PPI and PRE treatments were applied with XR80015 flat fan nozzles delivering 20 gpa at 30 psi. POST treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. Field peas were harvested on August 1.

		Pea			Control				
		Density	Injury		Wibw	Rrpw	Kocz		Tst
Treatment	Rate	May 26	May 25	Jul 15	Jul 15	Jul 15	Jul 15	Yield	Wt
		pl/m	—%—		—%—			lb/A	lb/bu
Untreated		8.9	0	0	0	0	0	3200	64.5
PPI									
Sonalan	2 pt	11.7	1	3	90	98	98	3580	64.9
Prowl	3.6 pt		1	0	88	98	98	3530	64.9
PPI/POST									
Spartan / Assure II	0.125 lb ai / 7 fl oz	13.4	3	0	70	100	100	3402	64.7
Spartan / Assure II	0.25 lb ai / 7 fl oz	12.2	5	2	90	100	100	3545	64.9
Spartan / Assure II	0.5 lb ai / 7 fl oz	10.1	9	7	95	100	100	3515	64.6
Prowl / Raptor + NIS	3 pt /4 oz + 0.25 %		0	3	93	100	98	3489	64.6
Handweeded check[a]		11.1	0	3	99	100	100	3356	64.6
PRE/POST									
Valor / Assure II	1 oz ai / 7 fl oz	11.8	10	4	55	100	100	2877	64.0
Valor / Assure II	1.5 oz ai / 7 fl oz	9.3	12	8	77	100	100	3169	64.5
Valor / Assure II	3 oz ai / 7 fl oz	7.7	63	20	87	100	100	3062	65.3
Spartan / Assure II	0.125 lb ai / 7 fl oz	10.5	2	1	73	100	100	3479	64.6
Spartan / Assure II	0.25 lb ai / 7 fl oz	12.1	8	4	93	100	100	3528	64.4
Spartan / Assure II	0.5 lb ai / 7 fl oz	11.4	20	7	95	100	100	3509	64.9
POST									
Raptor + NIS	3 oz + 0.25 %			4	65	100	82	3286	64.6
Raptor + NIS	4 oz + 0.25 %			3	80	100	88	3424	64.8
Raptor + Quad 7	4 oz + 1 %			18	73	100	89	2214	62.3
Raptor + Basagran + NIS + 28% N	4 oz + 0.5 pt + 0.25 % + 1 qt			3	89	100	93	3375	64.7
Raptor + Basagran + NIS + 28% N	4 oz + 1 pt + 0.25 % + 1 qt			2	90	100	93	3464	64.6
Basagran + Poast	2 pt + 1 pt			4	82	87	93	3332	64.3
Starane + Assure II + NIS	0.5 oz ai + 7 fl oz + 0.25 %			29	55	43	100	2633	64.2
Starane + Basagran + Poast	0.5 oz ai + 1 pt + 1 pt			32	84	82	100	2652	64.4
LSD		3	5	6	14	4	4	459	NS
CV		16	29	50	11	3	3	9	1.2

[a] Treflan was applied at 1.5 pt/A (PPI), followed by Assure II at 7 fl oz (POST).

We evaluated pea tolerance to Spartan, Valor, and Raptor compared to other herbicides. Spartan caused only slight injury at any rate or application timing and did not reduce crop yield. Valor caused moderate to severe injury at the high rate and reduced yield approximately 200-500 lbs. Raptor plus Quad 7 caused moderate visible crop injury and a significant yield reduction.

Weed control with soil- and POST-applied herbicides in field pea. Endres, Gregory J., and Jerrold J. Schneider.

Weed control and field pea tolerance to selected soil- and POST-applied herbicides were evaluated in a randomized complete block with four replicates. The experiment was conducted on a Heimdahl-Emrick loam soil with 6.2 pH and 3.3% organic matter at Carrington, ND in 2000. The trial area was cultivated twice on May 4 with a Melroe culti-harrow and harrowed on May 9. Herbicide treatments were made with a hand sprayer to 10 by 25 ft plots. PPI treatments were applied at 17.2 gal/A at 35 psi through 8002 flat fan nozzles on May 9 with 63 F, 32% RH, clear sky, and 7 mph wind. PPI treatments were immediately incorporated twice using a rototiller set at a 3-inch depth. On May 10, inoculated 'Profi' field pea was planted in 7-inch rows at pure live seed rates of 300,000 seeds/A. PRE treatments were applied at 17.2 gal/A at 35 psi through 8002 flat fan nozzles on May 10 with 64 F, 55% RH, 50% cloudy sky, and 11 mph wind on a dry soil surface. A total of 0.42 inches of rainfall occurred during the 1-wk period following application of PRE treatments. POST treatments were applied at 10.3 gal/ at 35 psi through 8001 flat fan nozzles. EPOST (early postemergence) treatments were applied on May 31 with 55 F, 55% RH, 90% cloudy sky, and 5 mph wind to 2- to 3-inch tall field pea, 0.5-inch tall common lambsquarters, redroot and prostrate pigweed, and wild buckwheat, and 2- to 4-leaf yellow and green foxtail. MPOST (mid postemergence) treatments were applied on June 7 with 61 F, 78% RH, 25% cloudy sky, and 3 mph wind to 4- to 6-inch tall field pea, 1- to 2-inch tall common lambsquarters, 0.5- to 1-inch tall redroot and prostrate pigweed, 2- to 8-inch tall wild buckwheat, 4- to 6-inch tall wild mustard, and 2- to 4-leaf yellow and green foxtail. LPOST (late postemergence) treatments were applied on June 16 with 47 F, 78% RH, 95% cloudy sky, and 11 mph wind to 6- to 8-inch tall field pea, 1- to 5-inch tall common lambsquarters, 0.5- to 3-inch tall redroot and prostrate pigweed, 1- to 10-inch tall wild buckwheat, and 3- to 5-leaf yellow and green foxtail. Field pea was harvested with a plot combine on August 10.

Table 1. Weed control with soil- and POST-applied herbicides in field pea

Treatment[a]	Rate	2 wk after treatment					4 wk after treatment			
		Fota	Colq	Piwe	Wibw	Wimu	Fota	Colq	Piwe	Wibw
	(lb/A)					%				
Untreated		0	0	0	0	0	0	0	0	0
PPI										
Ethafluralin+metribuzin	0.75+0.25	95	95	95	89	52	87	89	90	88
Sulfentrazone	0.125	66	99	93	74	49	65	99	98	63
Sulfentrazone	0.25	82	99	98	93	58	71	97	98	81
Sulfentrazone	0.5	87	99	99	96	82	87	99	99	96
Imep&pendimethalin	0.031+0.4	92	99	99	98	99	88	99	99	97
Pend/immx+NIS(MPOST)	1.5/0.031+0.025%	95	84	97	84	99	89	89	99	93
PRE										
Sulfentrazone	0.125	51	49	61	40	0	40	45	51	30
Sulfentrazone	0.25	78	66	77	65	75	61	70	73	66
Sulfentrazone	0.5	81	92	90	74	48	80	99	96	90
EPOST										
Imazamox+NIS	0.031+0.25%	93	66	94	65	99	79	65	91	65
MPOST										
Imazethapyr+NIS	0.031+0.25%	93	69	80	74	98	80	65	80	74
Immx+NIS	0.031+0.25%	85	65	92	69	99	72	54	93	72
Immx+Quad7	0.031+1%	94	85	97	72	99	87	76	97	71
Immx+bent+NIS+UAN	0.031+0.125+0.25%+0.25G	94	96	98	75	99	84	76	96	70
Immx+bent+NIS+UAN	0.031+0.25+0.25%+0.25G	93	96	98	75	99	83	88	92	74
Fomesafen+NIS	0.25+0.25%	0	12	91	46	99	0	33	87	18
LPOST										
Imazamox+NIS	0.031+0.25%	94	64	90	50	99	94	60	93	65
LSD (0.05)		11	16	6	11	19	10	13	9	13

a NIS=Class Preference, a nonionic surfactant from Cenex, St. Paul, MN; Quad7=a surfactant blend from AGSCO, GrandForks, ND; UAN=Class APM 28, a surfactant+fertilizer from Cenex, St. Paul, MN.

Table 2. Weed control with soil- and POST-applied herbicides in field pea

Treatment[a]	Rate	Injury		Seed yield	Test weight
		2 WAT	4 WAT		
	(lb/A)	%		(bu/A)	(lb/bu)
Untreated		0	0	28.9	64.0
PPI					
Ethafluralin+metrabuzin	0.75+0.25	0	0	33.1	63.0
Sulfentrazone	0.125	0	0	33.4	63.7
Sulfentrazone	0.25	0	0	36.3	62.9
Sulfentrazone	0.5	1	0	34.3	63.1
Imazethapyr&pendimethalin	0.031+0.4	0	0	39.0	63.1
Pend/immx+NIS (MPOST)	1.5/0.031+0.025%	0	0	36.1	62.9
PRE					
Sulfentrazone	0.125	0	0	32.5	64.0
Sulfentrazone	0.25	0	0	33.0	63.0
Sulfentrazone	0.5	2	0	33.7	63.3
EPOST					
Imazamox+NIS	0.031+0.25%	0	0	34.9	63.8
MPOST					
Imazethapyr+NIS	0.031+0.25%	0	0	33.1	63.4
Imazamox+NIS	0.031+0.25%	0	0	31.5	63.7
Imazamox+Quad7	0.031+1%	28	9	39.0	64.8
Immx+bent+NIS+UAN	0.031+0.125+0.25%+0.25G	0	0	32.7	63.5
Immx+bent+NIS+UAN	0.031+0.25+0.25%+0.25G	4	0	35.5	63.9
Fomesafen+NIS	0.25+0.25%	21	8	30.1	64.4
LPOST					
Imazamox+NIS	0.031+0.25%	0	0	32.5	64.3
LSD (0.05)		3	2	3.5	0.7

a NIS=Class Preference, a nonionic surfactant from Cenex, St. Paul, MN; Quad7=a surfactant blend from AGSCO, GrandForks, ND; UAN=Class APM 28, a surfactant+fertilizer from Cenex, St. Paul, MN.

Good to excellent (82 to 99%) weed control was achieved with sulfentrazone at 0.5 lb/A, imazethapyr&pendimethalin, and pendamethalin/imazamox+NIS (Table 1). PPI sulfentrazone provided better weed control compared to PRE treatments. Weed control and pea response generally were not impacted by application timing of imazamox. The addition of Quad7 or bentazon+NIS+UAN to imazamox improved control of common lambsquarters compared to imazamox+NIS. Imazamox+Quad7 injured the crop but yield and test weight were greater compared to other imazamox treatments (Table 2). Pea yield with fomesafen was similar to the untreated check due to crop injury and incomplete weed control.

Weed control in potato at Crookston, MN: Experiment 1. (Kegode and Ciernia). An experiment was conducted at the Northwest Experiment Station, Crookston, MN to evaluate control of grass and broadleaf weeds in potato with preemergence (Pre) and postemergence (POST) herbicides. 'Red Norland' potato was planted on May 10 with a row spacing of 36 in. Pre treatments were applied May 25 using a 4-nozzle bicycle wheel plot sprayer equipped with 8002 flat fan nozzles which delivered 17 gpa at 40 psi and covered 2 rows. Preemergence herbicide application air temp was 68 F, RH 20%, wind N 3-4 mph, partly cloudy sky, and dry soil surface. POST treatments were applied June 26 using the same sprayer equipped with 8001 flat fan nozzles that delivered 8.5 gpa at 40 psi. POST application air temp was 66 F, RH 22%, NW 12 mph wind, partly cloudy sky, and wet soil surface. Weeds present were: 4-leaf wild oat 6-8 in. with 2 tillers and 1-3-leaf foxtail 1-3 in. tall. Maintenance insecticides and fungicides were applied as needed. The field was vine killed the week previous to Sept. 11 when one row per plot was harvested for yield. Plot size was 4 rows by 22 ft and the experiment was a randomized complete block design with 4 replicates.

Treatment	Rate	Timing	6/26		7/10		7/25		Yield					
									Grade					
			Grass	Wibw	Grass	Wibw	Grass	Wibw	1	2	3	4	5	Total
	oz ai/A		%						cwt/A					
Dimethenamid-P	10.2	Pre	77	48	85	72	-	-	0	17	84	65	24	191
Dimethenamid-P	20.6	Pre	85	68	88	58	-	-	0	23	121	55	21	220
Dimethenamid-P	41.3	Pre	81	82	88	88	-	-	0	26	141	53	22	232
Metolachlor	24	Pre	68	37	82	43	-	-	0	17	67	92	26	202
Metolachlor	48	Pre	76	47	76	60	-	-	0	22	97	71	31	220
Sulfentrazone	3	Pre	50	75	38	84	-	-	0	11	85	77	27	200
Sulfentrazone	4	Pre	71	89	28	90	-	-	0	3	40	50	12	103
Sulf+Meto	3+24	Pre	74	90	74	93	-	-	0	9	86	42	27	163
Sulf+Meto	4+24	Pre	67	83	55	88	-	-	0	8	110	75	21	214
Pend+Flumioxazin	16+0.75	Pre	74	72	85	88	-	-	0	11	44	77	28	152
Flum+Meto	0.75+19.2	Pre	90	78	88	42	-	-	0	35	162	66	17	271
Metr+Clet+COC	6+2+0.25G	POST	-	-	99	95	98	96	0	19	96	68	26	210
Flum/Clet+COC+AMS	0.75/2+0.25G+40	Pre/POST	54	38	98	75	93	89	0	14	80	63	18	175
Flum/Clet+COC+AMS	0.75/2+0.25G+40	Pre/POST	75	27	99	73	96	80	0	54	94	40	19	208
Untreated	0	-	-	-	-	-	-	-	0	8	100	59	19	186
C.V. %			22	41	17	27	4	13	0	88	46	35	44	29
LSD 5%			NS	NS	22	NS	NS	NS	NS	NS	NS	NS	NS	NS
# OF REPS			4	3	3	2	4	3	3	3	3	3	3	3

Control of grasses (primarily foxtail, wild oat and volunteer wheat) with Pre herbicides was poor to fair by the second evaluation date. POST herbicides controlled grasses better. Control of wild buckwheat (Wibw) with Pre herbicides was best with sulfentrazone applications. Poor control with Pre herbicides may have been due in part to the long dry period that followed application and the excessively wet period thereafter. The best control was achieved with metribuzin plus clethodim applied POST. Yields were highly variable and may reflect partial flooding that occurred in some of the plots, and Colorado beetle infestations that were later controlled with insecticide.

Weed control in potato at Crookston, MN: Experiment 2. (Kegode and Ciernia). An experiment was conducted at the Northwest Experiment Station at Crookston, MN to evaluate control of broadleaf and grass weeds in potato with preemergence (Pre) and postemergence (POST) herbicides. 'Red Norland' potato was planted on May 10 with a row spacing of 36 in. Pre treatments were applied May 25 using a 4-nozzle bicycle wheel sprayer equipped with 8002 flat fan nozzles, which delivered 17 gpa at 40 psi and covered 2 rows. At Pre application, air temp was 68 F, RH 20%, wind N 3-4 mph, partly cloudy sky, and dry soil surface. POST treatments were applied June 26 using the same sprayer equipped with 8001 flat fan nozzles that delivered 8.5 gpa at 40 psi. At POST application, air temp was 66 F, RH 22%, NW 12 mph wind, partly cloudy sky, and wet soil surface. Weeds present were: 4-leaf wild oat 6-8 in. with 2 tillers and 1-3-leaf foxtail 1-3 in. tall. Maintenance insecticides and fungicides were applied as needed. The field was vine killed the week previous to Sept. 11 when one row per plot was harvested for yield. Plot size was 4 rows by 22 ft and the experiment was a randomized complete block design with 4 replicates.

Treatment	Rate	Timing	6/26	7/10			7/25			Yield					
										Grade					
			Grass	Grass	Wibu	Rrpw	Grass	Wibw	Rrpw	1	2	3	4	5	Total
	oz ai/A		%							cwt/A					
Sulfentrazone	3	Pre	82	84	76	88	-	-	-	0		102	63	23	197
Sulfentrazone	5.5	Pre	86	71	78	92	-	-	-	0	7	43	28	20	98
Sulfentrazone	8	Pre	92	88	97	93	-	-	-	0	14	74	41	20	150
Sulf+Dimethenamid-P	3+20	Pre	95	90	95	93	-	-	-	0	15	76	35	14	140
Sulf+Metribuzin	3+4	Pre	60	73	95	88	-	-	-	0	4	73	33	18	128
Sulf+Rimsulfuron	3+0.25	Pre	66	81	94	97	-	-	-	0	5	64	50	19	133
Rims+Sethoxydim+MSO	0.25+1.6+0.25G	POST	-	98	96	95	98	99	99	0	14	65	46	30	155
Rimsulfuron+Clet+MSO	0.25+1.5+0.25G	POST	-	99	90	99	98	85	99	0	12	60	36	33	141
Rims+Sethoxydim+MSO	0.375+4.8+0.25G	POST	-	95	93	90	98	93	99	0	20	87	27	27	161
Rims+Clethodim+MSO	0.375+2.5+0.25G	POST	-	99	90	99	98	95	99	0	21	98	58	35	212
Rims+Seth+Quad7	0.25+1.6+1%	POST	-	85	74	80	97	80	99	0	10	96	41	26	173
Rims+Clethodim+Quad7	0.25+1.5+1%	POST	-	99	90	95	98	83	99	0	31	115	50	28	224
Untreated	0		-	-	-	-	-	-	-	0	22	72	40	29	163
C.V. %			21	13	13	9	1	10	0	0	104	49	39	49	28
LSD 5%			NS	17	NS	NS	NS	NS	NS	N S	NS	NS	NS	NS	65
# OF REPS			4	4	2	2	4	2	2	4	4	4	4	4	4

At the second evaluation date grass control with Pre-applied herbicides (7/10) ranged from fair to good, but was excellent with POST-applied herbicides (7/25). Control of wild buckwheat (Wibw) and redroot pigweed (Rrpw) was rated one time for Pre-applied herbicides (7/10), because seedlings had not emerged by the first evaluation. Control of Wibw and Rrpw was best with POST-applied herbicides. Yields were highly variable and may reflect partial flooding that occurred in some plots, and Colorado beetle infestations that were later controlled with insecticide.

Weed control in potato at Dawson, ND: Experiment 1. (Kegode and Ciernia). An experiment was conducted on an irrigated site near Dawson, ND to evaluate control of grass and broadleaf weeds in potato with preemergence (Pre) and postemergence (POST) herbicides. 'Russet Burbank' was planted May 4 at a row spacing of 36 in. Plots were hilled and Pre treatments applied May 19 with a 4-nozzle bicycle wheel sprayer equipped with 8002 flat fan nozzles that delivered 17 gpa at 40 psi. Plots were 25 ft long and the spray boom covered 2 rows. At that time air temp was 79 F, RH 30%, wind S 10-15 mph, sky sunny, and soil surface dry. POST treatments were applied June 19 with the same sprayer with 8001 flat fan nozzles delivering 8.5 gpa at 40 psi and with 68 F air temp, 43% RH, SW 8-15 mph wind, overcast sky, and dry soil surface. Weeds present were: 4-5-leaf foxtail 4-7 in. with 3-5 tillers; 4-9 in. wild buckwheat; and 5-9 in. field bindweed. Maintenance insecticides and fungicides were applied as needed. The field was vine killed a week prior to Sept. 20 when one row per plot was harvested for yield. The experiment was a randomized complete block design with 4 replicates per treatment.

Table 1. Weed control in potato at Dawson, ND: Experiment 1

Treatment	Rate	Timing	6/01			6/15			7/05			7/17		
			Fota	Wibw	Fibw	Fota	Wibw	Fibw	Fota	Wibw	Fibw	Fota	Wibw	Fibw
	oz ai/A								%					
Dimethenamid	37.4	Pre	5	0	3	92	0	0	-	-	-	-	-	-
Dimethenamid-P	10.2	Pre	8	15	1	85	16	0	-	-	-	-	-	-
Dimethenamid-P	20.6	Pre	8	3	13	84	34	0	-	-	-	-	-	-
Dimethenamid-P	41.3	Pre	30	3	9	98	26	32	-	-	-	-	-	-
Metolachlor	24	Pre	25	6	0	83	5	33	-	-	-	-	-	-
Metolachlor	48	Pre	33	25	8	96	11	0	-	-	-	-	-	-
Sulfentrazone	3	Pre	56	98	20	87	100	33	-	-	-	-	-	-
Sulfentrazone	4	Pre	65	98	40	96	100	40	-	-	-	-	-	-
Sulf+Meto	3+15.2	Pre	59	100	14	94	100	25	-	-	-	-	-	-
Sulf+Meto	4+15.2	Pre	60	90	21	96	100	30	-	-	-	-	-	-
Flum+Pend	0.75+16	Pre	75	14	19	73	63	32	-	-	-	-	-	-
Flum+Meto	0.75+19.2	Pre	49	15	14	85	55	0	-	-	-	-	-	-
Metr+Clet+COC	6+2+0.25G	POST	-	-	-	-	-	-	99	90	24	98	38	26
Flum/Clet+COC+AMS	0.75/2+0.25G+40	Pre/POST	41	18	11	51	49	32	99	70	0	99	28	30
Flum/Clet+COC+AMS	½+0.25G+40	Pre/POST	41	16	18	61	73	10	99	70	19	98	41	36
Linuron	24	Pre	4	0	3	0	4	0	-	-	-	-	-	-
Untreated	0	-	-	-	-	-	-	-	-	-	-	-	-	-
C.V. %			41	46	80	16	37	129	0	9	186	1	21	31
LSD 5%			22	22	15	17	26	NS	NS	12	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	3	4	4	4	4	4	4

Table 2. Weed control in potato at Dawson, ND: Experiment 1

Treatment	Rate	Timing	Yield					
			Grade					
			1	2	3	4	5	Total
	oz ai/A		cwt/A					
Dimethenamid	37.4	Pre	0	15	105	105	30	255
Dimethenamid-P	10.2	Pre	0	8	79	89	34	210
Dimethenamid-P	20.6	Pre	0	17	141	103	30	291
Dimethenamid-P	41.3	Pre	0	5	96	113	34	247
Metolachlor	24	Pre	0	12	89	110	45	256
Metolachlor	48	Pre	0	4	99	103	35	241
Sulfentrazone	3	Pre	0	14	137	95	28	277
Sulfentrazone	4	Pre	0	33	143	103	28	296
Sulf+Meto	3+15.2	Pre	0	17	116	121	26	281
Sulf+Meto	4+15.2	Pre	0	26	131	90	29	277
Flum+Pend	0.75+16	Pre	0	14	86	58	26	184
Flum+Meto	0.75+19.2	Pre	0	17	114	70	26	227
Metr+Clet+COC	6+2+0.25G	POST	0	43	121	103	30	297
Flum/Clet+COC+AMS	0.75/2+0.25G+40	Pre/POST	0	20	127	87	27	262
Flum/Clet+COC+AMS	½+0.25G+40	Pre/POST	0	43	133	66	33	276
Linuron	24	Pre	0	2	67	100	41	210
Untreated	0	-	0	3	53	80	38	174
C.V. %			500	107	34	24	37	20
LSD 5%			NS	26	53	32	NS	71
# OF REPS			4	4	4	4	4	4

Foxtail (Fota) control with Pre herbicides was poor initially (6/01) but increased later (6/15). Sulfentrazone treatments (alone/tank-mixed) provided the best control of wild buckwheat (Wibw). The higher rates of dimethanamid-P, metolachlor and sulfentrazone gave foxtail control as good as clethodim POST. Sulfentrazone and Flumioxazin provided suppression of field bindweed.

Weed control in potato at Dawson, ND: Experiment 2. (Kegode and Ciernia). An experiment was conducted on an irrigated site near Dawson, ND to evaluate preemergence (Pre) and postemergence (POST) herbicides for grass and broadleaf control in potato. 'Russet Burbank' potato was planted May 4 at a row spacing of 36 in. Plots were hilled and Pre treatments applied May 19 with a 4-nozzle bicycle wheel sprayer equipped with 8002 flat fan nozzles, which delivered 17 gpa at 40 psi. Plots were 25 ft long and the spray boom covered 2 rows. At that time air temp was 79 F, RH 30%, wind S 10-15 mph, sky sunny, and soil surface dry. POST treatments were applied June 19 with the same sprayer with 8001 flat fan nozzles, which delivered 8.5 gpa at 40 psi and with 68 F air temp, 43% RH, SW 8-15 mph wind, overcast sky, and dry soil surface. Weeds present were: 4-5-leaf foxtail 4-7 in. with 3-5 tillers; 4-9 in. wild buckwheat; and 5-9 in. field bindweed. Maintenance insecticides and fungicides were applied as needed. The field was vine killed a week prior to Sept. 20 when one row per plot was harvested for yield. The experiment had a randomized complete block design with 4 replicates per treatment.

Table 1. Weed control in potato at Dawson, ND: Experiment 2

Treatment	Rate	Timing	6/01			6/15			7/05			7/17		
			Fota	Wibw	Fibw	Fota	Wibu	Fibw	Fota	Wibw	Fibw	Fota	Wibw	Fibw
	oz ai/A								%					
Sulfentrazone	3	Pre	19	91	16	83	99	5	-	-	-	-	-	-
Sulfentrazone	5.5	Pre	36	90	16	95	100	23	-	-	-	-	-	-
Sulfentrazone	8	Pre	49	94	25	99	100	45	-	-	-	-	-	-
Sulf+Dimenthenamid-P	3+20	Pre	30	100	26	99	100	10	-	-	-	-	-	-
Sulf+Metr	3+4	Pre	21	100	15	91	100	3	-	-	-	-	-	-
Sulf+Rims	3+0.25	Pre	30	93	13	81	100	12	-	-	-	-	-	-
Rims+Seth+MSO	0.25+1.6+0.25G	POST	-	-	-	-	-	-	96	69	68	97	63	59
Rims+Clet+MSO	0.25+1.5+0.25G	POST	-	-	-	-	-	-	98	71	66	98	65	69
Rims+Seth+MSO	0.375+4.8+0.25G	POST	-	-	-	-	-	-	94	76	75	94	72	77
Rims+Clet+MSO	0.375+2.5+0.25G	POST	-	-	-	-	-	-	97	76	73	97	74	62
Rims+Seth+Quad7	0.25+1.6+1%	POST	-	-	-	-	-	-	92	59	64	91	60	67
Rims+Clet+Quad7	0.25+1.5+1%	POST	-	-	-	-	-	-	95	56	63	94	61	68
Untreated	0	-	-	-	-	-	-	-	-	-	-	-	-	-
C.V. %			41	10	80	9	0	130	3	16	12	4	15	25
LSD 5%			19	NS	NS	12	0	NS	NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	3	4	4	4	4	4	4

Table 2. Weed control in potato at Dawson, ND: Experiment 2

Treatment	Rate	Application time	Yield					
			Grade					
			1	2	3	4	5	Total
	oz ai/A		cwt/A					
Sulfentrazone	3	Pre	0	16	140	116	26	298
Sulfentrazone	5.5	Pre	0	10	141	120	29	301
3 Sulfentrazone	8	Pre	0	6	97	141	48	292
Sulf+a-Dime	3+20	Pre	0	21	160	95	24	286
Sulf+Metr	3+4	Pre	2	27	130	77	29	265
Sulf+Rims	3+0.25	Pre	2	23	132	119	35	310
Rims+Seth+MSO	0.25+1.6+0.25G	POST	0	16	141	124	33	314
Rims+Clet+MSO	0.25+1.5+0.25G	POST	6	20	178	147	42	393
Rims+Seth+MSO	0.375+4.8+0.25G	POST	0	14	117	139	51	320
Rims+Clet+MSO	0.375+2.5+0.25G	POST	0	17	104	181	42	345
Rims+Seth+Quad7	0.25+1.6+1%	POST	0	26	151	117	30	325
Rims+Clet+Quad7	0.25+1.5+1%	POST	0	41	171	102	76	389
Untreated	0	-	0	2	98	134	49	283
C.V. %			469	84	31	33	59	18
LSD 5%			NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4

The higher rates of sulfentrazone, or sulfentrazone plus dimenthenamid-P gave foxtail control as good as the rimsulfuron plus clethodim/rimsulfuron plus sethoxydim POST treatments. Sulfentrazone treatments gave the best wild buckwheat control but rimsulfuron plus clethodim/rimsulfuron plus sethoxydim gave better field bindweed suppression

Potato vine desiccation, Fitterer and Zollinger. An experiment was conducted to evaluate potato vine desiccation from labeled and experimental herbicides. 'Russet Burbank' potato was planted May 12, 2000. Herbicides to desiccate potato vines were applied September 6 at 12:00 noon with 80 F, 54% RH, no cloud cover, no dew, and 5-10 mph SE wind to vines at the beginning of natural senescence (BNS). Sequential treatments were applied on September 13 at 10:00 am with 60 F, 68% RH, 100% cloud cover, light mist, and 3-5 mph NW wind seven days after the BNS applications (BNS+7 DAT). Treatments were applied to the center two rows of the four row 12 by 25 ft plots with a back-pack sprayer delivering 26 gpa at 40 psi through 8003 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The study was terminated on September 24 due to a 24 F freeze. Diquat at 0.25 lb/A applied on a 7 day split is considered a standard vine kill treatment. Treatments which were not as effective as the diquat standard included glufosinate, F8426, GX-550, GX-685, and GX-471. The addition of fungicides, with the exception of propanocarb plus chlorothalonil, tended to decrease the effectiveness of glufosinate. F8426 performance was improved with the addition of Scoil compared to Silwet. The addition of endothall helped to increase the desiccation of the F8426 treatment. GX-550 and GX-685 were not antagonized by the addition of triphenyltin hydroxide.

Treatments which were as effective as the standard two applications of diquat include endothall and paraquat. Endothall at 0.75 lb/A with the addition of AMS and LI-700 or Scoil increased the initial speed of desiccation. Following endothall with a sequential application of diquat at 0.375 lb/A equalized all treatments. The edition of linuron or carfentrazone did not enhance the performance of paraquat.

Yields were not significantly different compared to the mechanically topped treatment. No stem end discoloration was found for any treatments at harvest. Field and hedge bindweed was found throughout the trial at time of treatment application. Bindweed populations did not effect herbicide performance. Endothall provided excellent desiccation of field and hedge bindweed (data not included).

Treatment[a]	Rate	Potato vine desiccation														Oct 4
		Sept 7		Sept 9		Sept 11		Sept 13		Sept 17		Sept 19		Sept 21		
		Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Yield
	Product/A	%														cwt/A
BNS[b]																
Rely+AMS	3pt	3	0	7	1	20	7	38	17	60	33	67	40	76	53	473
Rely+AMS+Tattoo C	3pt+2.33pt	2	0	6	1	23	7	40	17	67	38	72	52	81	60	479
Rely+AMS+SuperTin	3pt+3.25oz	2	0	6	1	15	6	32	12	48	25	52	32	57	38	462
Rely+AMS+Mancozeb	3pt+1.25lb	1	0	6	2	11	4	27	8	38	13	55	28	62	33	502
Aim+Scoil	1.6 fl oz	2	0	6	4	12	5	22	9	33	14	37	20	37	20	508
Aim+Silwet	1.6 fl oz	2	0	5	2	9	5	16	7	25	10	25	10	25	10	505
Aim+Scoil	2.4 fl oz	2	0	6	2	14	7	28	11	35	16	38	21	43	22	476
Aim+Silwet	2.4 fl oz	2	0	6	4	10	6	17	8	25	12	28	13	30	15	534
Aim+Scoil	3.2 fl oz	3	0	8	3	15	5	25	11	35	14	35	14	35	14	534
Aim+Silwet	3.2 fl oz	2	0	6	6	12	6	22	9	27	13	28	12	28	12	517
Aim+Desicate II+Scoil	1.6floz+0.5qt	2	0	7	3	15	5	25	12	40	19	52	32	52	33	491
Aim+Desicate II+Scoil	2.4floz+0.5qt	3	0	7	4	14	6	23	10	40	17	48	25	50	25	485
Aim+Desicate II+Scoil	3.2floz+0.5qt	4	0	10	5	20	8	32	14	47	27	60	35	65	42	505
BNS/BNS+7 DAT																
Desicate II/Diquat+NIS	3 pt / 1.5 pt	2	0	7	2	13	5	22	8	72	45	87	58	95	75	468
Desicate II+AMS/Diquat+NIS	3 pt / 1.5pt	4	0	11	4	23	8	33	12	87	60	92	70	98	91	427
Desicate II+AMS+LI 700 / Diquat+NIS	3 pt / 1.5 pt	4	0	13	4	28	10	47	22	90	63	94	75	98	90	517
Desicate II+AMS+Scoil / Diquat+NIS	2 pt / 1.5 pt	2	0	9	2	17	8	27	12	82	47	88	68	98	82	508
Desicate II+AMS+Scoil / Diquat+NIS	3 pt / 1.5 pt	4	1	12	6	23	10	43	17	90	65	96	83	99	91	430
Diquat+NIS / Diquat+NIS	1.5 pt / 1.5 pt	4	0	11	5	25	8	40	15	73	43	90	60	96	80	450
Diquat+NIS / Diquat+NIS	1 pt / 1 pt	3	0	8	3	17	7	27	13	68	42	82	57	97	77	552
Paraquat+NIS / Paraquat+NIS	1 pt / 1 pt	2	0	9	5	27	12	40	18	82	50	90	73	98	88	468
Paraquat+Lorox+NIS / Paraquat+Lorox+NIS	1pt+0.125 lb/ 1 pt+0.125 lb	4	0	10	5	30	13	45	22	83	50	93	78	97	95	418
Paraquat+Aim+NIS / Paraquat+Aim+NIS	1 pt + 0.25 lb/ 1 pt + 0.25 lb	3	1	11	5	37	12	50	23	90	63	96	85	99	94	491
GX-550+Herbimax / GX-550+Herbimax	13.5 fl oz / 13.5 fl oz	3	1	8	4	15	6	25	10	45	20	65	40	73	43	462
GX-550+Herbimax+SuperTin / GX-550+Herbimax	13.5 fl oz +3.75oz / 13.5 fl oz	2	0	6	3	15	6	23	10	45	17	63	30	72	35	470
GX-685+Herbimax / GX-685+Herbimax	13.5 fl oz / 13.5 fl oz	3	1	9	5	20	7	32	13	67	35	82	58	89	70	462
GX-685+Herbimax+SuperTin / GX-685+Herbimax+SuperTin	13.5 fl oz+3.75 oz / 13.5 fl oz + 3.75 oz	3	1	8	5	18	6	30	13	67	38	82	52	89	67	491
GX-471 / GX-471	2 qt / 2 qt	0	0	0	0	6	1	11	4	27	11	43	22	57	33	418
Mechanically topped[c]		0	0	0	0	0	0	100	100	100	100	100	100	100	100	488
Untreated[d]		0	0	0	0	0	0	0	0	0	0	0	0	0	0	537
LSD (0.05)		2	1	4	3	5	5	7	7	9	8	8	10	10	11	120

[a]AMS = ammonium sulfate at 3 lb/A with glufosinate and 5 lb/A with endothall; Scoil is a methylated seed oil at 1 qt/A with F8426 and 24 oz/100 gal with endothall; Silwet is a surfactant with silicone at 1 pt/A; NIS = Activator 90 is a non ionic surfactant at 0.25% v/v; LI-700 is a non ionic surfactant at 32 oz/100 gal; and Herbimax is a petroleum oil at 0.5% v/v. Fungicide: Tattoo C = Propanocarb&Chlorthalonil, SuperTin = Triphenyl hydroxide, and Mancozeb = mancozeb.

[b]BNS = beginning of natural senescence.

[c]Plots were mechanically topped on September 13 to completely remove vines.

[d]Unntreated plots were mechanically topped just prior to harvest on October 4.

Potato vine desiccation with ET-751. Fitterer and Zollinger. An experiment was conducted to evaluate potato vine desiccation from ET-751. 'Red Norland' potato was planted May 16, 2000. Herbicides that desiccate potato vines were applied August 17 at 10:00 am with 59 F, 97% RH, 100% cloud cover, dew present, and 5-10 mph NW wind to vines which were at the beginning of natural senescence (BNS). Sequential treatments were applied on August 23 at 10:30 am with 74 F, 40% RH, no cloud cover, no dew, and 2-4 mph SW wind seven days after the BNS applications (BNS+7 DAT). Treatments were applied to the center two rows of the four row 12 by 25 ft plots with a back-pack sprayer delivering 34 gpa at 40 psi through 8004 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

		Potato vine desiccation											
		August 24		August 26		August 28		Aug 30		Sept 6		Sept 11	
Treatment[a]	Rate	Lf	Stm	Lf	Stm	Lf	Stm	Lf	Stm	Lf	Stm	Lf	Stm
	lb/A	%											
BNS/													
BNS+7 DAT													
ET-751 / ET-751	0.23 oz / 0.46 oz	33	5	43	7	55	17	60	22	90	72	93	85
ET-751 / ET-751	0.46 oz / 0.46 oz	47	7	57	10	72	25	77	28	94	88	98	92
ET-751 / Diquat	0.23 oz / 0.5 pt	30	7	35	7	42	15	45	15	87	78	88	80
ET-751 / Diquat	0.46 oz / 0.5 pt	37	7	43	8	53	17	57	22	82	73	88	78
BNS+7 DAT													
ET-751	0.92 oz	10	0	33	5	55	12	63	18	93	85	96	90
Diquat	1 pt	12	2	25	5	33	10	33	10	90	80	93	87
Diquat	0.5 pt	7	0	12	3	17	5	18	5	47	48	72	55
Untreated		0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		7	3	8	5	9	9	8	7	8	10	9	11

[a]ET-751 was applied with Herbimax a petroleum oil at 1% v/v; Diquat was applied with R-11 a non ionic surfactant at 1.5 pt/A.

Hedge and field bindweed infested the entire trial. ET-751gave complete control of bindweed. Diquat did not desiccate bindweed and reduced the overall activity as a vine desiccant. ET-751 applied at 0.009/0.009 lb/A had greater leaf and stem dessication than other treatments on August 28 and at later rating dates. Harvest is typically targeted for 10-14 days after vine kill treatment. For harvest 14 DAT (Sept. 6), stem desiccation was not complete and would interfere with harvest. Further vine desiccation did not increase on September 11 except diquat at 0.123 lb/A. In generally, leaf and stem dessication was not significantly different for ET-751 regardless of rate or application method when evaluated 14 days after application. However, speed of desiccation was faster and more effective when treatments were evaluated in 1998.

Assure II and combinations for weed control in safflower. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate weed control and safflower response to Assure II tank mixes with Harmony GT, Glean, Finesse and Ally. 'Finch' safflower was planted notill on land cropped to wheat in 1999 on May 8 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 7 to 4 to 5-leaf safflower, 3-5 leaf green foxtail, 1 to 3 inch Russian thistle, 2 to 6 inch kochia and horseweed with 75 F, 55% RH, clear sky, and 6 mph SW wind. Delayed treatments (indicated by a /) were applied June 12 to 6 leaf safflower, tillered green foxtail, 2 to 4 inch Russian thistle, 2 to 10 inch kochia and 6 inch horseweed with 67 F, 45% RH, clear sky, and 7mph ENE wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations ranged from 1 to 2 plts /yd2 for kochia, 1 to 2 plts/ft2 for horseweed, 3-4 plts/ft2 for Russia thistle and > 50 plts/ft2 for green foxtail. Plots were evaluated on June 26 and on September 24 for injury only. Safflower was machine harvested on September 28.

Treatment[a]	Rate	Crop injury		Weed control				Yield
		6/24	9/24	Ruth	Grft	Howe	Kocz	
	oz ai/ac	%						lb/A
AssureII+Act90	0.88+1%	0	0	0	98	0	0	1019
AssureII+Act90	0.88+0.5%	0	0	0	99	0	0	918
AssureII+PO	0.88+0.25G	1	0	0	98	0	0	972
AssureII+PO	0.88+0.5G	0	0	0	98	0	0	1016
AssureII+PO	0.88+1.0G	1	3	0	99	0	0	1036
AssureII+Harmony GT+Act90	0.88+0.125+1.0%	1	3	96	99	51	0	1022
AssureII+Harmony GT+Act90	0.88+0.15+1.05%	0	3	98	94	55	13	1006
AssureII+Harmony GT+Act90	0.88+0.1875+1.0%	1	7	99	97	86	16	1026
AssureII+Harmony GT+Act90	0.88+0.25+1.0%	3	8	98	98	81	34	974
AssureII+Harmony GT+Act90	0.88+0.15+0.5%	1	1	99	97	68	0	1039
AssureII+Harmony GT+Act90	0.88+0.1875+0.5%	0	3	99	98	75	0	982
AssureII+Harmony GT+PO	0.88+0.15+0.5G	1	10	99	97	83	0	1014
AssureII+Harmony GT+PO	0.88+0.1875+0.5G	8	18	98	98	86	10	945
AssureII+Harm+Starane+Act90	0.88+0.15+1.5+0.5%	9	13	99	99	74	69	1007
AssureII+Starane+Act90	0.88+2.0+0.5%	9	21	61	89	63	91	928
AssureII+Ally+Act90	0.88+0.05+0.5%	5	11	99	98	90	24	1055
AssureII+Glean+Act90	0.88+0.15+0.5%	0	5	95	90	91	39	1048
AssureII+PO/Harm+Act90	0.88+0.5G+0.1875+0.25%	3	1	94	95	51	0	1061
AssureII+PO/Glean+Act90	0.88+0.5G+0.15+0.25%	1	1	90	94	86	0	1108
Untreated	0	0	0	0	0	0	0	636
C.V. %		129	63	9	5	20	120	7
LSD 5%		4	5	9	7	15	25	100

[a] - Act90 = Activator 90 nonionic surfactant from Loveland / - delayed application PO = Class 17% Concentrate from Cenex

Using petroleum oil in the tank mix of Assure II/Harmony GT resulted in significant crop injury compared to using a NIS in that same tank mix. Starane increased crop injury in a tank mix of Assure II/Harmony GT. Starane and Glean caused slight reductions in Assure II control of green foxtail. Only Starane controlled kochia.

Kochia control in safflower, Williston. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate kochia control and safflower response to Starane and tank mixes with Harmony GT, Finesse and Ally. 'Finch' safflower was planted no till on land cropped to wheat in 1999 on May 8 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 7 to 4-5-leaf safflower, 3-5 leaf green foxtail, 1 to 3 inch Russian thistle, 2 to 6 inch kochia and horseweed with 67 F, 75% RH, clear sky, and less than 5mph SW wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations ranged from 3 to 5 plants/yd2 for kochia and horseweed, 5-6 plants/yd2 for Russia thistle and > 30 plts/ft2 for green foxtail. Assure II + MSO was applied to all plots to control green foxtail on June 12. Plots were evaluated on June 24 and on September 24. Safflower was machine harvested on September 28.

Treatment[a]	Rate	Crop injury		Weed control				Test	Seed	
				6/24		9/24				
		6/24	9/24	Kocz	Howe	Kocz	Ruth	weight	oil	Yield
	oz ai/A			%				lb/bu	%	lb/A
Starane	1.5	21	13	90	14	95	0	41.2	34.7	852
Starane	2.0	31	20	91	38	98	41	40.9	34.9	883
Starane	3.0	55	19	95	83	99	69	41.1	35.5	889
Harm.GT+Star+Act90	0.125+1.5+0.25%	21	9	84	58	97	98	41.2	34.9	981
Harm.GT+Star+Act90	0.15+1.5+0.25%	24	14	84	48	96	97	41.6	34.3	1030
Harm.GT+Star+Act90	0.15+2.0+0.25%	44	20	89	70	99	98	41.6	34.8	878
Harm.GT+Star+Act90	0.1875+1.5+0.25%	29	19	86	63	99	98	41.7	34.8	889
Glean+Star+Act90	0.125+1.5+0.25%	18	9	91	93	98	97	41.7	34.6	1023
Ally+Starane+Act90	0.04+1.5+0.25%	34	19	93	93	98	96	41.6	34.9	916
Finesse+Star+Act90	0.125+1.5+0.25%	33	6	90	94	98	99	41.4	34.6	913
Harmony GT+Act90	0.1875+0.25%	1	0	0	14	0	95	40.8	34.0	961
Glean+Act90	0.15+0.25%	7	1	14	84	23	98	41.0	34.9	974
Ally+Act90	0.05+0.25%	11	8	15	89	26	95	41.0	34.3	823
Finesse+Act90	0.15+0.25%	9	4	14	90	10	95	41.0	34.4	814
Untreated	0	0	0	0	0	0	0	41.0	34.7	886
C.V. %		40	90	8	21	14	7	1.2	1.5	12
LSD 5%		13	14	7	19	13	7	NS	NS	NS

[a] - Act90 = Activator 90 nonionic surfactant from Loveland.

Despite relatively low broadleaf weed population, kochia control was dramatic by Starane alone or in combination with selected SU herbicides and especially with Harmony GT. Early crop injury was significant with all Starane treatments but the late injury ratings indicate that safflower recovered sufficiently to avoid yield losses compared to the untreated check. As Starane rates increased, so did crop injury. August was hot and dry which may have masked the effects of crop injury and weed control on crop yields. However, this is not an unusual environmental effect for this semi-arid region.

Broadleaf weed control in safflower, Williston. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate Russian thistle control and safflower response to selected SU herbicides. 'Montola 2003' safflower was planted on land cropped to wheat in 1999 on May 16 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 7 to 2-4 leaf safflower, 3-5 leaf green foxtail, 1 to 3 inch Russian thistle, 2 to 6 leaf volunteer wheat with 85 F, 32% RH, mostly clear sky, and 5mph NE wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations ranged from 2 to 3 plants/ft2 for Russia thistle.Assure II + MSO was applied to all plots to the grassy weeds on June 12. Plots were evaluated on June 24 and on September 27. Safflower was machine harvested on September 29.

		Crop injury		Weed control				
				6/24	9/24	Test	Seed	
Treatment [a]	Rate	6/24	9/27	Ruth	Ruth	weight	oil	Yield
	oz ai/A	%				lb/bu	%	lb/A
Harmony+Act90	0.094+0.25%	0	0	45	43	39.3	35.1	646
Harmony+Act90	0.125+0.25%	0	1	66	55	39.3	35.6	645
Harmony+Act90	0.15+0.25%	1	1	78	81	39.9	35.5	703
Harmony+Act90	0.1875+0.25%	1	1	86	75	39.9	35.6	678
Harmony+Act90	0.25+0.25%	1	0	85	74	39.7	35.6	658
Ally+Act90	0.03+0.25%	1	1	70	75	39.7	36.2	696
Ally+Act90	0.04+0.25%	1	1	61	66	39.6	35.6	629
Ally+Act90	0.05+0.25%	5	5	80	75	39.9	35.7	632
Ally+Act90	0.06+0.25%	7	8	90	74	39.9	35.6	634
Glean+Act90	0.094+0.25%	0	0	66	69	39.5	35.7	644
Glean+Act90	0.15+0.25%	3	5	76	73	39.7	36.0	617
Glean+Act90	0.125+0.25%	5	3	80	74	39.5	36.4	690
Glean+Act90	0.1875+0.25%	6	3	73	81	39.8	36.1	618
Finesse+Act90	0.125+0.25%	4	4	79	75	39.5	36.3	648
Finesse+Act90	0.15+0.25%	6	4	83	65	40.0	35.9	679
Finesse+Act90	0.1875+0.25%	4	3	76	71	39.4	36.1	630
Untreated	0	0	0	0	38.4	36.5	547	
C.V. %		103	162	19	26	1.7	2.2	9
LSD 5%		4	NS	19	25	NS	NS	NS

[a] - Act90 = Activator 90 NIS from Loveland Industries.

About 0.10 inches of rain was recieved within eight hours of application. Injury and control of Russian thistle are less than expected. Ally exhibits the most injury to safflower; stunting and delaying maturity.

Poast and combinations for weed control in safflower. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate weed control and safflower response to Poast tank mixes with Harmony GT, Glean, Finesse and Ally. 'Finch' safflower was planted no till on land cropped to wheat in 1999 on May 8 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 7 to 4 to 5-leaf safflower, 3-5 leaf green foxtail, 1 to 3 inch Russian thistle, 2 to 6 inch kochia and horseweed with 80 F, 40% RH, clear sky, and 5mph SW wind. Delayed treatments (indicated by a /) were applied June 12 to 6 leaf safflower, tillered green foxtail, 2 to 4 inch Russian thistle, 2 to 10 inch kochia and 6 inch horseweed with 66 F, 58% RH, clear sky, and 8mph E wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations were 1 to 5 plts/yd2 for horseweed, 5 plts/ft2 for Russia thistle and > 30 plts/ft2 for green foxtail. Plots were evaluated on June 29 and on September 24 for injury only. Safflower was machine harvested on September 28.

Treatment [a]	Rate	Crop injury		Weed control			Yield
		6/29	9/24	Ruth	Grft	Howe	
	oz ai/A	%		%			lb/A
Poast+MSO	3+0.125G	5	0	0	94	0	977
Poast+MSO	3+0.25G	0	0	0	99	0	1137
Poast+Act90	3+1.0%	0	0	0	74	0	1027
Poast+MSO	4.5+0.25G	0	0	0	98	0	977
Poast+Harmony+MSO	3+0.15+0.25G	0	5	97	98	45	914
Poast+Harmony+Act90	3+0.15+1.0%	0	0	97	98	53	1014
Poast+Harmony+MSO	3+0.1875+0.25G	0	11	99	98	65	994
Post+Harm+Starane+MSO	3+0.15+1.5+0.25G	6	14	97	97	44	900
Poast+Glean+MSO	3+0.15+0.25G	6	13	98	91	72	1089
Poast+Ally+MSO	3+0.05+0.25G	3	8	98	97	70	1184
Poast+MSO/Ally+Act90	3+0.25G/0.05+0.25%	0	3	97	97	64	1194
Poast+MSO/Glean+Act90	3+0.25G/0.15+0.25%	5	0	97	99	64	974
Poast+MSO/Harmony+Act90	3+0.25G/0.1875+0.25%	3	0	89	96	41	1012
Poast+MSO/Harmony+Star+ Act90	3+0.25G/0.15+1.5+ 0.25%	4	6	82	94	71	1082
Harmony+Act90	0.1875+0.25%	0	1	98	13	36	792
Glean+Act90	0.15+0.25%	4	3	98	55	91	1052
Ally+Act90	0.05+0.25%	1	6	97	0	69	643
Poast+Starane+MSO	3+2.0+0.25G	5	15	59	98	59	1184
Poast+Starane+Act90	3+2.0+1%	6	14	66	97	38	1118
Untreated	0	0	0	0	0	0	781
C.V. %		173	63	14	16	62	20
LSD 5%		NS	4	13	18	39	286

[a] - Act90 = Activator 90 nonionic surfactant from Loveland; / - delayed application; G = gallons; MSO = MSO from Loveland

Treatments did not influence safflower seed oil content or test weight.

Weed control in sunflower. Zollinger and Fitterer. An experiment was conducted in Valley City, ND to evaluate weed control from herbicides applied PRE and POST. Cargill '270' sunflowers were planted on June 2, 2000. PRE treatments were applied June 5, 2000 at 12:30 pm with 68 F air, 62 F soil at a depth of 2 to 4 inch, 40% relative humidity, 0% clouds, 3 to 5 mph S wind, dry soil surface, and moist subsoil. POST treatments were applied June 29, 2000 at 10:00 am with 75 F air, 93 F soil surface, 29% relative humidity, 0% clouds, 1 to 3 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was 4 to 6 leaf. Weed species present were: 3 to 5 inch (5 to 10/ft^2) foxtail; 2 to 4 inch (1 to 3/ft^2) marshelder; and 1 to 3 inch (1 to 3/ft^2) Eastern black nightshade. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

		July 19		
Treatment	Rate	Fxtl	Mael	Ebns
	Product/A	%	%	%
PRE				
Spartan	3oz	68	88	88
Spartan	4oz	68	88	85
Spartan	5.33oz	77	98	98
Spartan+Prowl	3oz+3pt	82	91	90
Spartan+Prowl	4oz+3pt	88	96	93
PRE/POST				
Spartan/Select+PO+AMS	4oz/4oz+1qt+2.5lb	95	98	93
Spartan/Select+PO+AMS	4oz/6oz+1qt+2.5lb	96	96	95
Spartan/Select+PO+AMS	4oz/8oz+1qt+2.5lb	99	98	98
POST				
Select+PO+AMS	6oz+1qt+2.5lb	98	0	0
Select+PO+AMS	8oz+1qt+2.5lb	98	0	0
Select+Asana XL+PO	6oz+4oz+1qt	95	0	0
Untreated		0	0	0
LSD (0.05)		8	8	9

[a]AMS = ammonium sulfate and was applied at 2.5 lb/A; PO = petroleum oil = Herbimax and was applied at 1 qt/A. Refer to adjuvant glossary for adjuvant types.

No sunflower injury occurred. Soil was a medium to fine textured soil with high organic matter (8.2) and soil pH of 6.7. Spartan is mostly adsorbed on organic matter rather than clay soil particles. Timely rains occurred after application. As Spartan rates increased, greater broadleaf weed control increased. Spartan applied PRE did not antagonize grass control from Select applied POST. Spartan gave 88 to 98% marshelder control applied alone. Inadequate marshelder control has been reported by growers. Activity and solubility of Spartan increases as soil pH increase. High soil pH with water may cause Spartan to move down the soil profile with dilution as the end result. Timely rains activated Spartan despite low solubility from low soil pH but prevented Spartan dilution.

Sunflower tolerance to Meturon. Zollinger and Fitterer. Experiments were conducted in Valley City and Carrington, ND to evaluate sunflower tolerance to Meturon applied PRE and POST. In Valley City, Cargill '270' sunflowers were planted on June 2, 2000. PRE treatments were applied June 5, 2000 at 12:00 pm with 68 F air, 62 F soil at a depth of 2 to 4 inch, 40% relative humidity, 0% clouds, 3 to 5 mph S wind, dry soil surface, and moist subsoil. POST treatments were applied June 29, 2000 at 10:30 am with 75 F air, 93 F soil surface, 29% relative humidity, 0% clouds, 1 to 3 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was 4 to 6 leaf. In Carrington, ND SF '290' NL sunflowers were planted in each plot on May 30, 2000. PRE treatments were applied May 31, 2000 at 2:00 pm with 61 F air, 60 F soil at a depth of 2 to 4 inch, 39% relative humidity, 100% clouds, 2 to 5 mph W wind, dry soil surface, and moist subsoil. POST treatments were applied June 29, 2000 at 1:30 pm with 85 F air, 102 F soil surface, 28% relative humidity, 0% clouds, 2 to 4 mph W wind, dry soil surface, moist subsoil, excellent crop vigor, no dew present, and crop stage was 4 to 6 leaf. Weed species present were: 3 to 5 inch (15-20/ft^2) foxtail; 2 to 4 inch (5 to 10/ft^2) redroot pigweed; 2 to 5 inch (3 to 8/ft^2) common lambsquarters; and 2 to 4 inch (1 to 3/ft^2) wild mustard. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Table 1. Sunflower tolerance to Meturon - Valley City, ND.

Treatment [a]	Rate	Sunflower injury		
		June 29	July 7	July 19
	Product/A	%	%	%
PRE				
Meturon	1.5pt	0	0	0
Meturon	1qt	8	3	6
Meturon	2qt	27	32	25
Meturon+Prowl	1qt+3pt	0	2	2
POST				
Meturon	0.63lb	0	4	2
Meturon	0.94lb	0	1	0
Meturon	1.25pt	0	3	2
Meturon	1.5pt	0	10	4
Meturon+NIS	0.63lb	0	2	3
Meturon+NIS	0.94lb	0	10	5
Meturon+NIS	1.25lb	0	10	6
Meturon+NIS	1.5pt	0	11	5
Meturon+PO	0.63lb	0	17	15
Meturon+PO	0.94lb	0	22	16
Meturon+PO	1.25lb	0	27	19
Meturon+PO	1.5pt	0	23	17
LSD (0.05)		7	7	7

[a]NIS = nonionic surfactant = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil = Herbimax and was applied at 1 qt/A. Refer to adjuvant glossary for adjuvant types.

Table 2. Sunflower tolerance to Meturon - Carrington, ND.

Treatment [a]	Rate	Sunflower injury			July 21				
		June 29	July 7	July 21	Fxtl	Rrpw	Colq	Wimu	Pesw
	Product/A	%	%	%	%	%	%	%	%
PRE									
Meturon	1.5pt	0	0	0	0	0	0	0	0
Meturon	1qt	2	0	0	7	0	65	10	0
Meturon	2qt	27	8	8	73	10	93	52	95
Meturon+Prowl	1qt+3pt	8	5	2	53	47	95	52	72
POST									
Meturon	0.63lb	0	7	8	22	45	90	48	83
Meturon	0.94lb	0	13	14	22	68	93	65	95
Meturon	1.25pt	0	8	11	43	57	95	63	92
Meturon	1.5pt	0	8	10	23	55	95	58	95
Meturon+NIS	0.63lb	0	8	8	13	60	93	38	90
Meturon+NIS	0.94lb	0	10	7	35	50	90	48	80
Meturon+NIS	1.5pt	0	7	8	30	55	93	43	95
Meturon+NIS	1.25lb	0	12	10	35	72	95	50	95
Meturon+PO	0.63lb	0	17	17	28	52	95	52	95
Meturon+PO	0.94lb	0	17	27	35	72	95	60	95
Meturon+PO	1.5pt	0	23	22	40	53	98	58	98
Meturon+PO	1.25lb	0	17	22	52	77	98	67	98
LSD (0.05)		13	5	6	16	13	11	15	11

[a]NIS = nonionic surfactant = Activator 90 and was applied at 0.25% v/v; PO = petroleum oil = Herbimax and was applied at 1 qt/A. Refer to adjuvant glossary for adjuvant types.

At Valley City, the experiment was established in a weed-free environment. The most injury occurred with meturon PRE at 2 qt/A and POST at the higher rates with PO. Injury symptoms at June 29 were slight stunting and yellowing. At July 7, injury symptoms were stunting for PRE treatments and sunflower leaf burn and stunting for POST treatments. Sunflower injury was similar regardless of meturon formulation.

At Carrington, sunflower injury symptoms at July 21 was stunting. The most injury occurred with meturon PRE at 2 qt/A and POST at the higher rates with PO and sunflower did not recover at the last evaluation. Most treatments gave adequate common lambsquarters and pennsylvania smartweed control but did not control foxtail, redroot pigweed or wild mustard.

Imidazolinone resistant sunflower. Zollinger and Fitterer. An experiment was conducted near Prosper, ND to evaluate tolerance of imidazolinone resistant cultivated sunflower to imidazolinone herbicides applied POST. Sunflower was seeded on June 2, 2000. POST treatments were applied July 10, 2000 at 1:00 pm with 82 F air, 110 F soil surface, 60% relative humidity, 5% clouds, 3 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, no dew present, and crop stage was 4 to 6 leaf. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Treatment[1]	Rate	Sunflower injury		
		July 18	July 25	August 8
	(Product/A)	(%)	(%)	(%)
Untreated		0	0	0
Raptor+Activator 90+28-0-0	4 fl oz	0	8	0
Raptor+Activator 90+28-0-0	8 fl oz	5	28	0
Raptor+Activator 90+28-0-0	16 fl oz	20	50	0
Odyssey+Activator 90+28-0-0	1.5 oz 70WDG	0	28	0
Odyssey+Activator 90+28-0-0	3 oz 70WDG	6	55	0
Lightning+Activator 90+28-0-0	1.25 oz 70WDG	0	3	0
Lightning+Activator 90+28-0-0	2.5 oz 70WDG	0	15	0
Raptor+Arsenal+Activator 90+28-0-0	4 fl oz+1fl oz	4	20	2
Raptor+Arsenal+Activator 90+28-0-0	5 fl oz+1.2 fl oz	3	38	3
Raptor+Scoil	16 fl oz	22	60	3
Odyssey+Scoil	1.5 oz 70WDG	0	8	2
Lightning+Scoil	1.25 oz 70WDG	0	3	0
Raptor+Arsenal+Scoil	4 fl oz+1 oz 70WDG	0	3	0
LSD (0.05)		3	17	3

[1]Activator 90 = non ionic surfactant at 0.25% v/v; 28-0-0 at 5% v/v; Scoil = methylated seed oil at 2.5% v/v.

Raptor at 8 and 16 fl oz/A are 2X and 4X the labeled use rate for soybean. Lightning at 2.5 oz/A is 2X the labeled use rate for soybean. No sunflower injury was observed 4 days after application. Injury symptoms observed eight and 15 days after application were yellowing, primarily in the new growth region of sunflower plants and slight to severe leaf crinkling. Sunflower stunting occurred in plots that received the highest herbicide rates. Excess rain (standing water) occurred June 19, which resulted in injury to sunflower plants in some plots. Observed sunflower injury may be due to multiple stresses on sunflower plants from excess rain in combination with herbicides applied at high rates. Replacing NIS with Scoil did not increase injury at 8 days after application and had less injury than some NIS treatments 15 days after application. Sunflower plants recovered and injury was negligible at August 8.

Sunflower and Rotational Crop (Corn) Response to DPX-R6447 and Sulfentrazone, Carrington, 1999-2000.
(Hendrickson and Henson)

The study was conducted on a Heimdal silt loam soil with a 6.7 pH and 2.9% organic matter. Sunflower (SF290 NL) was seeded on June 11, 1999, into 30-inch rows at 20,000 seeds/A. DPX-R6447 and sulfentrazone were applied preemergence (PRE) on June 15, 1999 to 20 by 50 ft plots at 1.07, 2.14, and 4.29 oz ai/A and 3, 4.29, and 6 oz ai/A; respectively. Ethalfluralin applied PRE at 18 oz/A was included as a treated check. The trial area was reseeded to corn May 29, 2000, into 30-inch rows at 30,600 seeds/A. Weeds were controlled with post-emergence herbicides and cultivation to reduce the effect of weed interference on corn yield.

Sunflower injury was rated less than 10% in all plots and did not differ significantly from the untreated check (Table). Sulfentrazone reduced common lambsquarters densities from 73 to fewer than two plants per three ft^2, and redroot pigweed from 41 to fewer than 10 plants per three ft^2. No differences in common purslane and yellow foxtail densities were detected. Corn injury was rated less than 10% in all plots and did not differ significantly from the untreated check. Corn yield was not affected by DPX-R6447, sulfentrazone or ethalfluralin carryover.

Table.

		Sunflower	Weed density				Corn			
		6/29/99	6/14/00				6/12/00	7/6/00	7/20/00	11/3/00
Treatment	Rate	Injury	CHEAL[1]	AMARE[2]	POROL[3]	SETLU[4]		Injury		Yield
	oz ai/A	%	# of plants / 3 ft^2				%			bu/A
DPX-R6447	1.07	3	50	23	4	2	0	0	0	130
DPX-R6447	2.14	7	35	31	10	4	0	0	0	124
DPX-R6447	4.29	3	33	27	5	3	7	3	0	130
Sulfentrazone	3	2	1	8	5	1	3	3	0	119
Sulfentrazone	4.29	7	0	5	3	1	0	0	0	115
Sulfentrazone	6	7	0	1	3	2	0	0	0	115
Ethalfluralin	18	4	18	10	6	1	0	0	0	114
Untreated check	0	0	73	41	8	9	0	0	0	122
LSD 0.05		N.S.	32	23	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

[1]CHEAL = common lambsquarters *Chenopodium album*)
[2]AMARE = redroot pigweed (*Amaranthus retroflexus)*
[3]POROL = common purslane (*Portula oleracea*)
[4]SETLU = yellow foxtail (*Setaria glauca)*

Weed Control and Sunflower Tolerance of DPX-R6447 and Sulfentrazone, Carrington, 2000. (Hendrickson)

The study was conducted on a Heimdal silt loam soil with a 6.7 pH and 2.9% organic matter. Sunflower (SF290 NL) was seeded on May 26th, into 30-inch rows at 24,500 seeds/A. Preplant incorporated (PPI) and preemergence (PRE) treatments were applied to 10-by 25-ft plots with a hand-boom plot sprayer calibrated to deliver 20 gpa at 20 psi through XR8003 flat fan nozzles (Table 1). The POST treatments were applied with XR8002 flat fan nozzles calibrated to deliver 20 gpa at 35 psi. The PPI treatments were incorporated twice with a cultiharrow. The experimental design was a randomized complete block with three replicates.

Weeds evaluated were yellow foxtail, common lambsquarters and redroot pigweed. The trial area was heavily infested with yellow foxtail early in the season. On June 20, both DPX-R6447 and sulfentrazone applied PPI and PRE provided ≥75% control of yellow foxtail (Table 2). By July 20, DPX-R6447 applied PRE at 0.125 lb ai/A was the only treatment with ≥ 75% yellow foxtail control. Both treatments that included quizalofop-P-ethyl provided 99% control of the yellow foxtail. The addition of pendimethalin to DPX-R6447 and sulfentrazone did not improve yellow foxtail control. Both DPX-R6447 and sulfentrazone applied PPI and PRE provided excellent control of common lambsquarters and redroot pigweed.

No differences in sunflower injury were detected (data not shown). Due to the heavy yellow foxtail infestation, yields tended to increase as the yellow foxtail control increased (Table 2).

Table 1. Application data

Date:	May 25, 2000	May 30, 2000	July 7, 2000
Treatments applied:	PPI	PRE	POST
Temperature (F):	Air: 35 Soil: 56	Air: 54 Soil: 54	Air: 70 Soil: 68
% relative humidity	84	78	98 (light mist)
% cloud cover	0	20	100
Wind speed and direction	calm	8 mph North	3-9 mph east
Dew present?	yes	yes	yes
Time of day	5:30 AM	8:30 to 9:00 AM	8:30 AM

Table 2. Weed control in Sunflower

Treatment	Rate		6/20/00	7/20/00			Sunflower[4]
			SETLU[1]	SETLU	CHEAL[2]	AMARE[3]	yield
	lb ia/A	Timing	% control				lbs/ac
sulfentrazone	0.1875	PPI	75	40	100	100	1228
sulfentrazone	0.375	PPI	93	53	100	100	1562
sulfentrazone / quizalofop-P-ethyl	0.1875 / 0.055	PPI / POST	87	99	100	100	1650
DPX-R6447	0.125	PPI	89	50	100	100	1596
sulfentrazone	0.1875	PRE	87	27	95	93	943
sulfentrazone	0.375	PRE	94	67	100	100	1530
DPX-R6447	0.0625	PRE	78	33	90	90	1149
DPX-R6447	0.0938	PRE	97	60	98	99	1620
DPX-R6447	0.125	PRE	99	75	100	99	1637
DPX=R6447 / quizalofop-P-ethyl	0.125 / 0.055	PRE / POST	98	99	99	98	1885
DPX-R6447 + pendamethalin	0.0625 + 1	PRE	83	40	99	97	1409
sulfentrazone + pendamethalin	0.1875 + 1	PRE	83	33	100	99	1060
pendamethalin	1	PRE	27	20	83	80	877
check	0	check	0	0	0	0	497
LSD (0.05)			12	17	8	4	386

[1]SETLU = yellow foxtail (*Setaria glauca)*

[2]CHEAL = common lambsquarters *Chenopodium album*)

[3]AMARE = redroot pigweed (*Amaranthus retroflexus)*

[4]Harvested October 12, 2000

Leafy spurge control with imazapic combined or alternated with picloram plus 2,4-D. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Research at North Dakota State University has shown that imazapic provides good leafy spurge control when applied in the fall but can injure grass, especially cool-season species. Thus, picloram plus 2,4-D may need to be applied every other year to reduce grass injury in a long-term management program. The purpose of this research was to evaluate imazapic applied alone, in rotation with picloram plus 2,4-D, or the three herbicides applied together for long-term leafy spurge control.

The experiment was established at Jamestown and Valley City, North Dakota, in a dense stand of leafy spurge. Initial herbicide treatments were applied in early June 1998 during the true-flower growth stage or in mid-September when leafy spurge was in the fall regrowth growth stage. Initial treatments of imazapic were followed by picloram plus 2,4-D. Likewise, initial treatments of picloram plus 2,4-D were followed by imazapic. Imazapic was applied at 1 oz/A in the spring or 2 oz/A in the fall. Picloram plus 2,4-D was applied at the common use rate of 4 + 16 oz/A in the spring or 8 + 16 oz/A in the fall. The three-way mixture of picloram plus 2,4-D plus imazapic was applied once in the spring or fall with no follow-up treatment. Any treatment that included imazapic also contained methylated seed oil plus 28% N liquid fertilizer.

Treatments were applied with a hand-held sprayer delivering 8.5 gpa at 35 psi. The experiment was a randomized complete block design with four replications at both locations, and plots were 10 by 30 feet. Control was based on percent stand reduction as compared to the untreated check.

The three-herbicide mixture of picloram plus 2,4-D plus imazapic applied once in the spring provided the best long-term leafy spurge control (Table). Control averaged across locations was 99% in June 2000, 24 months after treatment (MAT). This high level of control was unexpected and is better than the long-term average of picloram applied alone at 32 oz/A, which generally provides the best long-term control in the region. The same three-herbicide treatment applied in the fall only averaged 61 and 15% control 12 and 24 MAT, respectively.

The best split treatments for long-term leafy spurge control were picloram plus 2,4-D applied in the spring followed by imazapic in the fall and imazapic fall-applied followed by picloram plus 2,4-D in the spring. These treatments averaged 85 and 61% control in August 1999 and 2000, respectively. No grass injury was observed following any of the rotational treatments.

In general, control at the Valley City location was better than at the Jamestown location. For instance, picloram plus 2,4-D plus imazapic spring applied provided 98% control in June 2000, 24 MAT at Jamestown, but control began to decline by August 2000 to an average of 75%. In comparison, leafy spurge control averaged 91% in August 2000 at Valley City. The high long-term control from the three-way mixture exceeded that from any previous herbicide treatments evaluated at North Dakota State University. To maintain such long-term control usually requires two or three annual applications of either imazapic or picloram plus 2,4-D.

Table. Leafy spurge control with imazapic combined or alternated with picloram and 2,4-D applied in the spring or fall at two locations.

				1998			1999						2000					
				August			June			August			June			August		
Treatment	Rate	Treatment	Rate	JMS[a]	VC[a]	Mean	JMS[a]	VC[a]	Mean	JMS[a]	VC[a]	Mean	JMS[a]	VC[a]	Mean	JMS[a]	VC[a]	Mean
	— oz/A —		- oz/A -	% control														
Spring 1998		Fall 1998																
Picloram+2,4-D	4+16	Imazapic+Scoil+28% N	2+1qt+1qt	85	88	86	99	99	99	70	95	82	64	82	73	42	75	58
Imazapic+MSO[c]+28% N	1+1qt+1qt	Picloram+2,4-D	8+16	28	58	43	99	99	99	53	82	67	43	76	59	18	69	43
Picloram+2,4-D+imazapic +MSO[c]+28% N	4+16+1+ 1qt+1qt	None		99	95	97	95	99	99	97	99	98	98	99	99	75	91	83
LSD (0.05)				11	16	7[b]												
Fall 1998		Spring 1999																
Picloram+2,4-D	8+16	Imazapic+Scoil+28% N	1+1qt+1qt				98	94	96	82	91	87	98	95	96	47	82	64
Imazapic+MSO[c]+28% N	2+1qt+1qt	Picloram + 2,4-D	8+16				99	99	99	96	98	97	77	81	79	25	62	43
Picloram+2,4-D+ imazapic+MSO[c]+28% N	8+16+2+ 1qt+1qt	None					99	99	99	59	64	61	26	50	38	3	28	15
LSD (0.05)							NS	2	NS	11	16	9[d]	11	16	10[d]	29	14	15[d]

[a] JMS = Jamestown, VC = Valley City

[b] Significant interaction between locations. Control with imazapic at Valley City was higher than at Jamestown.

[c] Methylated seed oil was Scoil by AGSCO, Grand Forks, ND.

[d] Control at Valley City was higher than at Jamestown.

Evaluation of diflufenzopyr with auxin herbicides for leafy spurge control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Previous research at North Dakota State University has shown that both initial and long-term leafy spurge control was increased when diflufenzopyr was applied with various auxin herbicides including dicamba, quinclorac, picloram, and 2,4-D. In the initial trials diflufenzopyr was applied at a ratio of 2.5:1 herbicide:diflufenzopyr. The purpose of this research was to evaluate the effect of varying the ratio of herbicide to diflufenzopyr on both short- and long-term leafy spurge control with various herbicides.

The first experiment evaluated the optimum ratio of diflufenzopyr when applied with dicamba or quinclorac. The diflufenzopyr ratio varied from the standard ratio of 2.5:1 herbicide:diflufenzopyr to 5:1 and 10:1. Experiments were established near Jamestown and Valley City, North Dakota, in early June 1998 when leafy spurge was in the true-flower growth stage. The herbicides were applied using a hand-held boom sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet, and treatments were replicated four times in a randomized complete block design. Leafy spurge topgrowth control was visually evaluated based on percent stand reduction compared to the untreated check.

Both initial foliar injury 1 month after treatment (MAT) and topgrowth control 3 MAT usually were higher when diflufenzopyr was applied with dicamba and quinclorac compared to the herbicide applied alone (Table 1). However, injury and control were similar regardless of diflufenzopyr rate. For instance, leafy spurge control 3 MAT with dicamba applied alone averaged 84% but increased to an average of 97% when applied with diflufenzopyr. Control with quinclorac alone averaged 78% but increased to an average of 97% when applied with diflufenzopyr. Control 3 MAT averaged 78% when diflufenzopyr was applied with glyphosate plus 2,4-D compared to 44% when the herbicide combination was applied alone.

The addition of diflufenzopyr increased long-term leafy spurge control when applied with either dicamba or quinclorac compared to the herbicides applied alone. For instance, leafy spurge control 24 MAT averaged 63 with dicamba plus diflufenzopyr, versus 39% with dicamba alone (Table 1). The increase in control was similar regardless of the dicamba:diflufenzopyr ratio. Similarly, long-term leafy spurge control 24 MAT averaged 71% when diflufenzopyr was applied with quinclorac compared to only 49% when quinclorac was applied alone. Again, the increase in control was similar regardless of the quinclorac:diflufenzopyr ratio. The addition of diflufenzopyr to glyphosate plus 2,4-D did not result in a long-term increase in leafy spurge control.

The second and third experiments were established to evaluate the optimum ratio of diflufenzopyr when applied with picloram or picloram plus 2,4-D for leafy spurge control. Diflufenzopyr was applied from 1.6 to 6.4 oz/A with picloram at 8 oz/A or picloram plus 2,4-D at 4 + 16 oz/A. Leafy spurge was in the true-flower growth stage, the air temperature was 63 F with a dew point of 57 F on June 9, 1998 when the second experiment was established. When the third experiment was established on September 15, 1998, leafy spurge was in the fall regrowth stage with approximately 15% yellow foliage, and the air temperature was 78 F with a dew point of 60 F.
Consistent with the previous experiments long-term leafy spurge control increased when diflufenzopyr was applied with picloram or picloram plus 2,4-D compared to the herbicides alone, and the increase was similar regardless of the herbicide:diflufenzopyr ratio (Tables 2 and 3). Leafy spurge control 15 MAT averaged 88 and 83% when picloram or picloram plus 2,4-D were applied with diflufenzopyr compared to 62 or 38%, respectively, when the herbicides were applied (Table 3). Control averaged 84% with picloram at 8 oz/A plus diflufenzopyr 27 MAT compared to only 31% when picloram was applied alone.

In general, long-term leafy spurge control also was increased when diflufenzopyr plus picloram or picloram plus 2,4-D was fall applied, but the increase was erratic (Table 3). For instance, leafy spurge control 12 MAT with picloram plus 2,4-D at 4 + 16 oz/A averaged only 1% compared to a range from 36 to 65% control when the same treatment was applied with diflufenzopyr. However, there was no clear trend between the amount of diflufenzopyr applied with picloram plus 2,4-D and leafy spurge control. Leafy spurge control with picloram at 8 oz/A averaged 37% 21 MAT compared to an average of 57% when applied with diflufenzopyr.

The fourth experiment was established to further evaluate the effect of the diflufenzopyr ratio on leafy spurge control with dicamba or quinclorac. Herbicides were applied at various rates with an herbicide:diflufenzopyr ratio of 2.5:1 or 10:1. The experiment was established at two locations, in early June 1999 near Valley City when leafy spurge was in the flowering growth stage and in mid-July near Fargo when leafy spurge was in late seed-set stage.

Leafy spurge control was similar when herbicides were applied at comparable rates regardless of the diflufenzopyr ratio (Table 4). Although not directly comparable, leafy spurge control tended to be higher when the herbicides were applied during the flowering growth stage compared to the seed-set stage. Control was independent of diflufenzopyr ratio (2.5:1 or 10:1).

In summary, diflufenzopyr increased long-term leafy spurge control by auxin-type herbicides and the increase was independent of the herbicide:diflufenzopyr ratio. No increase in non-target plant injury, such as grass injury, was observed at any location.

Table 1. Diflufenzopyr applied at various ratios with herbicides for leafy spurge control averaged over Jamestown and Valley City locations in North Dakota.

Treatment	Rate	Foliar injury	Control/MAT[a]			
		1 MAT[a]	3	12	15	24
	oz/A	%				
Dicamba + X-77 + 28% N	32 + 0.25% + 1 qt	64	84	29	25	39
Dicamba + diflufenzopyr + X-77 + 28% N	32 + 3.2 + 0.25% + 1 qt	67	94	75	58	65
Dicamba + diflufenzopyr + X-77 + 28% N	32 + 6.4 + 0.25% + 1 qt	78	99	89	57	60
Dicamba + diflufenzopyr + X-77 + 28% N	32 + 12.8 + 0.25% + 1 qt	70	98	83	59	63
Quinclorac + MSO[b]	12 + 1 qt	47	78	85	54	49
Quinclorac + diflufenzopyr + MSO[b]	12 + 1.6 + 1 qt	61	96	96	83	72
Quinclorac + diflufenzopyr + MSO[b]	12 + 3.2 + 1 qt	60	97	98	82	70
Quinclorac + diflufenzopyr + MSO[b]	12 + 4.8 + 1 qt	66	98	96	75	71
Glyphosate + 2,4-D[c]	6 + 10	88	44	31	17	30
Glyphosate + 2,4-D[c] + diflufenzopyr	6 + 10 + 6.4	84	78	53	27	31
LSD (0.05)		8	8	14	13	15

[a] Months after treatment.
[b] Methylated seed-oil was Scoil by AGSCO, Grand Forks, ND.
[c] Commercial formulation - Landmaster BW.

Table 2. Leafy spurge control with picloram or picloram plus 2,4-D combined with various ratios of diflufenzopyr applied in June 1998 near Valley City, North Dakota.

Treatment	Rate	Control/MAT[a]				
		3	12	15	24	27
	oz/A	%				
Picloram + diflufenzopyr	8 + 1.6	99	96	85	83	79
Picloram + diflufenzopyr	8 + 3.2	99	99	88	91	88
Picloram + diflufenzopyr	8 + 4.8	99	99	90	91	87
Picloram + diflufenzopyr	8 + 6.4	99	99	89	92	83
Picloram + 2,4-D + diflufenzopyr	4 + 16 +1.6	99	90	79	81	53
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 3.2	98	93	82	79	65
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 4.8	99	96	85	84	80
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 6.4	99	98	85	81	76
Picloram	8	92	85	62	51	31
Picloram + 2,4-D	4 + 16	80	79	38	52	40
LSD (0.05)		5	11	13	16	22

[a] Months after treatment.

Table 3. Leafy spurge control with picloram or picloram plus 2,4-D combined with various ratios of diflufenzopyr applied in September 1998 near Valley City, North Dakota

Treatment	Rate	Control/MAT[a]		
		9	12	21
	oz/A	%		
Picloram + diflufenzopyr	8 + 1.6	99	66	63
Picloram + diflufenzopyr	8 + 3.2	97	44	34
Picloram + diflufenzopyr	8 + 4.8	99	83	70
Picloram + diflufenzopyr	8 + 6.4	99	74	60
Picloram + 2,4-D + diflufenzopyr	4 + 16 +1.6	88	36	20
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 3.2	93	65	43
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 4.8	95	45	34
Picloram + 2,4-D + diflufenzopyr	4 + 16 + 6.4	95	40	31
Picloram	8	88	53	37
Picloram + 2,4-D	4 + 16	45	1	0
LSD (0.05)		12	26	22

[a] Months after treatment.

Table 4. Leafy spurge control with dicamba and quinclorac combined with various ratios of diflufenzopyr applied in June 1999 at Valley City during the flowering growth stage or in July 1999 during seed-set at Fargo.

		1999		2000		
		September		June		Aug
Treatment	Rate	Valley City	Fargo	Valley City	Fargo	Fargo
	lb/A	% control				
Dicamba + diflufenzopyr + X-77	2 + 0.2 + 0.25%	99	96	94	94	87
Dicamba + diflufenzopyr + X-77	2 + 0.8 + 0.25%	100	97	98	91	83
Dicamba + diflufenzopyr + X-77	1 + 0.1 + 0.25%	96	94	87	90	86
Dicamba + diflufenzopyr + X-77	1 + 0.4 + 0.25%	98	88	74	67	60
Dicamba + diflufenzopyr + X-77	0.5 + 0.05 + 0.25%	90	85	73	60	46
Dicamba + diflufenzopyr + X-77	0.5 + 0.2 + 0.25%	89	83	45	64	28
Quinclorac + diflufenzopyr + MSO[a]	0.75 + 0.075 + 1 qt	98	94	95	87	72
Quinclorac + diflufenzopyr + MSO[a]	0.75 + 0.3 + 1 qt	99	95	97	83	77
Quinclorac + diflufenzopyr + MSO[a]	0.5 + 0.05 + 1 qt	99	98	97	59	31
Quinclorac + diflufenzopyr + MSO[a]	0.5 + 0.20 + 1 qt	98	97	97	86	73
Quinclorac + diflufenzopyr + MSO[a]	0.25 + 0.025 + 1 qt	96	93	76	80	54
Quinclorac + diflufenzopyr + MSO[a]	0.25 + 0.10 + 1 qt	98	96	92	58	29
Diflufenzopyr + X-77	0.10 + 0.25%	0	0	0	14	0
Diflufenzopyr + X-77	0.20 + 0.25%	0	0	26	12	0
Diflufenzopyr + X-77	0.40 + 0.25%	0	0	0	8	0
Diflufenzopyr + X-77	0.80 + 0.25%	0	5	54	10	0
Picloram + 2,4-D	0.5 + 1	99	94	97	55	37
LSD (0.05)		4	8	32	21	29

[a] Methylated seed oil was Scoil by AGSCO, Grand Forks, ND.

Imazapic applied for 3 consecutive years for leafy spurge control. Rodney G. Lym. (Plant Sciences Department, North Dakota State University, Fargo, ND 58105). Imazapic (Plateau) has been registered for leafy spurge control in non-cropland. The label states that imazapic should be applied with a methylated seed oil (MSO) adjuvant plus 28% urea nitrogen. Also, the manufacturer recommends imazapic be applied in the fall prior to a killing frost or as a split application in the fall and the following spring. The purpose of these experiments was to evaluate imazapic for leafy spurge control and grass injury applied alone or with a MSO adjuvant in the spring or fall for 3 years.

Leafy spurge control with imazapic was evaluated following application in mid-summer or fall for 3 years at two locations in North Dakota. The herbicide treatments were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet and replicated four times with the herbicide treatments in a randomized complete block design. Herbicides were applied near Valley City or Jamestown on July 3, 1996, when the leafy spurge was in the flowering to seed-set growth stage. The air temperature was approximately 80 F and the soil temperature at the 4 inch depth was 57 F at Valley City and 69 F at

Jamestown. The fall treatments were applied at both locations on September 9 when the leafy spurge was in the fall regrowth growth stage and the air temperature was in the mid 80s. Treatments were reapplied in 1997 and 1998 on similar dates.

Imazapic applied in mid-summer at Valley City did not control leafy spurge when visually evaluated the year of treatment (Table 1). However, control by imazapic at 2 and 4 oz/A averaged 94 and 99%, respectively in May 1997. Imazapic at 4 oz/A provided 93% leafy spurge control in September 1997 with minimal grass injury, but 4 oz/A is above the maximum labeled use rate of 3 oz/A. Imazapic fall-applied at 2 or 4 oz/A provided excellent leafy spurge control the following spring but grass injury was very noticeable and averaged 43%. Imazapic applied at 1 or 2 oz/A with MSO provided 92% leafy spurge control when evaluated in the fall 12 MAT, which was higher than the standard picloram plus 2,4-D treatment which averaged 47%.

Imazapic applied at 2 oz/A plus an MSO in mid-summer provided 83% leafy spurge control 25 months after the last treatment (Table 1), with no visible grass injury. The grasses had recovered from the injury observed following the initial treatment and were not injured by the subsequent treatments. Leafy spurge control from imazapic fall-applied averaged greater than 85% control 24 months after the third application and was similar to the standard treatment of picloram plus 2,4-D.

Leafy spurge control with imazapic applied in mid-summer tended to be less at Jamestown than Valley City (Tables 1 and 2). Only imazapic at 4 oz/A provided greater than 90% control in May 1997 at Jamestown (Table 2). Control averaged 99% in September following a second application of picloram plus 2,4-D, but only was 71% or less with a second application of imazapic.

Imazapic applied in the fall at Jamestown provided excellent (99%) leafy spurge control in May 1997 regardless of application rate (Table 2). In contrast to the high grass injury observed at Valley City (Table 1), only imazapic at 4 oz/A fall-applied injured grass (18%) (Table 2). Leafy spurge control averaged 91 and 79%, respectively, 12 and 24 months after the third treatment with imazapic applied alone at 4 oz/A or at 2 oz/A with MSO.

In general, imazapic applied in the fall provided better leafy spurge control than the mid-summer treatment at both locations and control was improved when the herbicide was applied with a MSO compared to imazapic applied alone. Grass injury to cool season species tended to be higher when imazapic was applied in July compared to fall-applied, but the grasses generally recovered by 12 MAT. The most cost-effective treatment was imazapic applied in the fall at 2 oz/A with an MSO.

Table 1. Imazapic for leafy spurge control annually applied in mid-summer or fall for 3 yr at Valley City, ND.

Treatment[a]	Rate	Evaluation											
		Sept. 1996		May 1997		Sept 1997		1998		1999		2000	
			Grass		Grass		Grass	Control					
		Cont	inj.	Cont	inj.	Cont	inj.	June	Aug	June	Aug	June	Aug
	oz/A	%											
Imazapic (summer)	2	0	0	94	10	74	5	90	95	77	79	76	68
Imazapic (summer)	4	0	0	99	28	93	5	50	93	93	90	82	78
Imazapic + MSO[b] (summer)	1 + 1 qt	0	0	0	8	87	3	82	96	85	84	78	58
Imazapic + MSO[b] (summer)[c]	2 + 1 qt	0	0	99	28	73	16	59	96	91	95	86	83
Picloram + 2,4-D (summer)	4 + 16	74	4	75	0	38	0	26	96	83	93	82	78
Imazapic (fall)[c]	2			100	36	71	0	99	85	98	97	83	84
Imazapic (fall)[c]	4			100	53	99	0	100	98	99	99	87	93
Imazapic + MSO[b] (fall)[c]	1 + 1 qt			100	20	92	0	99	82	91	97	81	85
Imazapic + MSO[b] (fall)[c]	2 + 1 qt			100	40	92	0	99	85	96	99	77	75
Picloram + 2,4-D (fall)[c]	8 + 16			99	13	47	0	95	86	95	96	92	84
LSD (0.05)		34	NS	20	25	25	NS	26	10	9	NS	13	NS

[a] Treatments applied July 2, (summer) and September 9, 1996 (fall).
[b] Methylated seed oil was SunIt by AGSCO.
[c] Treatments reapplied 1997. All treatments were reapplied in 1998.

Table 2. Imazapic for leafy spurge control annually applied in mid-summer or fall for 3 yr at Jamestown, ND.

Treatment[a]	Rate	Evaluation											
		Sept 1996		May 1997		Sept. 1997	June 1998		Aug 1998	1999		2000	
			Grass		Grass			Grass		Control			
		Cont	inj.	Cont	inj.	Cont	Cont	inj.	Control	June	Aug	June	Aug
	oz/A	%											
Imazapic (summer)	2	0	0	0	0	0	34	0	22	20	6	5	3
Imazapic (summer)	4	13	14	92	1	71	96	2	99	96	88	69	50
Imazapic + MSO[b] (summer)	1 + 1 qt	28	0	33	0	13	58	0	36	37	11	21	10
Imazapic + MSO[b] (summer)	2 + 1 qt	17	0	72	0	45	85	0	82	76	67	48	30
Picloram + 2,4-D (summer)	4 + 16	46	0	15	0	99	42	0	87	40	56	46	24
Imazapic (fall)	2			99	5	28	97	0	45	100	74	64	34
Imazapic (fall)	4			100	18	97	100	23	99	100	91	85	78
Imazapic + MSO[b] (fall)	1 + 1 qt			99	6	70	99	0	29	95	66	55	38
Imazapic + MSO[b] (fall)	2 + 1 qt			100	6	96	100	6	96	100	90	82	79
Picloram + 2,4-D (fall)	8 + 16			95	0	26	97	0	26	99	73	63	30
LSD (0.05)		14	10	19	6	18	10	5	17	14	18	15	22

[a] Treatments applied July 2, (summer) and September 9, 1996 (fall). All treatments were reapplied in 1997 and 1998.
[b]Methylated seed oil was SunIt by AGSCO.

Using sonic sound waves to increase leafy spurge control with herbicides. Rodney G. Lym and Katheryn M. Christianson. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). A manufacturer[1] markets a system of sound emitters used with nutrient solutions (SonicBloom®) that reportedly increases plant growth both in greenhouse and field conditions. Recently, claims have been made that the use of the sound system with herbicides (SonicDoom®) can increase weed control compared to the herbicides alone. The purpose of this study was to evaluate the use of sound with various herbicides for leafy spurge control.

The experiment was established in separate growth chambers (sound and no sound) set at a 16 h photoperiod, a 75/65 day/night temperature and 30 to 40% relative humidity. Leafy spurge was propagated from cuttings in the greenhouse in cone-tanners (Lym, R. G. 1992. Propagation of *Euphorbia esula*) for leafy spurge biocontrol agents, *Weed Sci.* 40:326-332) and grown for 6 weeks, then the topgrowth was removed and the plants were allowed to regrow prior to treatment. Leafy spurge plants were 10 to 18 inches tall and vegetative (two replicates) or flowering (two replicates) at treatment. The plants were placed in growth chambers, with or without the sound source, 72 h prior to treatment. A sound box that emitted continuous sound in wavelengths designed to increase herbicide absorption[1] was turned on 48 h prior to treatment, during treatment (in the spray hood), and 24 h following herbicide treatment. Herbicides were applied with a one nozzle greenhouse sprayer delivering 17 gpa at 35 psi at rates that typically produce injury but not complete plant kill under greenhouse conditions. Thus, any increase in herbicide activity due to the sound treatment would be readily apparent. Plants were returned to the respective growth chamber immediately following treatment for 24 h and then moved to the greenhouse for the remainder of the study.

Leafy spurge control was evaluated by estimating injury to the topgrowth 7 and 14 days after treatment (DAT) with 0 equal to no injury and 100 equal to complete topgrowth kill. Then the topgrowth was removed and the plants were allowed to regrow for 6 weeks when the number of live plants was determined. The regrowth was harvested, dried, and weighed which provided an estimate of herbicide injury to the roots. There were four plants per treatment and the study was repeated.

Leafy spurge injury and plant regrowth with each herbicide treatment was similar whether or not the sound treatment was included (Table). For instance, picloram plus 2,4-D averaged 40% top growth injury 14 DAT, 218 and 223 mg of regrowth, and 100% and 88% live plants, when the herbicides were applied with our without sound, respectively. Mean dry weight of plant regrowth averaged 197 and 193 mg/plant with and without sound, respectively. Quinclorac provided the greatest leafy spurge injury and reduction in regrowth, but the results were similar regardless if applied with or without the sound treatment. In summary, no increase in leafy spurge control was observed when herbicides were applied with the sound emitter. Similar results would be expected with field applications.

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[1]Dan Carlson Scientific Enterprises, Inc. 708-119th Lane N. E., Blaine, MN 55434.

Table. Leafy spurge control with various herbicides applied with and without a sonic sound treatment.

Treatment	Rate	Topgrowth injury (DAT[a]) 7	14	Plant regrowth (8 WAT[b]) Dry weight	Live plants
	— oz /A —	——— % ———		mg/plant	— % —
With sound					
Picloram + 2,4-D + X-77	2 + 3 + 0.25%	25	40	218	100
Imazapic	0.015	10	15	151	100
Quinclorac + MSO[c]	3 + 1 qt	50	60	3	19
Glyphosate + 2,4-D	3.2 + 4.8	35	60	320	88
Dicamba + diflufenzopyr	3 + 1.2	55	60	165	75
Control		0	0	325	100
Mean (with sound)				197	
Without sound					
Picloram + 2,4-D + X-77	2 + 3 + 0.25%	35	40	223	88
Imazapic	0.015	5	15	250	88
Quinclorac + MSO[c]	3 + 1 qt	60	70	0	13
Glyphosate + 2,4-D	3.2 + 4.8	35	60	303	88
Dicamba + diflufenzopyr	3 + 1.2	45	60	267	88
Control		0	0	333	100
Mean (without sound)				193	NS
LSD (0.05) Trt				205	
LSD (0.05) Trt by sound				NS	

[a] Days after treatment.
[b] Weeks after treatment.
[c] Methylated seed oil was Sunit by AGSCO.

Leafy spurge control with *Aphthona nigriscutis* alone or combined with herbicides. Rodney G. Lym, Don A. Mundal, and Robert B. Carlson. An experiment to evaluate the effect of herbicide application timing on biocontrol insect population and leafy spurge control was established on a private farm near Cuba, North Dakota. Approximately 500 *Aphthona nigriscutis* were released in July 1989 in a moderately dense patch of leafy spurge. The insects established and began to spread to other patches of leafy spurge within the pasture prior to the beginning of this experiment.

The experiment was established in two patches of leafy spurge approximately 5000 square feet each and about 100 yards apart. The treatments included picloram plus 2,4-D at 0.5 + 1 lb/A fall applied, picloram plus 2,4-D at 0.25 + 1 lb/A spring applied, and an untreated control. Herbicides were applied annually beginning with the initial spring treatment on June 5, 1992, and the first fall treatment on September 10, 1992. Herbicides were reapplied at similar dates from 1993 to 1995. The plots were 15 by 50 feet, and treatments were replicated four times (two per patch). *A. nigriscutis* population was evaluated by sweep counts with a standard insect collection net and are reported as a mean of three square meters (five sweeps equals 1 m^2).

Leafy spurge stem density declined rapidly when herbicides were fall applied to plants infested with *A. nigriscutis* (Table 1). The leafy spurge stand declined from 164 stems/m^2 in 1992, to 10 stems/m^2 the following year. Leafy spurge gradually declined with the insect alone treatment from 187 stems/m^2 in June 1992 to 5 stems/m^2 by May 1995. Both the insect alone and fall-applied herbicide plus insect treatments provided more rapid leafy spurge stem reduction than the spring-applied herbicides plus insects treatment. Herbicides applied in June prevent the adult flea beetles from feeding on those plants, and thus probably reduce egg laying and subsequent larvae feeding.

Leafy spurge stem density continued to decline over time and averaged 11 stems/m^2 in 1999. Since herbicide application was stopped after 1995, the decline is due to control by *Aphthona* flea beetles alone (Table 1). Control tended to be better with the picloram plus 2,4-D applied in the fall with insects and the insects alone treatment compared to the same herbicides applied in the spring. It is likely that the *A. nigriscutis* will maintain long-term leafy spurge control without further chemical treatments.

The *A. nigriscutis* population gradually increased over time from 1993 to 1996 and averaged 90 adults/m^2 in 1997 and 1998 regardless of treatment (Table 2). Flea beetle population began to decline in 1997 as the leafy spurge density decreased. There was an average of only 23 beetles/m^2 in 1998 regardless of the initial treatment. Thus, 9 yr after the initial release of flea beetles, the population appeared to be in equilibrium with the leafy spurge population. It took 4 yr less for this equilibrium to be reached when herbicides were used in conjunction with the biocontrol agents compared to the insects alone. Both leafy spurge stem density and flea beetle counts were low in 2000. It appears the insects have moved on to infestations outside the experimental area.

In summary, the fall herbicide treatment combined with the biological control agent *Aphthona nigriscutis* provided more rapid leafy spurge control than the insects alone. The leafy spurge

density gradually declined when only insects were present and took 3 yr longer to reduce the infestation to the same level achieved in 1 yr by the herbicide-plus-insect combination treatment and 4 yr longer than herbicides alone (based on long-term averages). Leafy spurge density and *A. nigriscutis* population had reached an equilibrium by 6 yr after the first herbicide treatment and are expected to maintain acceptable long-term leafy spurge control.

Table 1. Leafy spurge stem density after treatment with *Aphthona nigriscutis* alone or combined with herbicide treatments near Cuba, ND.

		Stem density/evaluation date								
Treatment[a]	Rate	June 1992	May 1993	May 1994	May 1995	June 1996	June 1997	June 1998	June 1999	June 2000
	lb/A	No./m^2								
Picloram + 2,4-D (Spring)	0.25+1	220	208	134	16	22	13	15	17	3
Picloram + 2,4-D (Fall)	0.5+1	164	10	11	0.5	0.5	12	11	9	2
Insects only	. .	187	150	99	5	13	17	17	7	2
LSD (0.05)		30	27	20	10	10	NS	NS	5	NS

[a] Herbicides annually applied in June or September from 1992 to 1995.

Table 2. Effect of herbicide application on *Aphthona nigriscutis* population 3 yr after the biocontrol insect had established.

		A. nigriscutis counts[b]/year								
Treatment[a]	Rate	1992	1993	1994	1995	1996	1997	1998	1999	2000
	lb/A	No./m^2								
Picloram + 2,4-D (Spring)	0.25+1	1	0	19	76	25	12	17	19	4
Picloram + 2,4-D (Fall)	0.5+1	21	52	40	30	18	8	26	20	2
Insects only	. .	12	28	132	70	96	23	27	24	3
LSD (0.05)		5	16	63	26	29	6	NS	NS	NS

[a] Herbicides annually applied in June or September from 1992 through 1995.
[b] Highest number collected during sampling from June through September.

Evaluation of *Aphthona czwalinae/lacertosa* combined with various auxin herbicides for leafy spurge control. Rodney G. Lym and Katheryn M. Christianson. (Plant Sciences Dept., North Dakota State University, Fargo, ND 58105). Previous research at North Dakota State University has found that a combination of *Aphthona* spp. flea beetles with picloram plus 2,4-D provides more rapid and better leafy spurge control than either method used alone. The purpose of this research was to evaluate leafy spurge control using a mixed population of *A. czwalinae/lacertosa* flea beetles alone or combined with picloram and/or 2,4-D for leafy spurge control.

The experiment was established on a 2 acre area of leafy spurge where biocontrol agents had not previously been introduced near Buffalo, ND. The leafy spurge density was moderate to high and averaged 128 stems/m^2. The soil was a loam with 45:37:18 sand:silt:clay, 26% organic matter, and a pH of 8. The experiment was a randomized complete block design with two blocks of paired plots and four replications. The treatment block that included *Aphthona* spp. was separated from the herbicide only treatment block by 300 feet.

Foliar cover, percent forbs and grass, and leafy spurge density were determined on June 6, 1996, using a 0.25 m daubenmier frame. There were four counts diagonally across each plot. Approximately 10,000 *Aphthona czwalinae/lacertosa* were released into the insect block on July 10, 1996 with 2,000 released per replication and an additional 2,000 in an X formation across the block. *Aphthona* spp. population was evaluated by sweep counts with a standard insect collection net in late-June in 1997 and subsequent years. Population counts are reported as a mean of three square meters (five sweeps equals 1 m^2).

Herbicide treatments were applied using a hand-boom sprayer delivering 8.5 gpa at 35 psi in mid-September 1997 and again in 1998 to the same plots. Herbicides were applied to both the herbicide only and insect plus herbicide blocks in September because *Aphthona* spp. adults have completed their life-cycle by then. Leafy spurge stand counts were determined in May of each year in the manner as previously described. Visual evaluations of leafy spurge control were determined in late-August to early-September of each year and were an estimate of percent stand reduction as compared to the control .

In general, leafy spurge was reduced more rapidly when herbicides were combined with the biocontrol insects compared to either method used alone. For instance, leafy spurge stem density averaged 39 and 24 stems/m^2 in 1998 when picloram was applied alone or with 2,4-D, respectively, compared to 8 and 1 stem/m^2, respectively, when *Aphthona* were present (Table). 2,4-D applied alone did not reduce the leafy spurge stem density which averaged 118/m^2 in 1999 compared to 0.8/m^2 when 2,4-D was applied to leafy spurge infested with *Aphthona*. The flea beetles began to spread into the herbicide only study area in 1999. As a result, leafy spurge stem density rapidly declined from 118 to1.3/m^2 in the 2,4-D treated area in one year.

Aphthona czwalinae/lacertosa established following the 1997 release and averaged 18 beetles/m^2 across all herbicide plus insect treatments in 1998 (Table). There were more beetles in the insect only treatment compared to the insect plus herbicide treatments which averaged 103 compared to 18 beetles/m^2, respectively, in 1999. The combination of flea beetles and herbicides had reduced

the leafy spurge stem density to less than 1/m^2 so most adult beetles had moved out of the treated area.

Table. Aphthona czwalinae/lacertosa combined with various auxin herbicides for leafy spurge control.

Treatment	Rate	Visual cover[a] Forbs	grass	Litter	Leafy spurge stand count[b] 1996	1997	1998	1999	2000	*Aphthona* 1998	1999	2000
	– lb/A –	— % —			— No./m^2 —					—— No./m^2 ——		
Herbicide only												
Picloram + 2,4-D	0.5 + 1	31		9	128	167	24	3	0.2			215
2,4-D	1	23		9	138	173	139	118	1.3			46
Picloram	0.5	31		12	137	151	39	0.5	0.2			235
Untreated	...	47		13	120	170	144	101	0.6			75
												NS
Herbicide with insects												
Picloram + 2,4-D	0.5 + 1	31		15	129	144	1	0	1.8	13	13	39
2,4-D	1	26		13	146	166	66	0.8	2.1	25	34	59
Picloram	0.5	30		15	122	157	8	0	0.4	15	7	32
Insects only	...	47		13	103	81	47	13	1.4	17	103	32
LSD (0.05)		10		NS	NS	38	25	13	0.9	6	41	NS

[a] Average of four evaluations per plot made prior to insect release and to be repeated at end of study.
[b] Average of four 0.25m^2 counts per plot evaluated in late-May each year.

Summary of research progress at the Gilbert C. Grafton State Military Reservation. Rodney G. Lym and Katheryn M. Christianson. (Plant Sciences Department, North Dakota State University, Fargo, 58105) The long-term goal of this project is to control leafy spurge in a wide variety of environments using biological, grazing management and chemical control methods. Each control tool can successfully be used at Camp Grafton South (CGS); however, because of the mission to train troops on this land, varying terrain and ecosystems, and past history of land use, not all tools can be used successfully in all parts of CGS.

The purpose of the current research is to evaluate long-term leafy spurge control with herbicides combined insect biocontrol agents and with all herbicides currently labeled for leafy spurge control applied alone, in a rotational program, or as tank-mix combinations.

An experiment to evaluate the effect of herbicide application timing on biocontrol insect establishment and leafy spurge control was established on 15 July 1993 when 30,000 *Aphthona czwalinae/lacertosa* were released and stand density evaluated (Table 1). The treatments included picloram plus 2,4-D at 0.5 + 1 lb/A fall applied, picloram plus 2,4-D at 0.25 + 1 lb/A spring applied, and an insects-only untreated control. The initial herbicide treatment was fall-applied on September 24, 1993 or spring-applied on 22 June 1994 and repeated at approximately the same dates in 1994 and 1995. Herbicide treatments were discontinued in 1996. All treatments were replicated three times. *A. czwalinae/lacertosa* population and leafy spurge density were evaluated annually beginning in 1994.

The integration of herbicides with biocontrol insects provided more rapid leafy spurge control than either method used alone. The combination of picloram plus 2,4-D applied in the fall with *Aphthona* spp. flea beetles reduced leafy spurge stem density to less than 3 stems/m^2 following two annual treatments (1995) a level of control not reached by the insects alone until 1999 (Table 1). Biological control of leafy spurge was termed "successful" in 1999 when leafy spurge stem density averaged 15 stems/m^2 or less and the *Aphthona* population averaged 30 adults/m^2 regardless of original treatment. The insects had generally moved out of the experimental area in 1999, six years after release as there were very few stems remaining for them to feed on.

Herbicide treatments did not affect the *A. czwalinae/lacertosa* population which established rapidly at this location on CGS (Table 2). More adult flea beetles were found in the fall-applied herbicide treatment plots than either of the other treatments. This is similar to previous research which has shown that herbicides fall-applied on leafy spurge infested with flea beetle biocontrol agents results in more rapid leafy spurge control and a faster increase in flea beetle population than either control method used alone. The flea beetle population was generally stagnant until 1996, when there was a large increase observed, especially in the insect only treatment which averaged 75 beetles/m^2. The flea beetle population peaked at 48 beetles/m^2 averaged across all treatments in 1998 and declined to an average of 30 and 29 beetles/m^2 in 1999 and 2000, respectively.

A project to demonstrate leafy spurge control at CGS using presently labeled herbicides was first established in 1997 and expanded as necessary thereafter (Table 3). Treatments were spring or fall applied annually to one plot (15 by 50 feet) and were designed to demonstrate how much control and how long to expect control to last for each of the herbicides currently recommended for use on CGS.

The picloram plus 2,4-D combination treatment and imazapic provided good initial leafy spurge control at CGS without grass injury. Picloram plus 2,4-D at 0.5 + 1 lb/A provided better initial leafy spurge control than picloram plus 2,4-D at 0.25 + 1 lb/A, but also costs twice as much. Glyphosate plus 2,4-D (Landmaster BW) has not provided as good of leafy spurge control at CGS as in other areas of the state, which is unfortunate because it is much less expensive than other commonly used herbicides for leafy spurge control.

Three new treatments were added to the demonstration in June 2000. Quinclorac (Paramount)

applied with a combination of dicamba plus diflufenzopyr (Distinct) has provided excellent leafy spurge control in other NDSU research trials (Table 3). Initial control averaged 98% 3 MAT (months after treatment) in this study. Quinclorac is also available as a granular formulation, but control only averaged 10% 3 MAT. Previous research at NDSU has shown a three-way mix of picloram plus 2,4-D plus imazapic provides greater than 90% leafy spurge control for 3 years when applied in June. This treatment averaged 100% control 3 MAT at GGS, but grass injury averaged 30%. This is the first study where grass injury was observed following application of the three-way mix.

Imazapic (Plateau) was cleared for use on grazing land in 2000, and should be a welcome addition to the leafy spurge management program at CGS. Leafy spurge control averaged 90 to 100% in the initial trial at CGS with little or no grass injury. This compound is less expensive than the standard picloram plus 2,4-D treatment and is safe to use near trees. In this trial control averaged 98% in the spring following the first fall treatment and 75% in September 2000 following three annual applications (Table 3).

Table 1. Leafy spurge control with *A. czwalinae/lacertosa* and herbicide treatments, first treatment applied fall 1993 on Camp Grafton South.

Treatment	Rate	Leafy spurge stand count										
		1993	1994		1995		1996		1997	1998	1999	2000
		July	May	Aug	May	Aug	June	Aug	June	June	June	June
	– lb/A –	No./m^2										
Picloram + 2,4-D (Spring)	0.25 + 1	128	154	73	154	26	29	11	3	15	8	6
Picloram + 2,4-D (Fall)	0.5 + 1	124	2	79	3	74	7	44	20	35	17	12
Insects only	• • •	122	146	75	159	122	150	129	67	66	20	16
LSD (0.05)		NS	14	NS	18	14	13	15	9	10	5	2

Table 2. The effect of herbicide treatment on *A. czwalinae/lacertosa* population in leafy spurge.

Treatment	Rate	*A. czwalinae/lacertosa*						
		1994	1995	1996	1997	1998	1999	2000
		June	June	July	July	June	June	June
	— lb/A —	No./m^2						
Picloram + 2,4-D (Spring)	0.25 + 1	3	12	36	3	28	28	18
Picloram + 2,4-D (Fall)	0.5 + 1	10	32	22	17	57	23	23
Insects only	. . .	7	12	75	22	48	38	45
LSD (0.05)		NS	17[a]	20	9	18	NS	19

[a]LSD = (0.10)

Table 3. Demonstration of leafy spurge control with various herbicides at Camp Grafton South.

Annual treatment	Rate	1998 May Control	1998 May Grs inj.	1998 August Control[b]	1999 May Control	1999 Aug Control	2000 June Control	2000 September Control	2000 September Grs inj.
	— oz/A—					%			
Applied beginning in June 1998									
Picloram	4	..	..	20	12	50	38	94	0
Picloram + 2,4-D	4 + 16	..	..	50	7	80	70	90	0
Picloram + 2,4-D	8 + 16	..	..	55	83	90	90	99	0
Picloram	8	..	..	30	75	95	85	99	0
Fosamine	128	..	..	12	63	95	89	90	35
2,4-D	32	..	..	12	8	5	5	10	0
Dicamba	32	..	..	12	0	25	25	10	0
Glyphosate + 2,4-D[a]	16	..	..	73	8	50[c]	25	20	65
Applied beginning in June 2000									
Picloram+2,4-D + imazapic+MSO+28% N	4+16+1+1qt+ 1 qt							100	30[d]
Quinclorac+dicamba+diflufenzopyr[e]+MSO	6+3+1.2+1 qt							98	0
Quinclorac granule	8							10	0
Fall									
Picloram	8	85	15	45	92	40	95	65	0
Picloram + 2,4-D	8 + 16	88	25	33	92	25	92	72	0
Picloram + 2,4-D	4 + 16	78	10	10	86	30	68	40	0
2,4-D	32	20	0	0	50	0	45	0	0
Dicamba	32	65	5	40	75	20	70	70	0
Glyphosate + 2,4-D[a]	16	70	10	15	85[c]	10[c]	75	0[d]	80[f]
Imazapic+MSO+28% N	2 + 1 qt + 1qt	98	10	60	95	55	98	75	0
Quinclorac+dicamba+diflufenzopyr[e]+MSO	6+3+1.2+1 qt								

[a] Commercial formulation - LandmasterBW.
[b] No grass injury was observed
[c] Approximately 20% grass injury observed.
[d] Brown tips on brome species only.
[e] Commercial formulation - Distinct.
[f] Treatment was not reapplied in 2000 due to high grass injury.

TEAM leafy spurge herbicide/insect interaction research and herbicide research demonstration results. Rodney G. Lym and Katheryn M. Christianson. (Plant Sciences Department, North Dakota State University, Fargo, ND 58105). TEAM Leafy Spurge is a five-year IPM research and demonstration project funded by the USDA-ARS in partnership with the USDA-Animal and Plant Health Inspection Service. The long-term goal is to provide landowners and land managers with leafy spurge control techniques based on IPM strategies. Most of the demonstration plots and research areas are located along the Little Missouri River in southwestern North Dakota. The purpose of this part of the project was to demonstrate leafy spurge control with various herbicides and an integrated management program using biological and chemical control methods. The herbicide demonstration included representative treatments for both short- and long-term control at various costs including treatments for a variety of environments from open rangeland to near stream banks and under trees.
The herbicide demonstration area was established on the Roger Meyers Ranch, Medora, ND, in May 1998. The initial herbicide application for spring treatments was made on June 6, 1998 and the mid-summer treatment of glyphosate plus 2,4-D (Campaign) was applied on July 3, 1998 (Table 1). The initial fall-applied treatments were made on September 6, 1998. Retreatments were applied to the same plots in June and September 1999 and 2000. The demonstration plots were 15 by 50 feet and were not replicated. Leafy spurge control was visually evaluated and based on percent stand reduction compared to the untreated control.

Leafy spurge control was generally similar to that expected based on long-term research at North Dakota State University (Table 1). 2,4-D only provided short-term top growth control but is the least expensive of the herbicides evaluated. The most commonly used treatment in North Dakota is picloram plus 2,4-D at 4 + 16 oz/A or 8 + 16 oz/A applied as an annual treatment. Occasionally, the higher rate is applied the first year, followed by the lower rate in subsequent years. Control averaged 98 and 100% in 2000 when the annual treatment program was started with picloram plus 2,4-D applied at 4 + 16 oz/A or 8 + 16 oz/A, respectively. Control only averaged 75% when picloram was applied at 4 oz/A alone.

Fosamine can be used up to the waters edge, but control and averaged 80% control in Sept. 2000 following two annual treatments (Table 1). Dicamba at 32 oz/A only provided short-term control and is not cost-effective for leafy spurge. Glyphosate plus 2,4-D is the least expensive treatment evaluated that also provided longer-term control and averaged 65% control following three annual applications. This treatment provided 85% control when it was alternated with picloram plus 2,4-D in 1999 to avoid grass injury.

Quinclorac was labeled for leafy spurge control in 1999 and was added to the demonstration trial. Quinclorac was applied at 8 oz/A alone in 1999 and with dicamba plus diflufenzopyr at 6 + 3 + 1.2 in June 2000. Control from the initial application in June 1999 only averaged 65% control in June 2000 but control averaged 100% following the second application which included diflufenzopyr. The quinclorac granular formulation applied in June 2000 did not provide satisfactory leafy spurge control.

Previous research at North Dakota State University has shown a three-way mix of picloram plus 2,4-D plus imazapic provides excellent leafy spurge control for at least three growing seasons. This treatment was added to the demonstration in June 2000 and as expected provided nearly complete

leafy spurge topgrowth control the first year (Table 1).

Imazapic provided the best leafy spurge control of any of the fall applied treatments evaluated following the first application and averaged 95% in June 1999 compared to 60% with picloram plus 2,4-D (data not shown). No other treatment applied in the fall of 1998 provided satisfactory leafy spurge control in 1999. However, control increased dramatically with almost all treatments following a second fall application in 1999. For instance, picloram at 8 oz/A applied alone or with 2,4-D averaged 100% control in September 2000. Imazapic applied for two consecutive years or rotated with picloram plus 2,4-D averaged 99% control, respectively. Quinclorac was initially applied at 8 oz/A in September 1999 and control still averaged 100% by September 2000. Only annual applications of 2,4-D or dicamba had not provided satisfactory leafy spurge control.

A herbicide-biocontrol agent demonstration area was also established on the Roger Meyers Ranch in 1998. Both *Aphthona nigriscutis* and the mixed species *A. czwalinae/lacertosa* had been initially introduced into this area in 1993. Although present in small numbers the population had not increased from year to year and the leafy spurge infestation continued to expand.

The demonstration area was established in May 1998, and leafy spurge density and flea beetle population were determined in July (Table 2). Flea beetles were present in low numbers and no additional biocontrol insects were released. Herbicide treatments were applied in mid-September 1998 and included picloram plus 2,4-D, imazapic, and quinclorac. The plots were 15 by 50 feet and the treatments were applied so that an insect only treatment bordered at least one side of each herbicide treated plot.

Imazapic reduced the leafy surge stand the most of the treatments evaluated and averaged only 8 stems/m^2 compared to 114 stems/m^2 prior to treatment in 1998 (Table 2). Stem density increased with the *Aphthona* only treatment from 136 to 173 stems/m^2 in 1998 and 1999, respectively, even though there was a dramatic increase in adult beetles over the same time period.

Following the large increase in *Aphthona spp.* population observed in 1999 leafy spurge density was dramatically reduced to 0 stems/m^2 in 2000 regardless if preceded with an herbicide treatment (Table 2). There was an average of 65 beetles per square meter remaining in the plot area in June 2000 even though there was no leafy spurge stem growth to feed on. Many more insects were observed outside the plot area and were moving into other leafy spurge stands. Thus, following five years of no effect, the *Aphthona* biocontrol agent rapidly increased in population and thus controlled leafy spurge two years following a herbicide application.

Table 1. TEAM leafy spurge herbicide demonstration trial, Roger Meyers Ranch, Medora, ND.

Application time/ treatment	Rate	Application time/ treatment	Rate	Application/time treatment	Rate	Control 2000 June	Control 2000 Sept.
	oz/A		oz/A		oz/A	— % —	
Spring and summer							
1998 treatment		1999 treatment		2000 treatment			
2,4-D amine	16	2,4-D amine	16	2,4-D amine	16	5	10
Picloram	4	Picloram	4	Picloram	4	90	75
Picloram + 2,4-D	4 + 16	Picloram + 2,4-D	4 + 16	Picloram + 2,4-D	4 + 16	98	98
Picloram + 2,4-D	8 + 16	Picloram + 2,4-D	4 + 16	Picloram + 2,4-D	4 + 16	99	100
Picloram	16	Picloram	16	None		100	99
Fosamine	128	Fosamine	128	None		85	80
Dicamba	32	Dicamba	32	Dicamba	32	30	99
Glyphosate + 2,4-D[a]	6 + 10	Glyphosate + 2,4-D[a]	6 + 10	Glyphosate + 2,4-D[a]	6 + 10	25	65
Glyphosate + 2,4-D[a]	6 + 10	Picloram + 2,4-D	4 + 16	Glyphosate + 2,4-D[a]	6 + 10	98	85
		Quinclorac + MSO[c]	8 + 1 qt	Quinclorac + dicamba +diflufenzopyr+MSO[c]	6+3+ 1+1 qt	65	100
				Quinclorac granules	8		25
				Picloram+2,4-D+ imazapic+MSO+28% N	4+16+1 +1qt+1qt		99
Fall applied							
1998 treatment		1999 treatment		2000 treatment			
Picloram	8	Picloram	8	None		100	100
2,4-D amine	16	2,4-D amine	16	2,4-D	16	0	0
Picloram + 2,4-D	8 + 16	Picloram + 2,4-D	8 + 16	None		100	99
Dicamba	32	Dicamba	32	None		100	40
Imazapic + MSO + 28% N	2 + 1 qt + 1 qt	Imazapic+ MSO[c] + 28% N	2 + 1 qt + 1 qt	None		100	99
Imazapic + MSO + 28% N	2 + 1 qt + 1 qt	Picloram + 2,4-D	8 + 16	None		100	99
		Quinclorac + MSO[c]	8 + 1 qt	None		100	100
				Quinclorac granules	8		

[a] Commercial formulation - Campaign.

[b] Commercial formulation of dicamba plus diflufenzopyr - Distinct.

[c] Methylated seed oil was SunIt by AGSCO.

Table 2. TEAM leafy spurge herbicide insect IPM demonstration project, Roger Meyers Ranch, Medora, ND.

Treatment	Rate	Stand count[a]			*Aphthona* spp.[b]		
		1998	1999	2000	1998	1999	2000
	oz/A	——— No./m^2 ———					
Picloram + 2,4-D	8 + 16	108	81	0	17	90	51
Imazapic + MSO[c] + 28% N	2 + 1 qt + 1 qt	114	8	0	7	20	89
2,4-D	16	92	128	0	14	105	58
Aphthona spp. alone		136	173	0	17	90	62
LSD (0.05)		NS	25	NS	NS	43	NS

[a] Evaluated in June each year.
[b] Mixed population of *Aphthona nigriscutis*, *A. czwalinae*, and *A. lacertosa*, estimated in July each year.
[c] Methylated seed oil was SunIt by AGSCO, Grand Forks, ND.

Evaluation of imazapic applied alone or with 2,4-D for perennial weed control. Rodney G. Lym (Department of Plant Science, North Dakota State University, Fargo, ND 58105). Imazapic has provided good long-term leafy spurge control when fall applied. However, previous research at North Dakota State University has shown that imazapic alone provided poor leafy spurge control when applied in the spring and only fair to poor Canada thistle and spotted knapweed control regardless of application date. The purpose of this research was to evaluate the effect of imazapic applied alone or with 2,4-D (commercial formulation) for leafy spurge, Canada thistle, and spotted knapweed control.

The first experiment was established near Buffalo, ND with spring treatments applied on June 21, 1999, when leafy spurge was 24 to 34 inches tall and in the true flower growth stage. The herbicides were applied using a hand-held boom sprayer delivering 8.5 gpa at 35 psi. The air temperature was 72 F with a dewpoint of 67 F. Fall treatments were applied on September 15, 1999, when leafy spurge was in the fall growth stage with 4 to 6 inches regrowth from the main stem. The air temperature was 64 F. The plots were 10 by 30 feet, and treatments were replicated four times in a randomized complete block design. Leafy spurge topgrowth was visually evaluated with control based on percent stand reduction compared to the untreated check.

Imazapic provided better long-term leafy spurge control when fall-applied than spring-applied and the addition of 2,4-D generally decreased control compared to imazapic applied alone (Table 1). For instance, imazapic applied at 2 oz/A with a methylated seed oil in September provided 75% leafy spurge control 12 months after treatment (MAT) compared to only 34% control with the same treatment applied in June and evaluated 12 MAT. While initial leafy spurge control was similar or higher when imazapic was applied with 2,4-D compared to imazapic alone, long-term control was less. Leafy spurge control with imazapic at 3 oz/A fall-applied averaged 92% control 12 MAT compared to only 58% control when the same treatment was applied with 2,4-D. Imazapic fall-applied tended to provide better long-term leafy spurge control than the standard of picloram plus 2,4-D, but grass injury was also higher. Grass injury (cool season species) averaged over fall applications of imazapic was 41% in June and 22% in August 2000 compared to little or no grass injury from the same treatments applied in June.

An experiment to evaluate Canada thistle control with imazapic applied alone or with 2,4-D was established near Fargo, ND. Treatments were applied on June 16, 1999, to Canada thistle in the vegetative growth stage and beginning to bolt (6 to 14 inches tall) or on September 20, 1999, when Canada thistle was in the rosette

growth stage. The air temperature was 62 F and dew point was 51 F on the June application date and 68 F and 58 F in September, respectively. Experimental design and evaluation were similar to the first experiment.

Imazapic provided better Canada thistle control 12 MAT when applied in June than in September, and control was similar whether applied alone or with 2,4-D (Table 2). For instance, control 12 MAT with imazapic applied alone or with 2,4-D in June 1999 averaged 61 and 78%, respectively, compared to 11 and 20%, respectively, with the same treatments applied in September. Picloram plus 2,4-D provided the best long-term Canada thistle control and averaged 96% 12 MAT regardless of application date.
The spotted knapweed experiment was established on July 8, 1999, near Hawley, MN, when spotted knapweed was beginning to bolt. The weather was clear and very humid with an air temperature of 70 F and a dewpoint of 67 F. Experimental design and evaluation were similar to the leafy spurge experiment.

Imazapic applied alone or with 2,4-D (commercial mixture) did not provide satisfactory spotted knapweed control and averaged 38% 1 MAT. When the commercial mixture of imazapic plus 2,4-D was applied with 2,4-D ester initial control averaged 86% 1 MAT but only 52% the following growing season. By comparison, both picloram treatments averaged 94% spotted knapweed control 11 MAT.

In summary, the addition of 2,4-D to imazapic did not improve long-term Canada thistle or spotted knapweed control and decreased long-term leafy spurge control compared to imazapic applied alone. Leafy spurge control was best when imazapic was applied in the fall compared to spring, but Canada thistle control was better when treatments were applied in June compared to September. Imazapic applied alone or with 2,4-D did not control spotted knapweed.

Table 1. Leafy spurge control with imazapic alone or with 2,4-D applied in the spring or fall.

		Evaluation				
		Sept 1999	June 2000		Aug 2000	
Application time and treatment	Rate	Control	Control	Grass injury	Control	Grass injury
	oz/A			%		
June 1999 application						
Imazapic + MSO[a]	2 + 1 qt	71	34	0	3	0
Imazapic + MSO[a]	3 + 1 qt	74	63	0	30	0
Imazapic + 2,4-D[b] + MSO[a]	2 + 4 + 1 qt	90	56	0	55	5
Imazapic + 2,4-D[b] + MSO[a]	3 + 6 + 1 qt	91	47	0	15	0
Picloram + 2,4-D	8 + 16	99	74	0	54	0
September 1999 application						
Imazapic + MSO[a]	2 + 1 qt	••	92	35	75	9
Imazapic + MSO[a]	3 + 1 qt	••	95	48	92	24
Imazapic + 2,4-D[b] + MSO[a]	2 + 4 + 1 qt	••	95	31	48	28
Imazapic + 2,4-D[b] + MSO[a]	3 + 6 + 1 qt	••	91	50	58	25
Picloram + 2,4-D	8 + 16	••	94	30	55	0
LSD (0.05)		9	16	29	37	23

[a] Methylated seed oil was Sunit by AGSCO, Grand Forks, ND.
[b] Commercial formulation - Oasis by American Cyanamid, Princeton, NJ (now BASF).

Table 2. Canada thistle control with imazapic alone or with 2,4-D applied in the spring or fall.

Treatment/application time	Rate	Control Sept 1999	Control June 2000	Control Aug 2000
	oz/A		%	
June 1999 application				
Imazapic + MSO[a]	2 + 1 qt	19	56	15
Imazapic + MSO[a]	3 + 1 qt	16	65	18
Imazapic + 2,4-D[b] + MSO[a]	2 + 4 + 1 qt	21	84	16
Imazapic + 2,4-D[b] + MSO[a]	3 + 6 + 1 qt	46	72	31
Picloram + 2,4-D	8 + 16	96	95	70
September 1999 application				
Imazapic + MSO[a]	2 + 1 qt	••	82	6
Imazapic + MSO[a]	3 + 1 qt	••	90	15
Imazapic + 2,4-D[b] + MSO[a]	2 + 4 + 1 qt	••	80	21
Imazapic + 2,4-D[b] + MSO[a]	3 + 6 + 1 qt	••	88	19
Picloram + 2,4-D	8 + 16	••	99	96
LSD (0.05)		13	21	23

[a] Methylated seed oil was Sunit by AGSCO, Grand Forks, ND.

[a] Commercial formulation - Oasis by American Cyanamid, Princeton, NJ (now BASF).

Table 3. Spotted knapweed control with imazapic alone or with 2,4-D applied in the spring or fall.

Treatment	Rate	Evaluation/MAT[a] 1 Control	1 Grass injury	11 Control
	oz/A		%	
Imazapic + MSO[b]	2 + 1 qt	35	13	3
Imazapic + 2,4-D[c] + MSO[b]	1 + 2 + 1 qt	25	5	9
Imazapic + 2,4-D[c] + MSO[b]	2 + 4 + 1 qt	41	15	4
Imazapic + 2,4-D[c] + MSO[b]	3 + 6 + 1 qt	52	12	20
Imazapic + 2,4-D[c] + 2,4-D ester + MSO[b]	1 + 2 + 14 + 1 qt	81	6	62
Imazapic + 2,4-D[c] + 2,4-D ester + MSO[b]	2 + 4 + 12 + 1 qt	87	11	35
Imazapic + 2,4-D[c] + 2,4-D ester + MSO[b]	3 + 6 + 10 + 1qt	91	29	60
Picloram + MSO[b]	4 + 1 qt	75	9	91
Picloram + 2,4-D + MSO[b]	4 + 16 + 1 qt	92	0	96
LSD (0.05)		22	13	22

[a] Months after treatment

[b] Methylated seed oil was Sunit by AGSCO, Grand Forks, ND.

[c] Commercial formulation Oasis by American Cyanamid, Princeton, NJ (now BASF).

Evaluation of 2,4-D applied with various plant growth regulators for spotted knapweed control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). The herbicide 2,4-D remains one of the most cost-effective treatments for broadleaf weed control. 2,4-D is often applied with other auxin herbicides for improved perennial weed control compared to the herbicides applied alone. The purpose of this research was to evaluate 2,4-D applied with various plant growth regulators and/or imazapic or triclopyr for spotted knapweed control.

The experiment was established on July 8, 1999 near Hawley, MN when spotted knapweed was in the rosette growth stage and beginning to bolt. Herbicides were applied during warm humid conditions with an air temperature of 70 F and a dew point of 67 F. The soil was sandy gravel with an organic matter of 2.2% and a pH of 8.5. The experiment was a randomized complete block design with four replications. Treatments were applied with a hand-held sprayer delivering 8.5 gpa at 35 psi. The plots were 7 by 30 feet. Treatments were visually evaluated in late-May and late August 2000 with control based on percent stand reduction as compared to the control.

Treatment[a]	Rate	Control/MAT[a]		
		2	11	13
	lb/A	%		
2,4-D + sulfentrazone (NB30021)	1.97 + 0.03	84	97	89
2,4-D + sulfentrazone (NB30027)	1.97 + 0.03	86	92	86
2,4-D + sulfentrazone+5-ALA (NB30408)	1.96 + 0.03 + 0.01	85	97	91
2,4-D + sulfentrazone+imazapic (NB30409)	0.86 + 0.03 + 0.11	88	63	47
2,4-D+imazapic+sulfentrazone+mefluidide (NB30410)	0.7+0.088+0.025+0.19	83	46	52
2,4-D + carfentrazone (NB30411)	1.98 + 0.02	83	96	88
2,4-D + carfentrazone (NB30412)	1.97 + 0.02 + 0.01	86	96	90
2,4-D mixed amine[c]	1.92	86	87	82
Triclopyr + 2,4-D[d]	0.5 + 1	83	91	80
LSD (0.05)		NS	8	10

[a]Months after treatment.
[b]All treatments were applied with X-77 at 0.25%.
[c]Commercial formulation - Hi-Dep.
[d]Commercial formulation - Crossbow.

Spotted knapweed control was similar whether 2,4-D was applied alone as a mixed amine formulation or with sulfentrazone, carfentrazone, or triclopyr 2 and 11 months after treatment (MAT) and averaged 85% and 93% control, respectively (Table). However, there was a tendency for the spotted knapweed control to be higher when 2,4-D was applied with sulfentrazone or carfentrazone compared to triclopyr or alone 13 MAT and averaged 89% compared to 81%, respectively. Spotted knapweed control declined when imazapic was applied with 2,4-D plus sulfentrazone or 2,4-D plus sulfentrazone plus mefluidide compared to the mixtures applied alone. However, the 2,4-D application rate was reduced by 50% when the treatment contained imazapic.

Evaluation of dicamba and quinclorac applied alone and with diflufenzopyr for general broadleaf weed control in pasture. Rodney G. Lym and Katheryn M. Christianson. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Previous research at North Dakota State University has shown that leafy spurge and Canada thistle control increased when diflufenzopyr, an auxin transport inhibitor, was applied with various auxin herbicides compared to the herbicides alone. A unique attribute of quinclorac is the narrow spectrum of weed control compared to other herbicides used for leafy spurge control. Quinclorac generally does not injure most desirable broadleaf plants but the addition of diflufenzopyr may broaden the spectrum or weed control. The purpose of this research was to evaluate diflufenzopyr applied alone and with quinclorac or dicamba for general broadleaf weed control in pasture.

The experiment was established in a pasture that contained a variety of broadleaf weeds on the NDSU Albert Ekre Experiment Station near Walcott, ND. Treatments were applied on June 14, 1999, when most of the weeds were in the vegetative growth stage. Herbicides were applied alone and with diflufenzopyr at a ratio of 2.5:1 or 10:1 herbicide:diflufenzopyr. Treatments were applied with a hand-held boom sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet, and treatments were replicated four times in a randomized complete block design.

The major species present included wild licorice [Pursh *Glycyrrhiza lepidota* (Nutt.)], hairy vervain (*Verbena stricta* Vent.), and goldenrod (*Solidago* spp.), with common ragweed (*Ambrosia artemisiifolia* L.) and common milkweed (*Asclepias syriaca* L.) found occasionally throughout the experiment. None of the major weed species was found in every plot, so each plot was evaluated for species presence or absence prior to herbicide application. Weed control evaluations were based on presence or absence of the various species and reported as percent present or absent by plot compared to the initial population.

Diflufenzopyr applied alone tended to injure hairy vervain, goldenrod, and ragweed but not wild licorice, or common milkweed (Tables 1 and 2). Injury was independent of diflufenzopyr application rate regardless of weed species.

Quinclorac applied alone or with diflufenzopyr generally did not injure wild licorice except at the highest quinclorac plus diflufenzopyr rate of 0.75 + 0.3 lb/A (Table 1). Quinclorac alone had very little effect on hairy vervain. The increase in control when diflufenzopyr was applied with quinclorac likely reflected the effect that diflufenzopyr alone had on hairy vervain. However, quinclorac did reduce goldenrod stands and control increased as the quinclorac application rate increased, especially when diflufenzopyr was applied with the herbicide. For example, quinclorac at 0.25 and 0.75 lb/A alone reduced goldenrod to 25 and 0%, respectively, of the initial infestation 11 months after treatment (MAT). When quinclorac was applied with diflufenzopyr goldenrod was nearly eliminated regardless of quinclorac rate or diflufenzopyr ratio. Quinclorac controlled common ragweed but not common milkweed whether applied alone or with diflufenzopyr (Table 2).

In general, dicamba controlled goldenrod but not wild licorice whether applied alone or with diflufenzopyr (Table 1). Dicamba only slightly injured hairy vervain when applied alone at 0.5 and 1 lb/A and injury only increased when dicamba was applied with diflufenzopyr at the highest application rates. Dicamba generally controlled both common ragweed and common milkweed whether applied alone or with diflufenzopyr (Table 2).

A wider diversity of broadleaf plants remained following quinclorac application compared to dicamba regardless if the herbicides were applied alone or with diflufenzopyr. But diflufenzopyr did tend to broaden the quinclorac weed control spectrum. The spectrum of weeds controlled by an auxin herbicide will likely increase when applied with diflufenzopyr, but the amount of increase is herbicide and weed species dependent.

Table 1. Effect of quinclorac or dicamba applied alone or with diflufenzopyr for control of three pasture weeds.

Treatment[b]	Rate	Wild licorice/MAT[a]				Hairy vervain/MAT[a]				Goldenrod/MAT[a]			
		0	2	11	13	0	2	11	13	0	2	11	13
	lb/A	% of plots in the treatment with plants											
Diflufenzopyr+X-77	0.1+0.25%	25	50	50	100	50	25	50	50	100	25*i*[c]	25	25
Diflufenzopyr+X-77	0.2+0.25%	75	50	50	75	75	50*i*[c]	0	25	100	50*i*[c]	50	50
Diflufenzopyr+X-77	0.4+0.25%	100	75	75	75	75	50*i*[c]	25	25	100	75*i*[c]	100	100
Diflufenzopyr+X-77	0.8+0.25%	50	25	75	75	25	25*i*[c]	25	25	100	50*i*[c]	50	75
Quinclorac+MSO[d]	0.25+1 qt	100	75	50	75	75	100*i*[c]	75	75	100	50*i*[c]	25	25
Quinclorac+MSO[d]	0.5+1 qt	100	100	25	50	0	50	25	75	100	25*i*[c]	0	0
Quinclorac+MSO[d]	0.75+1 qt	75	50*i*[c]	50	50	50	75*i*[c]	50	75	100	25*i*[c]	0	0
Quin+diflu + MSO[d]	0.25+0.025+1 qt	75	75	25	75	50	50*i*[c]	50	50	100	0	25	25
Quin+diflu + MSO[d]	0.25+0.1+1 qt	50	50	75	75	75	25*i*[c]	0	50	100	0	0	0
Quin+diflu + MSO[d]	0.5+0.05+1 qt	50	50	50	50	0	25	25	50	100	25*i*[c]	0	0
Quin+diflu + MSO[d]	0.5+0.2+1 qt	100	75	100	100	50	25*i*[c]	25	25	100	0	0	0
Quin+diflu + MSO[d]	0.75+0.075+1 qt	75	75	50	75	50	0	0	25	100	0	0	0
Quin+diflu + MSO[d]	0.75+0.3+1 qt	75	50	25	25	50	0	25	25	100	0	0	0
Dicamba+X-77	0.5+0.25%	100	75	25	75	25	75	25	75	100	25*i*[c]	25	25
Dicamba+X-77	1+0.25%	75	50	75	75	25	50*i*[c]	25	50	100	0	0	0
Dicamba+X-77	2+0.25%	75	75	50	75	50	0	0	0	100	0	25	25
Dicamba+diflu+X-77	0.5+0.05+0.25%	100	75	50	100	25	25	0	25	100	0	0	0
Dicamba+diflu+X-77	0.5+0.2+0.25%	75	75	50	50	50	25	50	50	100	25	25	25
Dicamba+diflu+X-77	1+0.1+0.25%	50	50	25	50	0	0	25	50	100	0	0	0
Dicamba+diflu+X-77	1+0.4+0.25%	75	75	50	50	25	0	0	0	100	25	0	0
Dicamba+diflu+X-77	2+0.2+0.25%	75	50	75	75	50	0	25	50	100	0	0	0
Dicamba+diflu+X-77	2+0.8+0.25%	75	0	0	25	100	0	0	0	100	0	0	0
Picloram+2,4-D	0.5+1	100	25	25	50	0	0	50	50	100	25	0	0

[a] Months after treatment.

[b] Quin = quinclorac, diflu = diflufenzopyr.

[c] Plants were present but had auxin herbicide type injury or were otherwise stunted.

[d] Methylated seed oil by AGSCO, Grand Forks, ND.

Table 2. Effect of quinclorac or dicamba applied alone or with diflufenzopyr for control of common ragweed and common milkweed.

Treatment[b]	Rate	Ragweed/MAT[a]			Milkweed/MAT[a]			Other plant species noted growing in at least one plot
	lb/A	0	2	11	0	2	11	
		Plants found occasionally[c]						
Diflufenzopyr+X-77	0.1+0.25%	p	a	a	p	p	p	wood violet, western snowberry (*Symphoricarpos occidentalis* Hook.)
Diflufenzopyr+X-77	0.2+0.25%	a	a	a	p	p	a	
Diflufenzopyr+X-77	0.4+0.25%	a	a	a	a	a	a	
Diflufenzopyr+X-77	0.8+0.25%	p	a	a	p	p	p	wood violet, western snowberry, thistle
Quinclorac+MSO[d]	0.25+1 qt	a	a	a	p	p	a	
Quinclorac+MSO[d]	0.5+1 qt	a	a	a	p	p	p	wood violet (*Viola* spp.),western. snowberry
Quinclorac+MSO[d]	0.75+1 qt	p	a	a	a	a	p	wood violet
Quin+diflu[d] + MSO[d]	0.25+0.025+1 qt	p	a	a	p	p	p	parsnip (*Pastinaca sativa* L.), wild strawberry (*Fragaria virginiana* Duchn.), yarrow (*Achillea* spp.)
Quin+diflu + MSO[d]	0.25+0.1+1 qt	p	a	a	a	a	p	wood violet, thistle (Cirsium spp.)
Quin+diflu + MSO[d]	0.5+0.05+1 qt	p	a	a	a	a	a	western snowberry
Quin+diflu + MSO[d]	0.5+0.2+1 qt	a	a	a	p	p	a	wood violet, western snowberry
Quin+diflu + MSO[d]	0.75+0.075+1 qt	p	a	a	a	a	p	wood violet
Quin+diflu + MSO[d]	0.75+0.3+1 qt	p	a	a	a	a	a	wild rose (*Rosa arkansana*)
Dicamba+X-77	0.5+0.25%	p	a	a	p	p	a	wood violet, western snowberry, thistle
Dicamba+X-77	1+0.25%	p	a	a	p	p	a	wood violet, western snowberry
Dicamba+X-77	2+0.25%	a	a	a	p	p	a	wood violet
Dicamba+diflu+X-77	0.5+0.05+0.25%	p	a	a	p	a	a	wood violet
Dicamba+diflu+X-77	0.5+0.2+0.25%	p	a	a	p	p	a	wood violet
Dicamba+diflu+X-77	1+0.1+0.25%	p	a	a	a	a	a	wood violet, western snowberry
Dicamba+diflu+X-77	1+0.4+0.25%	p	a	a	a	a	a	wood violet
Dicamba+diflu+X-77	2+0.2+0.25%	p	a	a	p	p	a	wood violet
Dicamba+diflu+X-77	2+0.8+0.25%	a	a	a	p	a	a	wood violet
Picloram+2,4-D	0.5+1	p	a	a	p	a	a	

[a] Months after treatment.
[b].Quin = quinclorac, diflu = diflufenzopyr.
[c] P = plants were present, a= plants were absent in any of the plots prior to or following herbicide application.
[d] Methylated seed oil was Scoil by AGSCO, Grand Forks, ND.

Evaluation of herbicides for total vegetation control. Rodney G. Lym and Katheryn M. Christianson. (Department of Plant Science, North Dakota State University, Fargo, ND 58105). Total vegetation weed control (bare ground) is desirable around such areas as industrial sites, storage buildings, and utility areas. The purpose of this research was to evaluate established and recently labeled herbicides for long-term total vegetation management.

The experiment was established along a railroad right-of-way in West Fargo, ND, on May 26, 1999. The plot area was beneath an abandoned communications line and contained a variety of weed species including bluegrass, smooth bromegrass, leafy spurge, western snowberry, Canada thistle, wild rose, goldenrod, common milkweed, and young (< 2 feet tall) willows. The herbicides were applied using a hand-held boom sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet and treatments were replicated four times in a randomized complete block design. The air temperature was 66 F, the dew point 54 F, and the soil temperatures at the 1 and 4 inch depth was 70 and 62 F, respectively. Total vegetation control was evaluated by visually comparing the amount of bareground in each plot to the border strips between plots. The effect of the various herbicides on individual species was noted.

Treatment	Rate	Bare ground			Comments[c]
		Aug 99	May 00	Sept 00	
	lb/A	%			
Imazapyr + diuron[a] + MSO[b]	1 + 8.1 + 1 qt	82	77	60	Ex on *Poa*, fair to good control of bl.
Imazapyr + X-77	1 + 0.25%	88	82	64	Ex on *Poa*, weak on Canada thistle
Diuron	8	13	20	13	Very weak on all bl.
Diuron	16	19	71	31	Ex on *Poa* but little bl control
Bromacil	8	45	88	63	Ex on *Poa* but weak on all bl except willow.
Tebuthiuron	4	13	89	63	Ex grass but poor on all bl.
Chlorsulfuron	0.125	0	0	0	
Azafenidin	0.5	0	0	0	
LSD (0.05)		13	26	25	

[a] Commercial formulation - Sahara, American Cyanamid Co, Princeton, NJ (now BASF).
[b] Methylated seed oil was Sunit by AGSCO, Grand Forks, ND.
[c] Abbreviations: ex = excellent, bl = broadleaf species.

Treatments that contained imazapyr provided the greatest bare ground weed control and reduced leafy spurge, western snowberry, and wild rose by greater than 80% but did not control Canada thistle. Tebuthiuron provided excellent grass control but only slightly suppressed the broadleaf species present. Diuron and bromacil controlled grass species but generally did not reduce the broadleaf species, except bromacil did kill willow. Chlorsulfuron and azafenidin did not provide total vegetation control.

Biological control of purple loosestrife in North Dakota. Rodney G. Lym and Katheryn M. Christianson. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Purple loosestrife was added to the North Dakota noxious weed list in 1996. Purple loosestrife is found in 11 North Dakota counties with the largest infestations in urban areas. Biological control of purple loosestrife fits well in urban areas considering public apprehension of herbicides sprayed in close proximity to residential areas. Three species of purple loosestrife biological agents were introduced in North Dakota in 1997 and 1998. The biological control agents included two leaf beetles, *Galerucella calmariensis* and *G. pusilla,* released in Grand Forks and Valley City, ND, and *Hylobius transversevittatus,* a root feeding weevil in Grand Forks. The objective of this research was to evaluate purple loosestrife control with *Galerucella* spp. along a river in an urban area.

The experiment was established in Chautauqua Park along the Sheyenne River in Valley City, North Dakota. A mixed population of about 4000 *Galerucella calmariensis* and 10,000 *G. pusilla* were released at a single release point in June 1998 and 1999, respectively. The number of *Galerucella* spp. adults and egg masses, as well as purple loosestrife stems, plant height, and spike length were recorded at the release point and at 25 foot increments both up and down stream from the release point. In a 1 m^2 area the number of eggs, larvae, and adults was estimated by counting for 60 seconds, height the five tallest stems and five longest flower spikes were measured, and the total number of stems was counted.

Galerucella spp. established at Valley City as both adults and egg masses were found in 1999, 1 yr after release (Tables 1 and 2). *Gallerucella* began to decrease the loosestrife stem height and flower spike length 2 yr after release (2000). For instance, stem height was reduced at the release pole from 1.4 m to 0.4 m in 1999 and 2000, respectively. Also the average flower spike length in 2000 was reduced to zero at the release pole and 25 feet from the pole. The number of stems increased following the *Galerucella* spp. release even though the number of flowering plants and stem length decreased. In general, the plants were short and remained in the vegetative growth stage 2 years after the first biocontrol agent was released.

The number of eggs observed increased from an average of 1/m^2 in 1998 to 27/m^2 in 2000. However, there was no increase in the number of larvae observed and only a slight increase in adults. The reason for the large increase in eggs observed compared to the small increase in adults may be due to the adults moving to purple loosestrife further down stream from the experiment site. Also, since the area is in a city park, some of the reduction may be due to loss from insecticide spraying conducted for mosquito control.

In this study, *Galerucella* spp. established and began to reduce the purple loosestrife infestation 2 yr following release. Biological control of purple loosestrife can be an alternative to chemical control in urban areas as long as mosquito control programs are restricted in the release area.

Table 1. Purple loosestrife control with *Galerucella* spp. released in 1998 in Valley City, ND[a].

Distance from release	Flowering stems		Stem			Stem height		Spike length	
	1998	2000	1998	1999	2000	1999	2000	1999	2000
	No.		No.			m		cm	
0 (release)	0	0	10	15	58	1.4	0.4	0	0
25 feet	6	0	14	19	22	1.2	0.5	10	0
50 feet	0	0	35	14	50	0.9	0.8	6	10

[a] Estimates of purple loosestrife control were made in mid-July each year.

Table 2. Population change over time of *Galerucella spp.* on purple loosestrife at Valley City, ND[a].

Distance from release[a]	1998			1999			2000		
	Eggs	Larvae	Adults	Eggs	Larvae	Adults	Eggs	Larvae	Adults
	No./m^2								
0 (release)	0	2	1	0	0	0	40	0	4
25 feet	2	1	0	2	0	2	11	0	1
50 feet	0	1	0	6	0	2	30	0	2

[a] Estimates of *Galerucella* adults and egg masses were made in July of each year.

NDSU perennial weed demo experiment 193.

Leafy spurge demonstration plots, Ekre station.

Annual application date and treatment	Cost[a]	Rate	Control											
			1994		1995		1997		1998		1999		2000	
			June	Sept	June	Sept	June	Sept	June	Sept	June	Sept	June	Sept
	$/A	— lb/A —	%											
September (begun in 1993)														
Picloram + 2,4-D amine	28	0.5+1	90	80	98	95	100	99	100	88	100	92	100	99
Picloram	25	0.5	95	70	100	98	100	97	100	92	100	95	100	100
Picloram + 2,4-D amine	14	0.25+1	98	48	100	65	100	95	100	85	100	90	100	98
2,4-D amine	6	2	10	5	75	40	90	55	80	45	78	60	78	60
Dicamba	36	2	85	20	90	50	97	73	95	75	85	95	99	98
Glyphosate + 2,4-D[b]	8	0.4+0.6	80[c]	25[c]	35[e]	45	60[f]	0	..	..	..	40	40	60
Imazapic + Scoil + 28% N[g]	20	0.125+1 qt+1 qt					99	95	100	95	99	75	100	96
June (begun in 1994)														
Picloram	13	0.25		20[d]	30	68	80	78	88	83	87	90	94	95
Fosamine	80	8		78[d]	77	87	7	98	85	60	90	90	70[d]	79
Picloram + 2,4-D amine	28	0.5+1		63[d]	65	98	100	100	95	98	100	95	99	100
Picloram	25	0.5		33[d]	45	97	97	98	97	98	100	96	99	100
Picloram + 2,4-D amine	14	0.25+1		0[d]	•	25	68	90	90	98	83	96	85	100
2,4-D amine	6	2		0[d]	•	0	12	87	20	90	7	15	10	60
Dicamba	36	2		0[d]	•	23	50	100	50	90	18	55	53	99
Glyphosate + 2,4-D[b]	8	0.4+0.6		0[d]	•	25	35	0	70	98	20	10	33	70
June (begun 2000)														
Picloram+2,4-D +imazapic+MSO+28% N	25	0.25+1+0.06 +1 qt + 1 qt												100
Quinclorac + dicamba + diflufenzopyr[h] + MSO	32	0.375 + 0.18 + 0.075 + 1 qt												100
Quinclorac granules	NA	0.5												20

[a] Annual treatment cost, but does not include application cost.

[b] Commercial formulation - Landmaster BW.

[c] Grass injury was 60% in June 94 and 10% in Sept, treatment was discontinued after 1995 application because grass injury averaged 87%.

[d] Rain fell within 2 hours of treatment, resulting in much below average control.

[e] Grass injury was 60%.

[f] Grass injury was 30% and retreatments were stopped.

[g] Imazapic was first applied in Sept. 1996.

[h] Commercial formulation - Distinct.

Common mallow control. Brian Jenks, Denise Markle, and Gary Willoughby. (NCREC, Minot).
We evaluated many registered herbicides for controlling common mallow. The study was established in a large patch of common mallow with no crop to provide competition. Individual plots were 10 by 30 ft arranged in a RCBD with three replicates. Treatments were applied using XR8001 flat fan nozzles delivering 10 gpa at 40 psi. Postemergence treatments were applied on June 5 with a CO_2 pressurized bicycle sprayer. Common mallow (Coma) was 4-8 inches at application and 9-16 plants per sq ft.

Treatment	Rate	Coma
		Jun 20
		% Control
Starane	0.33 pt	57
Starane	0.67 pt	70
Starane + 2,4-D ester	0.67 pt + 1 pt	78
Starane + 2,4-D ester + Harmony Extra	0.33 pt + 1 pt + 0.3 oz	82
Liberty + AMS	34 fl oz + 3 lb	98
Liberty + AMS	20 fl oz + 3 lb	89
Roundup + AMS	1 pt + 1 %	87
Roundup + Liberty + AMS	1 pt + 10 fl oz + 1 %	89
Clarity	2 fl oz	8
Bronate	1 pt	45
Tough + NIS	1.5 pt + 0.25 %	40
Basagran + COC	1 pt + 1 qt	32
Curtail	2 pt	38
Untreated		0
LSD		8
CV		8

Liberty at 34 fl oz effectively controlled common mallow. Roundup alone or Liberty at 20 fl oz provided slightly less but still good control. A three-way mix of Starane + 2,4-D + Harmony Extra provided slightly better mallow control compared to Starane alone (full rate) or with 2,4-D. The half-rate of Starane was much weaker on mallow. From this and previous studies, we would recommend not cutting back on the Starane rate for mallow control and always include 2,4-D. Bronate, Tough, and Basagran caused slight stunting, but did not control the mallow. Clarity had almost no effect on the mallow.

2000 Control of Smooth Bromegrass with Imazapic&2.4-D and Glyphosate-ipa at Hettinger. (Eriksmoen) Treatments were applied to 1 foot tall smooth bromegrass that was in the early boot stage on june 9 with 74 F, 66^ RH, partly sunny sky and 9 mph wind. Treatments were applied with a tractor mounted CO_2 propelled lot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 10 foot wide area the length of 15 by 30 ft plots. The experiment was a randomized complete block design with three replications. Evaluations were on August 8 (60 DAT), September 6 (89 DAT) and on October 6 (119 DAT) for smooth bromegrass control.

Treatment[a]	Rate	8/08	9/06	10/06
	oz/A		%	
Untreated		0	0	0
Imazapic&2,4-D+Scoil+AMS	6+0.25G+46	15	50	33
Imazapic&2,4-D+Scoil+AMS	9+0.25G+46	40	68	57
Glyphosate-ipa+AMS	12+46	58	75	75
Glyphosate-ipa+AMS	24+46	85	90	93
Imazapic&2,4-D+Glyt-ipa+Scoil+AMS	6+12+0.25G+46	85	91	93
Imazapic&2,4-D+Glyt-ipa+Scoil+AMS	6+24+0.25G+46	96	99	98
Imazapic&2,4-D+Glyt-ipa+Scoil+AMS	9+12+0.25G+46	82	92	92
Imazapic&2,4-D+Glyt-ipa+Scoil+AMS	9+24+0.25G+46	99	99	99
C.V. %		11.3	11.8	21.5
LSD 5%		12	15	26
# of Reps		3	3	3

[a] AMS=ammonium sulfate

Summary

The imazapic&2,4-D treatments alone (trts 2 and 3) and the low rate of glyphosate-ipa alone (trt 4) provided significantly lower bromegrass control than when applied in combination. The 24 oz ai/A rate of glyphosate-ipa alone (trt 5) provided bromegrass control equal to the imazapic&2,4-D+glyphosate-ipa treatment combinations. The lower rate of imazapic&2,4-D + glyphosate-ipa (trt 6) provided bromegrass control equal to the higher rate combinations.

2000 Grass Tolerance to Various Herbicides at Hettinger. (Ericksmoen)

#	Treatment	Rate
1	Quinclorac+MSO	0.75+1%
2	Quinclorac+BAS654+MSO	0.75+0.075+1
3	Quinclorac+MSO	1.5+2%
4	Quinclorac+BAS654+MSO	1.5+0.15+2%
5	Quinclorac+dicamba&diflufenzopyr+MSO	0.75+0.263+1%
6	Quinclorac+dicamba&diflufenzopyr+MSO	1.5+0.525+2%
7	Propoxycarbazone+NIS	0.04+0.25%

Treatments 1 through 6 were applied June 2 and treatment 7 was applied June 23. The experiment was not randomized. Grass injury evaluations were on July 18.

Grass Species	Treatments						
	1	2	3	4	5	6	7
	% stunting						
Warm Season Grasses							
Garden sand bluestem	0	0	0	-	-	-	-
Killdeer sidoats grama	0	0	0	-	-	-	-
ND-4115 little bluestem	1	0	1	-	-	-	-
9063064 blue grama	0	0	0	-	-	-	-
ND-95 prairie sandreed	0	0	0	-	-	-	-
Bison big bluestem	0	0	0	-	-	-	-
Dacotah switchgrass	0	0	0	-	-	-	-
Cool Season Grasses							
Fairway wheatgrass							
Parkway	0	5	0	0	0	0	0
Kirk	0	0	0	0	0	0	0
SD-77	0	0	0	0	0	0	0
Ephraim	0	0	0	0	0	0	0
Ruff	0	5	0	0	0	0	0
NEAC1	0	5	5	0	0	0	0
NEAC2	0	10	1	0	0	0	0
Crested wheatgrass							
Summit	0	5	1	0	0	0	0
NEAD1	0	0	0	0	0	0	0
Fairway X crested cross							
Hycrest	0	0	0	0	1	0	0
Hycrest #2	0	0	0	0	0	0	0
Siberian wheatgrass							
P-27	0	0	0	0	0	0	0
Intermediate wheatgrass							
Chief	0	0	0	0	0	0	0
Clarke	0	0	0	0	0	0	0
MON-1813	0	0	0	0	0	0	0
Oahe	1	0	0	0	0	0	0
SD-54	0	0	0	----- Bromegrass ----			
Slate	0	0	0	0	0	1	0
NETI1	0	0	0	0	0	1	0
NETI2	0	0	0	0	0	0	0
NETI3	0	0	0	0	0	0	0
NE50c3	0	0	0	0	0	0	0
NECASPIAN3	0	0	0	0	0	0	0
Pubescent wheatgrass							
Greenleaf	0	0	1	0	0	0	0
I2781	0	0	0	0	0	0	0

2000 Grass Tolerance continued

Tall wheatgrass							
Orbit	0	0	0	0	0	0	0
Alkar	0	0	0	0	0	0	0
Platte	0	0	0	5	1	1	0
Quackgrass							
RSHoffman	0	0	0	0	0	0	0
Smooth bromegrass							
Magna	0	0	0	0	0	0	0
S-7133	0	0	0	0	0	0	0
Manchar	0	0	0	0	0	1	0
Cottonwood	0	0	0	0	0	0	0
Lincoln	0	0	0	0	10	0	0
Smooth x meadow brome cross							
S-9783	0	0	0	0	0	0	0
Meadow bromegrass							
Fleet	0	0	0	0	0	0	0
Paddock	0	0	0	1	0	0	0
Russian wildrye							
Mayak	0	0	0	1	0	0	0
Swift	0	0	0	0	0	0	0
Cabree	0	0	0	0	0	0	0
Vinall	0	0	0	5	0	0	0
MON-1808	0	0	0	5	5	1	0
MON-1831	0	0	0	0	0	0	0
Bozoisky Select	0	0	0	0	0	0	0
PI-272136	----- Bromegrass -----			0	0	0	0
Syn A NL	0	0	0	0	0	0	0
Mammoth wildrye							
ND-691	----- Bromegrass -----			0	0	0	0
PI-478832	0	0	0	0	0	0	0
Volga	0	0	0	5	0	5	0
European dunegrass							
ND-2100	0	0	0	0	0	0	0
Altai wildrye							
Prairieland	0	25	0	0	0	0	0
Pearl	0	0	0	0	0	0	0
Eejay	0	0	0	Chlor	0	5	0
Dahurian wildrye							
Arthur	0	0	0	0	0	Chlor	0
Basin wildrye							
M-718	0	0	0	0	0	0	0
PI-478831	0	0	0	0	0	0	0
Magnar	1	0	1	0	0	0	0
Beardless wildrye							
Shoshone	0	0	0	0	0	0	0
Bluebunch wheatgrass							
PI-232127	0	0	0	0	0	0	0
PI-232128	0	1	0	0	0	10	0
Goldar	0	5	0	0	0	0	0
Secar	25	0	5	Chlor	0	1	0
Bluebunch X quack cross							
RS-1 Hybrid N	0	0	0	0	0	5	0
RS-1 Hybrid R	0	0	0	0	0	0	0
Indian ryegrass							
Mandan 57-2	0	5	0	0	0	20	0
Nezpar	0	0	0	0	0	0	0

2000 Grass Tolerance continued

Green needlegrass							
SD-93	25	0	10	0	Chlor	0	0
Thickspike wheatgrass							
Elbee	0	0	0	0	0	0	0
Critana	0	0	0	0	0	0	0
Western wheatgrass							
Walsh	0	0	0	0	0	0	0
Flintlock	0	0	0	0	0	0	0
Slender wheatgrass							
Revenue	0	0	0	0	0	5	0
Adanac	0	0	0	0	0	0	0
Pryor	0	0	0	0	0	0	Chlor
Primar	0	0	0	0	0	0	0