1993
NORTH DAKOTA
Weed Control Research

WEED SCIENCE

BIOLOGICAL CULTURAL

CHEMICAL

NDSU

Weed Research Projects, Department of Crop and Weed Sciences
NORTH DAKOTA STATE UNIVERSITY
Fargo, N.D. 58105

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CLIMATIC DATA-CARRINGTON, 1993																	
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.11			36	21	55	28	65	37	73	52	74	50	75	55
2				.19	.15		41	21	64	38	65	39	78	48	71	53	74	-
3		T			.11		46	23	75	44	67	39	78	60	67	48	78	45
4				.02		.01	51	27	77	45	70	38	71	-	69	51	78	47
5		.38		.04	.26	T	52	29	77	45	72	45	69	54	69	56	63	40
6		.48	.28	.41			51	32	76	54	66	44	67	49	72	46	66	36
7	.09	.51	.78	.01	T		41	34	71	51	65	43	65	52	-	47	70	40
8		1.28	.85				46	27	57	47	63	49	73	51	82	-	83	47
9		.28	.69	.07			50	28	64	43	73	53	77	50	89	59	83	43
10	.30			.43		.01	53	31	74	44	82	54	78	56	89	60	67	39
11					.15		51	29	80	50	86	55	68	44	85	64	82	-
12					.19		50	29	76	49	84	63	65	42	76	53	-	46
13			.58	.62		.01	52	28	87	45	74	-	60	51	72	46	58	36
14					.30		53	32	67	37	59	49	70	44	84	60	54	35
15			.02	1.02			56	28	56	32	62	42	70	53	83	57	66	33
16			.46	.61			64	29	63	41	61	50	73	56	77	56	63	41
17	T			1.09			68	26	63	37	66	49	76	57	84	59	64	29
18	T			.46			65	33	51	36	71	49	76	55	81	49	67	35
19		T		.07			50	27	55	35	73	50	71	52	79	55	61	34
20							52	22	64	36	86	-	74	49	75	52	61	48
21		.03		.10		.05	61	28	73	41	90	52	72	55	83	54	59	47
22		.05	.10	2.20	.07	.02	67	27	84	51	82	63	71	59	82	65	56	39
23	.28	.42	1.86	.05	.10		66	40	51	42	77	52	72	58	77	60	68	32
24	.04		.17	.02			58	38	55	39	70	45	78	61	88	59	75	41
25				1.90			51	22	70	38	63	45	74	63	87	62	76	36
26		.42			.33	.02	51	32	56	39	-	-	80	57	76	57	57	33
27	.18	.02		.67			67	38	48	32	63	-	79	62	70	52	54	35
28		.02		.02	.09		64	33	60	41	65	42	76	57	78	50	56	33
29		.62	.71		1.38		50	36	60	46	66	45	80	57	59	51	61	29
30		.01	1.12		.03		44	34	61	39	74	55	86	61	67	50	69	34
31									60	39			87	60	70	40		

CLIMATIC DATA-CASSELTON, 1993																		
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.03			39	24	48	31	62	38	72	55	84	56	74	48
2							42	22	55	25	67	38	73	52	75	53	79	53
3				.58	.03	T	43	22	64	35	68	39	80	60	72	52	69	42
4						T	49	27	74	37	69	43	70	57	72	52	79	53
5						T	52	29	79	42	70	42	64	60	73	55	65	37
6			.54				53	30	83	41	70	42	73	57	77	48	69	37
7	.11	.12		.46			50	34	81	60	74	53	65	46	77	60	69	42
8	.28	.77	.20				45	35	83	56	65	53	68	49	77	60	73	46
9	.05	.48	.10	.01		T	51	31	74	53	66	56	72	52	85	62	85	51
10				.02		T	49	28	67	44	75	48	82	56	91	63	69	43
11							47	32	76	45	85	51	80	52	93	66	67	44
12					.16		50	29	84	47	89	65	70	44	83	63	80	51
13			.62	.32		.08	48	28	76	43	86	67	71	49	75	48	83	41
14		.02			.80	.05	48	34	89	48	76	52	59	45	79	49	46	40
15				.47			58	30	75	32	59	38	74	48	83	60	75	29
16			1.28	5.75			58	29	65	33	65	42	71	59	83	56	62	29
17							66	30	65	40	72	52	76	63	83	56	66	33
18	.04				T		71	38	70	35	67	50	77	67	79	53	63	39
19				T			55	26	56	38	71	50	79	56	82	53	69	33
20						.38	56	26	60	44	72	47	74	52	78	55	65	36
21						.04	63	27	67	35	80	58	75	54	75	55	58	50
22		.31					66	27	73	38	90	62	76	56	82	64	65	45
23			.76	.21		T	68	27	74	51	85	60	70	60	78	60	54	30
24	.12	1.12	.76				53	44	57	45	79	53	71	62	83	56	68	30
25		.02	.01	1.95			65	24	62	58	71	53	68	62	93	68	75	37
26		.01	.08	T			50	27	73	39	67	55	72	62	97	63	75	37
27		.70		.07			67	28	65	41	65	46	85	63	72	53	52	26
28				T		T	67	28	53	38	63	49	80	61	76	49	68	37
29				.04			68	32	66	39	69	49	78	56	81	60	56	29
30	T	.60	1.37	.03			53	32	65	38	67	53	83	61	71	55	61	30
31									65	40			87	63	71	40		

	CLIMATIC DATA-CROOKSTON, 1993																	
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1							39	22	53	32	66	37	73	53	70	51	78	55
2					.06		34	23	63	40	68	37	79	54	69	52	65	43
3				.15	.02	.33	48	26	73	45	67	38	77	62	68	52	77	47
4				.33	.16		51	30	80	42	74	38	74	57	73	54	60	40
5				.06			53	30	84	50	74	52	70	53	68	47	63	43
6	T		.52	.22			53	32	84	57	70	47	63	51	75	49	66	39
7	.10	.06	.65				49	35	80	58	69	53	64	47	76	58	68	45
8		.16	.20	.03	.18		45	29	76	59	67	55	73	49	83	59	76	52
9		T	T				47	27	63	39	73	49	79	57	87	60	62	39
10	T						45	31	79	41	82	57	73	49	92	65	65	41
11							47	27	85	49	85	66	65	47	83	61	73	52
12					.32	T	48	26	75	40	85	63	68	52	72	45	72	40
13			.21	.23		.08	52	33	89	45	73	52	63	47	75	53	45	39
14			.01		.28		58	27	65	35	58	36	74	50	83	61	53	28
15				.25			60	26	55	36	67	49	70	57	81	52	61	38
16			.44	.35			62	28	61	39	63	49	77	63	78	53	60	32
17	.03			.07			65	31	65	34	71	45	79	53	80	56	62	32
18				.33			51	26	57	38	72	49	80	55	81	56	69	36
19							53	22	58	40	73	44	72	50	75	55	67	41
20						.05	55	24	64	29	81	58	73	48	75	53	56	49
21						.55	61	32	71	45	89	61	73	57	81	59	63	46
22			.25	.05	T		67	36	75	52	87	60	75	60	78	63	53	34
23	.13	.80	.42	.04			60	40	58	44	77	55	75	63	82	58	67	36
24	T		.55	1.10			60	21	61	39	70	53	75	68	94	62	75	39
25		.05	.02	1.39			49	21	68	32	64	50	74	63	90	61	73	44
26					.02	.01	65	39	61	41	58	47	82	62	68	55	48	31
27	.02	.18	T	.07		.06	59	31	54	37	58	39	81	60	74	47	62	35
28	.04			.07	.96		66	37	65	40	68	48	75	51	80	55	50	25
29		T	.05		1.06		52	36	62	48	65	52	83	58	68	54	56	28
30	T	.25	.39				46	35	66	40	65	53	85	62	69	45	69	35
31		.08							61	34			76	57	72	47		

CLIMATIC DATA-DICKINSON, 1993																		
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	T		.07	.12			33	25	50	25	56	42	72	52	80	59	77	42
2			.14	.07			42	23	57	34	55	40	75	47	75	49	72	50
3				1.05	.02	.08	47	19	70	40	64	42	80	63	69	47	63	39
4			.01	T			53	28	72	47	63	35	74	56	62	50	81	46
5				.29	.01	.12	56	32	78	48	67	45	65	55	73	50	60	48
6	T	.18	.30	.01		.03	41	29	67	51	50	45	59	51	71	43	65	35
7	T	.32	.03	.29	.12	.15	49	32	70	50	61	47	70	59	71	53	67	35
8		T	2.55	.12			55	22	63	46	54	46	69	51	81	54	67	34
9		T	.03	.03			55	24	55	50	62	42	70	51	85	52	84	48
10	.50			.25			61	32	57	34	77	44	73	54	84	52	67	34
11	T			T			50	30	73	38	81	53	65	51	81	55	74	41
12					.05		51	28	77	37	81	53	70	48	89	48	88	56
13	T			.30			52	29	80	42	73	57	60	45	70	52	64	29
14	T				.15		50	29	85	45	60	40	60	41	71	53	41	17
15				T	T		52	22	71	42	70	45	63	51	82	57	60	23
16			.07	.23			57	29	69	30	54	47	56	67	83	57	70	38
17			.02	.17			62	30	68	46	60	45	64	44	83	55	58	26
18				.01			65	36	64	26	65	39	75	68	80	47	61	26
19	.68			.04			47	26	60	27	70	40	73	43	79	47	66	48
20							43	22	59	29	77	47	75	50	76	49	62	43
21	.02		.02	T			44	21	70	40	91	56	75	54	79	61	77	42
22			.05	.12			58	28	77	52	91	61	73	58	88	58	63	38
23	.24	T	.03	.06	.22		69	37	77	45	83	47	78	54	76	57	55	23
24	.24	.08	.40	.08			47	34	51	43	58	38	65	50	82	50	68	31
25	.02	.05	.05	.53			53	30	58	32	63	45	68	62	85	54	75	40
26	.06		T	.40			57	36	76	43	70	38	78	54	78	52	70	35
27	.05	.14		.37	.14		71	36	56	42	74	43	70	56	72	43	52	51
28				.01			63	34	62	41	68	48	65	47	73	47	66	32
29			.97				54	30	48	42	74	49	80	57	76	53	64	25
30		.80	.46		.12		54	25	64	45	70	44	84	57	58	43	68	27
31		.01		T	.08				60	43			87	62	65	33		

CLIMATIC DATA-FARGO, 1993

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				T		T	42	25	52	33	68	40	75	60	75	58	82	58
2				.27	.06		44	21	64	29	69	38	81	55	72	54	70	48
3				T	.01	.01	50	23	74	42	70	38	74	62	71	54	79	44
4				.03			51	27	80	46	72	42	75	63	74	53	66	47
5				.38	.07	.01	52	33	83	47	75	46	73	60	73	54	68	42
6			.26	T			51	35	83	60	70	56	65	53	77	51	70	39
7	.10	.14	.17	.01			45	38	82	62	67	55	69	46	78	56	72	45
8	.10	.14	.15	T	.07		49	36	76	58	68	57	75	50	85	64	85	48
9		T	.01	T		T	47	32	65	51	74	57	81	54	91	62	68	48
10	.11						43	28	77	47	85	51	80	56	95	63	69	40
11	.03		T		T		48	36	84	47	89	65	70	52	91	72	79	51
12				.34	T		47	32	78	50	86	67	73	47	75	55	84	49
13			.59			.15	50	30	89	45	76	61	62	54	79	47	49	42
14			T	4.42	.64	T	57	36	73	43	63	46	74	47	84	67	57	36
15			.10	.73			58	27	59	32	68	39	71	58	83	63	63	34
16	T		.66				66	28	64	34	73	54	79	62	79	57	67	41
17	T	T			.07		71	31	69	39	71	54	80	63	82	68	63	35
18	.01						54	35	58	34	72	50	81	58	82	56	69	35
19		T				.13	54	31	60	41	73	57	74	58	79	57	63	42
20		T			T	.10	56	26	66	39	81	50	76	53	78	57	58	51
21						.05	62	27	74	35	89	61	75	56	84	61	63	55
22		.07	.28	.08	T		68	37	75	53	86	67	76	62	76	67	57	36
23	.18	1.03	1.24	.01	T		55	47	61	50	80	62	73	63	82	63	68	31
24	T	.28	.02	1.05			63	33	63	46	73	54	75	66	94	60	74	39
25		.03	.01	.38			50	25	75	38	69	54	72	65	96	70	76	45
26		.02		T	T	T	67	31	63	39	66	51	84	63	72	60	60	34
27	.16	.49		.01		.04	62	44	54	48	63	48	82	64	76	53	66	29
28	.01				.01		68	37	66	39	71	47	78	61	83	52	53	32
29	.04	.25	.71	T	.17		52	35	66	48	67	54	84	57	79	57	60	30
30		.22	.08		.03	T	51	36	66	43	71	57	89	64	72	49	72	44
31		T							62	38			80	66	74	43		

CLIMATIC DATA-HETTINGER, 1993																			
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1			.40	.20			34	25	48	24	68	45	76	52	81	50	77	38
2			.20				40	24	54	27	57	45	74	51	73	51	73	47
3				.12			46	22	67	36	61	36	-	60	69	43	63	38
4						.02	50	22	73	47	62	35	76	52	60	44	82	44
5						.17	54	30	75	49	65	44	65	53	70	48	58	39
6		.17					45	28	64	49	71	49	66	53	70	45	61	33
7	.05	.21	.15		.20		52	32	73	49	60	51	70	46	66	49	67	34
8		.19	1.43				49	25	65	43	58	47	68	45	79	55	72	35
9		.26					57	30	65	43	59	47	73	45	86	52	84	53
10	.24			.18			59	37	63	34	75	48	78	49	88	50	66	35
11				.05			46	27	71	35	81	55	65	41	85	62	72	43
12					.36		48	32	73	35	82	55	69	49	88	53	88	43
13				.68			48	34	72	35	82	45	62	47	66	54	68	31
14					.15		44	29	83	50	82	41	60	41	72	54	41	18
15				.15			51	22	73	42	82	42	64	52	81	55	58	27
16			.10	.78			55	25	62	28	55	40	72	75	80	57	71	44
17		.07		.05			58	28	68	42	67	49	66	47	82	54	57	35
18				.73			65	36	64	28	61	42	72	51	80	47	56	30
19	.25			.08			57	27	63	34	66	42	73	44	78	47	56	30
20							36	25	58	28	73	48	73	51	77	52	55	45
21							41	21	68	37	89	54	74	60	75	59	72	44
22		.06		.15			59	30	74	57	88	60	72	59	87	57	65	34
23		.03	.08	.77	.02		70	45	76	50	84	46	77	55	76	57	51	23
24	.31		.15				48	34	55	45	56	39	67	54	82	48	68	32
25				.27			55	33	59	33	65	47	62	55	92	57	75	34
26					T		55	35	74	44	71	42	76	52	74	53	70	37
27		.06		.74			70	43	74	46	76	46	57	53	67	42	56	35
28							63	34	65	45	76	51	65	50	72	48	66	33
29			.85				60	26	58	44	74	53	78	55	76	47	62	26
30		.30	.98		T		57	27	70	49	63	44	81	62	56	46	66	43
31		.02							55	40			90	58	66	34		

CLIMATIC DATA-MINOT, 1993																		
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1							33	18	53	25	63	37	76	55	79	58	72	48
2					.06	.11	40	18	61	31	57	40	76	51	72	56	70	52
3		.02	.17	.18	.08		46	20	68	41	62	45	79	55	64	48	61	48
4						.07	51	27	73	41	66	41	65	51	65	45	78	49
5				.97			56	31	81	45	59	41	65	46	71	47	59	40
6	.03	.11	.47	.28		.02	55	32	81	53	59	48	61	51	70	46	62	37
7		.17		.24			43	35	73	55	67	47	64	46	74	49	65	41
8		.58	2.38	.03			54	28	73	41	59	49	64	47	76	58	69	42
9		T	.10		T		46	26	57	48	58	50	74	52	84	57	83	57
10	.60			.19			57	29	69	42	78	52	74	55	90	58	63	40
11	.65			.01	.11		35	30	78	50	82	59	66	45	82	61	67	40
12	.07			.06			47	32	83	49	83	63	58	42	85	49	82	51
13			T		.22	.12	48	28	82	51	79	51	62	46	70	48	58	34
14	.01			.44			55	29	89	46	67	46	67	44	74	52	58	28
15				.09			52	28	67	36	68	47	70	54	78	58	53	28
16			.06	.05			59	29	59	32	64	50	73	56	79	57	65	44
17			.09	.09			61	30	54	37	58	44	65	50	80	59	59	32
18	.03			.61			65	33	58	42	67	44	76	54	79	51	60	35
19							47	27	54	40	73	44	73	49	78	55	64	38
20				.29			49	27	58	34	77	61	71	49	751	49	61	41
21						T	51	27	69	43	92	42	75	53	77	52	70	42
22		.06		.57	.40	T	61	30	75	53	88	64	67	65	80	59	62	37
23		.65	.13	1.12	.10		72	34	79	49	85	49	74	53	80	62	53	36
24	.19		.17	.61			54	35	55	43	60	43	68	54	80	59	65	40
25			.07	.32			51	21	58	40	62	47	73	56	82	57	71	41
26			.02	.34			53	21	66	38	64	47	73	56	74	53	67	41
27	.03	.26		.03	.19		71	39	59	41	62	38	78	60	70	50	52	40
28		.12		.57			66	33	47	39	64	44	63	54	71	52	65	32
29		T	.46	.47	.11		51	33	60	40	67	48	89	56	67	51	53	33
30		.83	.13		.59		47	24	54	45	61	51	81	62	58	47	60	33
31					.06				63	41			84	53	62	43		

CLIMATIC DATA-OLIVIA, 1993																		
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	.23	.41			.58		34	22	54	34	63	38	66	59	80	59	69	47
2		.49	.28	.69			39	22	47	40	63	47	72	59	76	55	74	57
3					.04		44	28	55	32	68	43	79	59	74	55	73	46
4				.90			51	29	72	32	68	43	80	61	68	49	71	46
5				.17			51	30	65	32	69	46	79	62	71	53	70	40
6						.03	51	31	79	42	72	57	76	60	70	49	65	44
7		.48	.08			.07	46	32	69	60	76	57	75	59	73	53	68	46
8	.45	1.75	1.87	.74			41	36	73	56	73	57	73	56	76	62	70	43
9		.23	.06	.35	.06		41	33	75	59	74	55	78	62	82	65	74	51
10		.04					51	27	66	53	74	55	78	62	90	60	68	43
11	.74	.24		.32			49	31	59	52	84	59	72	61	89	63	65	47
12							43	33	78	51	89	62	77	51	85	67	77	52
13			.43	.02		.30	43	31	79	45	83	63	75	57	82	56	88	56
14	.34			.02		.10	43	31	76	47	77	55	73	58	80	62	63	42
15	.09				1.38		40	33	76	40	63	52	76	57	78	64	49	32
16			.69				52	31	62	38	70	55	80	60	84	66	59	33
17			4.53	.24			59	31	64	46	74	57	82	67	82	60	71	44
18			.18		.90	.06	60	31	66	44	70	56	82	63	83	65	56	39
19			.69	.34			69	29	61	39	61	55	83	62	83	66	65	45
20			.71			1.16	48	32	58	37	59	54	79	57	79	55	54	50
21							57	29	62	40	75	56	79	57	76	55	55	50
22			.96			.16	60	29	62	53	84	61	79	56	76	63	59	53
23				.66	.14		67	33	69	54	87	64	70	58	80	64	61	25
24		.37	.83				67	44	65	47	82	58	71	64	79	61	62	35
25		.05	.12	.88			60	34	58	43	73	56	82	62	89	61	68	44
26						.03	57	31	72	44	73	57	77	62	89	68	70	44
27	.48	.37			.21		60	36	73	49	76	51	83	62	90	62	52	29
28							66	39	75	42	72	51	83	63	73	55	66	30
29							71	39	64	46	72	54	73	57	74	56	49	29
30		.04	.58		.15		59	31	62	53	72	59	82	58	75	64	57	32
31		.35							57	41			86	65	75	47		

CLIMATIC DATA-PROSPER, 1993																				
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1									53	31	66	37	72	58	73	55	76	52
2					.20				65	26	58	42	81	53	70	52	68	43
3				.16		.04			79	36	66	40	74	58	70	52	77	40
4									79	38	71	41	72	60	72	52	63	43
5				.31	.08	.04			83	39	75	42	70	57	71	54	66	36
6			.35	.28					81	56	66	55	62	50	76	50	69	36
7		.94	.31						82	58	64	52	64	48	76	50	72	40
8		.31	.24		.16				72	57	65	57	72	49	84	60	82	44
9			.12						64	50	72	55	79	51	90	60	67	46
10				.08					75	45	85	48	77	56	91	60	68	38
11									83	44	88	58	67	50	82	68	78	45
12					.08				78	49	86	63	70	44	73	50	80	47
13			.63	.39		.08			91	43	74	58	60	63	76	46	48	40
14					.51				73	41	60	46	72	46	82	63	56	30
15			.16	2.24					58	35	66	39	67	56	82	60	62	28
16			.98	2.60					64	35	70	53	76	62	76	56	65	39
17									66	40	68	52	77	59	77	56	62	31
18				.04					57	36	70	48	78	54	79	53	69	30
19						.16			59	42	72	54	72	55	77	52	63	32
20						.04			65	39	81	47	72	51	76	56	56	50
21									74	33	91	57	74	52	81	53	62	53
22		.20	.47	.12					74	52	85	64	73	60	74	64	55	31
23		.71	1.46	.04					59	49	76	61	72	61	81	59	68	28
24		.28		1.34					59	45	70	53	77	64	90	56	75	32
25				.51					73	38	68	53	70	64	94	66	76	37
26		.08		.04					62	38	63	51	82	62	72	59	56	27
27		.47		.04		.04			52	46	63	47	79	61	75	47	66	25
28									64	40	60	45	76	50	79	46	54	28
29		.31	1.02		.31				66	47	65	52	83	54	70	55	61	26
30		.24	.12						64	42	71	56	86	60	70	46	72	42
31									62	41			78	63	71	41		

CLIMATIC DATA-WILLISTON, 1993

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation August	Precipitation September
1				.08		T
2			.10	.03	.14	.03
3			.14	3.80	.02	
4			.17	.26		
5	T		.21	.84	.09	.01
6	.27		.02	.40		T
7		.18	.10			
8			2.05	T		
9	T	.13	T	T		
10	.01			.01		
11	.04		.01			
12			.06	T	.14	.05
13	.04		.20	.28		.08
14	.03			.07	.04	
15				.12		
16			.50	.34		
17	T			.07	.42	
18	T			.19	T	
19				.07		
20	T					
21				.31		.08
22		T	.05	.40	3.77	
23		.05	.21	.02	.13	
24	.29		.18			
25					T	
26		T			.22	
27	T	.21		.90	.13	T
28	T				.01	
29	.01	.12	.47		.31	
30		.11	.02	T	.05	
31						

Date	April Max	April Min	May Max	May Min	June Max	June Min	July Max	July Min	August Max	August Min	September Max	September Min
1	43	28	62	31	67	49	75	50	76	53	66	53
2	51	25	71	29	67	41	81	49	76	54	65	50
3	56	25	70	42	54	40	81	57	63	45	80	48
4	61	31	80	46	68	44	68	53	73	52	77	48
5	59	30	80	47	68	50	60	51	72	51	65	43
6	53	29	80	54	66	44	69	53	71	47	69	39
7	59	30	77	54	62	52	68	46	80	54	73	42
8	54	31	58	44	60	46	73	49	86	61	84	51
9	60	25	67	40	77	47	71	52	90	56	76	48
10	58	36	77	41	81	52	72	53	91	58	71	38
11	53	33	82	42	81	58	69	44	87	61	86	46
12	53	29	85	47	80	55	68	45	68	47	84	43
13	53	29	88	50	68	48	67	49	72	51	46	32
14	53	34	71	50	70	43	70	45	81	57	59	25
15	60	30	54	40	70	50	69	55	84	56	65	41
16	64	32	70	37	66	51	67	50	83	58	60	41
17	66	37	60	42	69	42	74	49	81	55	63	32
18	59	37	62	32	71	44	75	54	77	50	69	36
19	50	28	63	36	79	49	74	47	77	54	68	46
20	52	27	73	36	90	45	75	53	80	51	74	41
21	65	30	84	43	90	57	75	58	82	58	62	49
22	70	27	81	53	89	61	76	57	82	62	60	35
23	70	46	73	47	68	48	72	51	80	59	69	32
24	64	37	62	45	59	42	77	53	81	60	73	37
25	60	26	73	42	58	50	78	60	79	55	74	43
26	74	40	71	41	72	43	77	54	62	63	66	34
27	71	35	55	45	73	41	72	47	72	47	68	45
28	62	30	62	42	71	51	79	53	73	53	66	33
29	56	34	64	51	72	53	83	59	71	51	70	31
30	60	27	63	48	75	48	83	68	63	45	70	49
31			70	44			82	53	74	44		

SOIL TEST RESULTS AT VARIOUS WEED EXPERIMENT LOCATIONS						
	Soil Texture	Organic matter	pH	lb/A N	PPM P	K
Camp Grafton (Goat)	Sandy loam	4.7	7.2	3	3	180
Camp Grafton (Insect)	Loamy sand	2.8	7.0	3	3	98
Carrington, ND	Loam	3.6	7.2	Fertilized by test		
Casselton, ND (Dalrymple)	Silty clay	5.0	7.9	Applied 80 lb N		
Chaffee, ND	Fine sandy loam	6.7	7.4	20	36	950
Crookston, MN	Loam	4.5	7.9	172	9	130
Crookston, MN (Multiple application)		6.3	8.2	466	71	>9999
Cuba, ND		7.0	8.2	3	4	100
Fargo, ND (Sec. 22)	Silty clay	6.0	7.5	190	26	1095
Fargo (time of thinning, new leaf removal, post Lorsban, Upbeet & insecticide)	Silty clay	5.0	7.3	111	32	380
Fargo (Grass control experiment)	Silty clay	4.9	7.5	125	20	290
Fargo (Cover crops, tillage, Upbeet over soil applied herbicides, Terra Betanex and Betamix, methanol)	Silty clay	5.1	7.2	133	15	345
Fargo (Sec.22) Sugarbeet weed control	Clay	5.7	7.7	29	13	365
Fargo (Sec. 22) 1992 Residue Expt.	Clay	5.3	7.7	84	14	430
Fargo (Sec. 22) Residue experiments	Clay	6.0	7.8	40	29	440
Hunter, ND	Sand	7.4	6.8	14		
Jamestown, ND (Pipestem Dam)		6.8	6.8	28	5	290
Minot, ND	Loam	2.7	7.0	Fertilized by test		
Minto, ND		7.7	7.7	122	58	1300
Mooreton, ND		3.9	7.0	19	22	250
Oslo, MN		6.1	7.8	119	26	280
Prosper, ND	Silt loam	3.6	7.5			
Renville, MN		7.4	7.9	36	9	125
Sheyenne ND, Grasslands (Goat)	Sandy loam	6.2	7.5	8	4	85
Sheyenne ND, Grasslands (Insect)	Loamy sand	2.5	6.9	3	7	125
St. Thomas, ND	Loam	3.8	7.8	66	30	160
Valley City, ND	Stony loam	9.4	6.7	5	5	1415
West Fargo, ND	Silty clay	3.6	7.2	8	42	1460
Williston, ND	Loam	2.3	6.8	Fertilized by test		
Wolverton, MN		5.8	6.6	32	25	430

KEY TO ABBREVIATIONS AND EVALUATIONS

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

All preplant incorporated or preemergence treatments were applied in 17 gpa water at 35 psi through 8002 nozzle tips and all postemergence treatments were applied in 8.5 gpa water at 35 psi through 8001 nozzle tips except where stated otherwise.

All treatments were applied with a bicycle wheel-type plot sprayer unless otherwise stated. Preplant incorporation was by field cultivator + harrow or as stated in table and preemergence incorporation was by harrowing twice.

Treatments with a + indicate tank mixtures, with an & indicate formulation mixtures and with a / indicate a separate application.

Species		
Abww = Absinth wormwood	Fota, fxtl = Foxtail species	Sabu, Fisb = Sandbur
Alfa = Alfalfa	Grft = Green foxtail	Safl, Saff = Safflower
Amaz = Amaranth	Gfpw = Greenflower pepperweed	Shpu = Shepardspurse
Barl, Bar = Barley	Girw = Giant ragweed	Soyb, Sobe = Soybean
Bdlf = Broadleaf	Howe = Horseweed	Spkw = Spotted knapweed
Biww = Biennial wormwood	Hrsw = Hard red spring wheat	Spsp = Spotted spurge
Bubu = Buffalo bur	KOCZ = Kochia	Sugb, Sgbt = Sugarbeet
Bygr = Barnyardgrass	Latu = Ladysthumb	Sunfl,Sufl, Cosf = Sunflower
Cath = Canada thistle	Lent = Lentils	Tabw = Tame buckwheat
Cano = Canola	Lesp = Leafy spurge	Tamu = Tansy mustard
Cocb = Common cocklebur	Llsa = Lanceleaf sage	Taoa = Tame oats
Colq = Common lambsquarters	Mael = Marshelder	Tumu = Tumble mustard
Coma = Common mallow	Mesa = Meadow salsify	Tymu = Tame yellow mustard
Copu = Common purslane	Mign = Mignonettte	Vowh = Volunteer wheat
Cosf = Volunteer sunflower	Nabe = Navy bean	Vele = velvetleaf
Cram = Crambe	Nfcf = Nightflowering catchfly	Vema = Venice mallow
Dobr = Downy brome	Pest = Perennial sowthistle	Wesa = Western salsify
Domu = Dog mustard	Pesw = Pennsylvania smartweed	Wht = Wheat
Duru = Durum wheat	Pnto = Pinto bean	Wibw = Wild buckwheat
Ebns = Eastern black nightshade	Powe = Pondweed	Wimu = Wild mustard
Fach = False chamomile	Prle = Prickly lettuce	Wioa = Wild oats
Fibw = Field bindweed	Prmi = Proso millet	Wipm = Wild proso millet
Fipc = Field pennycress	Prpw = Prostrate pigweed	Yeft = Yellow foxtail
Flwe, Flix = Flixweed	Qugr = Quackgrass	
Foba = Foxtail barley	Rrpw = Redroot pigweed	
Fomi, Ftmi = Foxtail millet	Ruth = Russian thistle	

METHODS

PPI = Preplant incorporated	EPOST = Early Postemergence
PEI = Preemergence incorporated	P, PO, POST = Postemergence
PRE, PE = Preemergence	POSTDIR = Postemergence Directed

MISCELLANEOUS

DF = Dry flowable	alk = alkanolamine
F = Fall	bee = Butoxyethyl ester
FL = F = Flowable	dea = diethanolamine
S = Spring	dma = Dimethylamine
L = Liquid	ioe = isooctyl ester
LC = Liquid concentrate	MS, MVO = methylated vegetable oil
WP = Wettable powder	
WDG = Water dispersible granules	PO, OC = Petroleum oil concentrate (17% emulsifier)
G = Granules or gallon/A	SURF = S = Surfactant
SG = Soluble granules	NIS = nonionic surfactant
Inc = I = Incorporation	28N, UAN = 28% liquid nitrogen fertilizer
%ir = inju = Percent injury rating	AMS = ammonium sulfate
%sr = %std, strd = Percent stand reduction	AMN = ammonium nitrate
HT = Plant height	
SPK = Spike stage	
Tswt = TW = Test weight	
Yld = Yield	

Adjuvants	Company
Mor-Act = Petroleum oil adjuvant	Wilbur Ellis
Scoil = Methylated seed oil	AGSCO
Sun-It II = containing methylated seed oil	AGSCO
DASH, DASH-HC	BASF Corp
Methoil	Farmland Industries
MSO	Loveland Industries
Dyne-Amic	Helena Chemical
MES-100	
ECO-Gard II	T-Tech
R-11	Wilbur Ellis
Preference	Cenex Land-O-Lakes
Li700	Loveland Industries
Kenetic	Helena
Silwet L-77	Loveland Industries
Spray Booster S	Cenex Land-O-Lakes
Activator 90	Loveland Industries
AD-100	Riverside
Active-it	AGSCO
ASPA-80	Amway
Wet-sol 99	Schoeffer Mfg
Agra-wet	Loveland Industries
Dispatch	Loveland Industries
Purity 100	Rosens
ChemPro 6000	
EOP	Wilbur Ellis
Cayuse	Wilbur Ellis
Cenex SAS	Cenex Land-O-Lakes
X-77 = Nonionic surfactant	Valent

LIST OF HERBICIDES TESTED IN 1993

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
Acetochlor+Dichlormid	Acet	Zeneca	6.4 lb/gal EC	Surpass
Acetochlor+MON 4660	Acet	Monsanto	7 lb/gal EC	Harness Plus
Acifluorfen	Acif	BASF	2 lb/gal E,S	Blazer
Alachlor	Alac	Monsanto	4 lb/gal E 4 lb/gal MT, 15% G 65% WDG	Several
Atrazine	Atra	Various	80% WP, 90% DF, 4 lb/gal F	Numerous
Bentazon	Bent	BASF	4 lb/gal S	Basagran
Bromoxynil	Brox	Rhone-Poulenc	2 lb/gal E	Buctril
Chlorimuron	Clim	DuPont	25% DF	Classic
Clethodim	Clet	Valent	2 lb/gal	Select
Clopyralid	Clpy	DowElanco	3 lb/gal S	Stinger
Clopyralid+2,4-D	Clpy&2,4-D	DowElanco	0.38 + 2 lb/gal S	Curtail
Cyanazine	Cyan	DuPont	80% WP, 90% DF 4 lb/gal F	Bladex
Cycloate	Cycl	Zeneca	6 lb/gal E	Ro-Neet
Desmedipham	Desm	Nor-Am	1.3 lb/gal E	Betanex
Desmedipham + Phenmedipham	Desm&Phen	Nor-Am	0.65+0.65 lb/gal E	Betamix
Dicamba	Dica	Sandoz	4 lb/gal S	Banvel, Clarity
Dimethenamid	Dime	Sandoz	7.5 lb/gal EC	Frontier
Diclofop	Difp	Hoechst-Roussel	3 lb/gal E	Hoelon
Diethatyl	Diet	Nor-Am	4 lb/gal E	Antor
Difenzoquat	Dife	American Cyanamid	2 lb/gal S	Avenge
Endothall	Endo	Pennwalt	3 lb/gal S	Herbicide 273
EPTC	EPTC	Zeneca	7 lb/gal E 25% G	Eptam
EPTC+Dichlormid	EPTC+Dclr	Zeneca	6.7 lb/gal EC 25% G	Eradicane

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
Ethalfluralin	Etha	DowElanco	3 lb/gal E 10% G	Sonalan
Ethametsulfuron	DPX-A7	DuPont	75% DF	Muster
Ethofumesate	Etho	Nor-Am	4 lb/gal F 1.5 lb/gal E	Nortron
F8426		FMC	50%	None
F6285		FMC	4 lb/gal F	None
Fenoxaprop	Fenx	Hoechst-Roussel	0.79 lb/gal E	Option II
Fenx & 2,4-D & MCPA		Hoechst-Roussel	2.71 lb/gal E	Tiller
Fenx & MCPA		Hoechst-Roussel	0.67+4 lb/gal E	Dakota
Fenx & MCPA & Thifensulfuron & Tribenuron		Hoechst-Roussel	1.6:7.6:0.187:0.092	Cheyenne
Fluazifop-P	Flfp-P	Zeneca	1 lb/gal E	Fusilade 2000
Fluazifop+P+ Fenoxaprop	Flfp+Fenx	Zeneca	2.66 lb/gal E	Fusion
Flumetsulam + Metolachlor	Flum & Meto NAF2	DowElanco	7.66 lb/gal	Broadstrike+Dual
Flumetsulam + Trifluralin	Flms & Trif XRM-5313	DowElanco	3.65 lb/gal	Broadstrike+Treflan
Flumichloral	Flmc	Valent	0.86 lb/gal EC	Resource
Fluroxypyr	Flox	Dow Elanco	1.7 lb/gal	Starane
Glyphosate	Glyt	Monsanto	3 lb/gal S	Several
Glyphosate & 2,4-D	Glyt & 2,4-D	Monsanto	0.9 + 0.8 lb/gal S	Landmaster II
Glyphosate + 2,4-D	Glyt & 2,4-D	Monsanto	0.9 + 1.5 lb/gal	Landmaster BW
Glyphosate & dicamba	Glyt & Dica	Monsanto	1.1 + 0.5 lb/gal S	Fallowmaster
Imazaquin	Imqn	American Cyanamid	1.5 lb/gal	Scepter
Imazethapyr	Imep	American Cyanamid	2.0 lb/gal	Pursuit
Imazamethabenz	Immb	American Cyanamid	2.5 lb/gal E	Assert
Lactofen	Lact	Valent	2 lb/gal S	Cobra

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
MCPA	MCPA	Rhone-Poulenc	4 lb/gal E, S	Several
Metolachlor	Meto	Ciba-Geigy	8 lb/gal E	Dual
Metribuzin	Metr	Mobay DuPont	4 lb/gal F, 75% DF 4 lb/gal F, 75% DF	Sencor Lexone
Metsulfuron	Mets	DuPont	60% DF	Ally/Escort
MON-12000	MON12037	Monsanto	75% DF	Permit
MON12041	MON12041	Monsanto	15% DF MON1200 45% DF MON13900	Battalion
MON-13200	MON13200	Monsanto	2 lb/gal	None
Nicosulfuron	Nico	DuPont	75% DF	Accent*
Paraquat	Para	Zeneca	2.5 lb/gal S 2 lb/gal S	Gramoxone Extra Cyclone
Pendimethalin	Pend	American Cyanamid	4 lb/gal E 3.3 lb/gal E	Prowl
Picloram	Picl	DowElanco	2 lb/gal S	Tordon 22K
Picloram + 2,4-D		DowElanco	2.54 lb/gal	Tordon 101
Picloram + Triclopyr		DowElanco	3.0 lb/gal	Access
Primisulfuron	Prim	Ciba Geigy	75% DF	Beacon
Propachlor	Prcl	Monsanto	4 lb/gal F	Ramrod
Propanil	Prnl	Rhom & Haas	80% DF	Stampede SDEDF
Pyrazon	Pyzn	BASF	4.2 lb/gal F	Pyramin
Quinclorac	Qucl BAS-514-34	BASF	75% WP 50% DF	Facet Impact
Quizalofop-P	Qufp	DuPont	0.88 lb/gal EC	Assure II
Sethoxydim	Seth, Sth	BASF	1.5 lb/gal E 1.0 lb/gal E	Poast Poast-plus*
Sulfometuron	Sume	DuPont	75% DF	Oust
Thifensulfuron	Thif	DuPont	25% DF	Pinnacle
Thifensulfuron & Tribenuron	Thif & Trib	DuPont	75% DF (2:1)	Harmony Extra
Tribenuron	Trib	DuPont	75% DF	Express

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
Triallate	Tria	Monsanto	4 lb/gal E, 10% G	Far-Go
Triflusulfuron	Tfsu	DuPont	50%DF	Upbeet
Triasulfuron	Trsu	Ciba-Geigy	75% DF	Amber
Triclopyr	Trcp	DowElanco	4 lb/gal	Garlon*
Trifluralin	Trif	DowElanco	4 lb/gal E 10% G	Several*
2,4-D	2,4-D	Various	Various E, S, WSP	Numerous
2,4-DB	2,4-DB	Various	2 lb/gal	Numerous

[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.

Preplant incorporated herbicides, Crookston, 1993. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots 1:00 pm April 28 when the air temperature was 65F, soil temperature at six inches was 46F, relative humidity was 44%, wind velocity was 14 mph, and soil moisture was good. Incorporation was with a rototiller set four inches deep for treatments containg EPTC or cycloate and two inches deep for dimethenamid. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 14. Counter 15G at 12 pounds product per acre was applied in a two inch band and drag chain incorporated at planting. Sethoxydim + crop oil at 0.2 lb ai/A + 1 qt/A was applied to the entire plot area June 15. Kochia, green foxtail, prostrate pigweed, and wild buckwheat control and sugarbeet injury were evaluated June 19.

Treatment	Rate	Sgbt inj	Kocz cntl	Grft cntl	Prpw cntl	Wibw cntl
	lb/A	%	%	%	%	%
EPTC	2	13	51	74	70	48
Cycloate	4	5	25	85	63	24
EPTC+Cycloate	1+2.5	14	38	91	75	29
EPTC+Cycloate	1.5+2.5	23	59	91	84	53
EPTC+Cycloate	1.5+2	16	48	90	75	35
EPTC+Cycloate	2+2	24	66	91	86	64
EPTC+Cycloate	1+3	13	45	91	74	35
EPTC+Cycl+Ethofumesate-SC	1+2+2	20	84	98	92	89
EPTC+Cycl+Ethofumesate-SC	1+2+3	23	83	98	92	90
Cycloate+Ethofumesate-SC	2+2	11	64	97	83	54
Dimethenamid	1.5	48	63	90	96	83
EXP MEAN		19	57	91	81	55
C.V. %		47	21	6	9	21
LSD 5%		13	17	8	11	17
LSD 1%		17	24	10	14	23
# OF REPS		4	4	4	4	4

Summary

All treatments except cycloate at 4 lb/A and cycloate+ethofumesate at 2+2 lb/A caused significant sugarbeet injury. Injury reported in this table at Crookston was greater than with the same treatments applied at Renville on a heavier soil. Dimethenamid caused greater injury than any other treatment. EPTC+cycloate+ethofumesate gave greater control of kochia and wild buckwheat than other treatments, except dimethenamid gave similar control of wild buckwheat. All treatments except EPTC alone and cycloate alone gave over 90% control of green foxtail. Only EPTC+cycloate+ethofumesate and dimethenamid gave over 90% control of prostrate pigweed.

Postemergence herbicides over soil applied herbicides, Minto, 1993. EPTC + cycloate at 1 + 2.5 lb ai/A was applied in 15 gpa water at 40 psi through 11002 nozzles to one half of each 40 foot plot May 5. Incorporation was twice with a "Kongskilde Triple K" field cultivator operated 3 inches deep. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split applied postemergence herbicide treatments was applied 2:45 pm May 25 when the air temperature was 58F, soil temperature at six inches was 60F, relative humidity was 72%, wind velocity was 9 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, redroot pigweed was in the cotyledon to 2 leaf stage, common lambsquarters was in the cotyledon to 4 leaf stage, and common mallow and wild mustard were in the cotyledon to 2 leaf stage. Single application treatments and the second half of split applications were applied 2:30 pm June 1 when the air temperature was 72F, soil temperature at six inches was 60F, relative humidity was 32%, wind velocity was 4 mph, soil moisture was good, sugarbeet and redroot pigweed were in the 2 to 4 leaf stage, common lambsquarters was in the 6 leaf stage, common mallow was in the 3 to 4 leaf stage, and wild mustard was in the 4 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim + Scoil at 0.3 lb ai/A + 1 qt/A was applied to entire plot area June 14. Redroot pigweed, common lambsquarters, common mallow, and wild mustard control and sugarbeet injury were evaluated June 24.

		No Soil Applied Herbicide				
		Sgbt	Rrpw	Colq	Coma	Wimu
Postemergence Treatment*	Rate	inj	cntl	cntl	cntl	cntl
	lb/A	-------------		%		------------
Desmedipham/Desmedipham	0.16/0.25	0	80	85	3	88
Desmedipham/Desmedipham	0.25/0.33	3	90	95	10	100
NA-307/NA-307	0.16/0.25	0	63	89	8	95
NA-307/NA-307	0.25/0.33	0	61	90	3	93
Clopyralid/Clopyralid	0.09/0.09	0	14	50	20	37
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	3	94	100	20	100
Des+Clpy+Tfsu/same	.16+.09+.0156/.25+.09+.0156	3	94	100	68	100
Des+Tfsu/Des+Tfsu	0.25+0.0156/0.33+0.0156	0	97	98	66	100
Des+Endo/Des+Endo	0.25+0.25/0.33+0.33	0	81	90	9	100
Des+Endo+AMS/same	0.25+0.25+2.5/.33+.33+2.5	16	59	70	68	95
--/Endothall	--/0.75	0	0	0	0	0
--/Endothall+AMS	--/0.75+2.5	0	0	0	38	0
Des+Tfsu+Endo/same	.25+.0156+.25/.33+.0156+.33	0	99	91	66	100
NA-307+Tfsu/same	0.16+0.0156/0.25+0.0156	0	81	88	64	100
Tfsu+X-77/same	0.0156+0.25%/0.0156+0.25%	0	68	23	66	100
No postemergence herbicide applied	0	0	0	0	0	0
C.V. %		154	12	14	27	7
LSD 5%		3	11	13	12	8
LSD 1%		4	14	18	16	11
# OF REPS		4	4	4	4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Experiment continued on next page.

Postemergence herbicides over soil applied herbicides, Minto, 1993.
(continued)

Postemergence Treatment*	Rate	EPTC + Cycloate				
		Sgbt inj	Rrpw cntl	Colq cntl	Coma cntl	Wimu cntl
	lb/A	%				
Desmedipham/Desmedipham	0.16/0.25	4	96	99	34	100
Desmedipham/Desmedipham	0.25/0.33	9	99	100	35	100
NA-307/NA-307	0.16/0.25	0	93	99	20	98
NA-307/NA-307	0.25/0.33	3	90	100	25	100
Clopyralid/Clopyralid	0.09/0.09	8	79	84	28	40
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	11	99	100	28	100
Des+Clpy+Tfsu/same	.16+.09+.0156/.25+.09+.0156	8	100	100	70	100
Des+Tfsu/Des+Tfsu	0.25+0.0156/0.33+0.0156	3	100	100	75	100
Des+Endo/Des+Endo	0.25+0.25/0.33+0.33	5	95	100	38	100
Des+Endo+AMS/same	0.25+0.25+2.5/.33+.33+2.5	38	89	99	73	100
--/Endothall	--/0.75	0	74	60	15	0
--/Endothall+AMS	--/0.75+2.5	0	75	50	48	0
Des+Tfsu+Endo/same	.25+.0156+.25/.33+.0156+.33	5	100	100	79	100
NA-307+Tfsu/same	0.16+0.0156/0.25+0.0156	5	96	97	73	100
Tfsu+X-77/same	0.0156+0.25%/0.0156+0.25%	0	95	68	75	100
No postemergence herbicide applied	0	0	74	61	0	0
C.V. %		82	7	10	28	3
LSD 5%		7	9	13	18	3
LSD 1%		9	13	17	23	5
# OF REPS		4	4	4	4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Desmedipham+endothall+ammonium sulfate caused more sugarbeet injury than the other treatments. Sugarbeet injury and weed control tended to be greater when postemergence herbicides were applied to plots previously treated with soil-applied EPTC+cycloate as compared to untreated plots. NA-307 gave less control of redroot pigweed and similar control of common lambsquarters and wild mustard compared to desmedipham in the absence of EPTC+cycloate. Best redroot pigweed control was from desmedipham in combination with clopyralid or triflusulfuron. Clopyralid, endothall, and triflusulfuron used alone gave less control of common lambsquarters than other treatments. None of the treatments gave over 80% control of common mallow but treatments including triflusulfuron gave better control than other treatments. Treatments including desmedipham gave excellent control of wild mustard. In the absence of EPTC+cycloate, desmedipham+endothall+ammonium sulfate gave less control of redroot pigweed and common lambsquarters, and more control of common mallow than desmedipham+endothall.

Triflusulfuron over soil-applied herbicides, Fargo, 1993. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots 4:00 pm May 6 when the air temperature was 75F, wind velocity was 20 mph, and soil moisture was fair. Incorporation was with a rototiller set four inches deep for cycloate and two inches deep for ethofumesate. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 6. The first half of split applied postemergence treatments was applied 8:30 pm June 11 when the air temperature was 81F, soil temperature at six inches was 68F, relative humidity was 48%, wind velocity was 10 mph, soil moisture was good, sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage and yellow foxtail was 1 to 2 inches tall. The second half of split treatments was applied 9:00 pm June 18 when the air temperature was 65F, soil temperature at six inches was 67F, relative humidity was 80%, wind velocity was 0 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, redroot pigweed was in the 2 to 6 leaf stage, and yellow foxtail was 1 to 3 inches tall. Postemergence herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Dash at 0.3 lb ai/A+1 qt/A was applied to all plots June 14. Redroot pigweed and yellow foxtail control and sugarbeet injury were evaluated July 9. Plots were hand weeded July 22. Sugarbeet was harvested and counted in the center two rows of 34 foot long plots September 24.

Treatment*	Rate	Sugarbeet injury	Redroot Pigweed control	Yellow Foxtail control
	lb/A	%	%	%
Ethofumesate-SC (PPI)	3.5	0	60	55
Etho-SC(PPI)/Tfsu+De&Ph/same	3.5/0.0156+0.33	16	99	94
Etho-SC(PPI)/Tfsu+De&Ph/same	3.5/0.031+0.33	25	100	93
Etho-SC(PPI)/Tfsu+X-77/same	3.5/0.0156+0.25%	11	95	76
Etho-SC(PPI)/Tfsu+X-77/same	3.5/0.031+0.25%	9	96	79
Cycloate (PPI)	4	0	0	96
Cycl (PPI)/Tfsu+De&Ph/same	4/0.0156+0.33	16	99	97
Cycl (PPI)/Tfsu+De&Ph/same	4/0.031+0.33	26	100	95
Cycl (PPI)/Tfsu+X-77/same	4/0.0156+0.25%	11	91	89
Cycl (PPI)/Tfsu+X-77/same	4/0.031+0.25%	13	92	94
Untreated Check	0	0	0	0
Triflusulfuron+Des&Phen/same	0.0156+0.33	6	96	79
Triflusulfuron+Des&Phen/same	0.031+0.33	9	97	91
Triflusulfuron+X-77/same	0.0156+0.25%	3	79	63
Triflusulfuron+X-77/same	0.031+0.25%	3	85	66
C.V. %		59	5	12
LSD 5%		8	5	14
LSD 1%		11	7	18
# OF REPS		4	4	4

* X-77=non-ionic surfactant from Valent

Postemergence herbicides used over soil-applied ethofumesate or cycloate gave greater sugarbeet injury than soil-applied herbicides alone or postemergence herbicides alone. Redroot pigweed and yellow foxtail control also was or tended to be better with soil-applied plus postemergence herbicides.

Experiment continued on next page.

Triflusulfuron over soil-applied herbicides, Fargo, 1993. (continued)

Treatment*	Rate	Harvest Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	lb/A	#/68ft	%	%	ton/A		lb/A
Ethofumesate-SC (PPI)	3.5	60	16.5	1.8	13.9	801	4029
Etho-SC(PPI)/Tfsu+De&Ph/same	3.5/0.0156+0.33	57	15.9	1.8	12.8	833	3610
Etho-SC(PPI)/Tfsu+De&Ph/same	3.5/0.031+0.33	53	15.9	2.0	12.1	905	3298
Etho-SC(PPI)/Tfsu+X-77/same	3.5/0.0156+0.25%	63	15.5	1.8	14.4	870	3871
Etho-SC(PPI)/Tfsu+X-77/same	3.5/0.031+0.25%	63	16.2	1.8	14.2	797	4052
Cycloate (PPI)	4	66	16.0	1.8	14.9	804	4176
Cycl (PPI)/Tfsu+De&Ph/same	4/0.0156+0.33	65	15.9	1.7	14.7	781	4132
Cycl (PPI)/Tfsu+De&Ph/same	4/0.031+0.33	64	14.9	2.0	13.5	1003	3424
Cycl (PPI)/Tfsu+X-77/same	4/0.0156+0.25%	63	16.5	1.7	13.7	746	4012
Cycl (PPI)/Tfsu+X-77/same	4/0.031+0.25%	62	16.0	1.8	13.6	846	3863
Untreated Check	0	52	16.6	1.8	13.1	812	3828
Triflusulfuron+Des&Phen/same	0.0156+0.33	61	16.8	1.7	15.4	761	4573
Triflusulfuron+Des&Phen/same	0.031+0.33	67	16.4	1.8	15.6	795	4506
Triflusulfuron+X-77/same	0.0156+0.25%	61	16.6	1.8	17.0	779	5005
Triflusulfuron+X-77/same	0.031+0.25%	63	16.5	1.8	16.5	795	4801
EXP MEAN		61	16.1	1.8	14.4	822	4079
C.V. %		11	4.0	9.2	14.7	11	15
LSD 5%		NS	0.9	NS	NS	130	871
LSD 1%		NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4

* X-77=non-ionic surfactant from Valent

Summary

Sugarbeet yield in extractable sucrose per acre from plots treated with soil-applied plus postemergence herbicides was or tended to be less than from postemergence herbicides alone even though weed control was superior with soil-applied plus postemergence. This suggests that sugarbeet injury was sufficient to cause yield loss. The two treatments with the highest injury evaluations had the lowest yields.

Preplant incorporated herbicides, Renville, 1993. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots 1:00 pm May 14 when the air temperature was 76F, soil temperature at six inches was 64F, relative humidity was 29%, wind velocity was 15 mph, and soil moisture was good. Incorporation was with a rototiller set four inches deep for treatments containg EPTC or cycloate and two inches deep for dimethenamid. 'ACH 198' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 14. Eastern black nightshade, redroot pigweed, velvetleaf, and green foxtail control and sugarbeet injury were evaluated.

Treatment	Rate	Sgbt inj	Ebns cntl	Rrpw cntl	Vele cntl	Grft cntl
	lb/A	%	%	%	%	%
EPTC	2	5	60	60	63	92
Cycloate	4	3	50	60	60	89
EPTC+Cycloate	1+2.5	3	55	45	65	89
EPTC+Cycloate	1.5+2.5	6	55	75	87	96
EPTC+Cycloate	1.5+2	3	63	70	83	97
EPTC+Cycloate	2+2	5	60	61	83	97
EPTC+Cycloate	1+3	3	50	81	77	95
EPTC+Cycl+Ethofumesate-SC	1+2+2	5	90	83	82	94
EPTC+Cycl+Ethofumesate-SC	1+2+3	11	94	92	92	96
Dimethenamid	1.5	20	99	96	80	96
EXP MEAN		6	68	72	77	94
C.V. %		77	18	13	13	5
LSD 5%		7	27	14	17	NS
LSD 1%		9	NS	19	NS	NS
# OF REPS		4	2	4	3	4

Summary

Only EPTC+cycloate+ethofumesate at 1+2+3 lb/A and dimethenamid caused significant sugarbeet injury. Injury reported in this table at Renville was less than with the same treatments applied at Crookston on a lighter soil. EPTC+cycloate+ethofumesate and dimethenamid gave better control of eastern black nightshade than the other treatments. Only EPTC+cycloate+ethofumesate at 1+2+3 lb/A and dimethenamid gave over 90% control of redroot pigweed. Treatments with 1.5 lb/A or more of EPTC and treatments with ethofumesate gave over 80% control of velvetleaf. All treatments gave similar control of green foxtail.

Postemergence herbicides on sugarbeet, Benson, 1993. Plots 40 feet long and six rows wide were established in a commercial sugarbeet field. The first half of split treatments was applied 1:00 pm May 12 when the air temperature was 80F, wind velocity was 10-15 mph, soil moisture was good, sugarbeet was in the cotyledon stage, and common sunflower and velvetleaf were in the cotyledon to 1 leaf stage. The second half of split treatments and single application treatments were applied 12:00 pm May 19 when the air temperature was 65F, wind velocity was 0-5 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, and common sunflower and velvetleaf were in the cotyledon to 2 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common sunflower and velvetleaf control were evaluated June 21.

Treatment*	Rate	Cosf cntl	Vele cntl	Sgbt inj
	lb/A	%	%	%
Desmedipham/Desmedipham	0.16/0.25	0	0	0
Desmedipham/Desmedipham	0.25/0.33	8	6	13
NA-307/NA-307	0.16/0.25	10	19	9
NA-307/NA-307	0.25/0.33	20	3	14
Clopyralid/Clopyralid	0.09/0.09	100	36	0
Desm+Clopyralid/Desm+Clpy	0.25+0.09/0.33+0.09	98	74	5
Des+Clpy+Tfsu/same	0.16+0.09+0.0156/0.25+0.09+0.0156	100	87	20
Des+Triflusulfuron/Des+Tfsu	0.25+0.0156/0.33+0.0156	63	69	14
Des+Endothall/Des+Endothall	0.25+0.25/0.33+0.33	25	25	11
Des+Endo+AMS/same	0.25+0.25+2.5/0.33+0.33+2.5	33	62	23
--/Endothall	--/0.75	18	14	8
--/Endothall+AMS	--/0.75+2.5	31	35	4
Des+Tfsu+Endo/same	0.25+0.0156+0.25/0.33+0.0156+0.33	76	73	28
NA-307+Tfsu/same	0.16+0.0156/0.25+0.0156	77	70	11
Triflusulfuron+X-77/same	0.0156+0.25%/0.0156+0.25%	70	77	6
EXP MEAN		48	43	11
C.V. %		28	34	104
LSD 5%		20	21	16
LSD 1%		26	28	NS
# OF REPS		4	4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Treatments including clopyralid gave better control of common sunflower than other treatments. Treatments including triflusulfuron and desmedipham + clopyralid gave or tended to give better velvetleaf control than the other treatments. Only desmedipham+clopyralid+triflusulfuron, desmedipham+endothall + ammonium sulfate, and desmedipham+triflusulfuron+endothall gave over 20% sugarbeet injury.

Postemergence grass control, Fargo, 1993. 'Starter' oats at 20 lb/A and 'Siberian' foxtail millet at 10 lb/A were seeded in 9 foot strips across herbicide plots April 26. Twelve rows of 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows across herbicide plots April 26. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split applications and the early single application treatments were applied 2:00 pm June 2 when the air temperature was 68F, soil temperature at six inches was 62F, relative humidity was 55%, wind velocity was 15 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, foxtail millet was 2 to 3 inches tall, oats was in the 3 to 5 leaf stage (4 to 10 inches tall), and common mallow was in the 2 leaf stage to 2 inches in diameter. The second half of split applications and late single applications were applied 6:00 pm June 10 when the air temperature was 84F, soil temperature at six inches was 68F, relative humidity was 32%, wind velocity was 4 mph, soil moisture was good, sugarbeet was in the 6 to 8 leaf stage, foxtail millet was 1 to 6 inches tall, oats was 12 to 18 inches tall, and common mallow was 2 to 4 inches in diameter. The number of days in parenthesis indicates the days between the first and second herbicide application for these treatments. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Foxtail millet, oats, and common mallow control and sugarbeet injury were evaluated June 26.

Treatment*	Rate	Fomi cntl	Oats cntl	Sgbt inj	Coma cntl
	lb/A	%	%	%	%
Sethoxydim+Scoil	0.2+0.19G	100	100	0	0
Quizalofop+Scoil	0.125+0.19G	89	100	4	3
Triflusulfuron+Desmed&Phenmed	0.0156+0.33	10	0	0	41
Triflusulfuron+Sethoxydim+Scoil	0.0156+0.2+0.19G	99	100	18	51
Tfsu+Des&Phen+Seth+Scoil	0.0156+0.33+0.2+0.19G	96	96	8	53
Tfsu+De&Ph/(1 day)/Seth+Scoil	0.0156+0.33/0.2+0.19G	100	99	3	33
Tfsu+De&Ph/(3 day)/Seth+Scoil	0.0156+0.33/0.2+0.19G	100	100	3	46
Tfsu+De&Ph/(5 day)/Seth+Scoil	0.0156+0.33/0.2+0.19G	100	100	0	43
Tfsu+De&Ph/(8 day)/Seth+Scoil	0.0156+0.33/0.2+0.19G	100	100	0	38
Tfsu-66037+Quizalofop+Scoil	0.0156+0.125+0.19G	58	100	0	60
Tfsu+De&Ph+Qufp+Scoil	0.0156+0.33+0.125+0.19G	58	99	6	46
Tfsu+De&Ph/(1 day)/Qufp+Scoil	0.0156+0.33/0.125+0.19G	80	100	3	55
Tfsu+De&Ph/(3 day)/Qufp+Scoil	0.0156+0.33/0.125+0.19G	92	100	0	36
Tfsu+De&Ph/(5 day)/Qufp+Scoil	0.0156+0.33/0.125+0.19G	92	100	0	38
Tfsu+De&Ph/(8 day)/Qufp+Scoil	0.0156+0.33/0.125+0.19G	100	100	0	36
Sethoxydim+Lorsban	0.1+1	96	80	0	3
Sethoxydim+DashHC	0.1+0.62%	93	99	0	0
Sethoxydim+DashHC	0.2+0.62%	99	100	0	0
Seth+Des&Phen/Seth+Des&Phen	0.1+0.33/0.1+0.33	76	66	0	14
Seth+Des&Phen+Mor-Act/same	0.1+0.33+1.25%/same	97	98	0	6
Seth+Des&Phen+DashHC/same	0.1+0.33+0.62%/same	97	96	0	10
Seth+De&Ph+Clpy+MorAct/same	0.1+0.33+0.09+1.25%/same	97	97	0	26
--/Sethoxydim+Des&Phen	--/0.2+0.75	79	60	0	18
--/Sethoxydim+Des&Phen	--/0.3+0.75	72	61	0	8
--/Sethoxydim+Des&Phen+Mor-Act	--/0.2+0.75+1.25%	96	71	0	14
--/Sethoxydim+Des&Phen+DashHC	--/0.2+0.75+0.62%	85	65	3	5
--/Seth+Des&Phen+BAS119-45+MorAct	--/0.2+0.75+2+1.25%	79	60	0	10

Table continued on next page.

Postemergence grass control, Fargo, 1993. (continued)

Treatment*	Rate	Fomi cntl	Oats cntl	Sgbt inj	Coma cntl
	lb/A	%	%	%	%
Des&Phen/Seth+DashHC	0.75/0.2+0.62%	100	99	0	3
Tfsu+Des&Phen+Seth/same	0.0156+0.33+0.1/same	78	69	8	53
Tfsu+Des&Phen+Seth/same	0.0156+0.33+0.2/same	96	96	8	42
Seth+Des&Phen/Seth+Des&Phen	0.2+0.33/0.2+0.33	100	94	0	4
Seth+Des&Phen/Seth+Des&Phen	0.3+0.33/0.3+0.33	100	100	0	3
Seth+Des&Phen+Mor-Act/same	0.2+0.33+1.25%/same	100	100	0	8
Seth+Des&Phen+Mor-Act/same	0.3+0.33+1.25%/same	100	100	0	17
Seth+De&Ph+DashHC/same	0.2+0.33+0.62%/same	100	100	0	9
Seth+Des&Phen+DashHC/same	0.3+0.33+0.62%/same	100	100	0	4
EXP MEAN		89	89	2	23
C.V. %		8	4	225	33
LSD 5%		10	5	5	11
LSD 1%		13	7	7	14
# OF REPS		4	4	4	4

* Dash HC=adjuvant from BASF; Mor-Act=petroleum oil concentrate from Wilbur-Ellis; Scoil=methylated seed oil from Agsco; BAS119-45=pyrazon.

Summary

Sethoxydim+Lorsban insecticide at 0.1+1 lb/A gave less oats control than sethoxydim+Dash HC at 0.1 lb/A+0.62% but better control of foxtail millet and oats than sethoxydim+desmedipham+phenmedipham with no oil additive. This suggests that Lorsban acted as an adjuvant with sethoxydim but was not as effective as the better oil adjuvants. Neither triflusulfuron nor triflusulfuron+desmedipham+phenmedipham antagonized grass control from sethoxydim but both herbicide treatments reduced foxtail millet control from quizalofop when used in tank-mix combination. A three day delay between the broadleaf herbicide application and the quizalofop+Scoil gave foxtail millet control similar to quizalofop+Scoil alone. Sethoxydim + desmedipham + phenmedipham applied once or twice gave less grass control than when Mor-Act or Dash HC was added to the treatment. Sethoxydim + desmedipham + phenmedipham + Mor-Act or Dash HC gave better grass control as a split application rather than a single dose. Addition of BAS119-45 had no effect on grass control. Desmedipham+phenmedipham+sethoxydim applied twice at 0.33+0.1 lb/A gave grass control similar to triflusulfuron + desmedipham + phenmedipham + sethoxydim applied twice at 0.0156+0.33+0.1 lb/A. Treatments where sethoxydim at 0.2 lb/A or more was applied twice resulted in nearly total grass control regardless of the presence of a broadleaf herbicide or the absence of an oil adjuvant.

Postemergence herbicides, St. Thomas, 1993. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split application herbicide treatments was applied 12:15 pm May 25 when the air temperature was 62F, soil temperature at six inches was 58F, relative humidity was 50%, wind velocity was 13 mph, soil moisture was good, sugarbeet was in the cotyledon to early 2 leaf stage, and redroot pigweed was in the cotyledon to 2 leaf stage. The second half of split applications was applied 12:30 pm June 1 when the air temperature was 65F, soil temperature at six inches was 66F, relative humidity was 40%, wind velocity was 3 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, and redroot pigweed was in the 4 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed control were evaluated June 12 and June 28.

		June 12		June 28	
Treatment*	Rate	Sgbt inj	Rrpw ratg	Sgbt inj	Rrpw ratg
	lb/A	%	%	%	%
Desmedipham&Phenmedipham/Desmed&Phenmed	0.25/0.33	8	74	0	66
Desmedipham/Desmedipham	0.25/0.33	8	85	0	83
NA-305/NA-305	0.375/0.5	23	85	13	76
NA-307/NA-307	0.25/0.33	10	68	4	61
NA-307/NA-307	0.375/0.5	25	83	8	78
NA-308/NA-308	0.25/0.33	9	74	0	68
NA-308/NA-308	0.375/0.5	16	81	5	71
CQ-1451/CQ-1451	0.375/0.5	13	84	5	70
Desmed&Phenmed+Clopyralid/same	0.25+0.09/0.33+0.09	18	84	10	77
Des&Phen+Clpy+Tfsu/same	0.16+0.09+0.0156/0.25+same	24	99	6	95
Des&Phen+Tfsu/Des&Phen+Tfsu	0.25+0.0156/0.33+0.0156	11	96	3	95
Desmed&Phenmed+Endothall/same	0.25+0.25/0.33+0.33	10	79	6	75
De&Ph+Tfsu+Endo/same	0.25+0.0156+0.25/0.33+0.0156+0.33	11	95	0	96
EXP MEAN		14	83	5	78
C.V. %		38	6	149	10
LSD 5%		8	7	NS	11
LSD 1%		10	9	NS	15
# OF REPS		4	4	4	4

* NA-305, NA-307, NA-308, and CQ-1451=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Some treatments were deleted from this experiment because some of the plastic spray bottles were contaminated with an ALS inhibiting herbicide. Desmedipham applied twice at 0.25 and 0.33 lb/A gave redroot pigweed control superior to NA307 at 0.25 plus 0.33 lb/A, NA308 at both rates, and CQ1451 at 0.375 plus 0.5 lb/A on June 28. Treatments including desmedipham, phenmedipham and triflusulfuron gave the best control of redroot pigweed. Sugarbeet injury was minor by June 28. Plots treated with NA305, NA307 or desmedipham&phenmedipham + clopyralid + triflusulfuron had more injury than other plots on June 12.

Redroot pigweed control with postemergence herbicides, Mooreton, 1993. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 13. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 12:20 pm June 11 when the air temperature was 80F, soil temperature at six inches was 66F, relative humidity was 61%, wind velocity was 9 mph, soil moisture was good, sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage. The second half of split treatments and single application treatments were applied 10:00 am June 21 when the air temperature was 79F, soil temperature at six inches was 66F, relative humidity was 72%, wind velocity was 8 mph, soil moisture was good, and sugarbeet and redroot pigweed were in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed control were evaluated July 2.

Treatment*	Rate	Sugarbeet injury	Redroot Pigweed control
	lb/A	-------- %	--------
Desmedipham/Desmedipham	0.16/0.25	8	91
Desmedipham/Desmedipham	0.25/0.33	13	97
NA-307/NA-307	0.16/0.25	10	88
NA-307/NA-307	0.25/0.33	5	87
Clopyralid/Clopyralid	0.09/0.09	0	3
Desmed+Clpy/Desmed+Clpy	0.25+0.09/0.33+0.09	0	99
Des+Clpy+Tfsu/same	0.16+0.09+0.0156/0.25+0.09+0.0156	9	100
Des+Triflusulfuron/Des+Tfsu	0.25+0.0156/0.33+0.0156	8	99
Desmed+Endothall/Desmed+Endo	0.25+0.25/0.33+0.33	40	95
Desmed+Endo+AMS/same	0.25+0.25+2.5/.33+.33+2.5	55	86
--/Endothall	--/0.75	28	4
--/Endothall+AMS	--/0.75+2.5	40	33
Des+Tfsu+Endo/same	0.25+0.0156+0.25/0.33+0.0156+0.33	38	98
NA-307+Triflusulfuron/same	0.16+0.0156/0.25+0.0156	13	97
Triflusulfuron+X-77/same	0.0156+0.25%/0.0156+0.25%	6	75
C.V. %		36	10
LSD 5%		9	11
LSD 1%		13	15
# OF REPS		4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Treatments including endothall gave more sugarbeet injury than other treatments and endothall+ammonium sulfate gave more injury than endothall alone. Treatments that included desmedipham gave better control of redroot pigweed than other treatments. NA-307 tended to give less control of redroot pigweed than desmedipham.

Kochia control with postemergence sugarbeet herbicides, Ortonville, 1993. 'ACH 198' sugarbeet was seeded in 22 inch rows April 29. The first half of split treatments was applied 2:00 pm May 11 when the air temperature was 75F, soil temperature at six inches was 67F, wind velocity was 10-15 mph, soil moisture was good, sugarbeet was in the cotyledon stage, and kochia was in the cotyledon to small rosette stage. The second half of split treatments and single application treatments were applied 1:00 pm May 18 when the air temperature was 60F, soil temperature at six inches was 67F, wind velocity was 0-10 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, and kochia was in the cotyledon stage to 1 inch rosette diameter. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and kochia control were evaluated June 21.

Treatment*	Rate	Kochia control	Sugarbeet injury
	lb/A	%	%
Desmedipham/Desmedipham	0.16/0.25	22	8
Desmedipham/Desmedipham	0.25/0.33	19	3
NA-307/NA-307	0.16/0.25	65	6
NA-307/NA-307	0.25/0.33	53	11
Clopyralid/Clopyralid	0.09/0.09	4	3
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	23	5
Des+Clpy+Tfsu/same	0.16+0.09+0.0156/0.25+0.09+0.0156	93	11
Des+Triflusulfuron/Des+Tfsu	0.25+0.0156/0.33+0.0156	98	13
Des+Endothall/Des+Endothall	0.25+0.25/0.33+0.33	55	9
Des+Endo+AMS/same	0.25+0.25+2.5/0.33+0.33+2.5	36	19
--/Endothall	--/0.75	0	3
--/Endothall+AMS	--/0.75+2.5	0	3
Des+Tfsu+Endo/same	0.25+0.0156+0.25/0.33+0.0156+0.33	89	9
NA-307+Triflusulfuron/same	0.16+0.0156/0.25+0.0156	95	13
Triflusulfuron+X-77/same	0.0156+0.25%/0.0156+0.25%	88	8
EXP MEAN		49	8
C.V. %		26	61
LSD 5%		18	7
LSD 1%		25	9
# OF REPS		4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Treatments that included triflusulfuron gave kochia control superior to other treatments. NA-307 gave kochia control superior to desmedipham.

Kochia control with postemergence herbicides, Oslo, 1993. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 4:15 pm May 25 when the air temperature was 60F, soil temperature at six inches was 58F, relative humidity was 68%, wind velocity was 20 mph, soil moisture was good, sugarbeet was in the cotyledon to 2 leaf stage and kochia was 0.25 to 0.5 inch rosette diameter. The second half of split treatments and single application treatments were applied 4:00 pm June 1 when the air temperature was 77F, soil temperature at six inches was 61F, relative humidity was 21%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 2 leaf stage and kochia was 0.5 to 1.5 inch rosette diameter. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. Sugarbeet injury and kochia control were evaluated June 24.

Treatment*	Rate	Sugarbeet injury	Kochia control
	lb/A	-------- %	--------
Desmedipham/Desmedipham	0.16/0.25	0	28
Desmedipham/Desmedipham	0.25/0.33	0	56
NA-307/NA-307	0.16/0.25	8	64
NA-307/NA-307	0.25/0.33	10	65
Clopyralid/Clopyralid	0.09/0.09	3	0
Desmed+Clpy/Desmed+Clpy	0.25+0.09/0.33+0.09	0	45
Des+Clpy+Tfsu/same	0.16+0.09+0.0156/0.25+0.09+0.0156	10	96
Des+Triflusulfuron/Des+Tfsu	0.25+0.0156/0.33+0.0156	13	98
Desmed+Endothall/Desmed+Endo	0.25+0.25/0.33+0.33	8	34
Desmed+Endothall+AMS/same	0.25+0.25+2.5/.33+.33+2.5	33	36
--/Endothall	--/0.75	0	0
--/Endothall+AMS	--/0.75+2.5	3	0
Des+Tfsu+Endo/same	0.25+0.0156+0.25/0.33+0.0156+0.33	11	98
NA-307+Triflusulfuron/same	0.16+0.0156/0.25+0.0156	5	96
Triflusulfuron+X-77/same	0.0156+0.25%/0.0156+0.25%	0	90
C.V. %		59	16
LSD 5%		6	12
LSD 1%		8	16
# OF REPS		4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Desmedipham+endothall+ammonium sulfate gave more sugarbeet injury than other treatments. Treatments including triflusulfuron gave better kochia control than other treatments. NA-307 at 0.16/0.25 lb/A gave better kochia control than desmedipham at 0.16/0.25 lb/A.

Lanceleaf sage control with postemergence herbicides, Wolverton, 1993. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 10:00 am June 10 when the air temperature was 71F, soil temperature at six inches was 64F, relative humidity was 82%, wind velocity was 5 mph, soil moisture was good, sugarbeet was in the cotyledon to 4 leaf stage and lanceleaf sage and common lambsquarters were in the cotyledon to 2 leaf stage. The second half of split treatments and single application treatments were applied 11:30 am June 21 when the air temperature was 82F, soil temperature at six inches was 66F, relative humidity was 69%, wind velocity was 6 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, lanceleaf sage was in the 2 leaf stage to 3 inches tall, and common lambsquarters was in the 2 leaf stage to 2 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common lambsquarters control were evaluated June 25. Lanceleaf sage control was evaluated June 25, July 3, and July 12.

		June 25			7-3	7-12
		Sgbt	Lasa	Colq	Lasa	Lasa
Treatment*	Rate	inj	cntl	cntl	cntl	cntl
	lb/A	-------------		%		------------
Desmedipham/Desmedipham	0.16/0.25	0	21	89	35	25
Desmedipham/Desmedipham	0.25/0.33	0	27	100	48	51
NA-307/NA-307	0.16/0.25	0	45	95	48	45
NA-307/NA-307	0.25/0.33	3	65	100	49	54
Clopyralid/Clopyralid	0.09/0.09	0	50	29	71	64
Desmed+Clpy/Desmed+Clpy	0.25+0.09/0.33+0.09	0	33	100	84	79
Des+Clpy+Tfsu/same	0.16+0.09+0.0156/.25+.09+.0156	5	80	100	86	85
Des+Tfsu/Des+Tfsu	0.25+0.0156/0.33+0.0156	8	34	98	60	44
Des+Endo/Des+Endo	0.25+0.25/0.33+0.33	40	74	100	59	44
Des+Endo+AMS/same	0.25+0.25+2.5/.33+.33+2.5	72	88	98	91	79
--/Endothall	--/0.75	36	38	5	16	25
--/Endothall+AMS	--/0.75+2.5	49	41	8	18	38
Des+Tfsu+Endo/same	0.25+0.0156+0.25/.33+.0156+.33	45	74	100	69	64
NA-307+Tfsu/same	0.16+0.0156/0.25+0.0156	0	55	100	66	61
Tfsu+X-77/same	0.0156+0.25%/0.0156+0.25%	0	51	16	74	66
C.V. %		28	19	8	17	17
LSD 5%		7	15	9	14	13
LSD 1%		9	20	12	19	18
# OF REPS		4	4	4	4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

All treatments that included endothall gave severe sugarbeet injury. Clopyralid, endothall, and triflusulfuron used alone gave less control of common lambsquarters than other treatments. Desmedipham+clopyralid, desmedipham+clopyralid+triflusulfuron, and desmedipham+endothall+ammonium sulfate gave lanceleaf sage control superior to other treatments. NA-307 at 0.16/0.25 lb/A gave or tended to give better weed control than desmedipham at 0.16/0.25 lb/A.

Multispecies evaluation of postemergence sugarbeet herbicides, Renville, 1993. 'ACH 198' sugarbeet was seeded in 22 inch rows May 14. The first half of split treatments was applied 2:00 pm May 20 when the air temperature was 67F, wind velocity was 0-5 mph, soil moisture was good, and sugarbeet was in the cotyledon stage. The second half of split treatments and single application treatments were applied 10:00 am May 26 when the air temperature was 62F, wind velocity was 0-5 mph, soil moisture was good, and sugarbeet was in the cotyledon stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common lambsquarters, velvetleaf, redroot pigweed, eastern black nightshade, and green and yellow foxtail control were evaluated June 21.

Treatment*	Rate	Sgbt inj	Colq cntl	Vele cntl	Rrpw cntl	Ebns cntl	G&Y Fxtl cntl
	lb/A	%	%	%	%	%	%
Desmedipham/Desmedipham	0.16/0.25	0	73	5	58	33	38
Desmedipham/Desmedipham	0.25/0.33	0	78	8	65	18	58
NA-307/NA-307	0.16/0.25	0	76	18	69	30	59
NA-307/NA-307	0.25/0.33	0	84	18	70	53	70
Clopyralid/Clopyralid	0.09/0.09	0	10	0	0	81	0
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	3	86	20	71	78	56
Des+Clpy+Tfsu/same	0.16+.09+.0156/.25+.09+.0156	13	93	55	86	96	58
Des+Tfsu/Des+Tfsu	0.25+0.0156/0.33+0.0156	8	83	41	76	51	61
Des+Endo/Des+Endo	0.25+0.25/0.33+0.33	3	76	17	65	50	60
Des+Endo+AMS/same	0.25+0.25+2.5/.33+.33+2.5	5	80	30	61	38	66
--/Endothall	--/0.75	0	0	5	0	0	8
--/Endothall+AMS	--/0.75+2.5	3	0	13	3	0	5
Des+Tfsu+Endo/same	0.25+.0156+.25/.33+.0156+.33	8	91	53	85	70	68
NA-307+Tfsu/same	0.16+0.0156/0.25+0.0156	5	79	35	65	60	55
Tfsu+X-77/same	0.0156+0.25%/0.0156+0.25%	0	8	33	15	15	10
EXP MEAN		3	61	23	53	45	45
C.V. %		143	19	66	25	42	30
LSD 5%		6	17	22	19	27	19
LSD 1%		8	22	29	25	36	26
# OF REPS		4	4	4	4	4	4

* X-77=non-ionic surfactant from Valent; AMS=ammonium sulfate; NA-307=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Clopyralid, endothall, and triflusulfuron used alone gave less control of common lambsquarters than the other treatments. Velvetleaf control was less than 60% with all treatments. Only desmedipham+clopyralid+triflusulfuron and desmedipham+triflusulfuron+endothall gave over 80% control of redroot pigweed. Only desmedipham+clopyralid+triflusulfuron gave over 90% control of eastern black nightshade. NA-307 gave weed control similar to desmedipham.

Multiple postemergence applications, Crookston, 1993. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. Herbicide applications were made on three different days separated by the "/" in each treatment. The "--" indicates no application on that date. The first application was 3:00 pm May 21 when the air temperature was 72F, soil temperature at six inches was 64F, relative humidity was 22%, wind velocity was 12 mph, soil moisture was fair, sugarbeet was in the 2 leaf stage, common mallow was in the cotyledon to 3 leaf stage, green foxtail was 0.5 to 1 inch tall, commom lambsquarters was in the cotyledon to 6 leaf stage, and marshelder was in the cotyledon to 2 leaf stage. The second application was 3:00 pm May 28 when the air temperature was 68F, soil temperature at six inches was 56F, relative humidity was 47%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, common mallow was in the 3 to 6 leaf stage, green foxtail was 1 to 2 inches tall, commom lambsquarters was in the 4 leaf stage to 1.5 inches tall, and marshelder was in the 2 to 4 leaf stage. The third application was 11:15 am June 4 when the air temperature was 68F, soil temperature at six inches was 61F, relative humidity was 59%, wind velocity was 4 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, common mallow was in the cotyledon to 8 leaf stage, green foxtail was emerging to 3 inches tall, commom lambsquarters was 2 to 3.5 inches tall, and marshelder was in the 4 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+crop oil at 0.2 lb ai/A + 1 qt/A was applied to the entire plot area June 15. Green foxtail, common lambsquarters, and marshelder control and sugarbeet injury were evaluated June 19. Common mallow control was evaluated June 19 and July 3.

		June 19					7-3
Treatment*	Rate	Sgbt inj	Coma cntl	Grft cntl	Colq cntl	Mael cntl	Coma cntl
	lb/A	%					
Desmed&Phenmed/Desmed&Phenmed/--	0.25/0.33	3	19	54	100	95	13
Desmed&Phenmed/Desmed&Phenmed/--	0.375/0.5	3	39	58	100	95	35
Des&Phen/Des&Phen/Des&Phen	0.25/0.33/0.33	5	45	89	100	100	40
Desmedipham/Desmedipham/--	0.25/0.33	0	25	48	98	89	18
Desmedipham/Desmedipham/--	0.375/0.5	0	25	54	100	95	20
Des&Phen+Tfsu/same/--	0.25+0.0156/0.33+0.0156	3	78	68	100	99	79
D&P+Tfsu/same/same/--	.25+.0156/0.33+0.0156/same	5	90	93	100	100	86
D&P+Tfsu/same/same	.25+.0156/0.33+same/0.5+same	3	94	93	100	100	90
Tfsu+X-77/same/--	0.0156+0.25%/0.0156+0.25%	0	89	38	20	98	76
Tfsu+Scoil/same/--	0.0156+1%/0.0156+1%	3	91	40	28	93	80
Tfsu+X-77/same/same	0.0156+0.25%/same/same	13	94	59	24	100	83
NA-305/NA-305/--	0.25/0.33	5	53	43	100	89	48
NA-305/NA-305/--	0.375/0.5	5	51	64	99	94	45
NA-307/NA-307/--	0.25/0.33	0	39	53	100	84	40
NA-307/NA-307/--	0.375/0.5	9	63	56	100	93	53
NA-308/NA-308/--	0.25/0.33	10	48	58	99	94	35
NA-308/NA-308/--	0.375/0.5	8	50	59	95	86	51
CQ-1451/CQ-1451/--	0.25/0.33	6	48	61	99	75	44
CQ-1451/CQ-1451/--	0.375/0.5	8	64	65	100	81	55
D&P+Etho-SC/D&P+Etho-SC/--	0.17+0.08/0.22+0.11	5	55	54	100	86	38
D&P+Etho-SC/D&P+Etho-SC/--	0.25+0.125/0.33+0.17	8	50	61	100	94	53
NA-308/NA-308/NA-308	0.29/0.29/0.29	8	69	89	100	98	43

Table continued on next page.

Multiple postemergence applications, Crookston, 1993. (continued)

Treatment*	Rate	June 19 Sgbt inj	June 19 Coma cntl	June 19 Grft cntl	June 19 Colq cntl	June 19 Mael cntl	7-3 Coma cntl
	lb/A	-------------			%		-------------
--/--/Desmed&Phenmed	--/--/0.75	0	23	60	69	35	15
--/--/Desmedipham	--/--/0.75	3	30	51	61	38	9
--/--/Des&Phen+Ethofumesate-SC	--/--/0.5+0.25	5	29	54	77	46	16
Tfsu+Clpy/Tfsu+Clpy/--	0.0156+0.09/0.0156+0.09	0	88	18	53	100	85
Tfsu+Clpy+X-77/same/--	0.0156+0.09+0.25%/same	0	95	18	69	100	90
D&P+Tfsu+Clpy/same/--	0.25+0.0156+0.09/0.33+same	0	88	63	100	100	85
Tfsu+Clpy+Scoil/same/--	0.0156+0.09+1%/same	0	97	41	89	100	94
De&Ph+Clpy/De&Ph+Clpy/--	0.25+0.09/0.33+0.09	0	50	45	100	100	59
D&P+Tfsu+Clpy+X77/same/-	.25+.0156+.09+.25%/same	10	93	73	100	100	88
--/NA-308/NA-308	--/0.375/0.5	0	40	91	100	91	38
--/Desmedipham/Desmedipham	--/0.375/0.5	0	38	69	100	90	31
--/Des&Phen/Des&Phen	--/0.375/0.5	3	41	91	100	83	30
C.V. %		116	17	21	10	11	26
LSD 5%		6	14	17	12	14	19
LSD 1%		8	18	23	17	19	25
# OF REPS		4	4	4	4	4	4

* X-77=non-ionic surfactant from Valent; Scoil=methylated seed oil from Agsco; NA-305, NA-307, NA-308, and CQ-1451=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Treatments that included triflusulfuron gave better control of common mallow than other treatments. The July 3 evaluation of mallow control was slightly lower but agreed well with the June 19 evaluation. Treatments where desmedipham+phenmedipham was applied three times or twice late at 0.375/0.5 lb/A gave better green foxtail control than other treatments. Triflusulfuron alone, late single application of herbicides, and triflusulfuron+clopyralid gave less control of common lambsquarters than other treatments. Triflusulfuron+clopyralid+Scoil gave better control of common lambsquarters than triflusulfuron+clopyralid alone or with X-77. All treatments gave very good control of marshelder except late applications of desmedipham, desmedipham+phenmedipham or desmedipham+phenmedipham+ethofumesate.

Multiple postemergence applications, Fargo (NW Secton 22), 1993. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 10. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. Herbicide applications were made on three different days separated by the "/" in each treatment. The "--" indicates no application on that date. The first application was 11:30 am June 3 when the air temperature was 62F, soil temperature at six inches was 54F, relative humidity was 50%, wind velocity was 11 mph, soil moisture was good, sugarbeet was in the cotyledon stage, kochia was in the cotyledon stage to 0.25 inch rosette diameter, wild mustard was in the cotyledon to 2 leaf stage, and common cocklebur was in the cotyledon stage. The second application was 5:15 pm June 11 when the air temperature was 89F, soil temperature at six inches was 67F, relative humidity was 36%, wind velocity was 19 mph, soil moisture was good, sugarbeet was in the cotyledon to 2 leaf stage, kochia was 0.25 to 1 inch rosette diameter, wild mustard was in the cotyledon to 4 leaf stage, and common cocklebur was in the cotyledon to 2 leaf stage. The third application was 5:30 pm June 18 when the air temperature was 69F, soil temperature at six inches was 66F, relative humidity was 64%, wind velocity was 4 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, kochia was 0.5 to 1.5 inch rosette diameter, wild mustard was 1 to 3 inches tall, and common cocklebur was in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Kochia, wild mustard, and common cocklebur control were evaluated June 26.

Treatment*	Rate	Kochia control	Wild Mustard control	Common Cocklebur control
	lb/A	------------	%	------------
Desmed&Phenmed/Desmed&Phenmed/--	0.25/0.33	53	96	6
Desmed&Phenmed/Desmed&Phenmed/--	0.375/0.5	68	100	10
Des&Phen/Des&Phen/Des&Phen	0.25/0.33/0.33	73	100	51
Desmedipham/Desmedipham/--	0.25/0.33	35	100	6
Desmedipham/Desmedipham/--	0.375/0.5	60	100	21
Des&Phen+Tfsu/same/--	0.25+0.0156/0.33+0.0156	97	100	36
D&P+Tfsu/same/same	0.25+0.0156/0.33+0.0156/same	99	100	84
D&P+Tfsu/same/same	0.25+0.0156/.33+same/.5+same	100	100	86
Tfsu+X-77/same/--	0.0156+0.25%/0.0156+0.25%	89	100	28
Tfsu+Scoil/same/--	0.0156+1%/0.0156+1%	96	100	45
Tfsu+X-77/same/same	0.0156+0.25%/same/same	94	100	60
NA-305/NA-305/--	0.25/0.33	51	95	19
NA-305/NA-305/--	0.375/0.5	74	100	33
NA-307/NA-307/--	0.25/0.33	56	95	16
NA-307/NA-307/--	0.375/0.5	76	100	25
NA-308/NA-308/--	0.25/0.33	50	95	23
NA-308/NA-308/--	0.375/0.5	85	100	29
CQ-1451/CQ-1451/--	0.25/0.33	54	93	21
CQ-1451/CQ-1451/--	0.375/0.5	69	98	16
De&Ph+Etho-SC/D&P+Etho-SC/--	0.17+0.08/0.22+0.11	48	96	16
De&Ph+Etho-SC/D&P+Etho-SC/--	0.25+0.125/0.33+0.17	63	100	20
NA-308/NA-308/NA-308	0.19/0.19/0.19	54	98	33
NA-308/NA-308/NA-308	0.29/0.29/0.29	74	100	48

Table continued on next page.

Treatment*	Rate	Kochia control	Wild Mustard control	Common Cocklebur control
	lb/A	------------	%	------------
--/--/Desmed&Phenmed	0.75	30	91	20
--/--/Desmedipham	0.75	20	85	18
--/--/Des&Phen+Ethofumesate-SC	0.5+0.25	33	95	36
Tfsu+Clpy/Tfsu+Clpy/--	0.0156+0.09/0.0156+0.09	69	99	100
Tfsu+Clpy+X-77/same/--	0.0156+0.09+0.25%/same	87	100	99
D&P+Tfsu+Clpy/same/--	0.25+0.0156+0.09/0.33+same	95	100	100
Tfsu+Clpy+Scoil/same/--	0.0156+0.09+1%/same	98	100	100
D&P+Tfsu+Clpy+X77/same/--	.25+.0156+.09+.25%/same	99	100	100
--/NA-308/NA-308	0.375/0.5	68	100	56
--/Desmedipham/Desmedipham	0.375/0.5	45	98	33
--/Des&Phen/Des&Phen	0.375/0.5	48	96	41
C.V. %		14	3	24
LSD 5%		13	4	14
LSD 1%		18	5	19
# OF REPS		4	4	4

* X-77=non-ionic surfactant from Valent; Scoil=methylated seed oil from Agsco; NA-305, NA-307, NA-308, and CQ-1451=desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio

Summary

Treatments that included triflusulfuron generally gave better kochia control than other treatments. Triflusulfuron+clopyralid gave less kochia control than other triflusulfuron treatments indicating antagonism from clopyralid. Addition of X-77 to triflusulfuron+clopyralid improved kochia control but addition of Scoil gave a greater increase. Desmedipham + phenmedipham + triflusulfuron + clopyralid gave kochia control similar to desmedipham + phenmedipham + triflusulfuron and better than triflusulfuron + clopyralid. The various formulations of desmedipham + phenmedipham + ethofumesate gave control of kochia and wild mustard similar to desmedipham + phenmedipham. Treatments that included clopyralid gave better control of common cocklebur than other treatments.

Adjuvant comparison with triflusulfuron, Crookston, 1993. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 3:00 pm May 21 when the air temperature was 72F, soil temperature at six inches was 60F, relative humidity was 22%, wind velocity was 12 mph, soil moisture was fair, sugarbeet, common lambsquarters, and prostrate pigweed were in the cotyledon to 2 leaf stage, kochia was 0.25 to 1 inch rosette diameter, and volunteer wheat was 3 inches tall. The second half of split treatments was applied 3:15 pm May 28 when the air temperature was 68F, soil temperature at six inches was 56F, relative humidity was 47%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, common lambsquarters was in the 4 to 6 leaf stage, prostrate pigweed was in the cotyledon to 2 leaf stage, kochia was 0.5 to 1.5 inch rosette diameter, and volunteer wheat was 5 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim + crop oil at 0.2 lb ai/A + 1 qt/A was applied to the entire plot area June 15. Sugarbeet injury and volunteer wheat were evaluated June 19; sugarbeet injury and control of prostrate pigweed, common lambsquarters and kochia were evaluated July 1; and kochia control was evaluated July 20.

		June 19		July 1				7-20
		Sgbt	Vowh	Sgbt	Prpw	Colq	Kocz	Kocz
Treatment*	Rate	inj	cntl	inj	cntl	cntl	cntl	cntl
	lb/A				%			
Tfsu+X-77/same	0.0078+0.25%/0.0078+0.25%	6	6	3	54	10	84	49
Tfsu+X-77/same	0.0156+0.25%/0.0156+0.25%	5	23	3	53	15	99	81
Tfsu+Scoil/same	0.0078+1%/0.0078+1%	0	31	0	50	15	95	64
Tfsu+Scoil/same	0.0156+1%/0.0156+1%	10	60	0	60	10	99	86
Tfsu+Scoil/same	0.023+1%/0.023+1%	15	43	5	73	21	99	91
Tfsu+Scoil/same	0.031+1%/0.031+1%	11	70	9	74	16	98	85
Tfsu+De&Ph+X77/same	0.0078+0.16+0.12%/same	5	48	0	74	88	94	78
Tfsu+De&Ph+X77/same	0.0078+0.16+0.25%/same	6	48	0	84	94	99	96
Tfsu+De&Ph+X77/same	0.0156+0.16+0.12%/same	13	53	3	85	95	91	76
Tfsu+De&Ph+X77/same	0.0156+0.16+0.25%/same	18	56	6	75	94	95	81
Tfsu+De&Ph+Scoil/same	0.0078+0.16+1%/same	14	74	5	68	89	95	84
Tfsu+De&Ph+Scoil/same	0.0156+0.16+1%/same	13	78	3	88	96	99	89
Tfsu+De&Ph/same	0.0156+0.33/0.0156+0.33	11	68	6	86	96	96	79
Des&Phen/Des&Phen	0.33/0.33	3	54	0	66	90	43	34
Tfsu+De&Ph+28%N/same	0.0078+0.16+4%/same	16	66	6	71	88	94	78
Tfsu+De&Ph+28%N/same	0.0156+0.33+4%/same	15	68	5	85	97	96	89
Tfsu+X-77+28%N/same	0.0078+0.25%+4%/same	3	29	0	30	10	91	85
Tfsu+X-77+28%N/same	0.0156+0.25%+4%/same	9	49	8	46	10	96	85
C.V. %		75	25	189	20	16	8	23
LSD 5%		10	18	NS	19	13	11	25
LSD 1%		NS	25	NS	26	17	14	34
# OF REPS		4	4	4	4	4	4	4

* X-77=non-ionic surfactant from Valent; Scoil=methylated seed oil from Agsco; 28%N=28% nitrogen solution containing urea and NH_4NO_3

SUMMARY: Triflusulfuron+Scoil gave better control of volunteer wheat and kochia (at low rate) than triflusulfuron+X-77. Weed control and sugarbeet injury were similar with 0.12% and 0.25% X-77. Triflusulfuron + desmedipham + phenmedipham + Scoil gave better control of volunteer wheat than the same herbicides + X-77. Triflusulfuron+X-77+28% N gave less control of prostrate pigweed but increased control of kochia on 7-20 as compared to triflusulfuron + X-77. Triflusulfuron+desmedipham+phenmedipham+28% N at 0.0078+0.16 lb/A gave more sugarbeet injury and increased control of volunteer wheat compared to the same herbicides plus X-77.

Comparison of Terra and Nor-Am desmedipham and desmedipham&phenmedipham, Fargo, 1993. 'Van Der Have 66156' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 19. The first half of split treatments was applied 8:30 pm June 11 when the air temperature was 81F, soil temperature at six inches was 68F, relative humidity was 48%, wind velocity was 10 mph, soil moisture was good, and sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage. The second half of split treatments was applied 9:00 pm June 18 when the air temperature was 65F, soil temperature at six inches was 67F, relative humidity was 80%, wind velocity was 0 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage and redroot pigweed was in the 2 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed control were evaluated July 9.

Treatment	Company Formulation	Rate	Sugarbeet injury	Redroot Pigweed control
		lb/A	%	%
Desmedipham/Desmed	(Terra)	0.25/0.33	4	93
Desmedipham/Desmed	(Terra)	0.33/0.5	4	98
Desmedipham/Desmed	(Terra)	0.5/0.75	18	99
Desmedipham/Desmed	(Nor-Am)	0.25/0.33	3	95
Desmedipham/Desmed	(Nor-Am)	0.33/0.5	11	97
Desmedipham/Desmed	(Nor-Am)	0.5/0.75	19	99
Des&Phen/Des&Phen	(Terra)	0.25/0.33	3	85
Des&Phen/Des&Phen	(Terra)	0.33/0.5	15	91
Des&Phen/Des&Phen	(Terra)	0.5/0.75	20	97
Des&Phen/Des&Phen	(Nor-Am)	0.25/0.33	5	87
Des&Phen/Des&Phen	(Nor-Am)	0.33/0.5	20	93
Des&Phen/Des&Phen	(Nor-Am)	0.5/0.75	24	97
EXP MEAN			12	94
C.V. %			39	3
LSD 5%			7	4
LSD 1%			9	6
# OF REPS			4	4

Summary

Desmedipham and desmedipham&phenmedipham from Terra and Nor-Am gave very similar sugarbeet injury and redroot pigweed control.

Comparison of Terra and Nor-Am desmedipham and desmedipham&phenmedipham, Mooreton, 1993. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 13. Counter 15G at 12 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 12:20 pm June 11 when the air temperature was 80F, soil temperature at six inches was 66F, relative humidity was 61%, wind velocity was 9 mph, soil moisture was good, and sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage. The second half of split treatments was applied 10:00 am June 21 when the air temperature was 79F, soil temperature at six inches was 66F, relative humidity was 72%, wind velocity was 8 mph, soil moisture was good, and sugarbeet and redroot pigweed were in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed control were evaluated July 2.

Treatment	Company Formulation	Rate	Sugarbeet injury	Redroot Pigweed control
		lb/A	%	%
Desmedipham/Desmed	(Terra)	0.25/0.33	11	96
Desmedipham/Desmed	(Terra)	0.33/0.5	20	99
Desmedipham/Desmed	(Terra)	0.5/0.75	24	100
Desmedipham/Desmed	(Nor-Am)	0.25/0.33	8	97
Desmedipham/Desmed	(Nor-Am)	0.33/0.5	18	98
Desmedipham/Desmed	(Nor-Am)	0.5/0.75	29	100
Des&Phen/Des&Phen	(Terra)	0.25/0.33	13	87
Des&Phen/Des&Phen	(Terra)	0.33/0.5	13	96
Des&Phen/Des&Phen	(Terra)	0.5/0.75	30	99
Des&Phen/Des&Phen	(Nor-Am)	0.25/0.33	11	87
Des&Phen/Des&Phen	(Nor-Am)	0.33/0.5	21	94
Des&Phen/Des&Phen	(Nor-Am)	0.5/0.75	28	97
EXP MEAN			19	96
C.V. %			34	4
LSD 5%			9	5
LSD 1%			12	7
# OF REPS			4	4

Summary

Desmedipham and desmedipham&phenmedipham from Terra and Nor-Am gave very similar sugarbeet injury and redroot pigweed control.

Triflusulfuron tank-mixed with insecticides, Fargo, 1993. Diethatyl+cycloate at 3+3 lb ai per acre was broadcast applied in 17 gpa water at 40 psi through 11002 nozzles to the entire plot area and incorporated twice with a 'Kongskilde Triple K' field cultivator operated three inches deep April 26. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. Treatments were applied 9:45 pm June 1 when the air temperature was 58F, soil temperature at six inches was 64F, relative humidity was 62%, wind velocity was 5 mph, soil moisture was good, and sugarbeet was in the 4 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim + Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. All plots were hand weeded May 15 and maintained weed free throughout the growing season by hand weeding and row-crop cultivation May 20, June 22, and August 9. Sugarbeet was hand thinned to an eight inch spacing June 1. Sugarbeet injury was evaluated June 15. Sugarbeet from the center two rows of 30 foot plots was harvested September 30.

Treatment*	Rate	Sgbt inj	Sucrose	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	lb/A	%	%	%	ton/A		lb/A
Triflusulfuron+X-77	0.0156+0.25%	0	18.0	1.5	19.3	609	6278
Triflusulfuron+X-77	0.031+0.25%	0	18.2	1.4	15.8	566	5290
Triflusulfuron+Diazinon	0.0156+2	1	18.1	1.5	18.8	618	6176
Triflusulfuron+Diazinon	0.031+2	10	18.1	1.6	17.5	638	5732
Triflusulfuron+Lorsban	0.0156+2	5	17.8	1.5	17.0	639	5439
Triflusulfuron+Lorsban	0.031+2	5	18.0	1.4	15.3	575	5011
Triflusulfuron+Lannate	0.0156+1	1	18.5	1.4	15.9	574	5370
Triflusulfuron+Lannate	0.031+1	4	18.5	1.5	17.3	588	5806
Triflusulfuron+Asana	0.0156+0.05	0	18.4	1.4	17.3	575	5795
Triflusulfuron+Asana	0.031+0.05	0	18.3	1.4	16.4	552	5542
Untreated Check	0	0	18.2	1.5	17.2	601	5734
EXP MEAN		2	18.2	1.5	17.1	594	5652
C.V. %		148	2.3	7.1	13.0	9	13
LSD 5%		5	NS	NS	NS	NS	NS
LSD 1%		7	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4

* X-77 = non-ionic surfactant from Valent

Summary

Combinations of triflusulfuron plus insecticide had no significant effect on sugarbeet yield. Triflusulfuron at 0.031 lb/A plus diazinon caused more sugarbeet injury than the other treatments.

Soil applied herbicides and Counter 15G insecticide, Crookston, 1993. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots 1:00 pm April 28 when the air temperature was 65F, soil temperature at six inches was 46F, relative humidity was 44%, wind velocity was 14 mph, and soil moisture was good. Incorporation was with a rototiller set four inches deep for EPTC and cycloate and two inches deep for ethofumesate-SC. 'Beta 2988' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. Counter 15G at 12 pounds product per acre was applied in a two inch band and drag-chain incorporated at planting to plots with insecticide. Sethoxydim+Oil at 0.2 lb ai/A+1 qt/A was applied to the entire plot area June 15. Sugarbeet injury was evaluated June 12. Sugarbeet stand in the center two rows of each plot was counted June 17 before thinning. Sugarbeet was hand thinned to an eight inch spacing and hand weeded June 17. Plots were maintained weed free throughout the growing season by hand weeding. Row-crop cultivation was June 18. Sugarbeet from the center two rows of 34 foot plots was harvested September 28.

Herbicide	Rate	Insecticide	Sgbt inj	Grft cntl	June 17 Sgbt Popul	Sucrose	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	lb/A		%	%	#/68ft	%	%	ton/A		lb/A
Etho-SC	3	Counter	0	93	206	16.3	1.9	18.5	861	5243
Etho-SC	5	Counter	0	97	206	15.8	2.0	18.2	914	4963
EPTC	2	Counter	0	45	168	16.0	2.0	17.9	924	4904
EPTC	4	Counter	14	68	159	15.6	2.1	18.5	986	4926
Cycloate	4	Counter	0	55	172	16.0	1.9	16.1	854	4520
Cycloate	6	Counter	0	88	192	16.0	2.0	19.5	904	5398
Etho-SC	3	None	0	93	208	16.2	1.8	15.9	817	4509
Etho-SC	5	None	0	97	202	16.2	1.8	16.9	791	4828
EPTC	2	None	0	61	189	16.8	1.7	17.4	742	5194
EPTC	4	None	13	68	162	16.2	1.8	15.6	802	4431
Cycloate	4	None	0	66	183	16.2	1.8	17.6	818	4962
Cycloate	6	None	0	88	181	16.2	1.8	16.9	794	4766
EXP MEAN			2	76	185	16.1	1.9	17.4	850	4887
C.V. %			137	13	10	2.8	8.4	10.2	10	9
LSD 5%			4	15	27	NS	0.2	NS	128	NS
LSD 1%			6	20	37	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4	4	4

EPTC alone or over Counter gave similar sugarbeet injury.

Experiment continued on next page.

Herbicide treatment averaged over insecticide and no insecticide.

Herbicide	Rate	Sgbt inj	Grft cntl	Sgbt Popul	Sucrose	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	lb/A	%	%	#/68ft	%	%	ton/A		lb/A
Ethofumesate-SC	3	0	93	207	16.3	1.9	17.2	839	4876
Ethofumesate-SC	5	0	97	204	16.0	1.9	17.6	853	4895
EPTC	2	0	53	178	16.4	1.9	17.7	833	5049
EPTC	4	13	68	160	15.9	1.9	17.0	894	4678
Cycloate	4	0	61	177	16.1	1.8	16.8	836	4741
Cycloate	6	0	88	187	16.1	1.9	18.2	849	5082
EXP MEAN		2	76	185	16.1	1.9	17.4	850	4887
C.V. %		131	11	10	2.4	9.9	13.9	11	13
LSD 5%		3	8	19	NS	NS	NS	NS	NS
LSD 1%		4	11	26	NS	NS	NS	NS	NS
# OF REPS		8	8	8	8	8	8	8	8

Ethofumesate gave better control of green foxtail than EPTC or cycloate. Sugarbeet plant populations were greater with ethofumesate than with EPTC or cycloate.

Insecticide over all herbicide treatments.

Insecticide	Sgbt inj	Grft cntl	Sgbt Popul	Sucrose	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	%	%	#/68ft	%	%	ton/A		lb/A
Counter 15G	2	74	184	16.0	2.0	18.1	907	4992
None	2	79	187	16.3	1.8	16.7	794	4782
EXP MEAN	2	76	185	16.1	1.9	17.4	850	4887
C.V. %	75	12	10	2.9	11.8	12.3	14	11
LSD 5%	NS	NS	NS	0.3	0.1	1.3	71	NS
LSD 1%	NS	NS	NS	NS	0.2	NS	96	NS
# OF REPS	24	24	24	24	24	24	24	24

Summary

Sugarbeet root maggot injury was not severe at this location since Counter-treated sugarbeet had extractable sucrose similar to non-insecticide-treated sugarbeet.

Postemergence Lorsban plus desmedipham, Fargo, 1993. Diethatyl+cycloate at 3+3 lb ai per acre was broadcast applied in 17 gpa water at 40 psi through 11002 nozzles to the entire plot area and incorporated twice with a 'Kongskilde Triple K' field cultivator operated three inches deep April 26. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. The first half of split treatments was applied 11:20 am May 26 when the air temperature was 56F, soil temperature at six inches was 54F, relative humidity was 50%, wind velocity was 7 mph, soil moisture was good, and sugarbeet was in the 2 to 4 leaf stage. The second half of split treatments and single application treatments were applied 9:45 pm June 1 when the air temperature was 58F, soil temperature at six inches was 64F, relative humidity was 62%, wind velocity was 5 mph, soil moisture was good, and sugarbeet was in the 4 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. All plots were hand weeded May 15 and maintained weed free throughout the growing season by hand weeding and row-crop cultivation May 20, June 22, and August 9. Sugarbeet was hand thinned to an eight inch spacing June 1. Sugarbeet injury was evaluated June 15. Sugarbeet from the center two rows of 30 foot plots was harvested September 30.

Treatment	Rate	Sgbt inj	Sucrose	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	lb/A	%	%	%	ton/A		lb/A
XRM-5318	1	1	17.8	1.5	11.9	610	3885
XRM-5318	2	0	18.2	1.3	12.5	533	4196
XRM-5318	3	6	18.2	1.3	12.7	540	4289
XRM-5318	4.5	14	18.0	1.4	10.1	557	3342
Desm/Desm+XRM-5318	0.33/0.5+1	15	17.6	1.5	12.8	611	4160
Desm/Desm+XRM-5318	0.33/0.5+2	16	17.5	1.4	10.6	594	3404
Desm/Desm+XRM-5318	0.33/0.5+3	20	17.7	1.4	10.1	592	3258
Desmedipham/Desmedipham	0.33/0.5	5	17.8	1.5	13.4	627	4304
EXP MEAN		10	17.8	1.4	11.8	583	3855
C.V. %		54	2.2	6.8	22.1	8	23
LSD 5%		8	NS	NS	NS	NS	NS
LSD 1%		10	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4

Summary

None of the treatments significantly affected sugarbeet yield. However, yield tended to be less from XRM-5318 at 4.5 lb/A and desmedipham in combination with XRM-5318 at 2 or 3 lb/A. Desmedipham plus XRM-5318 caused more sugarbeet injury than desmedipham alone.

Triflusulfuron and insecticide interaction, St. Thomas, 1993. 'Hilleshog 5135' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Counter 15G, Counter 20CR, and Lorsban 15G at 12, 8.9, and 13.5 pounds product per acre respectively was applied modified in-furrow or in a five inch band and drag chain incorporated at planting. The first half of split applied postemergence herbicide treatments was applied 12:15 pm May 25 when the air temperature was 62F, soil temperature at six inches was 58F, relative humidity was 50%, wind velocity was 13 mph, soil moisture was good, sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage and green foxtail was 1 inch tall. The second half of split treatments was applied 12:30 pm June 1 when the air temperature was 65F, soil temperature at six inches was 66F, relative humidity was 40%, wind velocity was 3 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, redroot pigweed was in the 4 to 6 leaf stage, and green foxtail was 1 to 2 inches tall. All postemergence herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. Redroot pigweed and green foxtail control were evaluated June 12. Sugarbeet injury was evaluated June 12 and July 20. Sugarbeet in the center two rows of each plot was counted June 14. Sugarbeet in the center four rows of each plot was hand thinned to an eight inch spacing and hand weeded June 15. All plots were cultivated June 21 and hand weeded a second time on July 1. Ten sugarbeet from each plot were rated August 2 for root maggot damage using the following scale: 0=no damage, 1=1 to 4 small scars, 2=5 to 10 small scars or up to 3 larger scars, 3=more than 3 larger scars, 4=50 to 75% of root blackened by scars, 5=more than 75% blackened or dead beet. The mean of these ten ratings is the sugarbeet root maggot damage rating. Sugarbeet was harvested and counted from the center two rows of 30 foot long plots September 27.

Experiment continued on next page.

Triflusulfuron and insecticide interaction, St. Thomas, 1993. (continued)

Insect-icide	Method of Appl	Herbicide Treatment*	Rate	June 12 Sgbt inj	July 20 Sgbt inj	Grft cntl	Rrpw cntl
			lb/A	%	%	%	%
Count15G	MIF	Tfsu+X-77/same	0.0156+0.25%	15	26	49	71
Count15G	Band	Tfsu+X-77/same	0.0156+0.25%	3	11	53	74
Count15G	MIF	None		4	33	0	0
Count15G	Band	None		0	15	0	0
Count15G	MIF	Tfsu+X-77/same	0.031+0.25%	28	36	55	76
Count15G	Band	Tfsu+X-77/same	0.031+0.25%	15	13	63	81
Count15G	MIF	Tfsu+De&Ph/same	0.0156+0.33	33	18	83	95
Count15G	Band	Tfsu+De&Ph/same	0.0156+0.33	15	4	83	95
Coun20CR	MIF	Tfsu+X-77/same	0.0156+0.25%	10	14	49	74
Coun20CR	Band	Tfsu+X-77/same	0.0156+0.25%	4	11	53	75
Coun20CR	MIF	None		0	20	0	0
Coun20CR	Band	None		0	19	0	0
Coun20CR	MIF	Tfsu+X-77/same	0.031+0.25%	5	23	61	79
Coun20CR	Band	Tfsu+X-77/same	0.031+0.25%	9	11	58	79
Coun20CR	MIF	Tfsu+De&Ph/same	0.0156+0.33	21	5	81	96
Coun20CR	Band	Tfsu+De&Ph/same	0.0156+0.33	15	13	81	96
Lorsb15G	MIF	Tfsu+X-77/same	0.0156+0.25%	30	19	50	71
Lorsb15G	Band	Tfsu+X-77/same	0.0156+0.25%	9	20	51	73
Lorsb15G	MIF	None		18	28	0	0
Lorsb15G	Band	None		0	23	0	0
Lorsb15G	MIF	Tfsu+X-77/same	0.031+0.25%	21	19	55	75
Lorsb15G	Band	Tfsu+X-77/same	0.031+0.25%	10	21	54	80
Lorsb15G	MIF	Tfsu+De&Ph/same	0.0156+0.33	31	18	85	96
Lorsb15G	Band	Tfsu+De&Ph/same	0.0156+0.33	16	9	85	96
None	--	Tfsu+X-77/same	0.0156+0.25%	3	43	44	71
None	--	Tfsu+X-77/same	0.031+0.25%	5	54	50	78
None	--	Tfsu+De&Ph/same	0.0156+0.33	18	39	83	95
None	--	None		0	41	0	0
C.V. %				46	46	11	5
LSD 5%				8	14	7	5
LSD 1%				10	18	9	6
# OF REPS				4	4	4	4

Sugarbeet injury on June 12 from herbicides was or tended to be greater when herbicides were applied over modified-in-furrow insecticides rather than band-applied insecticides. The injury on June 12 was primarily from herbicides since the non-herbicide-treated plots had little injury. The injury on July 20 was from a combination of injury from insecticide and injury from sugarbeet root maggot. The non-herbicide-treated plots had injury similar to herbicide-treated plots on July 20. Plots treated with MIF Counter 15G had more injury than plots treated with banded Counter 15G even though maggot injury was similar. This suggests that MIF Counter 15G caused injury directly to the sugarbeet. Weed control was similar regardless of insecticide application method. Triflusulfuron+desmedipham+phenmedipham gave better control of redroot pigweed and green foxtail than triflusulfuron+X-77.

Experiment continued on next page.

Triflusulfuron and insecticide interaction, St. Thomas, 1993. (continued)

Insecticide	Method of Appl	Herbicide Treatment*	Rate	6-14 Sgbt Popl	9-27 Sgbt Popl	Sucr	Loss to Mol	Root Yld	Imp Ind	Extr Sucr	Root Magg Dmg rtg
			lb/A	sgbt/60ft		%	%	T/A		lb/A	0-5
Count15G	MIF	Tfsu+X-77/same	0.0156+0.25%	115	53	16.9	1.6	9.1	693	2772	3.4
Count15G	Band	Tfsu+X-77/same	0.0156+0.25%	113	64	17.3	1.6	13.3	690	4147	3.4
Count15G	MIF	None		102	48	16.9	1.7	7.7	727	2335	3.3
Count15G	Band	None		111	56	16.7	1.6	9.3	721	2791	3.2
Count15G	MIF	Tfsu+X-77/same	0.031+0.25%	79	38	16.9	1.6	8.1	693	2449	3.5
Count15G	Band	Tfsu+X-77/same	0.031+0.25%	120	54	17.2	1.5	10.3	660	3168	3.3
Count15G	MIF	Tfsu+De&Ph/same	0.0156+0.33	83	47	16.7	1.8	13.4	787	3934	3.3
Count15G	Band	Tfsu+De&Ph/same	0.0156+0.33	124	65	17.2	1.6	14.5	689	4474	3.1
Coun20CR	MIF	Tfsu+X-77/same	0.0156+0.25%	118	62	17.1	1.6	12.3	705	3732	3.5
Coun20CR	Band	Tfsu+X-77/same	0.0156+0.25%	120	61	16.9	1.7	12.7	739	3793	3.5
Coun20CR	MIF	None		123	58	16.9	1.6	9.7	710	2935	3.3
Coun20CR	Band	None		118	54	17.1	1.6	8.2	671	2512	3.2
Coun20CR	MIF	Tfsu+X-77/same	0.031+0.25%	112	51	16.7	1.7	7.7	757	2281	3.5
Coun20CR	Band	Tfsu+X-77/same	0.031+0.25%	123	57	17.0	1.6	11.6	692	3516	3.4
Coun20CR	MIF	Tfsu+De&Ph/same	0.0156+0.33	129	66	17.3	1.6	16.5	694	5121	3.2
Coun20CR	Band	Tfsu+De&Ph/same	0.0156+0.33	121	64	16.7	1.7	13.2	765	3932	3.3
Lorsb15G	MIF	Tfsu+X-77/same	0.0156+0.25%	112	53	17.3	1.6	10.5	661	3275	3.4
Lorsb15G	Band	Tfsu+X-77/same	0.0156+0.25%	128	59	17.0	1.6	9.9	698	3034	3.5
Lorsb15G	MIF	None		111	49	17.0	1.6	9.7	692	2920	3.4
Lorsb15G	Band	None		119	49	16.7	1.7	7.7	746	2286	3.3
Lorsb15G	MIF	Tfsu+X-77/same	0.031+0.25%	122	58	17.0	1.7	11.0	724	3324	3.6
Lorsb15G	Band	Tfsu+X-77/same	0.031+0.25%	123	57	16.9	1.6	10.8	694	3283	3.5
Lorsb15G	MIF	Tfsu+De&Ph/same	0.0156+0.33	116	65	17.3	1.6	14.7	660	4563	3.3
Lorsb15G	Band	Tfsu+De&Ph/same	0.0156+0.33	121	64	17.2	1.6	13.4	684	4129	3.2
None	--	Tfsu+X-77/same	0.0156+0.25%	131	41	16.2	1.8	6.7	804	1904	3.7
None	--	Tfsu+X-77/same	0.031+0.25%	135	37	15.6	1.9	5.8	901	1605	3.8
None	--	Tfsu+De&Ph/same	0.0156+0.33	109	42	16.7	1.8	9.5	777	2813	3.8
None	--	None		112	49	16.4	1.7	8.8	774	2569	3.6
C.V. %				15	16	3.2	9.9	20.8	13	21	5.9
LSD 5%				24	12	0.8	NS	3.1	NS	955	0.3
LSD 1%				32	16	NS	NS	4.1	NS	1266	---
# OF REPS				4	4	4	4	4	4	4	4

* X-77=non-ionic surfactant from Valent

Summary

Sugarbeet treated with Counter 15G, modified-in-furrow, yielded less or tended to yield less extractable sucrose per acre than sugarbeet treated in a band. Sugarbeet treated with triflusulfuron+desmedipham+phenmedipham yielded more extractable sucrose per acre than other herbicide treated sugarbeet regardless of insecticide treatment. This suggests that desmedipham + phenmedipham was improving root maggot control in some manner and this is supported by the trend for lower maggot injury ratings in plots treated with desmedipham+phenmedipham plus an insecticide. Lower sugarbeet yields tended to be associated with lower sugarbeet populations at harvest.

Sugarbeet in rye cover crop, Fargo, 1992-1993. Cover crop 'Rymin' winter rye at 7.5, 15, or 22.5 lb/A was seeded in 21 inch rows diagonal or parallel to sugarbeet rows in cover crop blocks 44 feet (24 rows) wide and 40 feet long September 11, 1992. Glyphosate+AMS+X-77 at 0.75 lb/A+17 lb/100 gal+0.5% was applied April 27, 1993 in a 10 inch band where sugarbeet rows would be seeded in diagonally seeded rye cover crop blocks. Plots were rotary hoed twice before seeding 'Maribo 862' sugarbeet 1.25 inches deep in 22 inch rows April 30. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was broadcast applied to all plots May 13 when rye was 8 to 10 inches tall. First row-crop cultivation was May 20, June 2, June 14 or June 21 when rye was 8 to 10, 12 to 14, 16 to 18 or 18 to 20 inches tall respectively. All plots were cultivated a second time June 28. Sugarbeet was counted in the center two rows of each plot June 26. Sugarbeet was thinned by hand to an eight inch spacing July 8. The plot area was kept weed free by hand weeding throughout the growing season. Sugarbeet from the center two rows of each 40 foot long plot was harvested and counted September 23, 1993. The soil on September 23, 1993 was very hard causing dirt clods to go through the machine harvester with the sugarbeet. These dirt clods from each plot were weighed at harvest.

Table. Influence of rye seeding rate, seeding direction and time of cultivation.

Seeding direction	Rye seeding rate	Rye Height at first cultiv.	June 26 Sugarbeet population		Harvest sugarbeet population		Dirt clods through harvestor		Loss to Molasses	
	lb/A	inches	plt/80'	mean	plt/80'	mean	lb/plot	mean	%	mean
Straight	7.5	8-10	135		68		16		2.0	
		12-14	141		78		9		1.8	
		16-18	144		77		7		1.8	
		18-20	154	143	80	75	9	8	2.0	1.9
Diagonal	7.5	8-10	130		62		11		2.2	
		12-14	125		65		8		2.0	
		16-18	139		77		13		1.9	
		18-20	138	133	70	68	6	8	2.1	2.1
Straight	15	8-10	164		81		15		1.9	
		12-14	154		83		9		1.9	
		16-18	184		84		12		1.7	
		18-20	168	167	80	82	13	12	1.9	1.8
Diagonal	15	8-10	176		84		5		1.9	
		12-14	199		82		3		1.9	
		16-18	190		83		11		2.0	
		18-20	192	189	84	83	8	7	1.8	1.9
Straight	22.5	8-10	110		56		15		1.9	
		12-14	146		83		10		1.9	
		16-18	156		80		13		1.8	
		18-20	158	142	86	77	13	13	1.9	1.9
Diagonal	22.5	8-10	171		74		4		2.0	
		12-14	189		88		7		1.8	
		16-18	192		81		10		1.8	
		18-20	195	187	86	82	4	6	1.8	1.8
No Rye	---	8-10	135		76		10		1.7	
		12-14	160		76		10		1.8	
		16-18	157		75		12		1.8	
		18-20	149	150	79	77	13	11	1.7	1.8
LSD (0.05)			33	33	12	10	6	NS	0.2	0.2

Experiment continued on next page.

Sugarbeet in rye cover crop, Fargo, 1992-1993. (continued)

Table (cont.). Influence of rye seeding rate, seeding direction and time of cultivation.

Seeding direction	Rye seeding rate	Rye height at first cultiv.	Impurity Index		Sucrose		Root Yield		Extractable Sucrose	
	lb/A	inches		mean	%	mean	T/A	mean	lb/A	mean
Straight	7.5	8-10	910		16.4		19.5		5530	
		12-14	770		16.9		18.3		5450	
		16-18	790		17.3		20.5		6250	
		18-20	950	850	15.8	16.6	20.8	19.8	5640	5720
Diagonal	7.5	8-10	1040		15.7		19.7		5220	
		12-14	890		16.6		18.0		5190	
		16-18	840		16.8		21.8		6410	
		18-20	930	930	16.5	16.4	21.9	20.3	6190	5750
Straight	15	8-10	820		17.1		21.4		6410	
		12-14	810		17.2		21.8		6590	
		16-18	680		18.1		20.5		6680	
		18-20	800	780	17.1	17.4	20.1	21.0	6090	6440
Diagonal	15	8-10	790		17.4		22.1		6760	
		12-14	800		17.1		21.8		6550	
		16-18	850		17.2		21.7		6530	
		18-20	750	800	17.5	17.3	20.9	21.6	6500	6580
Straight	22.5	8-10	830		17.0		19.4		5790	
		12-14	840		16.7		22.6		6590	
		16-18	770		17.3		21.2		6480	
		18-20	830	820	17.1	17.0	21.4	21.1	6360	6300
Diagonal	22.5	8-10	830		17.2		20.6		6200	
		12-14	730		17.6		22.5		7070	
		16-18	780		17.4		20.7		6350	
		18-20	730	770	17.9	17.5	21.0	21.2	6690	6580
No Rye	----	8-10	740		17.3		21.0		6490	
		12-14	760		17.6		21.0		6530	
		16-18	800		16.7		19.8		5780	
		18-20	730	760	17.1	17.2	19.6	20.4	5990	6200
LSD (0.05)			120	120	0.8	0.7	2.5	NS	830	580
mean		8-10	850		16.9		20.5		6060	
		12-14	800		17.1		20.9		6280	
		16-18	790		17.3		20.9		6350	
		18-20	820		17.0		20.8		6210	
LSD (0.05)			50		0.3		NS		NS	

Summary: Sugarbeet populations on June 26 tended to be higher with diagonally seeded rye rather than with rows parallel to the sugarbeet rows at rye seeding rates of 15 and 22.5 lb/A. Harvested populations were similar with both rye seeding arrangements. Sugar content and extractable sucrose per acre were or tended to be less in sugarbeet grown with 7.5 lb/A of rye than from sugarbeet grown with other rye seeding rates or with no rye. The rye height at first cultivation had no consistent effect on sugarbeet yield.

Barley cover crop seeding rate and stage of control with cultivation, Fargo, 1993. 'Excel' barley at 0, 12, 24, and 48 lb/A was solid seeded in 7 inch rows across the 32 foot long by 11 feet wide cultivation plots April 28. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows across barley blocks April 30. The whole experiment was band sprayed with sethoxydim+Scoil at 0.3 lb ai/A+1.5 pt/A June 2. Row-crop cultivation to control barley between sugarbeet rows was done May 21, May 26, June 2, June 14, June 21 and June 28 when sugarbeet was in the cotyledon, cotyledon to 2 leaf, 2 to 4 leaf, 4 to 6 leaf, 6 to 8 leaf and 8 to 10 leaf stage respectively. Sugarbeet was counted in the center two rows of each 32 foot plot July 9. All plots were cultivated July 12. Sugarbeet was thinned by hand to an eight inch spacing July 14. Sugarbeet from the center two rows of 32 foot plots was harvested and counted September 24. Some plots were lost during the year and sufficient data for reporting was collected only from the no barley and 24 lb/A seeding rate plots.

Table. Influence of time of cultivation and barley cover crop when sethoxydim was band sprayed at four leaf stage of barley.

Barley leaves at first cultivation	Barley seeding rate	Sugarbeet Population July 9	Sugarbeet Population Harvest	Loss to Molasses	Impurity index
	lb/A	-- plants/64 ft --		%	
2	0	128	54	1.8	760
	24	145	54	1.8	770
3	0	124	59	2.1	910
	24	136	58	1.9	830
4	0	120	52	2.0	820
	24	124	55	1.9	770
6	0	112	54	2.0	880
	24	155	52	1.9	790
7	0	133	59	1.8	740
	24	151	58	1.7	720
8	0	146	56	1.9	790
	24	140	46	1.8	732
LSD (0.05)		20	8	0.2	108
mean	0	127	56	2.0	820
	24	142	54	1.8	770
LSD (0.05)		13	NS	NS	NS

Table continued on next page.

Barley cover crop seeding rate and stage of control with cultivation, Fargo, 1993. (continued)

Table (cont.). Influence of time of cultivation and barley cover crop when sethoxydim was band sprayed at four leaf stage of barley.

Barley leaves at first cultivation	Barley seeding rate	Sugar	Root Yield	Extractable Sucrose
	lb/A	%	ton/A	lb/A
2	0	17.6	19.4	6080
	24	17.7	18.3	5680
3	0	17.0	20.7	6070
	24	17.2	18.4	5540
4	0	17.6	20.6	6370
	24	17.7	19.4	6083
6	0	17.2	19.3	5710
	24	17.3	18.1	5440
7	0	18.0	20.7	6620
	24	17.9	18.8	5990
8	0	18.0	17.5	5510
	24	18.4	16.1	5210
LSD (0.05)		0.8	2.5	850
mean	0	17.6	19.7	6060
	24	17.7	18.1	5660
LSD (0.05)		NS	1.2	NS

Summary

Sugarbeet populations prior to thinning generally were higher with barley cover crop than without cover crop but harvested populations were similar except when cultivation was delayed until the eight-leaf stage of barley. Sugarbeet grown without cover crop tended to yield more than sugarbeet grown with cover crop.

Effect of tillage on sugarbeet, Fargo, 1992-1993. Tillage blocks 22 feet (12 rows) wide and 70 feet long were established in the fall of 1992. Early fall tillage was September 4, 1992 with a moldboard plow, chisel plow, or tandem disc and conventional tillage was chisel plow twice followed by a field cultivator and spring-tooth harrow. Late fall tillage was October 19, 1992 with a chisel plow or tandem disc and conventional tillage was chisel plow twice followed by a field cultivator and spring-tooth harrow. One block had no tillage. Half of each 70 foot long block received sping tillage April 23, 1993 with an 'Alloway Seedbetter' field cultivator. 'Van Der Have 66110' sugarbeet was seeded at a 4 inch spacing and 1.25 inches deep in 22 inch rows April 23. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Percent plant residue on the soil surface of each plot was measured May 10 using a beaded string. Each tillage block had six rows of sugarbeet that received no row-crop cultivation and six rows that were cultivated June 15 and June 21. Sugarbeet from the center two rows of each 33 foot long plot was harvested and counted September 23, 1993. The soil on September 23, 1993 was very hard causing dirt clods to go through the machine harvester with the sugarbeet. These dirt clods from each plot were weighed at harvest.

Table. Influence of fall and spring tillage averaged over row-crop and no row-crop cultivation.

Primary fall tillage	Spring Tillage	Plant residue on soil surface		Dirt clods through Harvestor		Harvest Sugarbeet Population		Loss to Molasses	
		%	mean	lb/plot	mean	plt/66'	mean	%	mean
Chisel, early	yes	41		12		37		2.2	
	no	59	50	38	25	31	34	2.2	2.2
Chisel, late	yes	38		9		43		2.1	
	no	48	43	28	18	34	39	2.2	2.2
Conventional, early	yes	43		5		36		2.2	
	no	44	43	12	8	31	34	2.3	2.3
Conventional, late	yes	32		7		37		2.2	
	no	42	37	20	14	39	38	2.1	2.1
Disc, early	yes	49		4		29		2.2	
	no	52	50	8	6	43	36	2.2	2.2
Disc, late	yes	36		7		33		2.2	
	no	49	42	22	15	41	37	2.1	2.1
Plow	yes	13		14		40		2.1	
	no	6	9	16	15	44	42	2.1	2.1
None	yes	62		5		34		2.3	
	no	86	74	17	11	24	29	2.4	2.3
LSD (0.05)		10	6	9	5	10	5	0.1	0.1
Field cult+rolling baskets in spring			39		8		36		2.2
No spring tillage			48		20		36		2.2
LSD (0.05) (averaged over all fall tillage)			*		*		NS		NS

Experiment continued on next page.

Effect of tillage on sugarbeet, Fargo, 1992-1993. (continued)

Table (cont.). Influence of fall and spring tillage averaged over row-crop and no row-crop cultivation.

Primary fall tillage	Spring Tillage	Sucrose		Root Yield		Impurity Index		Extractable Sucrose	
		%	mean	T/A	mean		mean	lb/A	mean
Chisel, early	yes	14.1		15.5		1170		3620	
	no	13.8	13.9	14.1	14.8	1150	1160	3250	3430
Chisel, late	yes	15.2		19.6		1020		5030	
	no	14.4	14.8	14.9	17.2	1110	1070	3590	4310
Conventional, early	yes	14.1		18.8		1170		4370	
	no	14.3	14.2	15.7	17.2	1170	1170	3780	4070
Conventional, late	yes	14.8		19.1		1100		4750	
	no	15.0	14.9	17.8	18.5	1010	1060	4560	4660
Disc, early	yes	14.7		16.6		1110		4080	
	no	14.8	14.7	18.7	17.7	1090	1100	4670	4370
Disc, late	yes	14.9		17.1		1060		4300	
	no	15.0	15.0	18.6	17.8	1030	1050	4780	4540
Plow	yes	14.8		19.7		1060		4960	
	no	15.6	15.2	18.6	19.2	970	1020	4990	4980
None	yes	14.2		14.4		1200		3390	
	no	13.7	13.9	12.8	13.6	1280	1240	2860	3130
LSD (0.05)		0.6	0.3	3.3	1.3	100	40	970	350
Field cult+rolling baskets in spring			14.6		17.6		1110		4310
No spring tillage			14.6		16.4		1100		4060
LSD (0.05) (averaged over all fall tillage)			NS		*		NS		*

SUMMARY: The least plant residue on the soil surface was after plowing and the greatest residue was after no spring or fall tillage. Plots with no spring tillage had more residue than those without spring tillage except for early conventional tillage, early disc, and plow. More dirt clods went through the harvester in plots without spring tillage than with spring tillage except for early conventional, early disc, and plow. On average, the most clods were collected from early chisel. Sugarbeet populations did not respond uniformly to spring tillage across fall tillage treatments. Spring tillage increased sugarbeet populations with fall no-tillage, reduced sugarbeet populations with early disc and had no significant effect with other fall tillage treatments. Sugarbeet from plots with no fall tillage had higher loss to molasses than with other fall tillage. Spring tillage increased sucrose content with late fall chisel and reduced sucrose with plow. Plots with early chisel and no fall tillage had less sucrose, lower root yield, and less extractable sucrose than other plots. Fall plowed plots yielded more extractable sucrose per acre than other plots and late-tilled plots yielded more than early-tilled plots. Averaged over fall tillage, plots with spring tillage yielded more tons and extractable sucrose per acre.

Herbicide soil residual, Fargo (NW section 22), 1989-1993. 'Evans' soybeans were solid seeded at 59 lb/A June 2, 1989 to the entire plot area. Herbicides were applied 10:00 am July 7, 1989 when the air temperature was 79F, soil temperature at six inches was 74F, relative humidity was 47%, wind was 8 mph, soil moisture was poor, and soybean was in the one trifoliolate stage (2 inches tall) to the four trifoliolate stage (6 inches tall). Plots were 14 feet wide and 45 feet long with the center 10 feet treated with herbicides in 8.5 gpa water at 38 psi through 8001 nozzles. The entire experiment was treated with sethoxydim+Dash at 0.2 lb/A + 1 qt/A June 26, 1989 and acifluorfen+sethoxydim+Dash at 0.25+0.2 lb/A + 1 qt/A July 10, 1989. Clopyralid at 0.2 lb/A was spot sprayed to control thistles July 10, 1989. Fall tillage of the plot area was with a chisel plow operated six inches deep and spring tillage was with a field cultivator operated three inches deep. All tillage was done at a slow speed moving parallel with the herbicide plots. Bioassay strips of sugarbeet, corn, wheat, and oats were seeded across herbicide plots for evaluation in 1990. 'Van Der Have Puressa II' sugarbeet was seeded in two directions over entire plot area May 24, 1991. Sugarbeet injury was evaluated June 24, 1991. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 19, 1992. Seeding was done parallel and perpendicular to plots to ensure a dense sugarbeet population. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.33 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 12, 1992. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.9 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 29, 1992. Sugarbeet injury was evaluated June 29 and July 10, 1992. 'Hilleshog 8277' sugarbeet was seeded 1.25 inches deep in 22 inch rows going two directions across plot area May 18, 1993. Sugarbeet injury was evaluated July 9, 1993.

1989 *	Rate	July 24 1991	June 29 1992	July 10 1992	July 9 1993
	(lb/A)	----- percent sugarbeet injury -----			
Imazethapyr+X-77	0.12+0.25%	85	3	5	0
Imazethapyr+X-77	0.06+0.25%	58	3	0	0
Imazethapyr+X-77	0.03+0.25%	14	3	8	0
Imazethapyr+X-77	0.015+0.25%	0	0	0	0
Imazamethabenz	0.6	0	0	0	0
Imazamethabenz	0.3	3	0	0	0
Imazamethabenz	0.15	0	0	0	0
Metribuzin-DF	1	0	0	0	0
Metribuzin-DF	0.5	0	0	3	0
Metribuzin-DF	0.25	0	0	0	0
Nicosulfuron	0.125	3	0	0	0
Nicosulfuron	0.06	5	0	3	0
Nicosulfuron	0.03	5	0	3	0
Rimsulfuron+Nicosulfuron	0.062+0.062	4	0	0	0
Rimsulfuron+Nicosulfuron	0.03+0.03	3	0	0	0
Rimsulfuron+Nicosulfuron	0.015+0.015	0	0	3	0
Primisulfuron	0.06	91	45	40	76
Primisulfuron	0.03	59	36	25	35
Primisulfuron	0.015	24	8	3	19
C.V. %		31	106	207	87
LSD 5%		8	8	14	8
LSD 1%		11	10	19	11
# OF REPS		4	4	4	4

* X-77 = non-ionic surfactant from Valent

SUMMARY: Sugarbeet seeded in 1991 were significantly injured by imazethapyr at 0.12, 0.06, and 0.03 lb/A and by primisulfuron at 0.06, 0.03, and 0.015 lb/A applied in 1989. Sugarbeet seeded in 1992 were significantly injured by primisulfuron at 0.06 and 0.03 lb/A applied in 1989. Sugarbeet injury in 1993 was greater than in 1992 and all three rates of primisulfuron caused significant sugarbeet injury.

Carryover of soybean herbicides, Fargo (NW section 22), 1990-1993. 'McCall' soybean was seeded May 24, 1990. The entire plot area was treated with acifluorfen+sethoxydim at 0.25+0.2 lb ai/A plus Dash at 1 qt/A June 26, 1990. Herbicide treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center 10 feet of 14 foot wide plots 9:15 am June 29, 1990 when the air temperature was 75F, soil temperature at six inches was 69F, relative humidity was 78%, wind velocity was 2 to 4 mph, soil moisture was good, and soybean was in the 2 to 3 trifoliolate stage. Spring and fall tillage was with a field cultivator or chisel plow operated the same direction as the herbicide plots. A six foot strip of 'Butte' wheat at 88 lb/A, a six foot strip of 'Valley' oats at 60 lb/A, a four row strip of 'Interstate 3001' sunflower at 25,000 seeds per acre, and twelve 11 inch rows of 'Van Der Have Puressa II' sugarbeet were seeded across herbicide plots May 24, 1991. Sugarbeet, wheat, oats, and sunflower injury were evaluated June 24, 1991 and July 8, 1991. Kochia control was evaluated June 24, 1991. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 19, 1992. Seeding was done parallel and perpendicular to plots to ensure a dense sugarbeet population. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.33 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 12, 1992. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.9 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 29, 1992. Sugarbeet injury was evaluated June 29 and July 10, 1992. 'Hilleshog 8277' was seeded 1.25 inches deep in 22 inch rows going two directions across the plot area May 18, 1993. Sugarbeet injury was evaluated July 9, 1993.

1990		June 24, 1991					July 8, 1991				1992		1993
											6-29	7-10	7-9
Treatment	Rate	Sgbt	Wht	Oat	Sufl	Kocz	Sgbt	Wht	Oat	Sufl	Sgbt	Sgbt	Sgbt
	lb/A	% injury											
Chlorimuron	0.004	94	30	31	54	98	91	30	19	48	70	53	83
Chlorimuron	0.008	98	33	18	69	97	98	46	15	74	90	76	100
Nicosulfuron	0.125	63	10	23	31	80	59	21	20	19	0	3	0
Nicosulfuron	0.06	30	10	3	10	40	33	18	8	8	0	0	0
Nicosulfuron	0.03	14	0	0	3	20	18	10	3	8	3	5	0
Rimsulfuron+Nico	0.062+0.062	39	5	20	38	65	38	23	15	20	0	3	0
Primisulfuron	0.06	100	84	84	98	99	100	97	73	99	96	86	100
EXP MEAN		62	24	25	43	71	62	35	22	39	37	32	40
C.V. %		23	61	92	30	16	25	36	49	34	17	33	12
LSD 5%		22	22	35	19	17	24	18	16	20	9	16	7
LSD 1%		29	30	48	26	24	32	25	21	27	13	22	10
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

Summary

Sugarbeet was significantly injured in 1991 by all treatments applied in 1990 except nicosulfuron at 0.03 lb/A. Wheat was significantly injured in 1991 by chlorimuron and primisulfuron applied in 1990. Oats was significantly injured only by primisulfuron. Sunflower was significantly injured in 1991 by all treatments applied in 1990 except nicosulfuron at 0.06 and 0.03 lb/A. Sugarbeet was significantly injured in 1992 and 1993 by both rates of chlorimuron and primisulfuron applied in 1990. Sugarbeet injury from all three treatments was greater in 1993 than in 1992.

Multispecies evaluation of soybean herbicide soil residual, Fargo (NW section 22), 1992-1993. 'McCall' soybean at 45 lb/A was solid seeded May 19, 1992 to the entire plot area. Preemergence herbicide treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center 13 feet of 18 foot wide by 60 foot long plots 2:00 pm May 20, 1992 when the air temperature was 88F, soil temperature at six inches was 61F, relative humidity was 38%, wind velocity was 34 mph, and soil moisture was good. Postemergence herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 13 feet of 18 foot wide plots 3:45 pm June 29, 1992 when the air temperature was 70F, soil temperature at six inches was 58F, relative humidity was 48%, wind velocity was 4 mph, soil moisture was good, and soybean was in the one to two trifoliolate stage. The entire experiment was treated with sethoxydim+Scoil at 0.3 lb ai/A + 1 qt/A July 20, 1992. The soybean crop was mowed and tillage was with a chisel plow moving parallel with the herbicide plots in October of 1992. Spring tillage was one pass with a field cultivator. Six 22 inch rows of 'Hilleshog 8277' sugarbeet, four 30 inch rows of 'Interstate IS353' corn, and 'Interstate IS3311' sunflower, and a ten foot strip of 'NewDak' oats and 'Marshall' wheat were seeded across herbicide plots as bioassay strips May 19, 1993. A natural stand of wild mustard and kochia was in the plot area. Wild mustard, kochia, sugarbeet, sunflower, and corn control were evaluated July 5, 1993. Wheat and oats control were evaluated July 5 and July 26, 1993.

1992 Treatment	Method of Applic.	Rate	July 5, 1993 Wimu cntl	Kocz cntl	Sgbt cntl	Wheat cntl	Oats cntl	Sufl cntl	Corn cntl	7-26-93 Wheat cntl	Oats cntl
		lb/A	%	%	%	%	%	%	%	%	%
Chlorimuron	post	0.004	100	60	100	5	3	55	10	4	4
Chlorimuron	post	0.008	100	74	100	16	10	74	13	29	8
Chlorimuron	post	0.01	100	74	100	29	20	78	25	40	6
MON 12000	post	0.03	100	75	100	3	6	83	3	6	3
MON 12000	post	0.09	100	79	100	19	34	100	17	12	20
Triasulfuron	post	0.03	100	69	100	3	30	100	16	9	25
Thiazopyr	pre	0.25	0	0	0	26	26	0	5	19	18
Thiazopyr	pre	0.5	25	10	15	75	65	0	58	68	56
Flumetsulam+ Metolachlor	pre	0.064+ 2.34	0	60	0	0	0	0	0	13	13
Flumetsulam+ Metolachlor	pre	0.128+ 4.67	29	74	10	0	0	0	0	0	0
EXP MEAN			65	57	63	18	19	49	15	20	15
C.V. %			16	22	12	41	50	19	78	61	89
LSD 5%			15	18	11	10	14	13	16	18	20
LSD 1%			21	24	14	14	19	18	22	24	26
# OF REPS			4	4	4	4	4	4	4	4	4

Summary

Chlorimuron at 0.004 lb/A applied in 1992 significantly injured all species in 1993 except wheat, oats, and corn. Chlorimuron at 0.01 lb/A injured all species but oats recovered by 7/26. MON 12000 at 0.03 lb/A injured all species except wheat, oats, and corn but 0.09 lb/A injured all species. Triasulfuron injured all species except wheat. Thiazopyr at 0.25 lb/A injured wheat and oats while 0.5 lb/A injured wild mustard, wheat, oats, and corn. Flumetsulam+metolachlor only injured wild mustard and kochia even at the high rate.

Fertilizer Effect on Sugarbeet Stand, Fargo, 1992-1993. A soil test of the plot area indicated 100 pounds per acre of nitrogen was the recommended rate of fertilizer for a sugarbeet crop. Ammonium nitrate and urea fertilizer at 50, 100, 200, and 300 pounds nitrogen per acre was applied September 4 and October 20, 1992 and April 23, 1993. Fall applied fertilizer was incorporated with a rototiller set two inches deep. Spring applied fertilizer was incorportated with an 'Alloway Seedbetter' set two inches deep. 'Van Der Have 66110' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 23, 1993. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. Sugarbeet stand was counted in the center two rows of 35 foot long plots June 2. Sugarbeet was hand thinned to an eight inch spacing June 3. All plots were row-crop cultivated June 14 and maintained weed free by hand weeding throughout the growing season. Sugarbeet was harvested and counted from the center two rows of six row plots September 21, 1993.

Fertilizer	Rate	Date of Application	6-2 Sgbt Popl	Harvest Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	lb N/A		#/70ft	#/70ft	%	%	ton/A		lb/A
Ammon. Nit.	50	Sept. 4, 1992	76	60	16.3	1.9	20.5	847	5828
Ammon. Nit.	100	Sept. 4, 1992	112	64	16.0	1.9	22.3	897	6175
Ammon. Nit.	200	Sept. 4, 1992	94	59	15.3	2.3	21.5	1115	5461
Ammon. Nit.	300	Sept. 4, 1992	110	57	15.0	2.4	20.1	1180	4946
Ammon. Nit.	50	Oct. 20, 1992	117	69	16.0	1.9	21.1	883	5890
Ammon. Nit.	100	Oct. 20, 1992	109	65	16.4	2.0	21.3	889	6053
Ammon. Nit.	200	Oct. 20, 1992	100	66	15.7	2.2	22.0	1036	5830
Ammon. Nit.	300	Oct. 20, 1992	104	61	15.2	2.3	21.6	1087	5503
Ammon. Nit.	50	April 23, 1993	112	66	16.6	1.8	21.5	810	6250
Ammon. Nit.	100	April 23, 1993	99	67	16.7	1.9	20.9	844	6092
Ammon. Nit.	200	April 23, 1993	86	62	16.0	2.1	20.8	972	5689
Ammon. Nit.	300	April 23, 1993	81	62	15.5	2.4	21.8	1118	5647
Urea	50	Sept. 4, 1992	106	65	16.1	1.8	21.7	846	6099
Urea	100	Sept. 4, 1992	116	65	16.0	2.0	22.1	901	6087
Urea	200	Sept. 4, 1992	110	58	16.1	2.1	20.4	937	5647
Urea	300	Sept. 4, 1992	112	70	15.6	2.2	21.2	1045	5598
Urea	50	Oct. 20, 1992	123	68	16.4	1.7	20.5	767	5913
Urea	100	Oct. 20, 1992	115	64	16.6	1.8	20.7	799	6066
Urea	200	Oct. 20, 1992	91	56	15.7	2.2	20.5	1016	5453
Urea	300	Oct. 20, 1992	65	49	15.5	2.3	18.4	1074	4776
Urea	50	April 23, 1993	93	63	16.2	1.8	21.3	819	6084
Urea	100	April 23, 1993	100	66	16.1	1.9	22.6	860	6327
Urea	200	April 23, 1993	71	54	16.2	2.0	20.5	924	5758
Urea	300	April 23, 1993	59	44	15.3	2.3	19.5	1095	4963
Untreated Check			111	69	16.9	1.7	19.9	749	5953
EXP MEAN			99	62	16.0	2.0	21.0	940	5763
C.V. %			23	12	3.5	7.4	8.5	10	10
LSD 5%			32	10	0.8	0.2	NS	133	812
LSD 1%			42	14	1.0	0.3	NS	176	NS
# OF REPS			4	4	4	4	4	4	4

Summary

Plots treated with ammonium nitrate on Sept. 4, urea on Oct. 20 and urea on April 23 all at 300 lb/A of N had less extractable sucrose per acre and lower harvested populations than the untreated check. Plots treated with ammonium nitrate on Sept. 4 or urea on Sept.4, Oct. 20 and April 23 all at 200 lb/A of N also had lower harvested populations than the untreated check.

Time of sugarbeet thinning, Fargo, 1993. Diethatyl+cycloate at 3+3 lb ai per acre was broadcast applied in 17 gpa water at 40 psi through 11002 nozzles to the entire plot area and incorporated twice with a 'Kongskilde Triple K' field cultivator operated three inches deep April 26. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. All plots were hand weeded May 15 and maintained weed free throughout the growing season by hand weeding and row-crop cultivation May 20, June 22, and August 9. Sugarbeet was hand thinned to an eight inch spacing May 21, May 26, June 3, June 10, June 18, or June 25. Sugarbeet was harvested from the center two rows of 30 foot plots September 30.

Date of Thinning	Sugarbeet Growth Stage	Sucrose	Loss to Mol	Root Yield	Impurity Index	Extract Sucrose
		%	%	ton/A		lb/A
May 21	2 leaf	18.2	1.5	17.6	625	5787
May 26	2-4 leaf	18.0	1.6	19.0	635	6195
June 3	6 leaf	18.1	1.5	17.8	616	5857
June 10	8 leaf	18.3	1.5	17.7	624	5850
June 18	10 leaf	18.2	1.5	18.0	610	5935
June 25	12 leaf	18.2	1.5	17.0	597	5615
EXP MEAN		18.2	1.5	17.9	618	5873
C.V. %		2.4	6.0	12.7	8	14
LSD 5%		NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS
# OF REPS		6	6	6	6	6

Summary

Time of sugarbeet thinning had no significant effect on sugarbeet yield.

Late season new leaf removal effect on sugarbeet, Fargo, 1993. Diethatyl + cycloate at 3+3 lb ai per acre was broadcast applied in 17 gpa water at 40 psi through 11002 nozzles to the entire plot area and incorporated twice with a 'Kongskilde Triple K' field cultivator operated three inches deep April 26. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire plot area June 14. All plots were hand weeded May 15 and maintained weed free throughout the growing season by hand weeding and row-crop cultivation May 20, June 22, and August 9. Sugarbeet was hand thinned to an eight inch spacing June 3. Initial removal of the four newest leaves from each plant in the center four rows of six row plots was July 21 for the two months before harvest treatments and August 18 for the one month before harvest treatments. Following initial leaf removal, new growth was removed each week until harvest. Sugarbeet from the center two rows of 30 foot plots was harvested September 30.

Leaf Removal	Sucrose	Loss to Mol	Root Yield	Impurity Index	Extract Sucrose
	%	%	ton/A		lb/A
No Leaf Removal	17.5	1.7	20.3	731	6327
August 18 and weekly until harvest	17.1	1.7	19.5	744	5922
July 21 and weekly until harvest	16.9	1.9	18.3	827	5429
EXP MEAN	17.2	1.8	19.4	767	5892
C.V. %	1.7	5.7	6.6	7	8
LSD 5%	NS	NS	NS	NS	NS
LSD 1%	NS	NS	NS	NS	NS
# OF REPS	4	4	4	4	4

Summary

Leaf removal had no significant effect on sugarbeet yield.

Methanol on sugarbeet, Fargo (airport), 1993. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. All treatments were applied three times. The first application was 10:00 am August 6 when the air temperature was 65F, soil temperature at six inches was 69F, relative humidity was 80%, and wind velocity was 5 mph. The second application was 11:25 am August 9 when the air temperature was 82F, soil temperature at six inches was 70F, relative humidity was 65%, and wind velocity was 2 mph. The third application was 10:00 am August 11 when the air temperature was 78F, soil temperature at six inches was 72F, relative humidity was 67%, and wind velocity was 7 mph. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots when the soil moisture was good and the sugarbeet canopy was full. Sugarbeet from the center two rows of 26 foot long plots was harvested and counted September 21.

Methanol	28%N	Iron chelate	T-x-100	Glycine	Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extrac Sucros
					#/52ft	%	%	ton/A		lb/A
0	0	0	0	0	61	16.9	1.8	18.7	780	5602
0	0.4%	0.008%	0.25%	0.1%	60	18.0	1.6	18.9	655	6147
20%	0	0	0.25%	0	71	17.3	1.8	18.7	756	5752
20%	0.4%	0.008%	0.25%	0.1%	77	17.1	1.7	20.4	742	6209
30%	0	0	0.25%	0	71	17.3	1.7	21.1	740	6479
30%	0.4%	0.008%	0.25%	0.1%	60	17.5	1.7	17.5	699	5449
EXP MEAN					67	17.3	1.7	19.2	729	5940
C.V. %					11	5.5	8.2	7.5	13	9
LSD 5%					11	NS	NS	2.2	NS	NS
LSD 1%					NS	NS	NS	NS	NS	NS
# OF REPS					4	4	4	4	4	4

28%N = 28% N solution containing urea and NH_4NO_3
T-x-100 = Triton x-100 surfactant from Sigma Chemical Co.

Summary

None of the treatments significantly affected extractable sucrose per acre. However, plots treated with 30% methanol plus T-x-100 at 0.25% yielded more tons per acre than the untreated check.

Wild oat control in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded on May 3. Treatments were applied to 2- to 2.5-leaf wheat, 2- to 3-leaf wild oats, 2- to 4-leaf wild mustard, and 2-leaf common lambsquarters on May 26, with 48 F, 70% RH, clear sky, and 5 to 7 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. Harvest for yield was on August 25.

		6/26				8/7			8/25
Treatment[a]	Rate	Wheat inj	Wioa	Wimu	Colq	Wheat inj	Wioa	Wibw	Wheat yield
	oz/A	%							bu/A
Diclofop+SUN-ITII	12+.18G	0	90	0	0	0	91	0	10.8
Diclofop+Brox	12+4	0	77	66	99	0	83	86	12.7
Imazamethabenz-LC+SUN-ITII	5+.18G	0	85	87	5	0	82	36	11.2
Imazamethabenz-LC+X-77	5+.25%	0	31	82	0	0	50	51	5.2
Immb-LC+Dife+X-77	2.5+6+.25%	0	34	64	0	0	50	48	5.2
Immb-LC+Dife+X-77	3.7+8+.25%	0	40	56	0	0	67	65	7.3
Immb-LC+Thif&Trib+SUN-ITII	5+.25+.18G	0	88	99	99	0	92	90	14.0
Difenzoquat	12	0	66	0	0	0	65	0	7.0
Dife+Thif&Trib+X-77	12+.25+.25%	0	67	99	99	0	74	98	8.5
Tiller	9.4	0	91	95	99	0	93	9	14.3
Tiller+Thif&Trib+Dica-dma	9.4+.22+1	0	15	99	99	0	39	88	5.5
Tiller+Trib+Dica-dma	9.4+.125+1	0	8	99	99	0	11	99	2.5
Cheyenne	8.52	5	86	96	99	0	88	94	14.0
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		411	12	19	5	0	19	27	35.2
LSD 5%		2	9	18	4	NS	17	21	4.3
# OF REPS		4	4	4	4	4	4	4	4

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA:thifensulfuron& tribenuron (1:6.3:0.22)

Summary

Wild oat densities were high at about 300 plants per square yard so wheat emergence was poor. The reduced wheat stand plus flooding and diseases account for the low yield. However, wheat yield generally related to control of wild oats, wild buckwheat, and wild mustard. Wild mustard was at about 5 and wild buckwheat 10 plants per square yard. Only diclofop, imazamethabenz + thifensulfuron & tribenuron + Sun-it II and Tiller gave more than 90% late season wild oat control. Sun-it II enhanced wild oat control from imazamethabenz to 85% early and 80% late compared to 31% early and 60% late respectively when applied with X-77. The inclusion of dicamba with Tiller greatly reduced wild oats control. Wild oat control was similar from imazamethabenz alone + X-77 at 5 oz/A to when at 3.7 with difenzoquat at 8 oz/A + X-77. Wild buckwheat control exceeded 85% when bromoxynil, thifensulfuron & tribenuron, or dicamba were part of the treatment.

Wild oat control in wheat, Hettinger 1993. 'Grandin' hard red spring wheat was seeded April 14. Treatments were applied to 6 leaf wheat and 4 leaf wild oats on May 31 with 60 F, cloudy sky, and 5 mph wind. Harmony extra at 0.33 oz/A was applied to entire plot on May 13. Treatments were applied with a tractor mounted type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 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 300 plants/yd^2.

		6/22		7/07			8/17	
Treatment[a]	Rate	Wheat inj	Wioa	Wheat inj	Wioa	Fibw	Plant height	Wheat yield
	oz/A	-- %	----------				cm	bu/A
Diclofop+Sun-itII	12+0.18G	0	64	0	66	11	56	9.0
Diclofop+Bromoxynil	12+4	2	48	0	51	10	54	10.5
Imazamethabenz-LC+Sun-itII	5+0.18G	0	49	5	76	54	52	9.3
Imazamethabenz-LC+X-77	5+0.25%	2	36	0	52	56	52	9.5
Imazamethabenz-LC+Dife+X-77	2.5+6+0.25%	0	32	3	55	33	52	8.3
Imazamethabenz-LC+Dife+X-77	3.7+8+0.25%	2	39	0	47	11	44	6.9
Immb-LC+Thif&Trib+Sun-it II	5+0.25+0.18G	0	43	6	82	36	50	7.6
Difenzoquat	12	0	27	0	40	24	50	7.0
Dife+Thif&Trib+X-77	12+0.25+0.25%	2	25	3	44	31	52	7.5
Tiller	9.4	0	82	0	71	55	53	11.6
Tiller+Thif&Trib+Dicamba-dma	9.4+.22+1	0	68	5	83	79	54	9.9
Tiller+Tribenuron+Dicamba-dma	9.4+0.125+1	0	72	1	59	59	54	9.7
Cheyenne	7.5	0	89	3	77	70	53	8.9
Untreated	0	0	0	0	0	0	49	9.1
C.V. %		378	58	151	32	62	14	33.0
LSD 5%		NS	28	4	26	33	NS	NS
# OF REPS		NS	37	4	4	4	NS	NS

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA:thifensulfuron& tribenuron (1:6.3:0.2 2);

Summary

Imazamethabenz control of wild oats was greater when applied with Sun-it II than X-77. Wild oats control from difenzoquat was low, probably because application was early for difenzoquat. Difenzoquat phytotoxicity to wild oats was not influenced by thifensulfuron & tribenuron. Tiller control of wild oats was antagonized when with dicamba and tribenuron, but not when dicamba and thifensulfuron & tribenuron were part of the treatment.

Wild oat control in wheat, Minot 1993. 'Stoa' hard red spring wheat was seeded May 11. Treatments were applied to 3.5- to 4-leaf wheat on June 4 with 50 F, 34% RH, partly cloudy sky and 3.5 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. Evaluation was on July 8 and harvest for yield was on September 9.

Treatment[a]	Rate	Wheat inj	Wioa	Plant height	Test weight	Wheat yield
	oz/A	--- %	---	cm	lb/bu	bu/A
Diclofop+Sun-itII	12+0.18G	1	99	109	59.2	41.1
Diclofop+Bromoxynil	12+4	3	99	107	59.5	37.7
Imazamethabenz-LC+Sun-itII	5+0.18G	1	99	103	59.9	40.1
Imazamethabenz-LC+X-77	5+0.25%	1	93	109	59.2	36.4
Imazamethabenz-LC+Dife+X-77	2.5+6+0.25%	2	97	107	59.8	36.6
Imazamethabenz-LC+Dife+X-77	3.7+8+0.25%	3	97	108	59.2	36.8
Immb-LC+Thif&Trib+Sun-itII	5+0.25+0.18G	0	99	107	59.5	38.6
Difenzoquat	12	2	93	107	59.1	37.5
Dife+Thif&Trib+X-77	12+0.25+0.25%	6	92	106	58.8	33.4
Tiller	9.4	14	99	105	59.4	39.0
Tiller+Thif&Trib+Dicamba-dma	9.4+.22+1	3	71	104	59.1	33.2
Tiller+Tribenuron+Dicamba-dma	9.4+0.125+1	1	54	105	59.4	34.2
Cheyenne	7.5	4	99	103	59.4	38.9
Untreated	0	0	0	111	59.3	30.2
C.V. %		83	8	3	.8	10.0
LSD 5%		4	10	4	NS	5.3
# OF REPS		4	4	4	4	4

[a] Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA: thifensulfuron&tribenuron (1:6.3:0.22).

Summary

Wild oat density was sprase at about 5 plants per square yard. Wild oats control exceeded 90% with all treatments, except tiller treatments containing dicamba. Most herbicide treatments increased wheat grain yield, but did not influence grain test weight.

Wild oat control in wheat, Williston 1993. 'Amidon' hard red spring wheat was seeded May 4. Treatments were applied to 4-leaf wheat and 3.5- to 4-leaf wild oats on June 2 with 61 F, 55% RH, partly cloudy sky, 7 mph wind, and soil temperature of 58 F at a 4 inch depth with dry soil and plant surfaces. Treatments were applied with a tractor mounted plot sprayer delivering 8.5 gpa at 32 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. Evaluation was July 8 and harvest for yield was on September 22.

Treatment[a]	Rate	July 8 Wheat inj	July 8 Wioa	July 29 Wheat inj	July 29 Wioa	Sept 22 Wheat yield
	oz/A	--------	%	-------		bu/A
Diclofop+Sun-itII	12+0.18G	8	94	13	97	30.7
Diclofop+Bromoxynil	12+4	3	98	1	96	34.0
Imazamethabenz-LC+Sun-itII	5+0.18G	4	91	26	93	27.6
Imazamethabenz-LC+X-77	5+0.25%	1	85	8	84	31.0
Imazamethabenz-LC+Dife+X-77	2.5+6+0.25%	1	79	0	74	32.6
Imazamethabenz-LC+Dife+X-77	3.7+8+0.25%	5	83	8	85	30.4
Immb-LC+Thif&Trib+Sun-itII	5+0.25+0.18G	6	87	9	91	29.7
Difenzoquat	12	1	60	0	66	30.7
Dife+Thif&Trib+X-77	12+0.25+0.25%	3	70	0	54	28.6
Tiller	9.4	10	86	21	93	26.0
Tiller+Thif&Trib+Dica-dma	9.4+.22+1	5	51	1	21	26.7
Tiller+Tribenuron+Dica-dma	9.4+0.125+1	6	36	0	15	28.5
Cheyenne	7.5	6	86	4	93	33.1
Untreated	0	0	0	0	0	25.9
C.V. %		89	13	145	17	13.2
LSD 5%		5	13	23	17	NS
# OF REPS		4	4	4	4	4

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA: thifensulfuron& tribenuron (1:6.3:0.22);

Summary

Wild oats density was at about 8 plants per square yard. Wild oats control exceeded 85% at both evaluations for diclofop alone or with bromoxynil, imazamethabenz alone or with thifensulfuron & tribenuron plus Sun-it II. Tiller applied alone and imazamethabenz + Sun-it II appeared to injure wheat at the late evaluation. Wheat yield was not influenced by any herbicide treatments.

Difenzoquat for wild oat control in barley, Fargo 1993. 'Excel' barley was seeded May 3. Treatments were applied to 5-leaf barley, 4-leaf wild oats, 6-leaf wild mustard, and 2- to 4-leaf wild buckwheat on June 1 with 58 F, 45 RH, clear sky, and 5 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 4 replicates. Evaluations were on June 26 and August 7. Harvest for yield was on August 17.

Treatment[a]	Rate	6/26			8/7	8/17
		Barley	Wioa	Wimu	Wioa	Yield
	oz/A	---------	%	---------		bu/A
Difenzoquat	16	1	88	0	83	30.1
Difenzoquat-SG+X-77	16+.5%	1	91	0	95	28.4
Difenzoquat-SG+Sun-itII	16+.25G	0	89	0	81	28.9
Imazamethabenz-LC+Dife-SG+X-77	3.7+8+.5%	1	81	99	77	30.6
Imazamethabenz-LC+Dife-SG+Sun-itII	3.7+8+.25G	1	76	99	70	29.4
Imazamethabenz-LC+Dife-SG+Scoil	3.7+8+.25G	3	79	99	82	30.2
Immb-LC+Dife-SG+Thif&Trib+MCPA+X-77	3.7+8+.5+4+.5%	5	76	99	52	22.7
Difenzoquat-SG+MCPA-dma+X-77	16+8+.5%	6	86	99	74	26.4
Difenzoquat-SG+Brox&MCPA+X-77	16+8+.5%	3	81	99	84	29.9
Difenzoquat-SG+24-Ddma+X-77	16+8+.5%	4	81	99	73	26.5
Difenzoquat-SG+Clpy&24D+X-77	16+9.5+.5%	3	83	99	63	29.8
Difenzoquat-SG+Trib+MCPA-ioe+X-77	16+.25+4+.5%	1	82	99	73	29.3
Dife-SG+Thif&Trib+MCPA-ioe+X-77	16+.5+4+.5%	3	83	99	75	27.6
Imazamethabenz-LC+Dife+X-77	3.7+8+.5%	3	81	0	93	30.7
Untreated	0	0	0	0	0	12.5
C.V. %		146	11	0	18	16.1
LSD 5%		NS	12	NS	19	6.3
# OF REPS		4	4	4	4	4

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA:thifensulfuron& tribenuron (1:6.3:0.22)

Summary

Difenzoquat gave similar wild oat control regardless of formulation or adjuvant. However, wild oat control from difenzoquat-SG + clopyralid & 2,4-D was less then for difenzoquat liquid alone, at the late evaluation. Wild oat control from imazamethabenz + difenzoquat was reduced with thifensulfuron & tribenuron + MCPA were included in the spray mixture. Barley yield was increased for all wild oat control treatments, except imazamethabenz + difenzoquat + thifensulfuron & tribenuron + MCPA.

Difenzoquat plus adjuvants for wild oat control in barley, Fargo 1993. 'Excel' barley was seeded May 3. Treatments were applied to 5-leaf barley, 4-leaf wild oat, 6-leaf wild mustard, 2- to 4-leaf wild buckwheat, and 5- to 6-leaf common lambsquarters on June 1 with 58 F, 45% RH, clear sky, and 5 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 experiments was a randomized complete block design with four replicates. Harvest for yield was on August 17.

		6/26					8/7	8/17
Treatment	Rate	Barley inj	Wioa	Wimu	Wibu	Colq	Wioa	Yield
	oz/A	%						bu/A
Difenzoquat	10	4	88	16	0	0	87	21.5
Difenzoquat-SG+X-77	10+.5%	3	77	3	0	0	87	20.2
Difenzaquat-SG+Scoil	10+.25G	0	90	14	0	0	94	23.7
Difenzoquat+28N	10+2%	0	76	5	0	0	88	22.5
Difenzoquat-SG+X-77+28N	10+.5%+2%	0	86	0	0	0	88	22.6
Difenzoquat-SG+Scoil+28N	10+.25G+2%	11	96	97	23	8	96	29.4
Difenzoquat-SG+E-93-N	10+1%	0	80	1	0	0	90	22.0
Untreated	0	0	0	0	0	0	0	10.7
C.V. %		187	10	27	566	566	5	15.3
LSD 5%		6	11	7	NS	NS	6	4.9
# OF REPS		4	4	4	4	4	4	4

Summary

Wild oat density was about 300 plants per square yard. Barley yield was increased from weed control with all herbicides, but yields were low because of flooding and disease. Late season wild oat control exceeded 85% for all treatments, but evaluation did not include wild oats beneath the barley canopy. At the June 26 evaluation, difenzoquat as the liquid formulation gave greater wild oat control than as the SG formulation with X-77. However, when difenzoquat SG was applied with Scoil, wild oat control equalled that from the commercial liquid formulation. Twenty-eight percent liquid nitrogen fertilizer applied with difenzoquat as the commercial liquid formulation reduced wild oat control. However, 28% liquid nitrogen fertilizer tended to enhance wild oat control from difenzoquat SG.

Control of wild oats plus other weeds, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 2- to 2.5-leaf wheat, 2- to 3-leaf wild oats, 2- to 4-leaf wild mustard, 2-leaf wild buckwheat, and 2-leaf common lambsquarters on May 26 with 70 F, 35% RH, partly cloudy sky, and 5- to 10-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 4 replicates. Evaluation was on June 26. Weed densities were wild oats 30 plants/ft^2, wild mustard 3 plants/ft^2, wild buckwheat 2 plants/ft^2, common lambsquarter and kochia 0.1 plant/ft^2 and a second flush of wild oats.

Treatment[a]	Rate	6/26 Wht inj	6/26 Wioa	6/26 Wimu	6/26 Wibu	6/26 Colq	6/26 KOCZ	8/7 Wioa	8/7 Wibu
	oz/A	%							
Tiller	6.6	1	89	76	13	99	20	91	26
Tiller	9.3	0	90	71	13	99	23	95	13
Tiller+Bromoxynil	9.3+3	0	89	80	85	99	98	95	8
Tiller+Bromoxynil-gel	9.3+3	0	89	80	91	99	99	95	39
Tiller+Bromoxynil	9.3+4	0	89	81	93	99	99	91	80
Tiller+Thif&Trib	9.3+.22	2	83	98	99	99	99	76	94
Tiller+Thif&Trib+Brox-gel	9.3+.22+2	0	49	99	99	99	99	64	98
Tiller+Tribenuron	9.3+.13	0	63	99	93	99	99	70	69
Tiller+Trib+Brox-gel	9.3+.06+2	0	69	97	98	99	99	71	67
Cheyenne	6.82	5	85	99	99	99	99	87	76
Immb+Thif&Trib+Scoil	4+.22+.18G	3	80	97	98	99	99	87	94
Diclofop+Brox+Scoil	12+4+.18G	0	84	48	92	99	99	88	90
Difenzoquat+Thif&Trib	10+.22	0	25	99	99	99	99	19	99
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		239	11	15	10	0	9	8	37
LSD 5%		3	11	17	10	NS	12	9	32
# OF REPS		4	4	4	4	4	3	4	4

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3); Cheyenne=Fenoxaprop:MCPA: thifensulfuron&tribenuron (1:6.3:0.22);

Summary

Wheat was not harvested for yield because of water and disease damage. Wild oat control from Tiller was antagonized when the spray contained thifensulfuron & tribenuron + bromoxynil-gel, tribenuron, or tribenuron + bromoxynil-gel. Difenzoquat did not adequately control wild oats, possibly because of the early stage of wild oats at treatment. All hericide treatments controlled common lambsquarters. Diclofop + bromoxynil gave only 48% wild mustard control. All treatments, except Tiller applied alone, gave 85% or more wild buckwheat and kochia control.

Barban plus thifensulfuron and tribenuron for wild oat control, Fargo 1993. 'Excel' barley was seeded May 3. Treatments were applied to 1-leaf barley, 1- to 2-leaf wild oats, cotyledon-to 2-leaf wild mustard, cotyledon- to 2-leaf wild buckwheat, cotyledon- to 1-leaf common lambsquarters, and less than 1-inch tall kochia on May 20 with 50 F, 80% RH, mostly cloudy sky, and 2 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. Evaluations were on June 26 and August 7. Wild oat density was 30 plants/yd^2

		6/26			8/7	
Treatment	Rate	Barley	Wioa	Wimu	Wioa	Wibu
	oz/A	%				
Barban(2E)	4	0	29	0	65	59
Barban(2E)	6	0	43	0	66	71
Barban(2E)+Scoil	4+0.18G	0	61	0	70	70
Barban(2E)+Act-90	4+0.25%	0	39	0	60	48
Barban(2E)+Thif&Trib+Scoil	4+0.33+0.18G	0	46	99	78	95
Barban+Thif&Trib+Act-90	4+0.33+0.25%	3	41	97	86	95
Barban(2E)+Thif&Trib+Scoil	6+0.33+0.18G	5	70	99	86	92
Barban+Thif&Trib+Act-90	6+0.33+0.25%	0	41	97	84	97
Untreated	0	0	0	0	0	2
C.V. %		294	28	5	10	19
LSD 5%		NS	17	3	9	20
# OF REPS		4	4	4	4	4

Summary

Thifensulfuron & tribenuron in tank mixture generally enhanced barban phytotoxicity to wild oats and at the early evaluation was most pronounced when with Scoil. These results are of interest because barban phytotoxicity generally was antagonized by other herbicides for broadleaf weed in past research.

Broadleaf weed control in wheat, Fargo campus 1993. 'Amidon' hard red spring wheat was seeded May 3. Treatments were applied to 3- to 4-leaf wheat, 3 leaf wild buckwheat, 1- to 3-inch kochia, 4-leaf common lambsquarters, and 4- to 6-leaf wild mustard on May 26 with 48 F, 70% RH, clear sky, and 5- to 10-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 an 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on June 18 and August 16. Harvest for yield was on August 26. Wild buckwheat and kochia at 10 plants/yd^2 in three of the four replications. Other weeds at a lower density.

		June 18						August 16				Aug 26
Treatment	Rate	Wht inj	Wibu	Kocz	Wimu	Colq	Grft	Wibu	Colq	KOCZ	Grft	Wht yield
	oz/A	%										bu/A
2,4-Ddma	6	0	68	48	99	99	0	19	99	43	0	26.1
MCPA-dma	6	0	23	28	99	99	0	0	99	35	0	22.9
2,4-Dbee	4	3	66	58	99	99	0	8	99	48	0	28.9
MCPA-ioe	4	0	28	30	99	99	0	10	99	40	0	20.3
Dicamba-dma	2	0	91	89	73	96	0	95	99	99	15	28.8
Bromoxynil&MCPA(4EC)	8	0	97	98	99	99	0	88	99	99	0	27.3
Bromoxynil	4	0	98	91	84	91	0	95	99	99	0	27.4
Dicamba-dma+MCPA-dma	1.5+4	0	74	91	99	99	0	94	99	99	0	29.7
Clopyralid&24-D	9.5	0	90	51	99	99	0	99	99	58	0	26.4
Thif&Trib+2,4-Dbee+Dicadma+X-77	0.225+4+1+0.125%	0	99	99	99	99	0	99	99	99	0	24.0
Thif&Trib+MCPAioe+Dicadma+X-77	0.225+4+1+0.125%	0	98	99	99	99	0	99	99	99	0	28.3
Trib+2,4-Dbee+Dica-dma+X-77	0.09375+4+1+0.125%	0	96	99	99	99	0	99	99	99	0	30.5
Trib+MCPA-ioe+Dica-dma+X-77	0.09375+4+1+0.125%	0	94	99	99	99	0	99	99	99	55	23.9
Thif&Trib+X-77	0.225+0.125%	0	97	99	99	99	0	99	99	99	15	25.5
Tribenuron+X-77	0.09375+0.125%	1	49	96	99	99	0	36	99	99	0	28.3
Thif&Trib+24-Dbee+X-77	0.225+4+0.125%	0	95	99	99	99	0	91	99	99	15	24.6
Thif&Trib+MCPA-ioe+X-77	0.225+4+0.125%	0	97	99	99	99	0	94	99	99	35	25.6
Propanil-DF+MCPA-ioe+PO	17+4+0.25G	0	67	76	97	99	30	66	99	90	50	26.3
Dakota	6.5	0	28	31	99	99	58	0	99	9	87	24.7
Untreated	0	0	0	0	0	0	0	0	0	0	0	18.6
C.V. %		449	19	13	8	3	132	22	0	14	130	15.8
LSD 5%		1	19	13	10	4	8	20	NS	15	37	5.8
# OF REPS		4	4	4	4	4	4	4	3	4	2	4

[a]Dakota=Fenoxaprop:MCPA (1:2.1);

Summary

Thifensulfruon & tribenuron treatments effectively controlled all broadleaf weeds. Tribenuron with 2,4-D or MCPA plus dicamba also controlled all broadleaf weed. Tribenuron alone did not adequately control wild buckwheat. Green foxtail plants were not competitive with the wheat which grew well with the cool moist conditions. Dakota gave adequate (84%) green foxtail control, August 16. Wheat yield was increased by most treatments and yield generally related to weed control.

Broadleaf weed control in wheat, Carrington 1993. 'Amidon' hard red spring wheat was seeded April 26. Treatments were applied to 3-leaf wheat, 4- to 6-leaf common lambsquarters, 2- to 3-inch Russian thistle, 1-inch kochia, and 2- to 4-leaf wild buckwheat on May 25 with 60 F, 54% RH, partly cloudy sky, and 17.5 mph wind. 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 25 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 9 and harvest for yield was on August 31.

		7/9						8/31	
Treatment	Rate	Wht inj	Wimu	Colq	Ruth	KOCZ	Wibu	Test weight	Yield
	oz/A	%							
2,4-D-dma	6	1	99	96	99	51	28	48.3	30.9
MCPA-dma	6	1	97	99	70	69	20	48.5	31.0
2,4-D-bee	4	1	99	98	99	89	59	47.8	31.3
MCPA-ioe	4	0	99	97	18	46	0	49.8	32.0
Dicamba-dma	2	0	99	99	90	99	88	48.3	32.4
Bromoxynil&MCPA(4EC)	4&4	1	99	99	99	97	92	49.3	31.8
Bromoxynil	4	0	99	80	98	93	91	50.0	31.1
Dicamba-dma+MCPA-dma	1.5+4	0	99	92	97	97	91	49.0	35.8
Clopyralid&2,4-D-bee	8&1.5	0	99	99	99	63	99	48.8	34.0
Thif&Trib+2,4-D-bee+Dica-dma+X-77	0.15&0.075+4+1+0.125%	1	99	99	99	99	84	48.5	32.7
Thif&Trib+MCPA-ioe+Dica-dma+X-77	0.15&0.075+4+1+0.125%	0	99	99	99	99	93	49.3	34.0
Tribenuron+2,4-D-bee+Dica-dma+X-77	0.09375+4+1+0.125%	0	99	99	99	99	81	48.3	32.5
Tribenuron+MCPA-ioe+Dica-dma+X-77	0.09375+4+1+0.125%	1	99	99	96	99	82	49.8	37.4
Thif&Trib+X-77	0.15&0.075+0.125%	0	99	89	95	81	71	50.8	34.8
Tribenuron+X-77	0.09375+0.125%	1	99	95	99	97	61	49.8	35.8
Thif&Trib+2,4-D-bee+X-77	0.15&0.075+4+0.125%	0	99	99	99	99	94	50.8	33.8
Thif&Trib+MCPA-ioe+X-77	0.15&0.075+4+0.125%	1	99	96	99	99	92	59.3	35.4
Propanil-DF+MCPA-ioe+PO	17+4+0.25G	0	99	99	50	94	84	49.5	34.3
Dakota	2.1&4.4	3	99	98	37	71	24	50.3	35.9
Untreated	0	0	0	0	0	0	0	49.0	33.0
C.V. %		240	1	7	17	23	32	3.1	6.5
LSD 5%		NS	1	9	20	27	31	NS	NS
# OF REPS		4	4	4	4	4	4	4	4

[a]Dakota=Fenoxaprop:MCPA (1:2.1).

Summary

Weed densities were uniform at about three plants per square yard. Test weight was low because the disease injury. The wheat had a yield potential of more than 60 bu/A but was reduced because of disease. Wheat was extremely competitive with the cool and moist conditions so yields were not reduced by weeds. Further, most herbicide treatments were highly phytotoxic to weeds with the moist conditions. MCPA treatments gave less than 70% Russian thistle control. Kochia control was below 90% only with 2,4-D, MCPA, clopyralid & 2,4-D and thifensulfuron & tribenuron alone.

Broadleaf weed control in wheat, Dickinson 1993. 'Stoa' hard red spring wheat was seeded May 5. Treatments were applied to 4.5-leaf wheat, 3-leaf green foxtail, 1.5 inch diameter redroot pigweed, and 4-leaf wild buckwheat on June 2 with 52 F, cloudy sky and no wind. Treatments were applied with a bicycle-wheel type plot sprayer delivering 35 gpa with 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 7 by 28 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 7. Weed density was variable.

		7/07				9/17		
Treatment	Rate	Wheat inj	Grft	Rrpw	Wibu	Test weight	Wheat yield	SD
	oz/A	--------	%	-------		lb/bu	bu/A	
2,4-Ddma	6	2	15	45	27	57.8	44.4 ±	6.2
MCPA-dma	6	3	26	50	56	58.5	40.9 ±	3.1
2,4-Dbee	4	0	18	51	29	57.8	39.2 ±	5.3
MCPA-ioe	4	1	0	49	37	58.3	45.5 ±	7.7
Dicamba-dma	2	7	23	86	54	57.4	45.9 ±	4.6
Bromoxynil&MCPA(4EC)	8	3	15	95	79	58.8	43.9 ±	4.1
Bromoxynil	4	4	0	90	80	58.3	40.1 ±	3.6
Dicamba-dma+MCPA-dma	1.5+4	3	6	92	71	58.1	46.8 ±	7.7
Clopyralid&24-D	9.5	3	23	70	86	58.6	42.6 ±	0.7
Mets+2,4-Dbee+Dicadma+X-77	0.062+4+1+.125%	9	0	98	92	57.9	39.9 ±	8.8
Mets+MCPA-ioe+Dicadma+X-77	0.062+4+1+.125%	4	18	92	98	58.1	42.8 ±	7.7
Trib+2,4-Dbee+Dicadma+X-77	0.09375+4+1+.125%	8	10	87	81	57.9	34.9 ±	7.3
Trib+MCPA-ioe+Dica-dma+X-77	0.09375+4+1+.125%	5	36	97	90	57.9	41.2 ±	5.1
Metsulfuron+X-77	0.062+.125%	3	15	98	47	58.1	44.1 ±	5.9
Tribenuron+X-77	0.09375+.125%	5	16	85	62	57.6	42.8 ±	8.8
Metsulfuron+24-Dbee+X-77	0.062+4+.125%	3	33	99	92	58.1	39.1 ±	6.3
Metsulfuron+MCPA-ioe+X-77	0.062+4+.125%	6	0	97	80	58.1	41.3 ±	10.0
Propanil-DF+MCPA-ioe+PO	17+4+.25G	2	10	35	44	58.6	50.3 ±	10.4
Dakota	6.5	5	97	36	0	57.0	43.6 ±	8.9
Untreated	0	0	10	16	0	57.5	31.8 ±	14.3
C.V. %		79	123	23	53			
LSD 5%		7	43	31	60			
# OF REPS		4	4	4	4	4	4	

[a]Dakota=Fenoxprop:MCPA (1:2.1).

Summary

Kochia control exceeded 85% with dicamba, bromoxynil, and metsulfuron treatments. Green foxtail was only controlled by fenoxaprop & MCPA. Wild buckwheat control was variable, but bromoxynil, dicamba, clopyralid, and tribenuron or metsulfuron in mixture with other herbicides were the most effective treatments. Wheat yield was generally increased by herbicide treatments. Variability in yield was from damage to plot area from vandalism. Area harvested differed for various plots because of the damage. Wheat grain test weight was not influenced by weed control treatment.

Broadleaf weed control in wheat, Williston 1993. 'Amidon' hard red spring wheat was seeded on April 26. Treatments were applied to 5- to 6-leaf wheat, 1- to 3-inch Russian thistle, and 2- to 4-leaf green foxtail on June 2 with 62 F, 46% RH, partly cloudy sky, 9 mph wind, soil temperature of 64 F at 4 inch depth, and dry plant and soil surfaces. Treatment were applied with a bicycle-wheel-type sprayer with a shield mounted on a G-Allis Chalmers tractor delivering 8.5 gpa at 32 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 24 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation dates were July 8 and July 23 and harvest for yield was on September 23.

Treatment	Rate	July 8 Wht inj	July 8 Ruth	July 23 Wht inj	July 23 Ruth	July 23 Grft	Sept 23 Wht yield
	oz/A	%					bu/A
2,4-D-dma	6	1	71	0	90	0	39.3
MCPA-dma	6	1	49	0	34	0	38.3
2,4-D-bee	4	1	85	1	96	0	38.4
MCPA-ioe	4	2	40	0	38	0	34.5
Dicamba-dma	2	5	61	3	81	0	36.0
Bromoxynil&MCPA(4EC)	4&4	3	98	0	97	0	37.8
Bromoxynil	4	2	98	0	98	0	40.0
Dicamba-dma+MCPA-dma	1.5+4	3	68	3	90	0	34.3
Clopyralid&2,4-D-bee	8&1.5	1	79	3	96	0	39.6
Mets+2,4-D-bee+Dica-dma+X-77	0.062+4+1+0.125%	5	94	1	98	0	37.0
Mets+MCPA-ioe+Dica-dma+X-77	0.062+4+1+0.125%	6	97	0	99	0	41.5
Trib+2,4-D-bee+Dica-dma+X-77	0.09375+4+1+0.125%	6	94	3	99	0	39.3
Trib+MCPA-ioe+Dica-dma+X-77	0.09375+4+1+0.125%	4	99	1	98	0	40.7
Mets+X-77	0.062+0.125%	1	78	3	85	0	36.3
Trib+X-77	0.09375+0.125%	4	83	1	95	0	40.6
Mets+2,4-D-bee+X-77	0.062+4+0.125%	6	95	0	96	0	35.4
Mets+MCPA-ioe+X-77	0.062+4+0.125%	6	91	1	85	0	35.9
Prop-DF+MCPA-ioe+PO	17+4+0.25G	3	11	0	5	48	31.7
Dakota	2.1&4.4	4	10	0	23	65	34.6
Untreated	0	0	0	0	0	0	31.8
C.V. %		101	14	228	13	180	9.2
LSD 5%		NS	14	NS	14	14	4.8
# OF REPS		4	4	4	4	4	4

[a]Dakota=fenoxaprop:MCPA (1:2.1).

Summary

All herbicide treatments that gave 95% or more late season Russian thistle control and increased yield by 5 or more bu/A. 2,4-D either as the amine or ester tended to be more effective than MCPA or dicamba for Russian thistle control. Metsulfuron alone or with MCPA was or tended to be less effective than tribenuron alone or metsulfruon with 2,4-D for Russian thistle control. Metsulfruon tribenuron in mixture with dicamba and 2,4-D or MCPA effectively controlled Russian thistle.

Sulfonylurea mixture for broadleaf weed control, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 1.5-inch common lambsquarters, and 2- to 3-leaf foxtail on June 10 with 80 F, 70% RH, clear sky, and 10 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. Evaluations were take June 21, August 20 and harvest for yield was on September 2.

Treatment	Rate	6/20 Wheat inj	6/20 KOCZ	8/20 Wheat inj	8/20 KOCZ	9/2 Wheat yield
	oz/A	---------	---------	%	--------	--------
Thifensulfuron&Tribenuron+NIS	0.225+0.125%	3	99	3	99	23.8
Thifensulfuron&Tribenuron+2,4-Dbee+NIS	0.225+4.0+0.125%	2	99	1	99	27.8
Thifensulfuron&Tribenuron+MCPA-ioe+NIS	0.225+4.0+0.125%	3	99	0	99	25.1
Thifensulfuron&Tribenuron+Dica-dma+NIS	0.225+1.0+0.125%	7	99	2	98	25.4
Thifensulfuron&Tribenuron+Brox+NIS	0.225+2.0+0.125%	1	99	1	99	26.3
Thif&Trib+2,4-Dbee+Dica-dma+NIS	0.225+4.0+1.0+0.125%	10	99	4	99	26.1
Thif&Trib+MCPA-ioe+Dica-dma+NIS	0.225+4.0+1.0+0.125%	4	99	1	99	23.6
Thif&Trib+Bromoxynil&MCPA+NIS	0.225+4.0+0.125%	3	99	0	99	26.5
Tribenuron+NIS	0.09375+0.125%	3	99	0	99	25.7
Tribenuron+2,4-Dbee+NIS	0.09375+4.0+0.125%	1	99	2	99	27.8
Tribenuron+MCPA-ioe+NIS	0.09375+4.0+0.125%	55	99	43	98	20.9
Tribenuron+Dicamba-dma+NIS	0.09375+1.0+0.125%	9	99	1	99	22.8
Tribenuron+Bromoxynil+NIS	0.09375+2.0+0.125%	1	99	0	99	22.5
Tribenuron+2,4-Dbee+Dicamba-dma+NIS	0.09375+4.0+1.0+0.125%	9	99	3	97	26.0
Tribenuron+MCPA-ioe+Dicamba-dma+NIS	0.09375+4.0+1.0+0.125%	5	99	2	99	24.2
Trib+Bromoxynil&MCPA+NIS	0.09375+4.0+0.125%	1	99	1	99	24.7
2,4-Dbee	4.0	1	35	0	28	24.1
MCPA-ioe	4.0	0	41	0	38	24.1
Dicamba-dma	1.0	2	60	0	82	25.0
Bromoxynil	2.0	0	85	0	75	23.7
Bromoxynil&MCPA	4.0	0	89	0	82	24.5
2,4-Dbee+Dicamba-dma	4.0+1.0	6	91	3	87	26.1
MCPA-ioe+Dicamba-dma	4.0+1.0	1	20	1	23	23.7
Untreated	0	0	0	0	0	24.6
C.V. %		41	11	279	10	13.1
LSD 5%		3	13	15	12	NS
# OF REPS		4	4	4	4	4

Summary

Sulfonylurea herbicides alone or in mixture with other broadleaf control herbicide completely controlled kochia. Tribenuron + MCPA + NIS treatment caused severe injury to wheat, which probably was from nicosulfuron residual in the spray bottle. Other tribenuron treatments did not cause important injury to wheat. Dicamba gave greater kochia control when applied with 2,4-D than MCPA.

Wild buckwheat control in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 3- to 4-leaf wheat, 1- to 3-leaf wild buckwheat, less than 2-inch kochia, 2- to 4-leaf wild mustard and common lambsquarters on May 12 with 55 F, 40% RH, clear sky, and 5 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 replications.

		6/18					8/16		8/25
Treatment	Rate	Wheat inj	Wibu	KOCZ	Wimu	Colq	Wibu	KOCZ	Yield
	oz/A	%							bu/A
Triasulfuron+X-77	0.22+0.25%	0	99	99	99	67	97	99	31.9
Triasulfuron+E-93-N	0.22+1%	0	99	99	99	67	99	99	33.0
Triasulfuron+X-77	0.29+0.25%	0	99	99	99	72	99	99	33.0
Triasulfuron+E-93-N	0.43+0.25%	0	99	99	99	70	99	99	33.4
Triasulfuron+Dica-dma+X-77	0.22+1+0.25%	0	99	99	99	99	99	99	31.7
Triasulfuron+Dica-dma+X-77	0.22+2+0.25%	0	98	99	99	99	99	99	33.2
Triasulfuron+Dica-GA+X-77	0.22+1+0.25%	0	98	99	87	87	99	99	31.4
Triasulfuron+2,4-Ddma+X-77	0.22+4+0.25%	0	96	99	99	98	99	99	33.2
Triasulfuron+2,4-Ddma+E-93-N	0.22+4+1%	0	99	99	99	99	97	99	31.0
Triasulfuron+2,4-Ddma+E-93-G	0.22+4+1%	0	99	99	99	97	99	99	30.1
Triasulfuron+2,4-Ddma+X-77	0.22+8+0.25%	0	96	99	99	99	97	99	32.5
Metsulfuron+2,4-Dbee+X-77	0.06+8+0.25%	1	89	99	99	99	60	99	30.2
Bromoxynil&MCPA	6	0	61	85	99	99	56	99	31.5
Bromoxynil&MCPA	8	0	75	87	99	99	83	99	31.6
Dicamba-dma+MCPA-dma	1.5+4	0	78	91	99	99	80	99	32.7
Dicamba-GA+MCPA-dma	1.5+4	0	75	90	99	99	78	99	32.0
Bromoxynil&MCPA-gel	6	0	49	73	99	99	58	97	27.4
Bromoxynil&MCPA-gel	8	0	43	73	99	99	75	99	28.6
Untreated	0	0	0	0	0	0	0	0	21.6
C.V. %		872	11	6	6	17	11	1	9.2
LSD 5%		NS	13	7	8	21	13	1	4.0
# OF REPS		4	4	4	4	4	4	4	4

Summary

Triasulfuron alone or in mixture with 2,4-D or dicamba gave complete control of wild buckwheat and kochia. Triasulfuron alone did not adequately (<75%) control common lambsquarters, regardless of adjuvant. Bromoxynil & MCPA-dma or GA (glycolamine) gave less than 85% wild buckwheat control. These herbicides are normally more effective on wild buckwheat. All herbicide treatments increased wheat grain yield.

Phenoxy and alternatives in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments (2 leaf) were applied to 3- to 4-leaf wheat, 3-leaf wild buckwheat, 1- to 3-inch kochia on May 26 with 48 F, 70% RH, clear sky, and 5- to 7-mph wind. Treatments (3 leaf) were applied to 4 leaf wheat, 6-inch to-cotyledon wild mustard, 1.5-inch kochia and common lambsquarters on June 2 with 58 F, 45% RH, clear sky, and 5 mph wind. Treatments (5 leaf) were applied to 5 leaf wheat, cotyledon- to 12-inch wild mustard, 1.5-inch kochia, and 2- to 4-inch common lambsquarters on June 7 with 60 F, 100% RH, cloudy sky, and 10- to 20-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. Evaluations were on June 18 and August 16. Harvest for yield was on August 25.

Treatment	Rate	6/18		8/16		8/25
		Wibu	KOCZ	Wibu	KOCZ	Yield
	oz/A	---------	%	--------		bu/A
Dicamba+MCPA(2lf)	1.25+4	93	95	68	98	27.7
Dicamba+MCPA(3lf)	1.25+4	95	97	86	98	28.2
Dicamba+MCPA(4lf)	1.25+4	86	78	55	97	23.8
Bromoxynil&MCPA(2lf)	8	98	98	91	98	32.7
Bromoxynil&MCPA(3lf)	8	88	89	79	97	25.9
Bromoxynil&MCPA(4lf)	8	99	88	86	89	23.9
Bromoxynil(2lf)	4	88	98	94	98	29.6
Bromoxynil(3lf)	4	51	86	71	96	26.3
Bromoxynil(4lf)	4	92	89	81	90	26.2
2,4-D(2lf)[a]	8	99	34	33	53	23.4
2,4-D(3lf)[a]	8	98	91	55	67	25.3
2,4-D(4lf)[a]	8	90	63	50	46	25.0
MCPA(2lf)[a]	8	96	73	16	42	26.0
MCPA(3lf)[a]	8	97	84	10	31	22.1
MCPA(4lf)	8	88	68	26	53	21.4
Dicamba(2lf)[a]	2	58	94	90	95	21.2
Dicamba(3lf)	2	71	91	96	96	23.9
Dicamba(4lf)	2	48	70	89	97	21.4
Untreated	0	0	0	0	0	11.1
C.V. %		8	12	23	12	21.6
LSD 5%		9	14	20	13	7.5
# OF REPS		4	4	4	4	4

[a] Treated with Curtail for canada thistle in replicate 3.

Summary

Weed stands were variable and certain areas of the experiment were infested with Canada thistle creating inconsistencies in the data. 2,4-D or MCPA did not give adequate wild buckwheat or kochia control, August 16. Dicamba or bromoxynil alone did not give adequate wild mustard control, but were effective when applied with MCPA. Thus, in order to control wild mustard, kochia, and wild buckwheat with one treatment MCPA and bromoxynil or dicamba were required.

F-8426 for weed control in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded on May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 1- to 4-inch wild buckwheat, 1.5-inch common lambsquarters, and 2- to 3-leaf foxtail on June 9 with 80 F, 70% RH, and 10 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. Evaluations were on June 21 and August 19.

Treatment	Rate	6/21 Wheat inj	6/21 Kochia	8/19 Kochia
	oz/A	%	%	%
F-8426(df)	0.37	1	99	99
F-8426(df)	0.50	1	99	90
F-8426(df)+Scoil	0.25+0.12G	6	99	99
F-8426(df)+2,4-Ddma	0.37+4	0	99	99
F-8426(df)+2,4-Dbee	0.37+2	0	99	99
F-8426(df)+Dicamba-dma	0.37+1	2	99	99
F-8426(df)+Bromoxynil	0.37+4	2	99	99
F-8426(df)+2,4-Ddma+Scoil	0.25+2+0.12G	3	99	94
F-8426(df)+2,4-Ddma+X-77	0.25+2+0.25%	1	99	99
2,4-Ddma	4	0	51	20
Bromoxynil	4	0	98	99
2,4-Ddma+Scoil	4+0.12G	3	82	60
Untreated	0	0	0	20
C.V. %		126	12	14
LSD 5%		3	15	25
# OF REPS		4	4	2

Summary

F-8426 at all rates alone or in combination with other herbicides gave complete kochia control at the early evaluation. The second evaluation of kochia control was variable as only two replicates could be evaluated because of flooding. Wheat was not harvested for grain yield because of water damage. Scoil adjuvant increased 2,4-D amine control of kochia.

Foxtail control in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 1- to 4-inch wild buckwheat, 1.5-inch common lambsquarters, and 2- to 3-leaf foxtail on June 10 with 80 F, 70% RH, and 10 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.

Treatment[a]	Rate	6/22 Wht inj	6/22 Fxtl	6/22 KOCZ	8/19 Fxtl	8/19 KOCZ	9/8 Wheat Yield
	oz/A	%	%	%	%	%	bu/A
Dakota	5.9	6	88	43	89	18	27.9
Dakota	8	4	91	43	93	26	27.6
Dakota+Dicamba-dma	5.9+1	10	79	97	84	99	24.2
Dakota+Bromoxynil	5.9+4	6	63	97	41	84	27.5
Dakota+Bromoxynil	8+4	6	76	98	70	99	26.3
Dakota+Triasulfuron[b]	8+0.21	0	88	45	92	24	27.6
Dakota+Tribenuron	8+0.13	5	83	99	83	99	25.2
Dakota+Thif&Trib	8+0.22	5	86	99	84	99	26.7
Tiller+Tribenuron	6.6+0.13	5	78	98	82	99	25.1
Tiller+Thif&Trib	6.6+0.22	5	88	99	83	99	23.8
Immb+Thif&Trib+Scoil	5+.22+0.18G	2	43	99	41	99	22.8
Propanil-wdg+MCPA-ioe+Mor-act	17+4+0.18G	6	78	69	68	68	25.2
Propanil-wdg+24-Dbee+Mor-act	17+4+0.18G	11	84	79	58	79	23.6
Thif&Trib+Scoil	0.22+0.18G	5	40	99	61	99	25.3
Thif&Trib+E-93-N	0.22+2%	5	36	99	50	99	24.7
Untreated	0	0	0	0	0	0	26.4
C.V. %		72	13	12	20	18	12.4
LSD 5%		5	12	14	19	19	NS
# OF REPS		4	4	4	4	4	4

[a]Dakota=fenoxaprop:MCPA (1:2.1), Tiller=fenoxaprop:2,4-D:MCPA (1:2:6.3);
[b]Data indicates that triasulfuron may not have been included.

Summary

Dakota control of green and yellow foxtail was antagonized by bromoxynil. All herbicide treatments containing sulfonylurea herbicides gave complete kochia control except triasulfuron. Triasulfuron gave kochia control in other experiments in the area. Wheat yield were variable because of head blight, so response to weed control was not detectable.

2,4-D plus surfactants in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 2- to 6-leaf wild buckwheat, 1.5-inch common lambsquarters, and 2- to 3-leaf green and yellow foxtail on June 9 with 70 F, 70% RH, clear sky, and no 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. Evaluations of reps 1 and 2 were on June 22, reps 2 and 3 on June 28.

Treatment	Rate	Wheat inj	KOCZ	Wimu
	oz/A	--------	%	--------
2,4-Dbee	4	0	44	99
2,4-Ddma	4	0	53	99
2,4-Ddma+X-77	4+0.25%	0	61	99
2,4-Ddma+IgepalCO630	4+0.25%	1	54	99
2,4-Ddma+IgepalCO887	4+0.25%	1	50	99
2,4-Ddma+SilwettL77	4+0.25%	0	52	99
2,4-Ddma+Scoil	4+0.18G	1	65	99
2,4-Ddma+CaCo-amineC23	4+0.25%	0	61	99
2,4-Ddma+ExpS3	4+2%	1	80	99
Untreated	0	0	0	0
C.V. %		308	29	0
LSD 5%		NS	22	0
# OF REPS		4	4	2

Summary

Weed densities were sparse making evaluation variable. Late evaluation was not taken because the area was flooded for a long period. 2,4-D phytotoxicity to kochia was not influenced by adjuvants, except for ExpS3 which enhanced phytotoxicity. Conditions were moist at treatment which may have reduced any response to adjuvants.

2,4-D plus surfactants in wheat Exp 2, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 5-leaf wheat and 0.5- to 3-inch kochia on June 10 with 80 F, 70% RH, wet soil, and 10- to 15-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.

Treatment	Rate	Kochia
		%
2,4-Ddma	4	58
2,4-Ddma+RHODAPEX CO-436 (58)	4+0.25%	75
2,4-Ddma+DOWFAX 2A1 (45)	4+0.25%	78
2,4-Ddma+GAFAC RM-710 (100)	4+0.25%	74
2,4-Ddma+ALPHASTEP ML-40 (100)	4+0.25%	76
2,4-Ddma+ARMEEN L-15 (100)	4+0.25%	85
2,4-Ddma+ETHOMEEN C/20 (100)	4+0.25%	84
2,4-Ddma+ARQUAD 2C-75 (75)	4+0.25%	82
2,4-Ddma+ARQUAD B-100 (100)	4+0.25%	84
2,4-Ddma+PLURONIC L-64 (100)	4+0.25%	75
2,4-Ddma+PLURONIC 10-R5 (100)	4+0.25%	78
2,4-Ddma+EXP S3	4+0.25%	82
2,4-Ddma+AGRIMUL PG2067 (70)	4+0.25%	80
2,4-Ddma+ALFONICS 810-60 (100)	4+0.25%	85
2,4-Ddma+ALFONICS 810-80 (100)	4+0.25%	82
2,4-Ddma+SILWET L-77 (100)	4+0.25%	78
2,4-Dioe	4	77
Untreated		0
LSD 5%		7
# of REPS		4

Summary

Isooctyl ester formulation of 2,4-D and 2,4-D dimethylamine with addition of surfactants gave greater kochia control than with 2,4-D dma alone. Kochia control with 2,4-D dma was generally enhanced more with cationic surfactants (ARMEEN L-15, ETHOMEEN C/20, ARQUAD 2C-75, and ARQUAD B-100) than with anionic surfactants (RHODAPEX CO-436, DOWFAX 2A1, and GAFAC RM-710). Nonionic surfactant enhancement of 2,4-D dma differed among chemistries. Kochia control with 2,4-D dma with addition of cationic surfactants was generally greater than with 2,4-D isooctyl ester. EXP S3 provided similar 2,4-D enhancement as the cationic surfactants.

2,4-D and MCPA formulations, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 2- to 6-leaf wild buckwheat, 1.5-inch common lambsquarters, and 2- to 3-leaf green and yellow foxtail on June 9 with 70 F, 70% RH, clear sky, and no 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.

Treatment	Rate	6/26 KOCZ	6/26 Wibu
	oz/A	---- % ----	
2,4-Dbee	4	58	53
2,4-D6E(WE)	4	63	53
2,4-Ddma	4	53	20
2,4-DSG(LI)	4	30	25
2,4-DSG-PBI	4	25	40
2,4-Ddma+X-77	4+0.25%	40	30
2,4-DSG(LI)+X-77	4+0.25%	50	33
2,4-DSG-PBI+X-77	4+0.25%	45	38
MCPA-dma	4	48	45
MCPA-SG(LI)	4	15	25
MCPA-SG-PBI	4	15	15
Dica-dma	2	92	85
Bromoxynil	4	93	98
Untreated	0	0	0
C.V. %		20	38
LSD 5%		19	33
# OF REPS		2	2

Summary

None of the herbicides injured wheat (data not presented). Weed density was sparse and only occurred in two replicates. Late season evaluation or yield were not taken because of flood damage. 2,4-D amine formulations, dry or liquid, gave similar weed control. The dry MCPA formulations were less effective than liquid MCPA-dma formulations for both kochia and wild buckwheat.

Propanil for foxtail control in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded on May 3. Treatments were applied to 5-leaf wheat, 0.5- to 3-inch kochia, 2- to 6-leaf wild buckwheat, 1.5-inch common lambsquarters, and 2- to 3-leaf foxtail spp. on June 9 with 70 F, 70% RH, clear sky, and no wind. Soil was moist at treatment. Treatments were applied with a hand held boom 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. Evaluations were on June 28 and August 16 harvest for yield was on September 2.

		6/28			8/16		9/2
Treatment	Rate	Wht inj	Fxtl	KOCZ	Fxtl	KOCZ	Yield
	oz/A	%					bu/A
Propanil-wdg+PO	16+.12G	1	82	76	83	80	29.9
Propanil-wdg+AG-98	16+0.25%	4	81	89	77	85	27.1
Propanil-wdg	16	3	83	78	79	74	27.3
Propanil-wdg+MCPA-ioe+PO	16+4+.12G	6	89	94	85	83	26.8
Propanil-wdg+MCPA-ioe+AG-98	16+4+0.25%	5	94	87	90	87	28.4
Propanil-wdg+MCPA-ioe	16+4	5	91	95	90	89	28.7
Propanil-wdg+MCPA-dma+PO	16+4+.12G	5	93	85	88	76	26.7
Propanil-wdg+MCPA-dma+AG-98	16+4+0.25%	4	88	97	73	72	26.8
Propanil-wdg+MCPA-dma	16+4	3	92	88	89	81	25.8
Propanil-wdg+MCPA-SG(LI)+PO	16+4+.12G	6	88	85	85	82	28.2
Propanil-wdg+MCPA-SB(LI)+AG-98	16+4+0.25%	6	90	90	79	75	25.5
Propanil-wdg+MCPA-SG(LI)	16+4	5	89	77	83	68	27.4
Propanil-wdg+2,4-Dbee+AG-98	16+8+.25%	8	95	96	76	90	27.1
Propanil-wdg+2,4-Ddma+AG-98	16+8+.25%	4	91	85	69	74	26.0
Tiller[a]	6.6	4	95	59	90	51	30.2
Propanil-wdg+MCPA-ioe+Brox(2E)	16+4+0.5	6	89	99	88	93	28.8
Untreated	0	0	0	0	0	0	24.8
C.V. %		75	8	14	12	13	8.3
LSD 5%		NS	9	16	13	14	NS
# OF REPS		4	4	4	4	4	4

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3).

Summary

Propanil applied with MCPA or 2,4-D gave or tended to give greater green and yellow foxtail control than propanil applied alone, at the early evaluation. Late season evaluation of foxtail control indicated similar trends to the early evaluation, except propanil with MCPA and 2,4-D amine and AG-98 tended to give less foxtail control than other propanil mixtures. Propanil with adjuvants gave similar kochia control to propanil with MCPA or 2,4-D regardless of fomulation or adjuvant. Wheat yield was not influenced by weed control because kochia and foxtail were not competitive with the vigorous wheat but yields were low because of head blight. The propanil-wdg formulation was difficult to resuspend and some treatments may not have the full rate.

Propanil for foxtail control in wheat Exp 2, Fargo 1993. 'Marshall' hard red spring wheat was seeded on May 14. Treatments were applied to 2.5-leaf wheat, 2-leaf foxtail spp, 0.5-inch kochia, and 2-inch wild mustard on June 10 with 80 F, 70% RH, and 10 to 15 mph wind. Treatments were applied with a hand held boom 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. Evaluations were on June 27 and August 19.

		6/27				8/19
Treatment	Rate	Wheat inj	Fxtl	KOCZ	Wimu	Fxtl
	oz/A	------------		%		------------
Propanil-wdg+PO	16+.12G	0	87	82	93	52
Propanil-wdg+AG-98	16+0.25%	2	88	79	93	45
Propanil-wdg	16	0	85	78	91	43
Propanil-wdg+MCPA-ioe+PO	16+4+.12G	2	81	88	98	32
Propanil-wdg+MCPA-ioe+AG-98	16+4+0.25%	0	62	67	94	20
Propanil-wdg+MCPA-ioe	16+4	0	87	94	99	47
Propanil-wdg+MCPA-dma+PO	16+4+.12G	3	86	94	99	47
Propanil-wdg+MCPA-dma+AG-98	16+4+0.25%	3	93	96	99	62
Propanil-wdg+MCPA-dma	16+4	0	78	79	99	40
Propanil-wdg+MCPA-SG(LI)+PO	16+4+.12G	2	90	66	99	43
Propanil-wdg+MCPA-SB(LI)+AG-98	16+4+0.25%	4	80	94	99	23
Propanil-wdg+MCPA-SG(LI)	16+4	0	84	87	99	43
Propanil-wdg+24-Dbee+AG-98	16+8+.25%	2	66	98	99	8
Propanil-wdg+24-Ddma+AG-98	16+8+.25%	3	93	99	99	60
Tiller[a]	6.6	3	98	65	99	63
Propanil-wdg+MCPA-ioe+Brox(2E)	16+4+0.5	3	74	97	99	25
C.V. %		146	11	22	4	42
LSD 5%		NS	14	30	6	27
# OF REPS		3	3	3	3	3

[a]Tiller=Fenoxaprop:2,4-D:MCPA (1:2:6.3).

Summary

Propanil without MCPA or 2,4-D was generally as effective as when with MCPA or 2,4-D in controlling foxtail and kochia. MCPA or 2,4-D in mixture with propanil generally enhanced wild mustard control. The late evaluation indicated poor foxtail control with all treatments, indicating recovery from early injury or later emerged plants. The wheat was not competitive because of late seeding, excess water, or low fertility altering foxtail growth.

Triasulfuron with adjuvants in wheat, Fargo 1993. 'Marshall' hard red spring wheat was seeded May 3. Treatments were applied to 3- to 4-leaf wheat, 2- to 4-leaf wild mustard, and common lambsquarters, 1- to 3-leaf wild buckwheat, and less than 2-inch kochia on May 21 with 55 F, 40% RH, clear sky, and 5 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. Evaluation was on June 18. Weed densities were wild buckwheat and kochia 3 plants/ft^2, wild mustard 1 plant/yd^2, and common lambsquarters 1 plant/ft^2.

		6/19				
Treatment	Rate	Wht inj	Wibu	KOCZ	Wimu	Colq
	oz/A	%				
Triasulfuron+X-77	0.06+0.25%	0	93	96	99	35
Triasulfuron+X-77	0.12+0.25%	0	99	99	99	56
Triasulfuron+E-93-N1	0.06+1%	0	99	99	99	40
Triasulfuron+E-93-N1[a]	0.12+1%	75	99	99	99	71
Triasulfuron+Scoil	0.06+1%	0	98	99	99	39
Triasulfuron+Scoil	0.12+1%	3	99	99	99	51
Untreated	0	0	0	0	0	0
C.V. %		48	2	3	0	27
LSD 5%		8	3	4	0	17
# OF REPS		4	4	4	4	4

[a]The high injury indicates possible spray bottle nicosulfuron residue.

Summary

The experiment was to evaluate adjuvants with triasulfuron, but wild buckwheat, kochia and wild mustard were completely controlled regardless of adjuvant. The triasulfuron at 0.12 oz/A + E-93-N1 was not included in the discussion as the wheat injury indicates spray bottle contamination, probably from nicosulfuron.

2,4-D or Dicamba with Penncozeb, Fargo 1993. 'Marshall' hard red spring wheat was seeded on May 4. Treatments were applied to 6- to 7-leaf wheat, 1- to 6-inch kochia, 1- to 8-inch flowering wild mustard, and 1- to 4-inch common lambsquarters on June 15 with 68 F, 80% RH, cloudy sky, and 10 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. Evaluation was on June 28.

Treatment	Rate	Wht inj	KOCZ
	oz/A	------ %	------
2,4-Ddma	4	0	50
2,4-Ddma+Penncozeb	4+32	0	44
2,4-Dbee	4	5	75
2,4-Dbee+Penncozeb	4+32	5	78
Dicamba	2	4	53
Dicamba+Penncozeb	2+32	4	59
Untreated	0	0	0
C.V. %		87	24
LSD 5%		3	18
# OF REPS		4	4

Summary

The moist conditions in 1993 gave a high potential for foliar diseases in wheat and inquiries about mixtures of fungicides with herbicides. Penncozeb applied with 2,4-D amine, 2,4-D ester, or dicamba-dma did not influence kochia control or wheat injury.

HRSW variety screening to difenzoquat herbicide, Casselton and Prosper. An experiment was conducted to evaluate difenzoquat herbicide on HRSW varieties. Wheat varities were seeded in the spring of 1993. Difenzoquat was applied at Prosper to 4 - 5-lf wheat on June 1, 1993 with 55 F, 30% RH, 20% cloudy sky, and 3-5 mph wind and at Casselton to 4 - 5-lf wheat on June 1, 1993 with 58F, 30% RH, 20% cloudy sky, and 3-5 mph wind. Treatments were applied to the entire plot area of 4 by 8 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

HRSW Variety	Rate	Total		Casselton		Prosper	
	lb/A	bu/A	lb/bu	bu/A	lb/bu	bu/A	lb/bu
XW398	0	24	47	22	48	26	47
XW398	1	27	47	25	47	30	47
XW398	1.5	23	48	26	48	26	48
ND671	0	37	53	36	54	38	53
ND671	1	34	52	32	52	36	53
ND671	1.5	33	52	32	50	34	53
Marshall	0	24	47	25	48	23	46
Marshall	1	23	48	22	48	23	48
Marshall	1.5	24	48	25	49	23	48
2371	0	26	48	24	47	28	48
2371	1	23	47	22	47	23	47
2371	1.5	25	46	23	45	26	47
2375	0	32	52	30	51	35	54
2375	1	29	50	26	49	33	52
2375	1.5	32	51	28	49	36	53
Norm	0	23	45	24	44	22	45
Norm	1	24	46	24	46	23	45
Norm	1.4	23	47	20	46	26	48
Bergen	0	31	49	30	48	33	49
Bergen	1	29	47	26	46	33	49
Bergen	1.5	29	49	24	48	32	50
Prospect	0	23	47	23	46	23	47
Prospect	1	21	46	21	47	21	46
Prospect	1.5	25	45	22	42	27	47
Sharp	0	35	53	35	53	35	53
Sharp	1	32	52	27	51	36	53
Sharp	1.5	37	54	36	54	38	54
Sonja	0	25	46	26	47	24	46
Sonja	1	24	46	21	45	27	47
Sonja	1.5	27	47	28	48	25	47
Gus	0	24	48	20	46	27	49
Gus	1	24	49	26	50	22	48
Gus	1.5	23	48	19	48	27	49
Grandin	0	24	47	25	47	24	48
Grandin	1	23	48	22	47	24	48
Grandin	1.5	21	48	19	47	22	49
LSD (0.5)		2	6	2	6	2	6

Visual injury ratings were not included because of the confounding effect of excessive rainfall that occurred after application. There were small differences within each variety by difenzoquat rate. Excellent growing conditions for small grains was probably a factor for limited effect and resulted in quick recovery.

Lanceleaf sage control in wheat, Minot. An experiment was conducted to evaluate lanceleaf sage control in wheat. 'Stoa' wheat was seeded in May 15, 1993. Herbicides were applied to 4.5 to 5.5-lf wheat and cotyledon to 8-lf tall (1.5 to 2 inch) lanceleaf sage on June 23, 1993 with 55 F, 75% RH, cloudy sky and no wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	Wheat inj 6/30	Lanceleaf sage 6/30	Lanceleaf sage 7/8	Lanceleaf sage 8/20
	lb/A	%	% control	% control	% control
Bromoxynil	1	0	79	99	84
Bromoxynil + MCPA	0.38	0	99	99	95
Bromoxynil + MCPA	0.64	0	99	99	97
MCPA ioe	0.5	0	81	71	71
2,4-D ioe	0.5	0	57	20	23
Dicamba (SGF)	0.25	8	16	20	28
Dicamba (SGF) + MCPA ioe	0.25 + 0.38	10	60	63	68
Clopyralid + 2,4-D	0.6	0	23	24	76
Clopyralid + 2,4-D	0.3	0	6	33	33
Harmony Extra + 2,4-D ioe	0.3 oz + 0.25	0	63	74	74
Harmony Extra + 2,4-D ioe	0.3 oz + 0.38	0	63	54	59
Express + 2,4-D ioe	0.1 oz + 0.25	0	42	11	28
Express + 2,4-D ioe	0.13 oz + 0.38	0	45	34	30
Express + 2,4-D ioe + Dicamba (SGF)	0.1 oz+0.25+0.25	6	38	30	35
Express + 2,4-D ioe + Dicamba (SGF)	0.13 oz+0.38+0.25	6	36	30	35
Express + 2,4-D ioe + Manzate	0.13 oz+0.38+1.5	0	39	43	33
Harmony Extra + 2,4-D ioe + Manzate	0.3 oz+0.38+1.5	0	63	58	59
Untreated		0	0	0	0
LSD (0.05)		4	20	22	24
CV		155	28	32	33

[a]Bromoxynil + MCPA was applied as Bronate, dicamba was applied as Banvel SGF, clopyralid + 2,4-D was applied as Curtail.

Treatments that gave at least 83% lanceleaf sage control at the final evaluation was bromoxynil or bromoxynil + MCPA. However, MCPA ioe at 0.5 lb/A was one of the most economical treatments that gave at least 70% control. Reduced ratings on some treatments may be due to others flushes that germinated after herbicide application.

Competition experiment in corn, Casselton 1993. 'Interstate 353' corn was seeded May 18. Treatment (spike) was applied to spike- to 2-leaf corn, less than 1.5 inch foxtail, less than 2 inch wild mustard, less the 0.5 inch kochia, and 1- to 3-inch cocklebur on June 7 with 60 F, 100% RH, cloudy sky, and 10- to 20- mph wind. Treatment (grass1-2in) was applied to 3-leaf corn, 1 inch foxtail, 0.5- to 2-inch kochia, cotyledon- to 2-inch wild mustard, and 1- to 2-inch common lambsquarters on June 11 with 85 F, 40% RH, and 15 mph wind. Treatment (grass2-4in) was applied to V-3 corn and 1- to 4-inch foxtail on June 19 with 71 F, 45% RH, 3- to 7-mph wind and cloudy sky. Treatment (grass4-6in) was applied to 6- to 7-leaf corn and 5- to 6-leaf foxtail on June 30 with 70 F, 60% RH, and 3- to 5-mph wind. Bentazon + Scoil at a rate of 0.75 lb + 1.5 pt. was applied June 21 to control broadleaf weeds. Treatment (grass6-10in) was applied to V-4 (8- to 12-inch) corn and 5- to 6-leaf foxtail on July 12 with 70 F, 60% RH, 5 mph wind, and cloudy sky. 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 4 replicates.

Treatment	Rate	7/27 Fxtl
	oz/A	- % -
Pendimethalin+Cyan-DF(spike)	24+32	99
Nicosulfuron+Scoil(grass1-2in)	0.5+1%	92
Nicosulfuron+Scoil(grass2-4in)	0.5+1%	97
Nicosulfuron+Scoil(grass4-6in)	0.5+1%	97
Nicosulfuron+Scoil(grass6-10in)	0.5+1%	90
Weed Free	0	95
Weedy	0	0
C.V. %		3
LSD 5%		3
# OF REPS		4

Summary

The experiment was discontinued because of excess water. All herbicide treatments effectively controlled foxtail. However, both foxtail and corn were stressed from excess moisture.

Total POST weed control in corn, Casselton 1993. 'Interstate 353' corn was seeded May 18. Treatments were applie to 3- to 4-leaf corn, 1- to 3-inch fxtl spp., cotyledon- to 6-leaf wild mustard, 0.5- to 3-inch kochia and common lambsquarters and cotyledon to 6-leaf common cocklebur on June 15 with 70 F, 40% RH, 5- to 10-mph wind and partly cloudy sky. Treatment after the (/) was applied to 8- to 12-inch corn and 5- to 6-leaf foxtail on July 12 with 70 F, 60% RH, 5 mph wind, and cloudy sky. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 3.5 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 replications.

Treatment	Rate	7/27 Fxtl	7/27 Coco	7/27 KOCZ
	oz/A	------	%	-------
Nicosulfuron+Scoil	0.5+0.18G	89	39	96
Nicosulfuron+Scoil	0.25+0.18G	81	53	97
Nicosulfuron+Scoil/Nicosulfuron+Scoil	0.25+0.18G/0.25+0.18G	99	53	99
Nicosulfuron+Atrazine-DF+Scoil	0.25+6+0.18G	99	57	99
Nicosulfuron+Atrazine-DF+Mor-act	0.25+6+0.18G	97	53	99
Nicosulfuron+Atrazine-DF+X-77	0.25+6+0.25%	92	55	82
Nicosulfuron+Atrazine-DF+E-93-N	0.25+6+0.18G	97	55	97
Nicosulfuron+Dicamba-dma+Scoil	0.25+2+0.18G	79	66	97
Nicosulfuron+Dicamba-dma+Mor-act	0.25+2+0.18G	79	81	97
Nicosulfuron+Dicamba-dma+X-77	0.25+2+0.25%	55	50	97
Nicosulfuron+Dicamba-dma+E-93-N	0.25+2+0.18G	59	69	97
Nicosulfuron+2,4-Ddma+Scoil	0.25+4+0.18G	86	70	97
Nicosulfuron+2,4-Ddma+Mor-act	0.25+4+0.18G	80	63	92
Nicosulfuron+2,4-Ddma+X-77	0.25+4+0.25%	43	50	85
Nicosulfuron+2,4-Ddma+E-93-N	0.25+4+0.18G	55	44	89
Nicosulfuron+Bromoxynil+Scoil	0.25+4+0.18G	83	76	80
Nicosulfuron+Bromoxynil+Mor-act	0.25+4+0.18G	71	77	84
Nicosulfuron+Bromoxynil+X-77	0.25+4+0.25%	70	75	92
Nicosulfuron+Bromoxynil+E-93-N	0.25+4+0.18G	65	61	82
Untreated	0	0	0	0
C.V. %		15	28	13
LSD 5%		15	23	16
# OF REPS		4	4	4

Summary

Foxtail (green and yellow) exceeded 90% when nicosulfuron was applied with atrazine at 6 oz/A regardless of adjuvant and as a split application. Common cockelbur control was variable and less than 85% with all treatments. Nicosulfuron control of kochia tended to be reduced by 2,4-D or bromoxynil with certain adjuvants. The experiment was flooded for several weeks which may have confounded the results.

Weed control in corn from PPI herbicides, Casselton. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in corn. 'Interstate 353' corn was seeded May 18, 1993. Treatments were applied on May 17 with 69 F, 38% RH, 50% cloudy sky and 8 to 12 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

		July 12					
Treatment[a]	Rate	Fxtl	Wimu	KOCZ	Rrpw	Colq	Cocb
	lb/A	% control					
EPTC & Diclormid	4	80	33	43	99	73	8
EPTC & Diclormid	5	78	29	43	99	73	5
EPTC & Dichlormid + Acetochlor & Dichlormid	3.35+ 0.6	95	71	50	99	80	38
EPTC & Dichlormid + Acetochlor & Dichlormid	3.35+ 0.8	95	51	70	99	93	20
Acetochlor & Dichlormid	1.8	82	65	79	99	95	38
Acetochlor & Dichlormid + Cyanazine	1.8+1.5	88	94	87	99	97	74
Metolachlor	3	93	25	38	99	71	10
Metolachlor + Cyanazine	3+1.5	96	73	79	99	93	40
Alachlor	3	76	38	48	99	83	23
Alachlor + Cyanazine	3+1.5	76	91	80	99	96	41
Dimethenamid	1.5	92	69	70	99	91	33
Dimethenamid + Cyanazine	1.5+1.5	88	77	85	99	95	48
Flumetsulam & Metolachlor	2.16	89	99	99	99	99	79
Flumetsulam & Metolachlor	2.4	94	99	99	99	99	74
Flumetsulam & Metolachlor + Cyanazine	2.16+1.5	93	99	99	99	99	93
Flumetsulam & Metolachlor + Cyanazine	2.4+1.5	96	99	99	99	99	98
Flumetsulam & Clopyralid + Metolachlor	0.17+2.5	97	96	96	99	97	78
Flumetsulam & Clopyralid + Metolachlor	0.21+2.5	94	99	99	99	99	86
Flumetsulam & Clopyralid + Metolachlor	0.25+2.5	97	99	99	99	99	98
Untreated		0	0	0	0	0	0
C.V.%		13	18	15	0	13	14
LSD 5%		9	13	12	0	9	16

[a]Dichlormid = safener. Acetochlor & Dichlormid is a premix marketed by Zeneca as Surpass (label pending spring of 1994). Flumetsulam & Metolachlor is a premix marketed by DowElanco as Broadstrike + Dual (available spring of 1994).

Foxtail control from EPTC & safener, alachlor and acetochlor was lower than observed in previous years. An excessive amount of rainfall occurred in June. Rainfall may have leached the herbicides below the effective weed germination zone. However, metolachlor gave greater foxtail control than observed in other years of less precipitation. Greater foxtail control from metolachlor in conditions of abundant moisture shows the necessity of abundant moisture for adaquate foxtail control from metolachlor in Valley soils. Dimethenamid gave adaquate foxtail control under abundant moisture conditions. Usually, cyanazine with the choro-acetamide herbicide resulted in greater weed control than the choro-acetamide herbicide alone. Broadleaf weed control (except cocklebur) was adaquate at all flumetsulam rates tested. Only flumetsulam or flumetsulam + clopyralid provided adaquate cocklebur control.

Weed control in corn from PRE herbicides, Casselton. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in corn. 'Interstate 353' corn was seeded May 17, 1993. Treatments were applied on May 19 with 53 F, 50% RH, 50% cloudy sky and 10 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	July 12					
		Fxtl	Wimu	KOCZ	Rrpw	Colq	Cocb
	lb/A	% control					
Metolachlor	3	74	28	25	74	74	10
Metolachlor + Cyanazine	3+1.5	99	35	51	99	99	13
Alachlor	3	99	48	79	99	99	23
Alachlor + Cyanazine	3+1.5	99	99	99	99	99	35
Alachlor + MON-12000 & MON-13900	3+0.1	99	97	98	99	99	28
Acetochlor & Dichlormid	1.2	99	46	70	99	99	34
Acetochlor & Dichlormid	1.8	99	59	77	99	99	20
Acetochlor & Dichlormid	2.2	99	50	87	99	99	16
Acetochlor & Dichlormid + Cyanazine	1.2+1.5	99	92	99	99	99	29
Acetochlor & Dichlormid + Cyanazine	1.8+1.5	99	95	99	99	99	60
Acetochlor & Dichlormid + Dicamba	1.2+0.25	99	53	99	99	99	18
Acetochlor & Dichlormid + Dicamba	1.8+0.25	99	72	93	99	99	35
Acetochlor & MON 4660	1.2	99	48	75	99	99	40
Acetochlor & MON 4660	1.8	99	64	92	99	99	18
Acetochlor & MON 4660 + Cyanazine	1.2+1.5	99	99	97	99	99	24
Acetochlor & MON 4660 + Cyanazine	1.8+1.5	99	93	94	99	99	48
Aceto&MON 4660 + MON12000&MON13900	1.2+0.1	99	99	99	99	99	92
Aceto&MON 4660 + MON12000&MON13900	1.8+0.12	99	99	99	99	99	95
Dimethenamid	1.38	99	50	72	99	99	18
Dimethenamid	1.5	99	60	51	99	99	33
Dimethenamid + Cyanazine	1.38+1.5	99	91	90	99	99	35
Dimethenamid + Cyanazine	1.5+1.5	99	91	92	99	99	36
Flumetsulam & Metolachlor	2.16	99	99	86	99	99	80
Flumetsulam & Metolachlor	2.4	99	99	99	99	99	86
Flumetsulam & Metolachlor + Cyanazine	2.16+1.5	99	99	99	99	99	83
Flumetsulam & Metolachlor + Cyanazine	2.4+1.5	99	99	98	99	99	94
Flumetsulam & Clopyralid + Metolachlor	0.17+2.5	99	99	99	99	99	91
Flumetsulam & Clopyralid + Metolachlor	0.21+2.5	99	99	87	99	99	93
Flumetsulam & Clopyralid + Metolachlor	0.25+2.5	99	99	99	99	99	99
Untreated		0	0	0	0	0	0
C.V.%		9	18	15	9	9	24
LSD 5%		13	20	23	13	13	22

[a]Dichlormid, MON 4660 or MON 13900 = safener. Acetochlor & Dichlormid = premix marketed by Zeneca as Surpass (label pending spring of 1994). Acetochlor & MON 4660 = premix marketed by Monsanto as Harness Plus (label pending spring of 1994). Flumetsulam & Metolachlor = premix marketed by DowElanco as Broadstrike + Dual (available spring of 1994). MON 12000 + MON 13900 = premix by Monsanto (Battalion).

Foxtail control from chloro-acetamid herbicides (except metolachlor) was higher than observed in previous years. An excessive amount of rainfall occurred in June. Rainfall may have distributed the herbicides in the effective weed germination zone. Dimethenamid gave adaquate foxtail control under abundant moisture conditions. Usually, cyanazine with the choro-acetamide herbicide resulted in greater broadleaf weed control than the choro-acetamide herbicide alone. Common cocklebur control was adaquate with treatments containing flumetsulam or MON 12000.

Weed control in corn from POST herbicides, Casselton. An experiment was conducted to evaluate weed control from nicosulfuron with various herbicides and commercial adjuvants. 'Interstate 353' corn was seeded May 17, 1993. The EPOST treatments were applied to V3 corn, 0.5-2.5" fxtl, 0.5-2" rrpw, 1-4" wimu, 0.5-3" KOCZ, 0.5-2" colq, and 1-4" cocb on June 12 with 71 F, 45% RH, 90% cloudy sky and 3 to 7 mph wind. POST treatments were applied to V3-V4 corn, 1-4" fxtl, 1-2" rrpw, 1-5" wimu, 1-3" KOCZ, 1-3" colq, and 1-5" cocb on June 19 with 72 F, 78% RH, partly cloudy sky and 6 mph wind. LPOST treatments were applied June 24. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four reps/treatment.

Treatment[a]	Rate	July 12					Aug 6				
		Fxtl	Wimu	KOCZ	Colq	Cocb	Fxtl	Wimu	KOCZ	Colq	Cocb
	oz/A	% control									
Nico+Dimethenamid+NIS*	0.25+11	94	99	92	87	50	92	99	99	99	47
Nico+Dimethenamid+Scoil*	0.25+11	99	99	99	99	82	99	99	99	99	55
Nico+Dimeth+Dica+NIS*	0.25+11	98	99	99	99	99	97	99	99	99	99
Nico+Dimeth+Dica+Scoil*	0.25+11	99	99	99	99	99	99	99	99	99	99
Flumichlorac + PO (POST)	0.42	48	45	81	99	86	30	99	99	99	70
Flumichlorac + Scoil (POST)	0.42	54	79	69	99	99	48	99	99	99	95
Nico + Flmc + PO (POST)	0.25+0.42	98	99	91	97	84	73	99	99	99	92
Nico + Flmc + PO (POST)	0.25+0.42	96	99	92	97	93	75	99	99	99	87
Nico + Flmc + Scoil (POST)	0.25+0.42	94	99	97	95	70	73	99	99	99	80
Nico + Flmc + Scoil (POST)	0.25+0.63	99	99	97	99	80	78	99	99	99	81
Nico + Atra + Scoil (POST)	0.25+6	99	99	99	99	80	99	99	99	99	70
Nico+Flmc+Atra+Scoil (POST)	0.25+0.42+6	99	99	99	99	94	99	99	99	99	92
Nico + Brmx + Scoil (POST)	0.25+4	86	99	99	99	97	70	99	99	99	90
Nico+Brmx(Gel)+Scoil (POST)	0.25+4	90	99	99	99	98	73	99	99	99	92
Nico+Brmx+Atra+Scoil (POST)	0.25+4+6	99	99	99	99	97	97	99	99	99	96
Nicosulfuron + NIS (POST)	0.25	63	99	50	55	43	63	99	95	94	30
Nico + Preference (POST)	0.25	59	99	47	53	39	68	99	92	89	21
Nicosulfuron + PO (POST)	0.25	79	99	81	77	40	73	99	99	93	28
Nicosulfuron + Scoil (POST)	0.25	97	99	96	94	71	86	99	97	99	38
Nicosulfuron + CL4769 (POST)	0.25	84	99	87	87	33	80	99	99	99	38
Nicosulfuron + CL7769 (POST)	0.25	94	99	92	91	35	85	99	99	99	41
Nicosulfuron + NIS (LPOST)	0.5	48	99	60	71	30	55	99	99	99	19
Nico + Preference (LPOST)	0.5	48	99	53	55	20	54	99	99	99	20
Nicosulfuron + PO (LPOST)	0.5	65	99	82	69	35	68	99	99	99	31
Nicosulfuron + Scoil (LPOST)	0.5	92	99	87	81	60	84	99	99	99	35
Nicosulfuron+CL4769 (LPOST)	0.5	85	99	84	75	53	81	99	99	99	35
Nicosulfuron+CL7769 (LPOST)	0.5	89	99	88	79	62	88	99	99	99	42
Metribuzin+2,4-D dma (POST)	1.5+5.33	54	99	94	99	99	56	99	99	99	92
Metribuzin+2,4-D iso (POST)	1.5+1.5	60	99	99	99	99	55	99	99	99	94
Metribuzin + Dicamba (POST)	1.5+4	70	99	99	98	95	55	99	99	99	96
Metribuzin + Brmx (POST)	1.5+4	69	99	99	99	96	61	99	99	99	95
Metribuzin + Brmx (POSTDIR)	2+4	28	99	99	99	94	71	99	99	99	97
Untreated		0	0	0	0	0	0	0	0	0	0
C.V.%		11	8	10	9	17	9	0	2	3	18
LSD 5%		8	7	8	7	14	8	0	3	4	15

a* = All treatments with dimethenamid applied at EPOST. NIS = X-77 and Preference applied at 0.25% v/v, PO = petroleum oil with 17% emulsifier applied at 1.5 pt/A; Scoil, CL4769, and CL7769 = methylated vegetable oils (MVO) applied at 1.5 pt/A; dma = dimethylamine = Savage; ioe = isooctyl ester = Salvo.

No corn injury and complete redroot pigweed control was observed with all treatments. Formulants in Frontier herbicide (dimethenamid) appear to enhance nicosulfuron activity similar to MVO adjuvants. Flumichlorac provided good to excellent control of wimu, kochia, rrpw, colq, and cocb. No nicosulfuron/Flumichlorac antagonism on weed control was observed. Scoil appeared to enhance Flumichlorac activity on wild mustard and cocklebur control but reduced kochia control at the 7/12/93 evaluation. Excellent control of all broadleaf weeds was observed at the 8/6/93 evaluation. Excess rains and flooding may have impacted weed ratings. Nicosulfuron + atrazine + Scoil was the most efficacous and economical treatment in this study with neglible risk of residue in 1994.

Weed control in corn, Carrington. An experiment was conducted to evaluate weed control in corn from soil and POST applied herbicides. 'AgriPro 082' corn was seeded and Eradicane was applied on May 12, 1993. PRE treatments were applied on May 13 with 63 F. POST treatments were applied to V3 corn, 2-3" fxtl, 1-4" wimu, 2" rrpw, 2" prpw, 3" colq, 1-3" ruth, 2-3" KOCZ, 2" wibw, and 3-4" wipm on June 17 with 61 F, 56% RH, light overcast skies and 14 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for soil applied treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment was a randomized complete block design with four reps/treatment.

		July 28									
Treatment[a]	Rate	Crop Inj	Fxtl	Wimu	Rrpw	Prpw	Colq	Ruth	KOCZ	Wibw	Wipm
	oz/A	% control									
EPTC & Dichlormid (PPI)	4	0	99	63	87	90	98	60	80	80	98
Alachlor (PRE)	2.5	0	90	45	93	68	33	64	58	34	30
Alachlor + Cyanazine (PRE)	2.5+1.5	0	99	96	84	70	68	74	79	70	60
Dimethenamid (PRE)	1.38	0	89	56	73	51	18	60	15	19	33
Dimethenamid (PRE)	1.5	0	94	68	63	60	51	28	35	15	44
Dimethenamid + Cyanazine (PRE)	1.38+1.5	0	96	94	61	56	51	74	36	43	40
Dimethenamid + Cyanazine (PRE)	1.5+1.5	0	95	98	64	51	56	54	51	76	45
Acetochlor & Dichlormid (PRE)	1.2	1.3	91	58	85	59	45	60	28	18	31
Acetochlor & Dichlormid (PRE)	1.8	0	92	97	94	82	56	62	55	51	40
Aceto. & Dichlor + Cyan. (PRE)	1.2+1.5	0	97	89	85	79	54	63	55	54	54
Aceto. & Dichlor + Cyan (PRE)	1.8+1.5	0.8	92	99	90	81	65	75	77	69	63
Acetochlor & MON 4660 (PRE)	1.2	0	86	57	85	45	15	18	38	25	15
Aceto & MON 4660 (PRE)	1.8	0	90	71	87	72	41	46	45	50	30
Aceto & MON 4660 + Cyan (PRE)	1.2+1.5	0	92	95	64	64	36	50	50	54	45
Aceto & MON 4660 + Cyan (PRE)	1.8+1.5	0	95	87	80	68	53	61	49	64	50
Flumetsulam & Metolachlor (PRE)	2.16	5.8	95	99	99	98	85	89	93	69	58
Flumetsulam & Metolachlor (PRE)	2.4	2.0	97	99	99	96	89	92	95	82	80
Flumet&Metol + Cyanazine (PRE)	2.16+1.5	1.3	96	97	99	94	80	85	92	81	71
Flumet&Metol + Cyanazine (PRE)	2.4+1.5	2.0	98	94	99	96	88	97	92	94	86
Flumet&Clopyralid + Metol (PRE)	0.21+2.5	4.0	98	99	99	98	92	94	96	92	64
Flumet&Clopyralid + Metol (PRE)	0.25+2.5	3.8	99	99	99	97	89	97	93	87	80
Nico + Dimethen + Dica (POST)	0.25+11.25	2.5	93	99	99	98	98	98	99	98	95
Nico + Atrazine + Scoil (POST)	0.25+6+1.5pt	0.8	99	99	99	99	91	94	93	85	98
Metribuzin + 2,4-D dma (POST)	1.5+5.33	5.0	65	99	97	95	97	95	76	90	61
Metribuzin + 2,4-D iso (POST)	1.5+1.5	6.3	70	99	99	92	99	98	78	80	68
Untreated		0	0	0	0	0	0	0	0	0	0
C.V.%		15	7	17	18	21	22	23	37	30	40
LSD 5%		2.9	8	12	12	13	9	14	18	15	17

[a]Dichlormid and MON 4660 = safeners. Acetochlor & dichlormid is a premix by Zeneca available as Surpass in spring 1994 (registration pending); acetochlor & MON 4660 is a premix by Monsanto available as Harness Plus in spring of 1994 (registration pending); dma = dimethylamine = Savage; ioe = isooctyl ester = Salvo.

Precipitation occurred soon after application which provided greater herbicide activity from soil applied herbicides than observed in previous years. Grass control was generally excellent from all chloro-acetamid herbicides with or without cyanazine. However, broadleaf control was variable. Flumetsulam generally provided excellent control of all broadleaf weeds. Flumetsulam has no activity on grasses, so the amount of foxtail and wild proso millet control observed resulted from metolachlor. Formulants in Frontier herbicide (dimethenamid) appear to enhance nicosulfuron. Nicosulfuron + atrazine + Scoil is the most efficacous and economical treatment in this study with neglible risk of carryover for crop rotation the following year.

Bentazon + Thifensulfuron in soybeans, Prosper 1993. 'McCall' soybeans were seeded May 17. Treatments were applied to first- to second-trifoliolate soybeans, 2- to 6-inch kochia and wild mustard, 4- to 10-leaf common lambsquarters, 2- to 4-leaf redroot pigweed, and 3 to 4 leaf foxtail on June 18 with 70 F, 35% RH, mostly cloudy sky, and 10 mph wind. Split treatments (/) were applied to second trifoliolate soybeans and 4- to 5-leaf foxtail on June 21 with 85 F, 50% RH, clear sky, and 5- to 7-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. Evaluations were July 3 and August 10.

		7/3					8/10		
Treatment	Rate	Sobe	KOCZ	Colq	Yeft	Rrpw	Fxtl	KOCZ	Colq
	oz/A				%				
Bent+Thif+28N+X-77/Seth(plus)+DASH-HC	12+.03+2.5%+.25%/2.25+.06G	38	95	99	94	92	85	74	81
Bent+Thif+28N+X-77/Seth(plus)	12+.03+2.5%+.25%/2.9	44	93	97	99	92	87	68	71
Bent+Thif+Seth(plus)+DASH-HC	12+.025+2.25+.06G	34	88	88	94	84	84	71	70
Bent+Thif+Seth(plus)+DASH-HC+28N	12+.025+2.25+.06G+2.5%	33	87	88	89	81	71	74	75
Bentazon+Thif/Seth(plus)+DASH-HC	12+.032/2.25+.06G	16	68	80	98	95	94	45	56
Bentazon+Thif/Seth(plus)+DASH-HC+28N	12+.032/2.25+0.6G+2.5%	20	55	70	99	90	97	35	49
Bentazon+Thif+Sethoxydim(plus)	12+.025+3	55	92	96	95	95	71	75	78
Bentazon+Thif+Sethoxydim(plus)+28N	12+.025+3+2.5%	62	99	98	93	98	46	86	94
Bentazon+Thif/Sethoxydim(plus)	12+.032/3	15	55	82	99	93	97	31	43
Bentazon+Thif/Sethoxydim(plus)+28N	12+.032/3+2.5%	16	73	84	99	89	98	34	45
Untreated	0	0	0	0	0	0	0	0	0
C.V.%		24	11	8	4	8	12	15	20
LSD 5%		10	11	10	5	9	13	12	18
# OF REPS		4	4	4	4	4	4	4	4

Summary

Bentazon + thifensulfuron injured soybeans severly when applied with the sethoxydim Plus formulation with or without 28% liquid nitrogen fertilizer. The addition of DASH-HC adjuvant to the bentazon + thifensulfuron + sethoxydim Plus reduced injury to soybeans. Soybeans recovered from injury before the second evaluation. Sethoxydim phytotoxicity to foxtail was antagonized by bentazon + thifensulfuron regardless of adjuvants, but was greatest in the presence of 28% liquid nitrogen fertilizer. Bentazon + thifensulfuron applied without a surfactant gave less than 60% kochia or common lambsquarters control. The greatest kochia and common lambsquarters control from bentazon + thifensulfuron occurred when applied with sethoxydim Plus + 28% liquiud nitrogen fertilizer. This treatment was the most antagonistic to foxtail control.

Imazethapyr with adjuvants in soybeans, Casselton 1993. 'McCall' soybeans were seeded May 17. Treatments were applied to 1st trifoliolate soybeans, 2- to 3-leaf foxtail, cotyledon- to 6-leaf wild mustard and coclebur, 0.5- to 3-inch kochia and common lambsquarters, and 0.5- to 1-inch redroot pigweed on June 15 with 70 F, 40% RH, partly cloudy sky, and 15 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. Weed densities wer foxtail 50/ft^2, wild mustard 1/ft^2, common cockelbur were small and may have emerged after treatment.

		7/12				8/10			
Treatment	Rate	Fxtl	Wimu	Colq	Cocb	Fxtl	Wimu	Colq	Cocb
	oz/A	%							
Imep+Sun-itII	0.3+.18G	86	97	83	81	87	91	47	79
Imep+Sun-itII+28N	0.3+.18G+2%	86	99	86	84	88	92	69	81
Imep+X-77	0.3+.25%	60	91	69	63	76	85	45	48
Imep+X-77+28N	0.3+.25%+2%	79	95	85	81	86	89	64	68
Imep+Preference	0.3+.25%	76	93	78	71	78	66	30	50
Imep+Preference+28N	0.3+.25%+2%	85	96	83	84	88	92	65	76
Imep+Li-700	0.3+.25%	65	90	71	64	75	82	42	54
Imep+Li-700+28N	0.3+.25%+2%	84	98	85	84	89	93	40	82
Imep+SilwetL-77	0.3+.25%	70	96	80	76	80	92	37	53
Imep+SilwetL-77+28N	0.3+.25%+2%	79	94	71	75	82	85	55	70
Imep+Scoil	0.3+.18G	84	96	85	82	93	94	76	87
Imep+Scoil+28N	0.3+.18G+2%	93	97	92	93	93	92	67	80
Imep+Mor-act	0.3+.25G	85	97	86	85	90	94	71	80
Imep+Mor-act+28N	0.3+.25G+2%	90	99	88	88	91	90	67	75
Imep+Vegoil(15AT-SF)	0.3+.25G	89	98	86	85	90	90	60	76
Imep+Vegoil+28N	0.3+.25G+2%	88	97	89	86	91	95	65	79
Imep+E-93-N	0.3+1%	81	97	81	76	85	93	23	57
Imep+SprayboosterS	0.3+.25%	78	91	79	64	86	94	56	59
Imep+SprayboosterS+28N	0.3+.25%+2%	78	97	81	74	90	91	63	81
Imep+Activator-90	0.3+.25%	78	94	76	71	85	90	38	51
Imep+Activator-90+28N	0.3+.25%+2%	80	93	80	70	88	94	67	64
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		9	5	11	13	5	12	25	17
LSD 5%		10	6	12	14	6	14	21	15
# OF REPS		4	4	4	4	4	3	4	4

Summary

Environmental conditions were extremely wet which may have reduced the response to various adjuvants. In general the oil adjuvants were more effective than the surfactants and the inclusion of 28% N with oils did not increase imazethapyr phytotoxicity to weeds. However, 28% N with surfactants generally enhanced phytotoxicity. None of the treatments injured soybean (data not included).

Soluble Boron plus acifluorfen and bentazon in soybeans, Prosper 1993. 'McCall' soybeans were seeded May 17. The foxtail infestation was sparse so no herbicides were applied for grass weed control. Treatments were applied to first to second trifoliolate soybeans, 2- to 6-inch kochia, 4-to 6-leaf wild mustard, 4- to 10-leaf common lambsquarters, 2- to 4-leaf redroot pigweed, 3- to 4-leaf foxtail on June 18 with 70 F, 35% RH, mostly cloudy sky, and 10 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 4 replicates. Evaluations were on June 22 and August 10.

Treatment	Rate	6/22			8/10		
		Sobe	KOCZ	Fxtl	Fxtl	KOCZ	Colq
	oz/A	%					
Bentazon&Acif+28N	15+2.5%	14	40	19	0	70	96
Bentazon&Acif+Mor-act	15+0.25G	16	73	26	0	94	99
Bentazon&Acif+28N+Mor-act	15+2.5%+0.25G	40	86	26	0	92	98
Bentazon&Acif+Boron	15+4	10	44	21	0	77	92
Bentazon&Acif+Boron+28N	15+4+2.5%	18	48	24	0	82	92
Bentazon&Acif+Boron+Mor-act	15+4+0.25G	20	75	31	0	89	96
Bent&Acif+Boron+28N+Mor-act	15+4+.25%+0.25G	26	75	28	0	91	99
Seth(plus)+Bent&Acif+28N	3+15+2.5%	46	93	85	81	48	65
Seth(plus)+Bent&Acif+Boron	3+15+4	40	85	89	82	53	65
Seth(plus)+Bent&Acif+Boron+28N	3+15+4+2.5%	56	95	91	80	50	63
Bentazon&Acifluorfen+ExpS3	15+1%	20	56	21	25	72	90
Bentazon&Acifluorfen+E-93-N	15+1%	16	55	25	38	89	96
Untreated	0	0	0	0	0	0	0
C.V. %		18	12	16	17	14	6
LSD 5%		6	11	9	8	21	10
# OF REPS		4	4	4	2	2	2

Summary

Boron only reduced bentazon + acifluorfen toxicity to soybeans when applied with Mor-act + 28% liquid nitrogen fertilizer. Bentazon + acifluorfen were most injurious to soybeans when applied with sethoxydim formulated with an adjuvant. Soybeans recovered from injury within several weeks after treatment. Early kochia control ratings did not relate to late season ratings. Treatments giving good early kochia control usually gave poor late season control. Early ratings probably reflect contact injury preventing translocation and plant death. Further, the treatments giving early contact injury to kochia also were most injurious to soybeans. Thus, injury to soybeans does not necessarily indicate effective weed control, but could indicate ineffective control. Two replicates were only evaluated for late season weed control because of late season foxtial emergence which dominated the area.

<u>Weed control in soybean from PPI herbicides, Casselton</u>. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in soybean. 'McCall' corn was seeded May 17, 1993. Treatments were applied on May 17 with 68 F, 38% RH, 50% cloudy sky and 6 to 11 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

		Aug 6					
Treatment[a]	Rate	Fxtl	Wimu	KOCZ	Rrpw	Colq	Cocb
	lb/A	% control					
Trifluralin	0.75	86	53	74	95	92	20
Alachlor	3	70	43	58	89	80	20
Metolachlor	3	78	50	55	91	74	23
Dimethenamid	1.38	74	64	38	95	81	20
Dimethenamid	1.5	93	73	50	95	76	24
F-6285	0.38	65	74	99	99	99	77
F-6285 + Trifluralin	0.75	86	77	97	98	97	92
Flumetsulam & Trifluralin	0.69	92	99	99	99	99	86
Flumetsulam & Trifluralin	0.8	95	99	99	99	99	99
Flumetsulam & Trifluralin	0.91	95	99	99	99	99	99
Flumetsulam & Metolachlor	1.92	55	99	99	99	99	68
Flumetsulam & Metolachlor	2.16	68	99	99	99	99	73
Flumetsulam & Metolachlor	2.4	74	99	99	99	99	79
Untreated		0	0	0	0	0	0
C.V.%		7	18	9	3	7	21
LSD 5%		7	15	9	4	9	19

[a]Flumetsulam & trifluralin is a premix marketed by DowElanco as Broadstrike + Treflan. Flumetsulam & metolachlor is a premix marketed by DowElanco as Broadstrike + Dual.

No crop injury was observed with any treatments. An excessive amount of rainfall occurred in June. Rainfall may have leached some herbicides below the effective weed germination zone. Dimethenamid gave adaquate foxtail control under abundant moisture conditions and gave equal or greater foxtail and broadleaf control than alachlor or metolachlor. Except for wild mustard, F-6285 gave excellent broadleaf weed control. Trifluralin increased foxtail and common cocklebur control with F-6285 and gave excellent control of all weeds. Flumetsulam has no activity on grasses so the grass control observed results from the grass tank-mix pardner. Flumetsulam & trifluralin gave greater common cocklebur control than flumetsulam & metolachlor. Only flumetsulam or F-6285 plus trifluralin provided adaquate cocklebur control.

Weed control in soybean from PRE herbicides, Casselton. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in soybean. 'McCall' corn was seeded May 17, 1993. Treatments were applied on May 19 with 53 F, 50% RH, 50% cloudy sky and 10 to 20 mph wind. Treatments were applied with a shield to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	Aug 6						
		Fxtl	Wimu	KOCZ	Rrpw	Colq	Cocb	Fibw
	lb/A	% control						
Alachlor	3	99	76	79	94	93	13	0
Metolachlor	3	84	65	56	91	83	23	0
Dimethenamid	1.38	93	68	56	95	79	28	0
Dimethenamid	1.5	99	78	68	97	83	31	0
Acetochlor + Dichlormid	1.2	99	88	86	99	97	48	0
Acetochlor + Dichlormid	1.8	99	88	93	99	98	60	0
F-6285	0.38	91	99	99	99	99	99	93
F-6285 + Trifluralin	0.38+0.75	98	99	99	99	99	99	93
Flumetsulam & Metolachlor	1.92	83	99	99	99	99	99	40
Flumetsulam & Metolachlor	2.16	94	99	99	99	99	99	54
Flumetsulam & Metolachlor	2.4	99	99	99	99	99	99	78
Untreated		0	0	0	0	0	0	0
C.V.%		3	6	5	1	4	12	19
LSD 5%		4	7	5	2	5	10	8

[a] Flumetsulam + metolachlor is a premix marketed by DowElanco as Broadstrike + Dual (available spring of 1994).

No crop injury was observed with any treatments. An excessive amount of rainfall occurred in June. Weed control was greater than observed in years with less precipitation. Possibly the rainfall moved the herbicides into the effective weed germination zone. Except metolachlor, all chloro-acetamide herbicides gave excellent foxtail control and labeled weeds. F-6285 gave excellent control of all weeds including field bindweed. Flumetsulam gave excellent control of all weeds and suppression of field bindweed. Flumetsulam has no activity on grasses so the grass control observed results from the grass tank-mix pardner.

Weed control in soybean from POST herbicides, Casselton. An experiment was conducted to evaluate weed control from imazethapyr with adjuvants and tank-mix combinations in soybean. 'McCall' soybean was seeded May 17, 1993. POST treatments were applied to V1 soybean, 0.5-4" fxtl, 0.5-3" KOCZ, 0.5-2" colq, 0.5-2" rrpw, 1-5" wimu, and 1-5" cocb on June 18 with 71 F, 55% RH, 100% cloudy sky and 3 to 5 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

		August 6						
Treatment[a]	Rate	Inj	Fxtl	Wimu	KOCZ	Rrpw	Colq	Cocb
	oz/A	% control						
Imazethapyr + NIS	0.5	0	85	99	99	99	68	74
Imazethapyr + Preference	0.5	0	81	99	99	99	59	62
Imazethapyr + PO	0.5	0	90	99	99	99	80	82
Imazethapyr + Sun-It II	0.5	0	96	99	99	99	90	95
Imazethapyr + CL4769	0.5	0	92	99	99	99	90	91
Imazethapyr + CL7769	0.5	0	93	99	99	99	92	91
Imazethapyr + NIS	1	0	64	99	99	99	50	69
Imazethapyr + Preference	1	0	64	99	99	99	51	65
Imazethapyr + PO	1	1	71	99	99	99	65	68
Imazethapyr + Sun-It II	1	0	80	99	99	99	80	75
Imazethapyr + CL4769	1	0	76	99	99	99	81	80
Imazethapyr + CL7769	1	0	78	99	99	99	83	83
Imazethapyr + Lactofen + NIS + UAN	0.5+1	4	73	99	99	99	60	88
Imazethapyr + Lactofen + NIS + UAN	0.5+1.5	5	81	99	99	99	75	85
Imazethapyr + Lactofen + NIS + UAN	0.5+2	7	81	99	99	99	81	86
Imazethapyr + Lactofen + Sun-It II + UAN	0.5+1+0.5qt	7	94	99	99	99	89	94
Imazethapyr + Lactofen + Sun-It II + UAN	0.5+1.5+0.5qt	7	96	99	99	99	89	94
Imazethapyr + Lactofen + Sun-It II + UAN	0.5+2+0.5 qt	4	95	99	99	99	93	95
Flumichlorac + PO + UAN	0.42	5	5	55	99	99	99	91
Flumichlorac + Sun-It II + UAN	0.42	8	38	79	99	99	99	92
Imazethapyr + Flumichlorac + PO + UAN	0.5+0.42	7	92	99	99	99	96	94
Imazethapyr + Flumic + Sun-It II + UAN	0.5+0.42	13	96	99	99	99	98	98
Untreated		0	0	0	0	0	0	0
CV		16	6	4	0	0	8	7
LSD (0.05)		3	6	6	0	0	9	9

[a]NIS and Preference was applied at 0.25% v/v, PO was applied at 1 qt/A; Sun-It II, CL4769, CL7769 are methylated vegetable oil (MVO) adjuvants and were applied at 1 qt/A, UAN 28% was applied at 2 qt/A.

All treatments gave complete control of wild mustard, kochia, and redroot pigweeed. Adjuvant enhancement of imazethapyr was MVO>PO>NIS. Sun-It II enhanced imazethapyr control of foxtail, common lambsquarters and common cocklebur control over NIS. Sun-It II enhanced flumichlorac control of wild mustard over PO. Imazethapyr plus flumichlorac provided excellent control of all weeds present in study.

Weed control in soybean, Mooreton, ND. An experiment was conducted to evaluate weed control from PPI, PRE and POST herbicides in soybean. 'Dawson' soybean was seeded May 13, 1993. PPI and PRE treatments were applied with shield on May 13, 1993 with 86 F, 67% RH, parly cloudy sky and 10-15 mph wind. PPI treatments were incorporated with a roto-tiller at a depth of 2 inches. POST treatments were applied with shield to unifoliate to V1 soybean, 1-4" rrpw, 1-3" colq, and 4" wheat and barley on June 15 with 68 F, 35% RH, 30% cloudy sky and 5 to 10 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI and PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	July 26 Inj	July 26 Vol Grains	July 26 Rrpw
	oz/A	% control		
Alachlor (PPI)	3 lb	0	95	98
Metolachlor (PPI)	3 lb	0	97	75
Dimethenamid (PPI)	1.38 lb	9	90	87
Dimethenamid (PPI)	1.5 lb	13	93	95
Flumetsulam + Trifluralin (PPI)	0.69 lb	5	70	99
Flumetsulam + Trifluralin (PPI)	0.91 lb	4	85	99
Flumetsulam + Metolachlor (PPI)	1.92 lb	3	81	99
Flumetsulam + Metolachlor (PPI)	2.4 lb	0	92	99
Alachlor (PRE)	3 lb	0	23	99
Metolachlor (PRE)	3 lb	0	0	80
Dimethenamid (PRE)	1.38 lb	0	41	97
Dimethenamid (PRE)	1.5 lb	0	49	99
Acetochlor + Dichlormid (PRE)	1.2 lb	0	83	99
Acetochlor + Dichlormid (PRE)	1.8 lb	0	85	99
Flumetsulam + Metolachlor (PRE)	1.92 lb	0	21	99
Flumetsulam + Metolachlor (PRE)	2.4 lb	0	29	99
Imazethapyr + NIS	0.5	0	73	99
Imazethapyr + PO	0.5	0	99	99
Imazethapyr + Sun-It II	0.5	0	99	99
Imazethapyr + Lactofen + Sun-It II	0.5+1	21	99	99
Imazethapyr + Lactofen + Sun-It II	0.5+2	28	99	99
Imazethapyr + Flumichlorac + Sun-It II	0.5+0.42	12	99	99
Clethodim + Imazethapyr + Scoil	1+0.5	8	99	99
Clethodim + Imazethapyr + Scoil	1.5+0.5	0	99	99
Clethodim + Imazethapyr + Scoil	2+0.5	3	99	99
Fusion + Imazethapyr + Scoil	2.66+0.5	0	99	99
Fusion + Galaxy + Scoil	2.66+14.7	31	99	99
Fusion + Thifensulfuron + Scoil	2.66+0.64	13	99	99
Fusion + Fomesafen + Scoil	2.66+2	17	99	99
Untreated		0	0	0
LSD (0.05)		9	5	6
CV		31	10	11

[a]NIS was applied at 0.25% v/v, PO, Sun-It II, and Scoil were applied at 1.5 pt/A.

An excessivie amount of rainfall occurred after application which affected crop injury ratings. Chloro-acetamide herbicides applied PPI provided adaquate control of wheat and barley. Acetochlor appplied PRE provided at least 85% wheat and barley control. With the exception of metolachlor, most all treatments gave adaquate control of redroot pigweed.

Weed control in dry bean, Minto, ND. An experiment was conducted to evaluate weed control from PPI, PRE and POST herbicides in Pinto type dry edible bean. 'Othello' dry bean was seeded May 5, 1993. PPI and PRE treatments were applied May 5, 1993 with 79 F, 42% RH, parly cloudy sky and 1 mph wind. PPI treatments were incorporated with a roto-tiller at a depth of 2 inches. POST treatments were applied to unifoliate to V2 dry bean, 0.5-2.5" fxtl, 2" to bolt wimu, 0.5-3" rrpw, 1-3" prpw, 0.5-3" colq, 1-5" wibw, 1-3" coma, 1-4" pesw, 0.5-3" seedling Cath, 2-4" seedling pest, 1-5" KOCZ, 1-6" biennial wormwood, rosette-bolt fipc, 0.5-1" spsp, 0.5"tall to 3" rosette shpu, 1-1.5" girw, 2-4" mael, 1-3" nfcf, rosette dock and 1-3" swcl on June 18 with 71 F, 55% RH, 100% cloudy sky and 3 to 5 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI and PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	July 26					
		Fxtl	Wimu	Rrpw	Colq	Wibw	Coma
	oz/A	% control					
Alachlor (PPI)	3 lb	94	37	99	94	38	0
Metolachlor (PPI)	3 lb	92	57	98	96	18	0
Dimethenamid (PPI)	1.38 lb	99	30	99	99	58	0
Dimethenamid (PPI)	1.5 lb	99	66	99	99	61	0
Flumetsulam + Trifluralin (PPI)	0.69 lb	99	99	99	99	99	99
Flumetsulam + Trifluralin (PPI)	0.91 lb	99	99	99	99	99	99
Flumetsulam + Metolachlor (PPI)	1.92 lb	99	99	99	99	75	99
Flumetsulam + Metolachlor (PPI)	2.4 lb	99	99	99	99	83	99
Alachlor (PRE)	3 lb	55	0	32	23	0	0
Metolachlor (PRE)	3 lb	61	0	18	13	0	0
Dimethenamid (PRE)	1.38 lb	49	0	50	0	0	0
Dimethenamid (PRE)	1.5 lb	61	0	81	10	0	0
Acetochlor + Dichlormid (PRE)	1.2 lb	78	0	79	61	29	0
Acetochlor + Dichlormid (PRE)	1.8 lb	81	0	86	85	51	0
Flumetsulam + Metolachlor (PRE)	1.92 lb	86	96	97	99	56	51
Flumetsulam + Metolachlor (PRE)	2.4 lb	84	99	98	96	56	63
Imazethapyr + NIS	0.5	74	86	81	50	46	0
Imazethapyr + PO	0.5	86	96	97	76	44	0
Imazethapyr + Sun-It II	0.5	89	99	99	84	70	0
Imazethapyr + Lactofen + Sun-It II	0.5+1	90	99	99	86	80	45
Imazethapyr + Lactofen + Sun-It II	0.5+2	96	99	99	86	91	48
Imazethapyr + Flumichlorac + Sun-It II	0.5+0.42	97	98	99	97	95	99
Clethodim + Imazethapyr + Scoil	1+0.5	86	99	94	75	75	0
Clethodim + Imazethapyr + Scoil	1.5+0.5	83	99	94	86	78	0
Clethodim + Imazethapyr + Scoil	2+0.5	86	99	94	70	78	0
Fusion + Imazethapyr + Scoil	2.66+0.5	86	99	97	80	78	0
Fusion + Galaxy + Scoil	2.66+14.7	91	99	87	89	40	0
Fusion + Thifensulfuron + Scoil	2.66+0.64	83	99	99	85	81	0
Fusion + Fomesafen + Scoil	2.66+2	99	99	99	88	80	75
Untreated		0	0	0	0	0	0
LSD (0.05)		9	14	8	8	8	5
CV		16	24	15	16	15	14

[a]NIS was applied at 0.25% v/v, PO, Sun-It II, and Scoil were applied at 1.5 pt/A.

The following weeds were noted in PPI and PRE plots of alachlor, metolachlor and dimethenamide: KOCZ, coma, mael, pesw, fipc, coma, biww, swcl, nfcf, prpw, cath, pest, cocb. The following weeds were noted in PPI and PRE plots of acetochlor: swcl, fipc, cocb, coma, cath, biww, pest. Flumetsulam + trifluralin gave complete control of all weeds. Variable common cocklebur control was attributed to flushes emerging after POST herbicides were applied. Most POST treatments controlled pesw, seedling cath and pest, biww, fipc, spsp, shpu, girw, mael, and dock.

Weed control in Flax, Fargo 1993. 'Omega' flax was seeded May 5. Treatments were applied to 4-inch flax, 2- to 8-leaf wild mustard, 2- to 3-lead foxtail spp, 2-inch common lambsquarters, 1- to 4-leaf redroot pigweed, 3-inch wild buckwheat, and 0.5- to 4-inch kochia on June 10 with 80 F, 70% RH, clear sky, and 10 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 4 replicates. Evaluation was on June 21 and harvest for yield October 6. Weed densities were foxtail 10/ft^2, wild mustard 1- to 10-/yd^2, kochia 1/ft; colq 3/ft^2.

		6/21					10/6
Treatment	Rate	Flax inj	Fxtl	Wimu	KOCZ	Colq	Flax yield
	oz/A	%					bu/A
MCPA-ioe+Seth+Scoil	4+3+0.18G	14	99	91	16	99	3.1
Brox&MCPA+Seth+Scoil	8+3+0.18G	23	98	98	92	99	8.3
Brox+Seth+Scoil	4+3+0.18G	19	99	93	89	97	6.3
MCPA-dma+Thif+Seth+Scoil	4+0.06+3+0.18G	66	97	99	99	99	6.6
MCPA-ioe+Thif+Seth+Scoil	4+0.06+3+0.18G	69	99	99	99	99	6.4
Brox+Thif+Seth+Scoil	4+0.06+3+0.18G	75	99	99	99	99	3.8
Seth+Scoil	3+0.18G	0	92	9	3	0	1.7
MCPA-dma+Thif+Scoil	4+0.06+0.18G	78	5	99	99	99	1.6
MCPA-ioe+Thif+Scoil	4+0.06+0.18G	74	15	99	99	99	3.4
Bent+MCPA-dma+Seth+Scoil	8+4+3+0.18G	31	99	98	79	99	5.9
Untreated	0	0	0	0	0	0	.7
C.V. %		23	11	8	7	2	66.0
LSD 5%		14	11	9	8	2	4.1
# OF REPS		4	4	4	4	4	4

Summary

All herbicide treatments were injurious to flax, probably because of the moist warm environment at treatment. Excellent wild mustard, kochia, and common lambsquarters control occurred when thifensulfuron was applied with MCPA and bromoxynil. However, thifensulfuron severely injured flax. The flax recovered from injury and yield was similar to that of flax treated with bromoxynil and MCPA plus sethoxydim which also gave effective weed control. The thifensulfuron treated flax was delayed in maturity by several weeks. Plots with excessive weeds were not harvested accounting for the high coefficient of variability. Injury to flax from thifensulfuron was similar when applied with or without sethoxydim. The severe injury from thifensulfuron probably occurred because of the wet conditions as such injury had not occurred in past 3 years with experiments at many locations.

<u>Sunflower response to nicosulfuron residue, Grand Forks</u>. An experiment was conducted to determine response of sunflower planted in 1993 in soil treated with nicosulfuron in 1992. Nicosulfuron was applied to V3 to V5 corn on July 16, 1992. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. 'Interstate 3311' sunflower was seeded May 26, 1993 in the same plots previously treated with nicosulfuron. The experiment was a randomized complete block design with four replicates/treatment. The randomization was forced to allow for convenience in seeding half of the study with potato and the other half with sunflower.

Treatment	Rate	Sunflower seed weight (g)
	oz/A	Average of 10 heads
Nicosulfuron + NIS	0.5 + 0.25%	41
Nicosulfuron + NIS	1 + 0.25%	33
Untreated		36
LSD (0.05)		NS
CV		133

Visual injury ratings were not included because of the confounding effect of excessive rainfall and poor stand due to variability in the planter. When visual evaluation was taken (July 14, 1993) there were no symptoms of stunting, yellowing, termination of the main growing point or any other negative expression that would have been developed as a result of exposure to nicosulfuron residues in the soil. In addition, there were no apparent differences in plant height or evidences of stand loss that could not be explained by excessive moisture or planter problems (no dead sunflower carcasses). Yield was taken by harvesting 10 sunflower heads per plot, drying the heads for 5 days, threshing and weighing the seed. Approximately, 40% of the study was negatively affected by excess rainfall. Heads from sunflower that were affected were visable smaller than those from plants not effected by rainfall. It is the opinion of the authors that negative effects on sunflower did not result from nicosulfuron residue and the large varibility was due to excessive rainfall.

Effect of imazethapyr on establishing alfalfa. An experiment was conducted to evaluate weed control and effect of imazethapyr on alfalfa establishment. 'Vernal' alfalfa was seeded at 10 lb/A on April 29, 1992 and and at 12 lb/A on April 23, 1993. POST herbicides were applied on May 27, 1992 to 0.5-2 inch alfalfa with 69 F, 58% RH, partly cloudy sky and 3 mph wind and on May 20, 1993 to 0.5-2 inch (late unifoliate to 1st trifoliate) alfalfa with 66 F, 60% RH, partly cloudy sky and 8 mph wind. Treatments were applied to the center 16 ft of 20 by 30 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.

Table 1. Forage yield of Vernal alfalfa and weeds treated with imazethapyr, Fargo, 1992.

Treatment*	Rate	Total forage yield			Alfalfa yield			Alfalfa density	Weeds 7-24
		7-24	9-4	Total	7-24	9-4	Total		
	oz/A	tons DM/A						Pls/ft²	%
Imazethapyr	0.5	1.51	1.41	2.92	1.47	1.41	2.88	35	3
Imazethapyr	0.75	1.50	1.46	2.96	1.50	1.46	2.96	31	0
Imazethapyr	1	1.38	1.42	2.80	1.36	1.42	2.78	35	1
Imep+Brox	0.5+3	1.27	1.33	2.60	1.24	1.33	2.57	34	3
Imep+Seth	0.5+1.28	1.50	1.53	3.03	1.46	1.54	3.00	35	3
Untreated		1.78	1.28	3.06	1.29	1.28	2.57	35	28
LSD (0.05)		0.25	0.16	0.31	0.21	0.16	0.30	NS	7

*All herbicide treatments contained Sun-It II and 28% UAN applied at 1.5 pt/A and 1 qt/A, respectively.

Table 2. Forage yield of Vernal alfalfa and weeds treated with imazethapyr, Fargo, 1993.

Treatment*	Rate	Total forage yield			Alfalfa density
		7-27	8-27	Total	
	oz/A	tons DM/A			Plants/ft²
Imazethapyr	0.5	1.57	0.98	2.55	43
Imazethapyr	0.75	1.62	0.93	2.55	41
Imazethapyr	1	1.58	0.95	2.53	44
Imep+Brox	0.5+3	1.64	1.02	2.66	39
Imep+Seth	0.5+1.28	1.64	1.06	2.70	42
Untreated		2.21	0.83	3.04	42
LSD (0.05)		0.15	0.09	0.17	NS

*All herbicide treatments contained Sun-It II and 28% UAN applied at 1.5 pt/A and 1 qt/A, respectively.

All treatments gave greater than 97% control of green foxtail, yellow foxtail, waterpod, field pennycress, sheperd's-purse, redroot pigweed, prostrate pigweed, kochia, wild mustard, curly dock, common mallow, common sunflower, common ragweed, perennial sowthistle, common lambsquarters, common purslane, and prickly lettuce. All treatments gave poor control of Canada thistle, field bindweed and had little activity on common milkweed. No crop injury was observed at evaluation. Imazethapyr applied alone had little effect on establishing alfalfa. Imazethapyr plus bromoxynil had lower harvest measurments in 1992 but not in 1993, probably due to the cooler weather in 1993. Plots that received treatments of imazethapyr plus sethoxydim usually had greater forage yield. More biomass was harvested in the untreated plots than treated plots at the first harvest but treated plots had greater biomass than untreated plots at the second harvest. This was due to heavy weed infestations in the untreated area and the limited weed regrowth after the first cutting. Alfalfa stand was similar with all treatments.

Control of established alfalfa, Fargo. An experiment was conducted to evaluate alfalfa control from normally recommended herbicides. 'Vernal' alfalfa was seeded April 29, 1992. Herbicides were applied to 8 inch tall alflafa on May 11, 1993 with 78 F, 61% RH, partly cloudy sky and 5 to 7 mph wind. Treatments were applied to an 16 ft wide area the length of 20 by 20 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	Alfalfa control 6/2	6/21	8/31
	lb/A	% control		
Glyphosate + NIS + AMS	0.75	63	68	48
2,4-D ioe	1	81	96	64
2,4-D ioe	2	88	98	84
Glyphosate + 2,4-D[b] + AMS	1	88	95	68
Dicamba	0.25	55	79	11
Dicamba + Glyphosate[c] + AMS	0.65	83	92	39
Clopyralid + 2,4-D[d]	1.2	80	98	94
Untreated		0	0	0
LSD (0.05)		10	8	11
CV		11	7	13

[a]NIS was applied at 0.25% v/v. [b]Applied in the premix form of Landmaster BW at the equivalent rate of 54 fl oz/A. [c]Applied in the premix form of Fallow Master at the equivalent rate of 3.25 pt/A. [d]Applied in the premix form of Curtail at the equivalent rate of 4 pt/A.

Treatments that gave at least 80% control in the 6/2 evaluation provided 90% or greater alfalfa control at the 6/21 evaluation. However, at the 8/31 evaluation 2,4-D at 2 lb/A and Curtail provided 84% control or greater.

Surfactants and salts with Roundup, Fargo, 1993. 'Newdak' oat, 'McCall' soybeans, and 'Siberian' foxtail millet were seeded in adjacent strips May 11. Treatments were applied to 5- to 6-leaf oats, 1st trifoliolate soybeans, and 4-leaf foxtail millet on June 19 with 65 F, 50% RH, cloudy sky, and 5 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. Fargo city water was used as the spray carrier. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/26			7/20	
		Oats	Sobe	Mill	Oat	Sobe
	oz/A	%				
Roundup	1	50	36	85	43	43
Roundup+X-77	1+0.5%	63	51	85	67	63
Roundup+R-11	1+0.5%	84	49	87	89	70
Roundup+Preference	1+0.5%	79	54	93	84	66
Roundup+Li-700	1+0.5%	74	48	87	80	55
Roundup+Kinetic	1+0.5%	68	33	87	66	40
Roundup+SilwetL-77	1+0.5%	63	26	87	63	43
Roundup+SprayBoosterS(Cenex)	1+0.5%	68	43	91	74	69
Roundup+Activator90	1+0.5%	80	51	88	85	68
Roundup+AD-100(Riverside)	1+0.5%	80	43	88	86	66
Roundup+Active-it	1+0.5%	69	50	80	74	68
Roundup+Amway	1+0.5%	78	49	88	87	75
Roundup+Wet-sol99	1+0.5%	81	50	86	86	56
Roundup+Agra-Wet	1+0.5%	59	49	87	62	70
Roundup+Cayuse+R-11	1+0.5%+0.5%	91	59	92	94	72
Roundup+CenexSAS	1+2%	94	54	97	96	74
Roundup+Dispatch	1+2%	88	50	94	91	79
Roundup+ExpS3	1+2%	97	66	99	97	81
Roundup+E93-G1	1+2%	97	65	99	98	84
Roundup+ChemPro 6000	1+5%	86	53	97	90	67
Roundup+Purity 100	1+0.5%	83	50	91	89	70
Roundup+EOP	1+0.5%	49	38	79	43	41
C.V. %		11	17	6	14	19
LSD 5%		12	12	7	16	18
# OF REPS		4	4	4	4	4

Summary

Soil moisture was excessive at treatment and plant growth generally good. Conditions were positive for glyphosate as foxtail millet control was complete and not evaluated at the second rating. All adjuvants enhanced oats control from glyphosate (Roundup), except EOP which was an oil type adjuvant unintentionally included in the treatments. Oil adjuvants are known to reduce glyphosate phytotoxicity. Roundup control of oats varied from 60 to 90% depending upon the adjuvant. Adjuvants most effective with glyphosate for oats control were also most effective for soybean control.

Surfactants and salts with Roundup, Carrington 1993. 'Grandin' hard red spring wheat, 'Sunup' proso millet, and 'Linton' flax were seeded in adjacent strips as bioassay species on May 21. Treatments were applied to 5-leaf wheat, 3- to 4-leaf proso millet, and 5- to 6-inch flax on June 28 with 58 F, 66% RH, clear sky, and 7 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 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/9		
		Prmi	Flax	Wht
	oz/A	------	%	-----
Roundup	1	9	10	13
Roundup+X-77	1+0.5%	13	20	29
Roundup+R-11	1+0.5%	11	20	34
Roundup+Preference	1+0.5%	19	19	31
Roundup+Li-700	1+0.5%	8	15	16
Roundup+SilwetL-77	1+0.5%	29	19	46
Roundup+SprayBoosterS(Cenex)	1+0.5%	13	11	26
Roundup+Activator90	1+0.5%	8	23	43
Roundup+AD-100(Riverside)	1+0.5%	10	15	15
Roundup+Active-it	1+0.5%	3	3	20
Roundup+Amway	1+0.5%	11	11	26
Roundup+CAYUSE+R-11	1+0.5%+0.5%	46	58	66
Roundup+CenexSAS	1+2%	69	73	80
Roundup+Dispatch	1+2%	40	43	72
Roundup+ExpS3	1+2%	45	60	71
Roundup+E93-G1	1+2%	67	78	83
Untreated	0	1	3	1
C.V. %		39	39	24
LSD 5%		13	16	14
# OF REPS		4	4	4

Summary

Areas of the experiment were partly flooded making evaluation difficult and may have confounded the results. Roundup (glyphosate) gave generally less control of the species than occurred at Fargo. The ammonium salt type adjuvants (Cayuse, Cenex SAS, Dispatch, ExpS3, E93-G1) were generally more effective than the surfactant adjuvants. At the level of species control obtained surfactant differences were not detectable. The large increase from the ammonium adjuvants indicates that the Carrington station water maybe high in glyphosate antagonistic salts.

Surfactants and salts with Roundup, Minot 1993. 'Excel' barley, 'Siberian' foxtail millet, and 'Linton' flax were seeded in adjacent strips as bioassay species on July 1. Treatments were applied to 5- to 6-leaf barley, 4 inch foxtail millet, and 3.5 leaf flax on August 5 with 60 F, 80% RH, 7 to 10 mph wind and partly cloudy sky. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		9/10	
Treatment	Rate	Flax	Barley
	oz/A	----- %	-----
Roundup	1	15	50
Roundup+X-77	1+0.5%	26	65
Roundup+R-11	1+0.5%	71	82
Roundup+Preference	1+0.5%	43	76
Roundup+Li-700	1+0.5%	33	68
Roundup+SilwetL-77	1+0.5%	6	73
Roundup+SprayBoosterS(Cenex)	1+0.5%	26	73
Roundup+Activator90	1+0.5%	48	67
Roundup+AD-100(Riverside)	1+0.5%	25	68
Roundup+Active-it	1+0.5%	21	66
Roundup+Amway	1+0.5%	58	76
Roundup+CAYUSE+R-11	1+0.5%+0.5%	70	73
Roundup+CenexSAS	1+2%	76	95
Roundup+Dispatch	1+2%	73	92
Roundup+ExpS3	1+2%	85	93
Roundup+E93-G1	1+2%	76	85
Untreated	0	0	0
C.V. %		25	14
LSD 5%		16	14
# OF REPS		4	4

Summary

All adjuvants enhanced glyphosate (Roundup) control of barley. Glyphosate phytotoxicity to flax varied greatly with the various adjuvants. Silwet L-77 was less effective than many other adjuvants for flax, but equally as effective as others for barley. Flax is generally considered a species difficult to wet and Silwet L-77 considered an excellent wetter. Thus, the flax response to Silwet L-77 is of special interest. Adjuvants containing ammonium salts (Cenex SAS, Dispatch, ExpS3, E93-G1) generally were most effective in the enhancement of phytotoxicity to barley, except Cayuse. Surfactant R-11 was more effective than the other surfactants in enhancement of glyphosate phytotoxicity to flax and tended to be more effective for barley.

Surfactants and salts with Roundup, Williston, 1993. 'Otana' oats, 'Indian head' lentil beans, 'Dawn' proso millet were seeded in adjacent strips as bioassay species on May 25. Treatments were applied to 5 leaf oats, 4- to 5-leaf millet, and 3- to 4-inch tall lentils on June 30 with 73 F, 45% RH, partly cloudy sky, and 9 mph wind. Treatments were applied with a bicycle-wheel-type sprayer with a wind shield mounted on a G-Allis Chalmers tractor delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 24 ft plots. The experiment was a randomized complete block design with four replicates.

		7/7			
Treatment	Rate	Ruth	Grft	Oats	Lentils
	oz/A	--------	%	---------	
Roundup	1	44	73	50	40
Roundup+X-77	1+0.5%	60	81	74	49
Roundup+R-11	1+0.5%	71	86	76	63
Roundup+Preference	1+0.5%	54	83	58	45
Roundup+Li-700	1+0.5%	58	73	58	40
Roundup+SilwetL-77	1+0.5%	46	83	68	41
Roundup+SprayBoosterS(Cenex)	1+0.5%	56	74	66	43
Roundup+Activator90	1+0.5%	63	76	81	34
Roundup+AD-100(Riverside)	1+0.5%	61	80	60	42
Roundup+Active-it	1+0.5%	54	80	75	40
Roundup+Amway	1+0.5%	83	85	76	51
Roundup+CAYUSE+R-11	1+0.5%+0.5%	86	93	86	59
Roundup+CenexSAS	1+2%	87	91	88	44
Roundup+Dispatch	1+2%	84	91	86	54
Roundup+ExpS3	1+2%	86	93	90	63
Roundup+E93-G1	1+2%	86	93	88	60
Untreated	0	0	0	0	0
C.V. %		20	7	14	28
LSD 5%		18	8	14	18
# OF REPS		4	4	4	4

Summary

Adjuvants generally enhanced glyphosate (Roundup) phytotoxicity to all species except lentiles. Phytotoxicity to lentiles was only enhanced by Cayuse, ExpS3, and E93-G1. Silwet L-77 did not enhance glyphosate phytotoxicity to Russian thistle, but enhanced phytotoxicity to oats and green foxtail. These results appear to relate to those from Minot where phytotoxicity to flax was not increased by Silwet L-77. Flax and Russian thistle both have small leaves considered hard to wet by spray. Silwet L-77 is considered to impart a low dynamic surface tension to spray carriers that should increase spray retention by such plants. The salt type adjuvants were generally most effective for all species.

Sethoxydim with commercial adjuvants, Fargo 1993. 'Newdak' oats, 'McCall' soybeans, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 11 ?. Treatments were applied to 5- to 6-leaf oats, 1st trifoliolate soybeans, 4-leaf foxtail millet, and 3- to 4-leaf foxtail on June 19 with 65 F, 50% RH, 5-mph wind, and cloudy sky. 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 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/14 Oat	7/14 Sobe	7/14 Fomi	8/20 Oat	8/20 Mil
	oz/A	%				
Sethoxydim+DASH	1+0.18G	86	0	99	90	99
Sethoxydim+DASH	1+0.12G	80	0	99	82	99
Sethoxydim+DASH-HC[a]	1+0.18G	41	0	95	19	94
Sethoxydim+DASH-HC	1+0.12G	70	3	99	70	98
Sethoxydim+Scoil	1+0.18G	62	0	99	71	98
Sethoxydim+Scoil	1+0.12G	69	5	99	73	99
Sethoxydim+Methoil	1+0.18G	74	9	99	73	99
Sethoxydim+Methoil	1+0.12G	58	5	99	59	98
Sethoxydim+MSO	1+0.18G	49	0	98	47	94
Sethoxydim+MSO	1+0.12G	45	0	99	23	93
Sethoxydim+Dyn-amic	1+0.18G	69	0	99	72	98
Sethoxydim+Dyn-amic	1+0.12G	66	0	99	63	99
Sethoxydim+MES-100	1+0.18G	78	0	99	78	99
Sethoxydim+MES-100	1+0.12G	74	3	99	67	99
Sethoxydim+ECO-GARDII	1+0.18G	74	0	99	77	99
Sethoxydim+ECO-GARDII	1+0.12G	73	0	99	83	99
Untreated	0	0	0	0	0	0
C.V. %		17	331	1	26	3
LSD 5%		15	NS	2	23	4
# OF REPS		4	4	4	4	4

[a]The negative response to DASH-HC volume indicates that it may not have been included in the treatment.

Summary

Foxtail millet was highly susceptable to sethoxydim with greater than 90% control regardless of adjuvant. Soybean was not injured by sethoxydim regardless of adjuvant. DASH-HC adjuvant was less effective at the high than low volume indicating a possible misapplication. DASH was or tended to be more effective than the methylated oils as an adjuvant with sethoxydim for oats control and was significantly more effective than MSO.

Wheat response to clomazone plus safener, Fargo 1993. The experiment was designed to test the efficacy of phorate insecticide applied in-furrow as a safener to protect wheat from clomazone injury. The experimental site had a conventionally tilled silty clay with pH 7.8 and 4% organic matter. On May 20 herbicides were applied using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Air temperature was 55 F, RH was 70%, the wind was 3 to 7 mph, skies were sunny, and the soil surface was dry. All treatments were then incorporated with two passes (opposite directions) with a field cultivator. Marshall wheat was planted 1.5 inches deep on May 21 with two offset passes of a 22-inch-row planter resulting in 12 11-inch rows per plot. Phorate at 1.2 ounces/1,000 ft of row was applied with the planter as a "modified in-furrow" or "T-band" application. Visual estimates of wheat injury were made June 24. All plots were sprayed June 28 with 0.75 lb/A bentazon plus 1 quart/A Scoil for broadleaf weed control. Grain yields were harvested Sept. 7 with a plot combine (four rows wide by 25 ft long). Plot size was 12 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment	Rate	Phorate applied	Wheat injury	Grain yield
	(lb/A)		(%)	(bu/A)
Clomazone(PPI)	0.25	No	28	19
Clomazone(PPI)	0.375	No	48	13
Clomazone(PPI)	0.5	No	69	12
Clomazone(PPI)	0.75	No	88	10
Clomazone(PPI)	0.25	Yes	6	22
Clomazone(PPI)	0.375	Yes	28	20
Clomazone(PPI)	0.5	Yes	66	13
Clomazone(PPI)	0.75	Yes	74	14
Clomazone+Trifluralin(PPI)	0.25+0.75	Yes	39	18
Clomazone+Trifluralin(PPI)	0.375+0.75	Yes	64	17
Clomazone+Trifluralin(PPI)	0.25+0.5	Yes	28	21
Clomazone+Trifluralin(PPI)	0.375+0.5	Yes	29	23
Trifluralin(PPI)	0.75	No	34	20
Weedy check	0	No	0	13
C.V. %			34	26
LSD 5%			21	6

Summary. Phorate appeared to reduce wheat injury from clomazone at 0.25 and 0.375 lb/A, but not from higher clomazone rates. Even at the lower clomazone rates, however, phorate did not eliminate clomazone injury.

Thifensulfuron plus synergists for foxtail control in wheat, Fargo 1993. 'Marshall' wheat was seeded May 12 at 90 lb/A in a conventionally tilled silty clay. Treatments were applied June 22 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. At time of application, wheat was 6 to 8 inches tall and 5.5 leaf (including two tillers), yellow foxtail was 2 to 4 inches tall with 3 to 5 leaves, air temperature was 86 F, relative humidity was 60%, wind was 25 mph, skies were cloudy, and the soil was dry on the surface. The sprayer was shielded. Visual estimates of wheat injury were made July 2, and wheat injury, foxtail control, and wild mustard control were estimated July 20. The experiment was a randomized complete block design with four replications.

		Wheat injury			
Treatment[a]	Rate	July 2	July 20	Yeft	Wimu
	(oz/A)	(%)			
Thifensulfuron	0.33	0	0	0	100
Thifensulfuron	1.33	0	0	0	100
Thif+Mefluidide	0.33+2	27	90	41	98
Thifensulfuron+Piperonyl butoxide	0.33+8	0	0	15	96
Thifensulfuron+MGK-264	0.33+8	0	0	6	96
Thifensulfuron+Chlorpyrifos	0.33+8	6	0	15	100
Thifensulfuron+Malathion	0.33+8	14	2	37	100
Thifensulfuron+Paclobutrazole	0.33+8	3	5	21	97
Mefluidide	2	32	94	13	0
Piperonyl butoxide	8	0	0	0	0
MGK-264	8	0	0	0	0
Chlorpyrifos	8	0	0	0	0
Malathion	8	0	0	0	0
Paclobutrazole	8	3	7	0	0
C.V. %		70	26	72	4
LSD 5%		6	5	14	4

[a]All treatments were applied with 1.5 pint/A Scoil (methylated seed oil containing emulsifier; MGK-264 is an analogue of piperonyl butoxide.

Quinclorac plus adjuvants in wheat, Harbin, Heilongjiang Prov., China 1993. Wheat (Northeast Agricultural University 120) was seeded April 13 in rows 30 cm apart. Treatments were applied May 19 using a backpack sprayer delivering 8.5 gal/A with 8001 nozzles and 30 psi (pressure generated by a hand-pump lever). Conditions at time of treatment were: 72 F air temperature, 50% relative humidity, clear skies, wheat 3 to 4 leaf, common lambsquarters 2 to 4 leaf and 0.5 to 1.5 inch tall, willowleaf knotweed (Polygonum bungeanum) 2 to 3 leaf and 0.5 to 1.5 inch tall, barnyardgrass 2 to 3 leaf and 1 to 1.5 inch tall, and yellow foxtail 2 to 3 leaf and 1 to 1.5 inch tall. Visual estimates of percentage weed control were taken June 3. Plot size was 10 by 27 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate[b]	Wheat injury	Weed control Colq	Wlkw	Bygr	Yeft
	(oz/A)	(%)				
Quinclorac	4.3	0	18	0	50	38
Quinclorac+Activator 90	4.3+0.5%	0	25	2	79	65
Quinclorac+Herbimax	4.3+0.25G	0	31	4	77	68
Quinclorac+Penetrator Plus	4.3+1%	0	26	2	79	72
Quinclorac+Dyne-Amic	4.3+0.5%	0	28	3	84	72
Quinclorac+Silowet L77	4.3+0.5%	0	28	8	80	71
Quinclorac+Scoil	4.3+0.188G	0	68	10	87	87
Quinclorac+Scoil	5.7+0.188G	0	44	7	95	87
Quinclorac+Scoil	11.4+0.188G	0	49	8	94	83
Qucl+Chlorsulfuron+Activator 90	5.7+0.17+0.5%	0	99	87	77	64
Qucl+Chlorsulfuron+Scoil	5.7+0.17+0.188G	0	98	87	95	84
C.V. %		0	42	31	9	14
LSD 5%		NS	28	8	11	17

[a]Quinclorac was 75% DF by BASF; chlorsulfuron was 75% DF by DuPont.
[b]G = gal/A (e.g. 0.25G = 0.25 gal/A or 1 qt/A).

Summary. Barnyardgrass was slightly more susceptible to quinclorac than was yellow foxtail. Overall, Scoil provided the greatest enhancement of weed control by quinclorac although Dyne-Amic and Silowet L77 appeared to enhance barnyardgrass control by quinclorac as well as Scoil. The addition of chlorsulfuron to quinclorac was required for high levels of common lambsquarter and willowleaf knotweed control.

POST chlorimuron and imazethapyr in soybean, Harbin, Heilongjiang Prov., China 1993. Soybeans were planted in rows spaced 27.6 inches apart and placed on ridges at the Northeast Agricultural University Experimental Station. Cultivation was done July 2. Treatments were applied June 5 under sunny skies, a 1 to 5 mph wind, 55% relative humidity, and 71 F air temperature using a backpack sprayer delivering 8.5 gal/A with 8001 nozzles and 25 psi pressure (generated by a hand-pump lever). Plant stages at time of treatment were: soybeans 1 small trifoliolate; barnyardgrass 3 to 5 leaf and 1 to 3 inches tall; common lambsquarters 6 to 8 leaf and 2 to 4 inches tall; willowleaf knotweed (Polygonum bungeanum) 4 to 6 leaf and 2 to 4 inches tall; field horsetail (Equisetum arvense) 4 to 7 inches tall. Visual estimates of percentage soybean injury and weed control were taken June 30. Plot size was 10 by 27 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate[b]	Soybean injury	Weed control			
			Bygr	Colq	Wlkw	Hota
	(oz/A)	(%)				
Imazethapyr+Activator90+AMN	0.5+0.5%+1.5	5	70	18	71	2
Imazethapyr+Herbimax	0.5+0.25G	1	45	19	50	-
Imazethapyr+Scoil	0.5+0.19G	24	75	28	85	23
Imazethapyr+PenetratorPlus	0.5+1%	12	72	30	73	3
Imazethapyr+Dyne-Amic	0.5+0.5%	8	61	21	46	0
Imazethapyr+SilwetL77	0.5+0.5%	9	27	18	23	2
Imazethapyr	0.75	5	50	21	34	1
Imazethapyr+Activator90	0.75+0.5%	8	74	28	69	5
Imazethapyr+Activator90+AMN	0.75+0.5%+1.5	3	63	31	86	2
Imazethapyr+DWL	0.75+0.5%	17	79	28	44	0
Imazethapyr+Herbimax	0.75+0.25G	4	76	33	58	3
Imazethapyr+Bio-Veg	0.75+0.25G	4	63	42	64	4
Imazethapyr+Scoil	0.75+0.19G	4	58	41	82	2
Imazethapyr+PenetratorPlus	0.75+1%	5	73	43	85	0
Imazethapyr+Dyne-Amic	0.75+0.5%	3	58	16	48	5
Imazethapyr+LI-700	0.75+0.5%	15	69	33	55	0
Imazethapyr+SilwetL77	0.75+0.5%	11	76	23	63	3
Imazethapyr+Quinclorac+Scoil	0.5+4.3+0.19G	74	91	89	93	25
Chlorimuron+Quinclorac+Scoil	0.29+5.7+0.19G	81	98	91	94	28
Chlorimuron+Quinclorac+Scoil	0.29+11.4+0.19G	87	97	93	95	34
C.V. %		33	22	32	21	94
LSD 5%		9	21	17	19	10
LSD 1%		12	28	23	26	13

[a]Activator90 is a nonionic surfactant; AMN = ammonium nitrate; Herbimax is a petroleum oil adjuvant containing 17% emulsifier; Scoil is a methylated soybean oil adjuvant containing emulsifier; SilwetL77 is a silicone-base adjuvant; imazethapyr is made by American Cyanamid, 5% SC containing adjuvant; DWL = dishwashing liquid; Bio-Veg = vegetable oil adjuvant containing 15% emulsifier; LI-700 is a nonionic surfactant; chlorimuron is Chinese-made, 20% WP; quinclorac is Chinese-made, 50% WP.
[b]G = gal/A (0.19G = 1.5 pint/A; 0.25G = 1 quart/A).

POST chlorimuron and imazethapyr in soybeans, 81378 Army Farm, Heilongjiang Prov., China 1993. Soybeans (93-292 cultivar developed by a state farm in Heilongjiang Province) were planted May 10 in 70-cm rows placed on ridges at the 81378 Army Farm. Cultivation was done on June 1 and July 16. Treatments were applied June 20 under partly cloudy skies, no wind, 60% relative humidity, and 24 C air temperature using a backpack sprayer delivering 80 L/ha with 8001 nozzles and 207 kPa pressure generated by a hand-pump lever. Plant stages at time of treatment were: soybeans 1 trifoliolate, 12 to 14 cm tall; wild oats 20 to 30 cm tall and well-tillered; barnyardgrass 3 to 4 leaf and 4 to 7 cm tall; dayflower (*Commelina communis*) 4 to 6 leaf and 7 to 10 cm tall; hempnettle (*Galeopsis tetrahit*) 7 to 15 cm tall; wild mint (*Mentha arvensis*) 4 to 6 leaf and 4 to 7 cm tall; (*Bidens tripartita*) 4 to 10 cm tall. Visual estimates of percentage soybean injury and weed control were taken July 21.

Treatment[a]	Rate	Soybean injury	Weed control Wioa	Bygr	Dafl	Hene	Wimi	Bide
	(oz/A)	(%)						
Chlorimuron+Activator90	0.125+0.5%	6	33	29	2	100	100	100
Chlorimuron+DWL	0.125+0.5%	8	10	19	0	100	95	98
Chlorimuron+DWL	0.15+0.5%	10	46	20	1	-	-	98
Chlorimuron+DWL	0.18+0.5%	12	14	10	3	-	-	-
Chlorimuron+DWL(HWC)	0.125+0.5%	9	-	-	-	-	-	-
Chlorimuron+DWL(HWC)	0.18+0.5%	7	-	-	-	-	-	-
Chlorimuron+DWL(HWC)	0.25+0.5%	12	-	-	-	-	-	-
Chlorimuron+DWL+AMN	0.125+0.5%+24	3	1	11	0	100	-	-
Chlorimuron+DWL+AMN	0.18+0.5%+24	13	5	55	2	-	-	-
Chlorimuron+Scoil	0.125+0.188G	10	10	7	3	100	-	-
Chlorimuron+Scoil	0.18+0.188G	48	1	12	0	100	-	-
Chlorimuron+Fluazifop-P	0.125+2	12	99	10	0	100	-	-
Chlorimuron+Fluazifop-P	0.18+2	29	100	28	0	100	-	-
Chlorimuron+Fluazifop-P+DWL	0.125+2+0.5%	17	100	9	0	-	-	-
Chlorimuron+Fluazifop-P+DWL	0.18+2+0.5%	22	99	21	0	100	-	-
Fluazifop-P	2	0	99	71	0	0	1	2
Fluazifop-P+DWL	2+0.5%	0	100	94	0	0	0	1
Chlorimuron+Quinclorac+DWL	0.125+4.3+0.5%	15	0	16	0	99	90	99
Chlorimuron+Quinclorac+DWL	0.18+4.3+0.5%	19	0	47	0	98	67	-
Clim+Quinclorac+Scoil	0.125+4.3+0.188G	78	4	100	1	100	100	-
Clim+Quinclorac+Scoil	0.18+4.3+0.188G	83	0	99	0	100	-	-
Imazethapyr+AMN	0.5+24	0	100	97	30	74	-	-
Imazethapyr+Herbimax	0.5+0.25G	7	62	92	34	76	75	-
Imazethapyr+Scoil	0.5+0.188G	8	87	85	30	50	-	76
Imazethapyr	0.75	2	97	95	51	80	-	-
Imazethapyr+AMN	0.75+1700	2	99	99	62	85	-	-
Imazethapyr+Herbimax	0.75+0.25G	4	94	100	31	33	37	40
Imazethapyr+Scoil	0.75+0.188G	6	100	96	75	80	91	90
Imazethapyr	1	4	99	99	68	83	-	-
C.V. %		70	27	34	70	12	29	20
LSD 5%		15	22	26	15	13	27	19

[a]DWL = "White cat" brand dishwashing detergent, commonly available in China; HWC = handweeded check; AMN = ammonium nitrate; Activator 90 = surfactant; Scoil = methylated vegetable oil adjuvant with emulsifier; Herbimax = petroleum oil adjuvant with 17% emulsifier; chlorimuron is Chinese-made, 20% WP; quinclorac is BASF-made, 75% DF; imazethapyr is Cyanamid-made, 5% SC (5 g/100 ml).

Comments. Considerable rain and cool weather was received for several days before and after treatment. These conditions probably increased soybean injury by chlorimuron. Similar conditions also were associated with high levels of chlorimuron injury at a number of other Army farms throughout Heilongjiang Province.

Weed control economics in a minimum till and no-till soybean-wheat rotation, Fargo 1992. The experiment was established in 1988 as a multi-year study on a silty clay soil having a pH of 7.8 and organic matter of 5%. Treatments were arranged as a split plot with three tillage-row spacing combinations serving as main plots and herbicide systems in soybeans constituting sub-plots. The experiment is conducted on two adjacent areas with soybeans planted in one area and wheat in the other. Each area is seeded to wheat one year and to soybeans the next in a continuous rotation. Individual plot identity is preserved over the duration of this long-term experiment in order to assess the net returns and shifts in weed species associated with a particular treatment.

1992 SOYBEANS

Methods

Minimum till plots were chisel plowed in late October of 1991 and received one pass with a field cultivator in early May 1992. McCall soybeans were seeded 1.5 inches deep at 185,000 seeds/A on May 15 using a Hiniker no-till planter for 30-inch rows and at 215,000 seeds/A on May 18 with a Haybuster drill for 7-inch rows. Broadcast herbicide treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A for all postemergence (including burndown) treatments and 17 gal/A for soil-applied treatments. Postemergence treatments in 30-inch-row soybeans were applied in a 10-inch band using an ATV-mounted sprayer delivering 22.2 gal per treated acre (7.4 gal per field acre) with 4002E twinjet tips. All postemergence and burndown treatments were applied only as required and at a rate deemed necessary by the investigator. Rates and dates of all herbicide applications are given in Tables 1 and 2. Cultivation of 30-inch-row plots also was done on an as-needed basis, and took place on June 12 for the total postemergence treatment in rowed soybeans (tilled and no-till) and for PRE metribuzin treatment in no-till rowed soybeans. All rowed soybeans (except the handweeded checks) were cultivated July 14. Aboveground wheat residues in no-till plots were sampled randomly from four 0.25 m^2 areas on May 1 and yielded an average of 8300 lb/A dry weight. Weed numbers per m^2 (by species) were determined at time of postemergence herbicide application (June 29) with two 0.25 m^2 subsamples per plot. Broadleaf weeds taller than 6 inches and foxtail plants of any size found within a plot were counted just before harvest. Grain yields were machine harvested in early October and values adjusted to 12% moisture. Plots requiring post-harvest control of perennial weeds were treated on October 9. Soil was sampled to 2 ft and fertilized on October 21 for a 60-bu/A yield goal (for 1993 wheat) with the application of 115 lb N/A to no-till plots and 75 lb N/A to tilled plots (surface-applied ammonium nitrate). Tilled plots were chisel plowed 8 inches deep on October 22. Four 0- to 2-inch soil samples were taken from each plot between Oct. 19 and 21. Subsamples were bulked and analyzed for pH and organic matter. Herbicide application, tillage, and seeding costs were used in developing the economic analysis.

Table 1. Rates and dates of planned herbicide treatments (early preplant, preplant incorporated, and preemergence) and as-needed burndown applications in 1992 soybeans.

Planned herbicide treatment[a]			As-needed burndown application[b]			
Herbicide	Rate (lb/A)	Date	Herbicide	Rate (lb/A)	Date	Target weed species
TILLED, 30-INCH ROWS						
Trif+Metr(PPI)	1+0.2	5/15	None	-	-	None
Trif+Imep(PPI)	1+0.047	5/15	None	-	-	None
Trif+Clom(PPI)	1+0.75	5/15	None	-	-	None
Trif+Clam(PPI)	1+2.5	5/15	None	-	-	None
Total post(PO)	-	-	None	-	-	None
HWC - Trif+ Imep+Clom(PPI)	0.75+ 0.04+0.4	5/15	None	-	-	None
NO-TILL, 30-INCH ROWS						
Cyanazine(EPP)	3	4/29	Glyt+S	0.5+0.13%	5/20	Ftba, annual weeds
Metribuzin(EPP)	0.25	4/29	Glyt	0.375	5/6	Ftba (spot spray)[c]
			Glyt+ 2,4-D+S	0.25+ 0.19+0.38%	5/20	Annual weeds
Imazethapyr(EPP)	0.063	4/29	Glyt+S	0.5+0.13%	5/20	Ftba
Metribuzin(PRE)	0.2	5/20	Glyt	0.375	5/6	Ftba (spot spray)[c]
			Glyt+ 2,4-D+S	0.25+ 0.19+0.38%	5/20	Annual weeds
Total post(PO)	-	-	Glyt+S	0.5+0.13%	5/20	Ftba, annual weeds
HWC - Pend+	2+		Glyt	0.375	5/6	Ftba (spot spray)[d]
Imep+Clom(EPP)	0.04+0.4	4/29	Glyt	1.5	5/20	All weeds
NO-TILL, 7-INCH ROWS						
Cyanazine(EPP)	3	4/29	Glyt	0.375	5/6	Ftba (spot spray)[c]
			Glyt+S	0.25+0.38%	5/21	Annual weeds
Metribuzin(EPP)	0.25	4/29	Glyt	0.375	5/6	Ftba (spot spray)[c]
			Glyt+S	0.5+0.13%	5/21	Ftba, annual weeds
			Glyt+ 2,4-D+S	0.5+ 0.25+0.13%	5/21	Cath (spot spray)[d]
Imazethapyr(EPP)	0.063	4/29	Glyt+ 2,4-D+S	0.625+ 0.13+0.13%	5/21	Smwd, Cath
Metribuzin(PRE)	0.2	5/21	Glyt+S	0.5+0.13%	5/21	Ftba, annual weeds
Total post(PO)	-	-	Glyt	0.375	5/6	Ftba (spot spray)[d]
			Glyt+S	0.5+0.13%	5/21	Ftba, annual weeds
HWC - Pend+	2+			0.375	5/6	Ftba (spot spray)[d]
Imep+Clom(EPP)	0.04+0.4	4/29	Glyt	1.5	5/21	All weeds

[a] EPP = early preplant; PPI = preplant incorporated; PRE = preemergence; PO = postemergence; HWC = hand-weeded check.

[b] Glyt = glyphosate, always applied with ammonium sulfate at 1.5 lb/A; S = X-77 nonionic surfactant; 2,4-D = 2,4-D amine.

[c] Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field.

[d] Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field.

Table 2. Rates and dates of postemergence herbicide applications in 1992 soybeans.

Planned herbicides[a]		As-needed postemergence application[b]			
Herbicide	Rate (lb/A)	Herbicide	Rate (lb/A)	Date	Target weed species
TILLED, 30-INCH ROWS					
Trif+Metr(PPI)	1+0.2	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Colq, Rrpw
Trif+Imep(PPI)	1+0.047	Bentazon	1	6/29	Canada thistle (spot spray)[c]
Trif+Clom(PPI)	1+0.75	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Rrpw, Colq, Wimu
Trif+Clam(PPI)	1+2.5	Sethoxy	0.15	6/28	Yellow foxtail
		Bentazon	1	6/29	Cath, KOCZ
		Bentazon	1	7/9	Canada thistle (spot spray)[d]
Total post(PO)	-	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Rrpw, Colq, Wimu, Wibw
NO-TILL, 30-INCH ROWS					
Cyanazine(EPP)	3	Acif+Seth	0.13+0.15	6/29	Yeft, Rrpw, Wibw
		Bentazon	1	6/29	Canada thistle (spot spray)[c]
Metribuzin(EPP)	0.25	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Rrpw, Colq, Wibw, Dand
Imazethapyr(EPP)	0.063	None	0	-	-
Metribuzin(PRE)	0.2	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Rrpw
Total post(PO)	-	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Colq, Rrpw, Cath
NO-TILL, 7-INCH ROWS					
Cyanazine(EPP)	3	Acif+Seth	0.13+0.15	6/28	Yeft, Rrpw, Dand
Metribuzin(EPP)	0.25	Bent+Acif	0.75+0.13	6/28	KOCZ, Rrpw, Colq, Cath
		Sethoxy	0.15	6/29	Yellow foxtail
Imazethapyr(EPP)	0.063	Bentazon	1	6/28	Canada thistle (spot spray)[c]
Metribuzin(PRE)	0.2	Sethoxy	0.15	6/28	Yeft, Foxtail barley
		Bent+Acif	0.75+0.13	6/29	KOCZ, Wibw, Dand
Total post(PO)	-	Sethoxy	0.15	6/28	Yellow foxtail
		Bent+Acif	0.75+0.13	6/29	KOCZ, Rrpw, Colq
		Bentazon	0.75	6/29	Canada thistle (spot spray)[d]

[a] EPP = early preplant; PPI = preplant incorporated; PRE = preemergence; PO = post-emergence.

[b] Postemergence treatments were applied in a 10-inch band (22 gal/A) for all 30-inch-row plots (spot sprays were applied broadcast), and broadcast (8.5 gal/A) for 7-inch-row plots; applications containing acifluorfen were applied with 1 pt/A Scoil adjuvant; bentazon spot sprays were applied with 1.5 pt/A Scoil; sethoxydim was Poast Plus and was applied with 0.5 pt/A Scoil.

[c] Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field (cost was reduced by 1/4).

[d] Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field (cost was reduced by 1/8).

Table 3. Weeds present in 1992 soybeans at time of postemergence herbicide treatments.

Planned herbicide treatment	Weed density at postemergence herbicide application on June 29[a]							
	Yeft	KOCZ	Rrpw	Colq	Wibw	Wimu	Prsp	Cath
	(no. per m^2)							
TILLED, 30-INCH ROWS								
Trifluralin+Metribuzin(PPI)	9	1	0	0	0	0	0	0
Trifluralin+Imazethapyr(PPI)	11	0	0	0	0	1	0	3
Trifluralin+Clomazone(PPI)	5	1	1	0	0	1	0	0
Trifluralin+Chloramben(PPI)	7	0	0	1	0	1	1	0
Total postemergence	82	12	5	14	0	0	5	1
Average:	26	3	1	4	0	0	1	1
NO-TILL, 30-INCH ROWS								
Imazethapyr(EPP)	18	1	0	1	0	0	1	0
Cyanazine(EPP)	21	1	0	0	0	0	0	5
Metribuzin(EPP)	32	2	0	1	0	0	1	0
Metribuzin(PRE)	46	2	3	1	0	0	5	0
Total postemergence	64	6	6	5	0	0	1	0
Average:	36	2	2	1	0	0	1	1
NO-TILL, 7-INCH ROWS								
Imazethapyr(EPP)	30	2	0	0	0	0	0	4
Cyanazine(EPP)	54	0	0	0	0	0	0	0
Metribuzin(EPP)	112	16	2	0	0	0	0	0
Metribuzin(PRE)	102	2	0	0	0	0	2	0
Total postemergence	106	16	2	8	0	0	0	4
Average:	81	7	1	2	0	0	0	2
LSD 5% (Treatments within a tillage)	23	5	3	NS	NS	NS	NS	NS
Tillage effect (P-value)	.012	.818	.365	.508	-	.253	.875	.870

[a] Yeft = yellow foxtail; KOCZ = kochia; Rrpw = redroot pigweed; Colq = common lambsquarters; Wibw = wild buckwheat; Wimu = wild mustard; Prsp = prostrate spurge; Cath = Canada thistle.

Table 4. Weed control and grain yield of 1992 soybeans grown in rotation with wheat.

Planned herbicide treatment	Weed density at harvest[a] Yeft	KOCZ	Rrpw	Colq	Wibw	Ftba	Dand	Cath	Smwd	Biww	Bygr	Soybean grain yield
	(no. per 100 m^2)											(bu/A)
TILLED, 30-INCH ROWS												
Trif+Metribuzin(PPI)	41	5	1	5	0	0	1	5	0	1	2	16.3
Trif+Imazethapyr(PPI)	18	0	0	0	0	0	5	91	0	2	2	15.5
Trif+Clomazone(PPI)	74	10	0	6	0	0	0	2	0	0	1	15.3
Trif+Chloramben(PPI)	16	2	1	4	0	0	1	95	0	0	0	15.8
Total postemergence	433	109	2	219	0	0	7	6	26	3	3	16.7
Hand-weeded check[b]	-	-	-	-	-	-	-	-	-	-	-	14.0
Average:	116	25	1	47	0	0	3	40	5	1	2	15.5
NO-TILL, 30-INCH ROWS												
Cyanazine(EPP)	245	1	8	3	7	8	4	149	2	0	16	18.8
Metribuzin(EPP)	258	13	2	6	11	8	10	6	13	0	24	17.1
Imazethapyr(EPP)	87	2	0	3	0	30	104	11	112	8	86	21.4
Metribuzin(PRE)	192	40	3	5	3	28	5	12	16	0	0	18.0
Total postemergence	291	40	3	64	10	2	9	24	20	0	16	19.5
Hand-weeded check[c]	-	-	-	-	-	-	-	-	-	-	-	22.1
Average:	215	19	3	16	6	15	26	40	33	2	28	19.5
NO-TILL, 7-INCH ROWS												
Cyanazine(EPP)	474	2	99	4	1	21	1	2	15	0	4	14.5
Metribuzin(EPP)	309	22	36	22	3	108	2	9	69	2	4	13.9
Imazethapyr(EPP)	103	2	0	13	0	103	54	45	53	11	155	17.8
Metribuzin(PRE)	216	38	85	12	11	75	19	17	34	2	2	14.9
Total postemergence	307	69	93	127	3	21	4	24	61	0	0	11.3
Hand-weeded check[c]	-	-	-	-	-	-	-	-	-	-	-	14.0
Average:	282	27	63	36	4	66	16	20	46	3	33	14.4
LSD 5% (in a tillage)	221	60	NS	104	7	NS	31	NS	NS	6	50	NS
Tillage (P-value)	.214	.81	.15	.52	.12	.03	.04	.70	.14	.37	.13	.062

[a] Yeft = yellow foxtail; KOCZ = kochia; Rrpw = redroot pigweed; Colq = common lambsquarters; Wibw = wild buckwheat; Ftba = foxtail barley; Dand = dandelion; Cath = Canada thistle; Smwd = perennial smartweed; Biww = biennial wormwood; Bygr = barnyardgrass.

[b] Hand-weeded check was treated with trifluralin + imazethapyr + clomazone (PPI) at 0.75 + 0.04 + 0.4 lb/A plus hand weeding.

[c] Hand-weeded check was treated with pendimethalin + imazethapyr + clomazone (EPP) at 2 + 0.04 + 0.4 lb/A plus hand weeding.

Table 5. Herbicide and adjuvant costs for burndown and postemergence treatments in tilled and no-till soybeans in 1992.

Planned treatment			Burndown treatment			Postemergence treatment		
Herbicide	Rate	Cost	Herbicide or adjuvant	Rate	Cost	Herbicide or adjuvant	Rate	Cost
	(lb/A)	($/A)		(lb/A)	($/A)		(lb/A)	($/A)
TILLED, 30-INCH ROWS								
Trifluralin+	1	7.92	None	-	0	Sethoxy+	0.15	2.19
Metribuzin	0.2	6.32				Scoil	0.5 pt	.31
						Bentazon+	0.75	3.81
						Acif+	0.125	.62
						Scoil	1 pt	.62
Trifluralin+	1	7.92	None	-	0	Bentazon+	1	3.81[b]
Imazethapyr	0.047	12.95				Scoil	1.5 pt	.70
Trifluralin+	1	7.92	None	-	0	Sethoxy+	0.15	2.19
Clomazone	0.75	14.05				Scoil	0.5 pt	.31
						Bentazon+	0.75	3.81
						Acif+	0.125	.62
						Scoil	1 pt	.62
Trifluralin+	1	7.92	None	-	0	Sethoxy+	0.15	2.19
Chloramben	2.5	28.00				Scoil	0.5 pt	.31
						Bentazon+	1	5.08
						Scoil	1.5 pt	2.79
						Bentazon+	1	1.91[b]
						Scoil	1.5 pt	.35
Total post	-		None	-	0	Sethoxy+	0.15	2.19
						Scoil	0.5 pt	.31
						Bentazon+	0.75	3.81
						Acif+	0.125	.62
						Scoil	1 pt	.62
NO-TILL, 30-INCH ROWS								
Cyanazine (EPP)	3	16.50	Glyphosate+	0.5	6.23	Sethoxy+	0.15	2.19
			NIS+	0.13%	.18	Acif+	0.125	.62
			AS	1.5	.38	Scoil	0.5 pt	.31
						Bentazon+	1	3.81[b]
						Scoil	1.5	.70
Metribuzin (EPP)	0.25	7.90	Glyphosate+	0.375	1.17[b]	Sethoxy+	0.15	2.19
			AS	1.5	.10	Scoil	0.5	.31
			Glyphosate+	0.25	3.11	Bentazon+	0.75	3.81
			2,4-D+	0.188	.45	Acif+	0.125	.62
			NIS+	0.38%	.55	Scoil	1 pt	.62
			AS	1.5	.38			
Imazethapyr (EPP)	0.063	17.27	Glyphosate+	0.5	6.23	None	0	0
			NIS+	0.13%	.18			
			AS	1.5	.38			
Metribuzin (PRE)	0.2	6.32	Glyphosate+	0.375	1.17[b]	Sethoxy+	0.15	2.19
			AS	1.5	.10	Scoil	0.5 pt	.31
			Glyphosate+	0.25	3.11	Bentazon+	0.75	3.81
			2,4-D+	0.188	.45	Acif+	0.125	.62
			NIS+	0.38%	.55	Scoil	1 pt	.62
			AS	1.5	.38			
Total post	-	-	Glyphosate+	0.5	6.23	Sethoxy+	0.15	2.19
			NIS+	0.13%	.18	Scoil	0.5 pt	.31
			AS	1.5	.38	Bentazon+	0.75	3.81
						Acif+	0.125	.62
						Scoil	1 pt	.62

Table 5, continued. Herbicide and adjuvant costs for burndown and postemergence treatments in tilled and no-till soybeans in 1992.

Planned treatment			Burndown treatment[a]			Postemergence treatment[a]		
Herbicide	Rate	Cost	Herbicide or adjuvant	Rate	Cost	Herbicide or adjuvant	Rate	Cost
	(lb/A)	($/A)		(lb/A)	($/A)		(lb/A)	($/A)
NO-TILL, 7-INCH ROWS								
Cyanazine	3	16.50	Glyphosate+	0.375	1.17[b]	Sethoxy+	0.15	6.58
(EPP)			AS	1.5	.10	Acif+	0.125	1.86
			Glyphosate+	0.25	3.11	Scoil	0.5 pt	.93
			NIS+	0.38%	.55			
			AS	1.5	.38			
Metribuzin	0.25	7.90	Glyphosate+	0.375	1.17[b]	Sethoxy+	0.15	6.58
(EPP)			AS	1.5	.10	Scoil	0.5	.93
			Glyphosate+	0.5	6.23	Bentazon+	0.75	11.43
			NIS+	0.13%	.18	Acif+	0.125	1.86
			AS	1.5	.38	Scoil	1 pt	1.86
			Glyphosate+	0.5	.78[c]			
			2,4-D+	0.25	.07			
			NIS+	0.13%	.02			
			AS	1.5	.05			
Imazethapyr	0.063	17.27	Glyphosate+	0.63	7.79	Bentazon+	1	3.81[b]
(EPP)			2,4-D+	0.125	.30	Scoil	1.5 pt	.70
			NIS+	0.13%	.18			
			AS	1.5	.38			
Metribuzin	0.2	6.32	Glyphosate+	0.5	6.23	Sethoxy+	0.15	6.58
(PRE)			NIS+	0.13%	.18	Scoil	0.5	.93
			AS	1.5	.38	Bentazon+	0.75	11.43
						Acif+	0.125	1.86
						Scoil	1 pt	1.86
Total post	-	-	Glyphosate+	0.375	.58[c]	Sethoxy+	0.15	6.58
			AS	1.5	.05	Scoil	0.5	.93
			Glyphosate+	0.5	6.23	Bentazon+	0.75	11.43
			NIS+	0.13%	.18	Acif+	0.125	1.86
			AS	1.5	.38	Scoil	1 pt	1.86
						Bentazon+	0.75	1.43[c]
						Scoil	1.5 pt	.35

[a] AS = ammonium sulfate; NIS = X-77 nonionic surfactant; Scoil = methylated vegetable oil adjuvant with emulsifier.
[b] Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field (cost was reduced by 1/4).
[c] Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field (cost was reduced by 1/8).

Table 6. Herbicide and adjuvant costs for post-harvest treatments in tilled and no-till soybeans in 1992. Treatments were applied October 9, 1992.

Planned treatment	Herbicide or adjuvant[a]	Herbicide Rate	Herbicide Broadcast or spot spray	Herbicide Cost	Application cost	Target weeds
		(lb/A)		($/A)	($/A)	
TILLED, 30-INCH ROWS						
Trif+Metr(PPI)	Clopyralid&2,4-D	0.095&0.5	Spot spray[b]	1.78	.19	Cath, Smwd
	+2,4-D amine	+0.5		.30		
Trif+Imep(PPI)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath
Trif+Clom(PPI)	Clopyralid&2,4-D	0.095&0.5	Spot spray[c]	.89	.10	Cath
	+2,4-D amine	+0.5		.15		
Trif+Clam(PPI)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath
Total post	Clopyralid&2,4-D	0.095&0.5	Spot spray[b]	1.78	.19	Cath, Smwd
	+2,4-D amine	+0.5		.30		
NO-TILL, 30-INCH ROWS						
Cyanazine(EPP)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Ftba
	+glyphosate	+0.56		6.98		
Metr(EPP)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Imep(EPP)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Metr(PRE)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Total post	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
NO-TILL, 7-INCH ROWS						
Cyanazine(EPP)	Glyphosate	0.56	Spot spray[b]	1.75	.19	Ftba, Smwd, Cath, Dand
	+2,4-D amine	+1.5		.89		
Metr(EPP)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Imep(EPP)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Metr(PRE)	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		
Total post	Clopyralid&2,4-D	0.095&0.5	Broadcast	7.14	.76	Cath, Smwd, Ftba, Dand
	+glyphosate	+0.56		6.98		
	+2,4-D amine	+1		2.38		

[a] 2,4-D = 2,4-D amine; clopyralid&2,4-D = CURTAIL herbicide.
[b] Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field (cost was reduced by 1/4).
[c] Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field (cost was reduced by 1/8).

Table 7. Economic analysis for minimum till and no-till soybeans grown under various weed control systems in 1992.

Planned herbicide treatment	Variable production costs[a]						
	Seed	Herbicide plus adjuvant	Herbicide appl. and incorp.	Culti-vation	Chisel plow & seedbed prep.	Crop value[b]	Net return
	($/A)						
TILLED, 30-INCH ROWS							
Trif+Metribuzin(PPI)	12.22	23.87	8.85	2.98	7.70	84.43	28.81
Trif+Imazethapyr(PPI)	12.22	32.52	8.66	2.98	7.70	80.29	16.21
Trif+Clomazone(PPI)	12.22	30.56	8.76	2.98	7.70	79.25	17.03
Trif+Chloramben(PPI)	12.22	55.69	9.61	2.98	7.70	81.84	-6.36
Total postemergence	12.22	9.63	8.09	5.96	7.70	86.51	42.91
Average:	12.22	30.45	8.79	3.58	7.70	82.46	19.72
NO-TILL, 30-INCH ROWS							
Cyanazine(EPP)	12.22	45.04	3.23	2.98	0	97.38	33.91
Metribuzin(EPP)	12.22	37.71	3.99	2.98	0	88.58	31.68
Imazethapyr(EPP)	12.22	40.56	2.28	2.98	0	110.85	52.81
Metribuzin(PRE)	12.22	36.13	3.99	5.96	0	93.24	34.94
Total postemergence	12.22	30.84	3.04	5.96	0	101.01	48.95
Average:	12.22	38.06	3.31	4.17	0	98.21	40.46
NO-TILL, 7-INCH ROWS							
Cyanazine(EPP)	14.20	33.82	2.66	2.98	0	75.11	21.45
Metribuzin(EPP)	14.20	56.04	4.09	2.98	0	72.00	-5.31
Imazethapyr(EPP)	14.20	46.93	2.47	2.98	0	92.20	25.62
Metribuzin(PRE)	14.20	52.27	3.80	2.98	0	77.18	3.93
Total postemergence	14.20	48.36	3.23	2.98	0	58.53	-10.24
Average:	14.20	47.48	3.25	2.98	0	75.00	7.09

[a] Variable cost rates derived from University of Minnesota values reduced by 25% (Minnesota values assume a farmer owns all new equipment). Included in variable cost rates is equipment overhead, repairs, maintenance, and fuel. Labor is not included. Costs are as follows: spraying, $.76/A; herbicide incorporation, $3.19/A per pass; cultivation, $2.98/A; chisel plowing, $4.51/A.

[b] 1992 soybeans were valued at $5.18 per bushel (Ave. price for Sept.-Nov. 1992, North Dakota Agricultural Statistics).

Table 8. Soil pH and organic matter (0 to 2 inch depth) in the fall of 1992 for various treatments in a soybean-wheat rotation experiment initiated in 1987. Data pertain to the area planted to soybeans in 1992.

Herbicide treatments in soybeans	pH	Organic matter
		(%)
TILLED, 30-INCH ROWS		
Trifluralin+Metribuzin(PPI)	7.6	4.4
Trifluralin+Imazethapyr(PPI)	7.5	4.6
Trifluralin+Clomazone(PPI)	7.7	4.2
Trifluralin+Chloramben(PPI)	7.4	4.4
Total postemergence	7.7	4.3
Hand-weeded check	7.7	4.2
Average:	7.6	4.3
NO-TILL, 30-INCH ROWS		
Cyanazine(EPP)	7.8	4.5
Metribuzin(EPP)	7.7	4.5
Imazethapyr(EPP)	7.7	4.8
Metribuzin(PRE)	7.6	4.7
Total postemergence	7.7	4.7
Hand-weeded check	7.6	4.7
Average:	7.7	4.6
NO-TILL, 7-INCH ROWS		
Cyanazine(EPP)	7.4	4.8
Metribuzin(EPP)	7.5	4.5
Imazethapyr(EPP)	7.6	4.7
Metribuzin(PRE)	7.4	4.7
Total postemergence	7.4	4.7
Hand-weeded check	7.4	4.7
Average:	7.4	4.7
Treatments in a tillage (LSD 5%)	NS	NS
Tillage effect (P-value)	NS	NS

Rep	Average pH	Average organic matter
1	7.3	4.6
2	7.8	5.0
3	7.8	4.1
4	7.3	4.5
LSD 5%	0.13	0.14

1992 WHEAT

Methods

Tilled plots were chisel plowed late October 1991. Ammonium nitrate was applied in November 1991 at 205 lb/A (94 lb N/A) for tilled plots and 248 lb/A (114 lb N/A) for no-till plots according to soil test recommendations for a 60-bu/A yield goal. Butte 86 hard red spring wheat was seeded 1.5-inch deep at 95 lb/A April 29, 1992 with a Haybuster drill. Tilled plots were worked once with a field cultivator/harrow (2.5 to 3-inches deep) on April 28. Preemergence burndown treatments were applied May 7 (Table 9). Postemergence treatments were applied May 24 (Table 9). All herbicide tratments were applied only when needed and at rates deemed necessary by the investigator. Herbicides were applied broadcast using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Weed counts were taken at harvest (three 0.25-m^2 quadrats per plot). Wheat was machine-harvested Aug. 20 by taking two 4-ft-wide by 37-ft-long subsamples per plot. Post-harvest herbicide treatments on tilled and no-till plots were applied Sept. 22 and a second treatment was made Sept. 29 on selected no-till plots (Table 10). All tilled plots were chisel plowed 8 inches deep on Oct. 1 and received one pass with a field cultivator/harrow (3-inch depth) Oct. 5 to further incorporate heavy wheat residues.

Table 9. Rates and dates of as-needed burndown and postemergence applications in tilled and no-till wheat in 1992.

1991 soybean herbicide treatments	As-needed burndown application[a] Herbi-cide	Rate (lb/A)	Date	Target weeds	As-needed postemergence application[a] Herbi-cide	Rate (oz/A)	Date	Target weeds
TILLED, 30-INCH ROWS								
Trif+Metr(PPI)	None	0	-	None	Trib +2,4-D	0.125 +4	5/24	KOCZ, Colq
Trif+Imep(PPI)	None	0	-	None	Trib +2,4-D	0.25 +6	5/29	KOCZ, Colq, Cath
Trif+Clom(PPI)	None	0	-	None	Trib +2,4-D	0.125 +4	5/24	KOCZ, Colq, Wimu
Trif+Clam(PPI)	None	0	-	None	Trib +2,4-D	0.25 +6	5/29	KOCZ, Colq, Wibw, Cath
Total post(PO)	None	0	-	None	Trib +2,4-D	0.188 +4	5/24	Colq, KOCZ
HWC - Trif+ Imep+Clom(PPI)	None	0	-	None	Thif&Trib	0.375	6/11	Wimu
NO-TILL, 30-INCH ROWS								
Cyanazine(EPP)	Glyt	0.375[b]	5/7	Ftba	Trib +2,4-D	0.188 +4	5/24	KOCZ, Colq, Ftba, Cath
Metribuzin(EPP)	None	0	-	None	Thif&Trib +2,4-D	0.225 +4	5/24	KOCZ, Wibw, Dand
Imazethapyr(EPP)	None	0	-	None	Thif&Trib +2,4-D	0.225 +4	5/24	KOCZ, Wibw, Colq, Dand
Metribuzin(PRE)	Glyt	0.375[c]	5/7	Ftba, KOCZ, Wibw	Thif&Trib +2,4-D	0.338 +4	5/24	KOCZ, Wibw, Colq, Wimu
Total post(PO)	Glyt	0.375[b]	5/7	Ftba, Dand, KOCZ, Wibw	Trib +2,4-D	0.25 +6	5/24	Cath, KOCZ, Wibw, Colq
HWC - Pend+ Imep+Clom(EPP)	Glyt	0.75	5/7	Ftba	Thif&Trib	0.375	6/11	
NO-TILL, 7-INCH ROWS								
Cyanazine(EPP)	Glyt	0.49[b]	5/7	Smwd, Wibw, Ftba	Trib +2,4-D	0.25 +6	5/24	Cath, Wibw, KOCZ
Metribuzin(EPP)	Glyt	0.375[c]	5/7	Ftba, KOCZ	Trib +2,4-D	0.25 +6	5/24	Cath, KOCZ, Wibw, Colq
Imazethapyr(EPP)	Glyt	0.49[c]	5/7	Smwd	Trib +2,4-D	0.25 +6	5/24	KOCZ, Cath, Wibw
Metribuzin(PRE)	Glyt	0.375[c]	5/7	Ftba, KOCZ	Trib +2,4-D	0.25 +6	5/24	Cath, Wibw, Colq
Total post(PO)	Glyt	0.49[b]	5/7	Dand, Wibw, KOCZ, Ftba	Trib +2,4-D	0.25 +6	5/24	KOCZ, Smwd, Cath, Dand
HWC - Pend+ Imep+Clom(EPP)	Glyt	0.75	5/7		Thif&Trib +Clpy&24D	0.225 1.5&8	6/11	KOCZ

[a]Glyt (glyphosate) always applied with ammonium sulfate at 1.5 lb/A; 2,4-D = 2,4-D butoxyethyl ester; Trib (tribenuron) and Thif&Trib (thifensulfuron-tribenuron package mix) applied with nonionic surfactant at 0.125% except when the 2,4-D rate was 0.375 lb/A in which case surfactant was not used.

[b]Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field.

[c]Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field.

Table 10. Herbicide treatments applied following the 1992 harvest of tilled and no-till wheat.

1991 soybean herbicides	Herbicide or adjuvant[a]	Rate (lb/A)	Date	Broadcast or spot spray	Cost[b] ($/A)	Target weeds
TILLED, 30-INCH ROWS						
Trif+Metr(PPI)	Clpy&2,4-D	0.024&0.13	9/22	Spot spray[c]	.22	Cath
	+Glyt	+0.75			1.17	
	+AS	+1.5			.05	
Trif+Imep(PPI)	Clpy&2,4-D	0.024&0.13	9/22	Spot spray[c]	.22	Cath
	+Glyt	+0.75			1.17	
	+AS	+1.5			.05	
Trif+Clom(PPI)	None	0	-	-	0	None
Trif+Clam(PPI)	Clpy&2,4-D	0.024&0.13	9/22	Spot spray[c]	.22	Cath
	+Glyt	+0.75			1.17	
	+AS	+1.5			.05	
Total post	Clpy&2,4-D	0.024&0.13	9/22	Spot spray[c]	.22	Cath
	+Glyt	+0.75			1.17	
	+AS	+1.5			.05	
NO-TILL, 30-INCH ROWS						
Cyanazine(EPP)	Glyt	0.375	9/22	Broadcast	4.67	Ftba, Yeft, Wibw,
	+Surfact.	+0.125%			.18	vol. wheat
	+AS	+1.5			.38	
	Clpy&2,4-D	0.024&0.13	9/29	Spot spray[c]	.22	Canada thistle
	+Glyt	+0.375			.58	
	+Surfact.	+0.125%			.02	
	+AS	+1.5			.05	
Metr(EPP)	Glyt	0.375	9/22	Broadcast	4.67	Ftba, Yeft, Wibw,
	+Surfact.	+0.125%			.18	vol. wheat
	+AS	+1.5			.38	
	Clpy&2,4-D	0.024&0.13	9/29	Spot spray[b]	.44	Canada thistle
	+Glyt	+0.375			1.17	
	+Surfact.	+0.125%			.04	
	+AS	+1.5			.10	
Imep(EPP)	Clpy&2,4-D	0.024&0.13	9/22	Broadcast	1.78	Cath, Ftba, Wibw,
	+Glyt	+0.5			6.23	KOCZ, Dand, Llsa,
	+Surfact.	+0.125%			.18	Yeft, vol. wheat
	+AS	+1.5			.38	
Metr(PRE)	Clpy&2,4-D	0.024&0.13	9/22	Broadcast	1.78	Cath, Yeft, Ftba,
	+Glyt	+0.5			6.23	Wibw, KOCZ, vol.
	+Surfact.	+0.125%			.18	wheat
	+AS	+1.5			.38	
Total post	Glyt	0.375	9/22	Broadcast	4.67	KOCZ, Wibw, Dand,
	+Surfact.	+0.125%			.18	Corw, Colq, Ftba,
	+AS	+1.5			.38	vol. wheat
	Clpy&2,4-D	0.024&0.13	9/29	Spot spray[b]	.44	Cath, Ftba
	+Glyt	+0.375			1.17	
	+Surfact.	+0.125%			.04	
	+AS	+1.5			.10	

Table 10, continued. Herbicide treatments applied following the 1992 harvest of tilled and no-till wheat.

1991 soybean herbicides	Herbicide or adjuvant[a]	Rate	Date	Broadcast or spot spray	Cost[b]	Target weeds
		(lb/A)			($/A)	
NO-TILL, 7-INCH ROWS						
Cyanazine(EPP)	Clpy&2,4-D	0.024&0.13	9/29	Spot spray[b]	.44	Cath, Wibw, Yeft, vol. wheat
	+Glyt	+0.75			2.34	
	+AS	+1.5			.10	
Metr(EPP)	Clpy&2,4-D	0.024&0.13	9/22	Broadcast	1.78	Cath, Ftba, Yeft, Wibw, Dand, vol. wheat
	+Glyt	+0.5			6.23	
	+Surfact.	+0.125%			.18	
	+AS	+1.5			.38	
Imep(EPP)	Dicamba	0.125	9/22	Broadcast	2.15	Wibw, Yeft, Llsa, vol. wheat
	+Glyt	+0.188			2.34	
	+Surfact.	+0.5%			.73	
	+AS	+1.5			.38	
	Clpy&2,4-D	0.024&0.13	9/29	Spot spray[b]	.44	Canada thistle
	+Glyt	+0.5			1.56	
	+Surfact.	+0.125%			.04	
	+AS	+1.5			.10	
Metr(PRE)	Clpy&2,4-D	0.024&0.13	9/22	Broadcast	1.78	Cath, Smwd, Ftba, Dand
	+Glyt	+0.5			6.23	
	+Surfact.	+0.125%			.18	
	+AS	+1.5			.38	
Total post	Glyt	0.375	9/22	Broadcast	4.67	Wibw, Dand, Ftba, Llsa, vol. wheat
	+Surfact.	+0.125%			.18	
	+AS	+1.5			.38	

[a] Clpy&2,4-D = CURTAIL herbicide.
[b] Only 2 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/4 of the field.
[c] Only 1 of 4 plots required treatment. For cost calculations, this treatment was considered to be spot sprayed over 1/8 of the field.

Table 11. Weeds present at harvest, wheat stand density, and wheat grain yield of 1992 wheat grown in rotation with soybeans.

1991 soybean herbicide treatments	Weed density at harvest								1992 wheat	
	Yeft	KOCZ	Rrpw	Colq	Wibw	Cath	Ftba	Dand	Stand density	Grain yield
	(no. per 100 m^2)								(no./m)	(bu/A)
TILLED, 30-INCH ROWS										
Trifluralin+Metribuzin(PPI)	367	100	0	100	100	67	0	33	32.3	56.4
Trifluralin+Imazethapyr(PPI)	233	33	33	67	33	67	0	33	33.3	58.0
Trifluralin+Clomazone(PPI)	133	0	0	67	67	0	33	33	29.3	56.9
Trifluralin+Chloramben(PPI)	933	89	44	356	0	89	0	133	32.6	55.7
Total postemergence	1267	200	0	400	0	167	0	33	32.5	50.3
Hand-weeded check	-	-	-	-	-	-	-	-	31.4	62.2
Tillage average:	568	84	14	190	42	77	7	49	31.9	56.6
NO-TILL, 30-INCH ROWS										
Cyanazine(EPP)	1667	0	0	0	200	133	67	33	28.0	61.7
Metribuzin(EPP)	700	33	0	67	67	0	0	67	30.9	61.9
Imazethapyr(EPP)	800	200	0	0	200	33	0	133	33.3	60.5
Metribuzin(PRE)	1033	33	0	33	100	467	0	33	31.3	53.4
Total postemergence	333	100	33	233	400	67	0	100	29.6	58.5
Hand-weeded check	-	-	-	-	-	-	-	-	33.6	68.0
Tillage average:	907	73	7	67	193	140	13	73	31.1	60.7
NO-TILL, 7-INCH ROWS										
Cyanazine(EPP)	578	0	0	0	889	565	44	89	31.4	60.1
Metribuzin(EPP)	533	33	0	33	233	156	67	33	30.5	57.1
Imazethapyr(EPP)	933	0	0	44	222	938	0	178	28.8	58.4
Metribuzin(PRE)	2000	0	0	100	233	599	67	100	33.9	54.0
Total postemergence	311	89	0	44	756	0	89	400	30.4	61.5
Hand-weeded check	-	-	-	-	-	-	-	-	32.6	62.1
Tillage average:	918	24	0	47	439	243	55	149	31.3	58.5
LSD 5% Trts within a tillage	602	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tillage effect (P-value)	.279	.339	.575	.321	.236	.146	.261	.299	.557	.163

Table 12. Economic analysis for 1992 tilled and no-till spring wheat grown in rotation with soybeans produced with various herbicide programs.

1991 planned herbicide treatment in soybeans	1992 Variable production costs[a] Herbicide plus adjuvant	Herbicide application	Fall chisel plowing	Seedbed preparation	1992 HRSW value[b]	Net return
	(\$/A)					
TILLED, 30-INCH ROWS						
Trif+Metr(PPI)	5.52	.86	4.51	3.19	174.28	160.20
Trif+Imep(PPI)	8.88	.86	4.51	3.19	179.22	161.78
Trif+Clom(PPI)	4.08	.76	4.51	3.19	175.82	163.28
Trif+Clam(PPI)	8.88	.86	4.51	3.19	172.11	154.67
Total post	7.11	.86	4.51	3.19	155.43	139.76
Average:	6.89	.84	4.51	3.19	171.37	155.94
NO-TILL, 30-INCH ROWS						
Cyanazine(EPP)	13.03	1.81	0	0	190.65	175.81
Metribuzin(EPP)	11.18	1.71	0	0	191.27	178.38
Imazethapyr(EPP)	12.77	1.52	0	0	186.95	172.66
Metribuzin(PRE)	15.06	1.62	0	0	165.01	148.33
Total post	15.68	1.90	0	0	180.77	163.19
Average:	13.54	1.71	0	0	182.93	167.67
NO-TILL, 7-INCH ROWS						
Cyanazine(EPP)	11.94	1.14	0	0	185.71	172.63
Metribuzin(EPP)	16.64	1.62	0	0	176.44	158.18
Imazethapyr(EPP)	15.99	1.81	0	0	180.46	162.66
Metribuzin(PRE)	16.64	1.62	0	0	166.86	148.60
Total post	14.29	1.71	0	0	190.04	174.04
Average:	15.10	1.58	0	0	179.90	163.22

[a] Variable cost rates derived from University of Minnesota values reduced by 25% (Minnesota values assume a farmer owns all new equipment). Included in variable cost rates is equipment overhead, repairs, maintenance, and fuel. Labor is not included. Herbicide application cost was \$0.76/A.

[b] 1992 hard red spring wheat was valued at \$3.09 per bushel (average for Sept.-Nov. 1992, North Dakota Agricultural Statistics).

Table 13. Soil pH and organic matter (0 to 2 inch depth) in the fall of 1992 for various treatments in a soybean-wheat rotation experiment initiated in 1987. Data pertain to the area planted to wheat in 1992.

Herbicide treatments in soybeans	pH	Organic matter (%)
TILLED, 30-INCH ROWS		
Trifluralin+Metribuzin(PPI)	7.8	4.2
Trifluralin+Imazethapyr(PPI)	7.9	3.9
Trifluralin+Clomazone(PPI)	7.7	4.0
Trifluralin+Chloramben(PPI)	7.7	4.1
Total postemergence	7.8	4.1
Hand-weeded check	8.0	4.0
Average:	7.8	4.0
NO-TILL, 30-INCH ROWS		
Cyanazine(EPP)	7.7	4.2
Metribuzin(EPP)	7.9	4.1
Imazethapyr(EPP)	7.9	4.2
Metribuzin(PRE)	8.0	4.2
Total postemergence	7.8	3.9
Hand-weeded check	7.8	4.2
Average:	7.8	4.1
NO-TILL, 7-INCH ROWS		
Cyanazine(EPP)	7.7	4.1
Metribuzin(EPP)	8.0	4.3
Imazethapyr(EPP)	7.7	4.0
Metribuzin(PRE)	7.8	4.0
Total postemergence	7.7	4.2
Hand-weeded check	7.8	4.1
Average:	7.7	4.1
Treatments in a tillage (LSD 5%)	NS	NS
Tillage effect	NS	NS

Rep	Average pH	Average organic matter
1	7.3	4.1
2	8.0	4.1
3	7.9	3.6
4	8.0	4.6
LSD 5%	0.14	0.15

Multiple applications of bentazon in drybeans, Fargo 1993. The experiment was established on a conventionally tilled silty clay with pH 7.8 and 4% organic matter. Oilseed sunflower seed was spread by hand before seedbed preparation to simulate volunteer sunflowers. Othello pinto beans were planted 1.5 inches deep at 70,000 seeds/A and in 30-inch rows. Plots were treated either 1, 2, 3, or 4 times, each time at the lb/A rate shown in the table below. Treatment dates were as follows: July 9 for plots treated once; July 9 and June 28 for plots treated twice; July 9, June 28, and June 22 for plots treated 3x; July 9, June 28, June 22, and June 15 for plots treated 4x. All herbicides were applied with a bicycle wheel or backpack sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Conditions on June 15 were as follows: unifoliolate drybeans, 2 to 3 inches tall; cotyledonary sunflowers, wild mustard, and redroot pigweed; kochia 0.5 inch tall; 2-leaf foxtail; air temperature 62 F; relative humidity 50%; wind 2 to 5 mph; sunny skies; dry soil surface. Conditions on July 9 were: 1 to 2 trifoliolate drybeans (yellowed from water stress), 4- to 6-leaf and 2- to 4-inch-tall sunflowers, 6-leaf and 4-inch-tall wild mustard, 4- to 6-leaf and 2-inch-tall lambsquarters, 1- to 2-inch-tall kochia, 70% relative humidity, 80 F air temperature, wind 5 to 10 mph, sunny skies, and wet soil. The entire experiment was sprayed on July 12 with sethoxydim at 0.2 lb/A plus Scoil at 1 quart/A for foxtail control. Visual estimates of weed control were made July 23 and Aug. 10. Plot size was 10 by 30 ft and the experiment was a randomized complete block design with four replications.

			Weed control							
			Evaluated July 23				Evaluated Aug. 10			
Treatment[a]	Rate[b]	No. of applications	Cosf	Wimu	Colq	KOCZ	Cosf	Wimu	Colq	KOCZ
	(lb/A)		(%)							
Bentazon+POC	0.25+1Q	4	3	100	76	98	3	99	64	96
Bentazon+POC	0.33+1Q	3	3	100	34	79	25	75	25	46
Bentazon+POC	0.5+1Q	2	0	99	31	64	0	83	0	36
Bentazon+POC	1+1Q	1	0	94	8	52	0	96	0	53
Bentazon+Dash	0.25+0.5Q	4	6	99	90	77	3	99	-	-
Bentazon+Dash	0.33+0.5Q	3	8	100	79	98	0	100	-	98
Bentazon+Dash	0.5+0.5Q	2	0	100	76	100	3	95	73	100
Bentazon+Dash	1+0.5Q	1	0	93	5	88	0	97	3	89
Bentazon+AS	0.25+2.5	4	0	100	53	86	18	99	4	86
Bentazon+AS	0.33+2.5	3	5	97	0	16	9	97	0	5
Bentazon+AS	0.5+2.5	2	0	96	9	6	0	42	1	5
Bentazon+AS	1+2.5	1	0	98	5	8	0	43	0	1
C.V. %			317	4	45	26	390	22	96	39
LSD 5%			NS	5	23	22	NS	25	21	29

[a]POC = petroleum oil adjuvant containing 17% emulsifier; Dash = Dash HC spray adjuvant from BASF, different from Dash; AS = ammonium sulfate.
[b]Q = quart per acre; rate shown indicates the amount applied for each separate application. Thus, a plot receiving 0.25 lb/A bentazon four times was treated with a total of 1 lb/A (all plots received a total of 1 lb/A).

Summary. Extremely heavy rains in July slowed crop growth and made evaluation of weed control and crop injury difficult. Volunteer sunflowers were not controlled by any treatments. Other weeds, however, were controlled most effectively by four separate applications of 0.25 lb/A bentazon.

Bentazon, acifluorfen, and imazethapyr in drybeans, Fargo 1993. The experiment was established on a conventionally-tilled silty clay with pH 7.8 and 4% organic matter. Oilseed sunflower seed was spread by hand (to simulate volunteer sunflower) before tilling the entire area once with a field cultivator 3 to 5 inches deep to prepare a seedbed. Othello pinto beans were planted 1.5 inches deep on June 2 at 70,000 seeds/A using a Hiniker no-till planter set on 30-inch rows. The first POST treatments were applied June 15 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles, 40 psi, and the following conditions: unifoliolate drybeans, 2 to 3 inches tall; cotyledonary sunflowers, wild mustard, and redroot pigweed; 0.5-inch kochia; 2-leaf yellow foxtail; air temperature 62 F; RH 50%; sunny skies; dry soil surface; wind 2-5 mph. The second POST treatments were applied July 9 under very wet conditions using a 4-nozzle backpack sprayer with nozzles, gpa, and pressure as above, and conditions as follows: 1- to 2-trifoliolate, 3- to 4-inch-tall drybeans; 4- to 6-leaf, 2- to 4-inch-tall sunflowers; 4- to 6-leaf, 2-inch-tall common lambsquarters; 6-leaf, 4-inch-tall wild mustard, 2- to 4-leaf, 1-inch-tall redroot pigweed; 1- to 2-inch-tall kochia; air temperature 80 F; RH 70%; wind 5 to 10 mph; sunny skies; wet soil surface. The entire experiment was sprayed July 12 with 0.2 lb/A sethoxydim plus 1 quart/A Scoil for foxtail control. Estimates of percentage weed control were made July 23 and Aug. 11. Drybean yields were taken by hand Sept. 28 from the two center rows of each plot. Plot size was 10 by 26.5 ft and the experiment was a randomized complete block design with four replications.

		Weed control								
		Evaluated July 23				Evaluated Aug. 11				Grain
Treatment[a]	Rate[b]	Cosf	Wimu	Colq	KOCZ	Cosf	Wimu	Colq	KOCZ	yield
	(lb/A)	(%)								(lb/A)
Untreated	0	0	0	0	0	0	0	0	0	182
Bentazon+POC/ Bentazon+POC	0.5+1Q/ 0.5+1Q	10	100	77	100	0	97	85	99	258
Bent+Acif+POC/ Bent+Acif+POC	0.5+0.06+0.5Q/ 0.5+0.06+0.5Q	11	100	88	99	5	100	77	89	329
Bent+Imep+POC/ Bentazon+POC	0.5+0.016+1Q/ 0.5+1Q	20	100	96	100	6	95	74	99	413
Ben+Imep+X7+28%/ Bentazon+POC	0.5+0.016+0.13%+2.5%/ 0.5+1Q	30	100	99	100	0	98	95	99	405
Bentazon+POC	1+1Q	16	100	100	100	0	100	99	99	205
Ben+Imep+X7+28%/ Ben+Imep+X7+28%	0.5+0.016+0.13%+2.5%/ 0.5+0.016	97	100	100	100	99	100	100	100	359
Ben+Imep+X7+28%/ Bentazon+POC	0.5+0.032/ 0.5+1Q	75	100	100	100	26	100	100	100	295
Bentazon+POC/ Ben+Imep+X7+28%	0.5+1Q/ 0.5+0.032	83	100	97	100	95	100	96	100	253
C.V. %		31	0	11	1	16	4	16	5	39
LSD 5%		17	NS	13	1	6	5	19	6	NS

[a]Acif = Acifluorfen; Imep = Imazethapyr; Bent or Ben = bentazon; POC = petroleum oil concentrate containing 17% emulsifier.
[b]1Q = 1 quart/A; 0.5Q = 0.5 quart/A.

Bentazon combinations in drybeans, Fargo 1993. The experiment was conducted on a conventionally-tilled silty clay with pH 7.8 and 4% organic matter. The entire experiment was treated before planting with trifluralin at 1 lb/A and incorporated twice with a field cultivator to control grasses. Othello pinto beans at 70,000 seeds/A and Upland navy beans at 90,000 seeds/A were planted 1.5 inches deep in alternating rows (30 inches apart) so that the treated area would contain one row of each variety. Initial treatments (P01) were applied June 15 with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles at 40 psi. Conditions at time of treatment were as follows: unifoliolate drybeans, 2 to 3 inches tall; air temperature 62 F; RH 50%; wind 2 to 5 mph; sunny skies; dry soil surface. Final treatments (P02) were applied July 9 using a 4-nozzle backpack sprayer (nozzles, gpa, and pressure as above) when air temperature was 80 F, RH was 70%, wind was 5 to 10 mph, skies were sunny, the soil surface was wet, and drybeans were 1 to 2 trifoliolate and 3 to 5 inches tall. The entire experiment was cultivated Aug. 11. Drybean yields were hand harvested Sept. 17. Plot size was 10 by 26.5 ft and the experiment was a randomized complete design block with four replications.

Treatment[a]	Rate[b]	Grain yield Pinto	Grain yield Navy
		—(lb/A)—	
Untreated	0	257	259
Bentazon+POC(P01)/ Bentazon+POC(P02)	0.5+1Q/ 0.5+1Q	266	307
Bentazon+Acifluorfen+POC(P01)/ Bentazon+Acifluorfen+POC(P02)	0.5+0.06+0.5Q/ 0.5+0.06+0.5Q	304	296
Bentazon+POC(P01)	1+1Q	297	234
Bentazon+Imazethapyr+X77+28%UAN(P01)	0.5+0.031+0.125%+2.5%	376	301
Bentazon+Imazethapyr+X77+28%UAN(P01)/ Bentazon+Imazethapyr+X77+28%UAN(P02)	0.5+0.016+0.125%+2.5%/ 0.5+0.016+0.125%+2.5%	306	306
Bentazon+Sethoxydim+POC(P01)/ Bentazon+Sethoxydim+POC(P02)	0.5+0.15+1Q/ 0.5+0.15+1Q	325	356
C.V. %		27	29
LSD 5%		NS	NS

[a]POC = petroleum oil adjuvant containing 17% emulsifier; X77 = nonionic surfactant by Valent; 28%UAN = 28% urea ammomium nitrate fertilizer solution.
[b]Q = quart/A.

Comments: Due to extreme flooding in mid July, drybean injury could not be evaluated.

EPTC for weed control in drybeans, Fargo 1993. The experiment was established on a conventionally tilled silty clay with pH 7.8 and 4% organic matter. On June 2 the entire experiment was worked with a field cultivator. All PPI treatments were applied using a bicycle wheel sprayer with 8002 nozzles delivering 17 gal/A at 40 psi when air temperature was 62 F, relative humidity was 50%, skies were sunny, wind was 5 to 9 mph, and the soil surface was dry. All treatments were immediately incorporated with two passes in opposite directions using a field cultivator set to till 2 to 3 inches deep. Othello pinto beans were planted 1.5 inches deep at 70,000 seeds/A on 30-inch rows. Visual estimates of percentage weed control were made July 2 and Sept. 9. Grain yields were taken by hand from the center two rows of each plot on Sept. 14. Plot size was 10 by 26.5 ft and the experiment was a randomized complete block design with four replications.

		Evaluated July 2					Evaluated Sept. 9					Grain
Treatment[a]	Rate	Fxtl	Wimu	Colq	KOCZ	Rrpw	Fxtl	Wimu	Colq	KOCZ	Rrpw	yield
	(lb/A)	(%)										(lb/A)
EPTC	4	85	20	97	6	99	18	13	82	15	47	342
EPTC+Trif	2.2+0.5	98	11	99	76	100	74	0	100	95	100	389
EPTC+Etha	2.2+0.75	99	46	100	100	100	61	6	100	99	100	458
EPTC+Alac&Trif	2.2+0.5&0.063	98	39	92	0	96	18	10	85	0	95	377
EPTC+Imep	2.5+0.031	100	100	100	100	100	46	100	100	100	100	481
Weedy check	0	0	0	0	0	0	0	0	0	0	0	207
C.V. %		14	57	4	26	3	45	79	9	20	26	23
LSD 5%		16	28	4	21	4	24	23	10	17	31	129

[a] EPTC = Eptam 7E emulsifiable concentrate; Trif = Treflan 4E emulsifiable concentrate; Etha = Sonalan 3E emulsifiable concentrate; Alac&Trif = Freedom 3E which is 2.67 lb/gal alachlor + 0.33 lb/gal trifluralin; Imep = Pursuit soluble concentrate.

Comments. Low temperatures throughout the season and extremely heavy rains during July produced poor crop growth and low yields, and made it difficult to evaluate any crop injury.

Economics of fallow with Detectspray, broadcast sprayer, and tillage, Fargo 1993. The experiment was established on a silty clay with pH 7.8, 4.5% organic matter, and standing wheat stubble. The objective was to compare the full-season economics of controlling weeds as needed in fallow using Detectspray, a conventional broadcast sprayer, or tillage. Herbicide treatments were applied with a sprayer mounted on an all-terrain vehicle treating a 10-ft-wide effective spray swath (6 nozzles spaced 20 inches apart). Plot size was 20 by 220 ft, requiring two adjacent passes of the sprayer to treat the entire plot area. Alleys 10 by 220-ft were placed between plots to protect against spray drift from one plot to the next. All herbicides were applied with X-77 nonionic surfactant at 0.5% v/v and were applied at 7 mph and 25 psi pressure using extended-range nozzle tips. Standard broadcast treatments were applied at 5 gal/A with 80015 nozzles, while Detectspray treatments were applied at 10 gal/A with 8003 nozzles. Higher spray volume was used for Detectspray because of the potential for spray displacement by wind. Tillage was done 2 to 3 inches deep with a field cultivator. The experiment was a randomized complete block design with four replications.

All treatments (Detectspray, conventional broadcasting, and tillage) were applied on an as-needed basis as judged by the investigator. The tilled treatment was tilled when weeds were 4 to 5 inches tall. Weed stages at time of herbicide application are given in Table 1.

Costs and prices used to generate the economic analysis (Table 2) were as follows:

1993 herbicide prices were obtained from Ostlund Chemical Co. in Fargo and were $37/gal for glyphosate (Roundup RT, 3 lb ae/gal), $9.50/gal for 2,4-D dimethylamine, and $17.50/gal for X-77 surfactant. Conventional broadcast application cost was $0.76/A and tillage cost was $3.19/A (both supplied by Univ. of Minnesota Exten-

Table 1. Weed species and sizes and environmental conditions at time of applications in fallow at Fargo.

Application date	Weeds present at application: Species	Weeds present at application: Size	Environmental conditions: Air temp. (F)	Relative humidity (%)	Soil moisture
May 11	volunteer wheat	4 to 6 inches tall	81	35	dry
	dancelion	4 to 8 inches diam.			
	kochia	1 inch tall			
May 13	Same as May 11	Same as May 11	53	70	dry
June 15	dandelion	8 to 12 inches diam.	66	50	moist
	volunteer wheat	6 to 8 inches tall			
	Canada thistle	6 to 8 inches tall			
	kochia	4 to 6 inches tall			
	yellow foxtail	1 to 3 inches tall			
	cocklebur	4 inches tall			
Sept. 10	volunteer wheat	4 to 6 inches tall	58	-	dry
	yellow foxtail	4 to 6 inches tall			
	redroot pigweed	2 to 6 inches tall			
	dandelion	4 to 8 inches diam.			
	Canada thistle	6 to 10 inches tall			

sion). Conventional broadcasting was assumed to be done by the farmer and labor was assumed to be "free". Detectspray application cost was assumed to be done by a custom applicator and was estimated at $3.23/A. This includes a custom broadcast cost of $2.48/A (U. of Minn. Extension) plus an additional $0.75/A premium for Detectspray application (figure supplied by Kelly Johnson, Saskatchewan custom applicator, adjusted for a U.S.-Canada exchange rate of $1.00:$0.75).

1993 was unusually cool throughout the season and wet through July with extremely wet conditions during the last 2 weeks of July following over 5 inches of rain July 16. Weed growth on no-till fallow plots was especially slowed by these conditions.

Table 2. Comparative economics of using Detectspray, conventional broadcasting, and tillage for weed control in fallow at Fargo.

Treatment plan	Herbicide[a] or tillage treatment applied: Herbicide	Rate (lb/A)	Date	Spray vol. red. (%)	Cost[a]: Herbicide+S ($/A)	Application ($/A)	Total ($/A)
First application							
Broadcast	Glyt+2,4-D	0.25+1	5/13	-	5.90	0.76	6.66
Detectspray	Glyt+2,4-D	0.25+1	5/11	59	2.60	3.23	5.83
Tillage	None	-	5/3	-	-	-	3.19
Second application							
Broadcast	Glyt+2,4-D	0.28+1	9/10	-	6.27	0.76	7.03
Detectspray	Glyt+2,4-D	0.28+0.5	6/15	43	3.15	3.23	6.38
Tillage	None	-	6/11	-	-	-	3.19
Third application							
Broadcast	None	-	-	-	0	0	0
Detectspray	Glyt+2,4-D	0.28+0.38	9/10	34	3.45	3.23	6.68
Tillage	None	-	7/12	-	-	-	3.19
Fourth application							
Broadcast	None	-	-	-	0	0	0
Detectspray	None	-	-	-	0	0	0
Tillage	None	-	8/4	-	-	-	3.19
Fifth application							
Broadcast	None	-	-	-	0	0	0
Detectspray	None	-	-	-	0	0	0
Tillage	None	-	9/1	-	-	-	3.19
Total							
Broadcast	Glyt+2,4-D	0.53+2[b]	-	-	12.17	1.52	13.69
Detectspray	Glyt+2,4-D	0.45+0.88[b]	-	45	9.20	9.69	18.89
Tillage	None	-	-	-	-	-	15.95
C.V. %				31			
LSD 5%				NS			

[a]X-77 nonionic surfactant (S) at 0.5% v/v was added to all treatments; herbicide cost includes surfactant cost; glyt = glyphosate; 2,4-D = 2,4-D dimethylamine.

[b]Represents the total amounts of glyphosate and 2,4-D applied for these treatments.

Sulfosate and glyphosate for control of volunteer wheat and foxtail, Fargo 1993. Marshall wheat was planted May 12 at 90 lb/A on silty clay soil to simulate volunteer wheat. Treatments were applied June 21 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Conditions at time of treatment were: wheat 6 to 8 inches tall with 5.5 leaves (including two tillers), yellow foxtail 3- to 5-leaf and 2 to 4 inches tall, air temperature 87 F, relative humidity 65%, wind 3 to 7 mph, skies sunny, and the soil was dry at the surface. Visual estimates of percentage weed control were made July 2 and July 19. Plot size was 10 by 30 ft and the experiment was a randomized complete block design with four replications.

		Weed control			
		Eval. July 2		Eval. July 19	
Treatment[a]	Rate	Wheat	Yeft	Wheat	Yeft
	(lb/A)	(%)			
Sulfosate	0.19	23	84	46	88
Sulfosate	0.25	33	88	78	95
Sulfosate	0.375	70	97	98	99
Sulfosate+2,4-D	0.19+0.25	18	63	54	79
Sulfosate+2,4-D	0.25+0.25	35	82	89	92
Sulfosate+2,4-D	0.375+0.25	78	100	99	99
Sulfosate+Dicamba	0.19+0.125	25	88	43	92
Sulfosate+Dicamba	0.25+0.125	41	84	91	94
Sulfosate+Dicamba	0.375+0.125	68	99	98	99
Glyphosate	0.19	91	99	100	99
Glyphosate	0.25	96	100	100	99
Glyphosate+2,4-D	0.19+0.25	60	99	99	99
Glyphosate+2,4-D	0.25+0.25	89	98	100	99
Glyphosate+Dicamba	0.19+0.125	76	100	99	99
Glyphosate+Dicamba	0.25+0.125	90	100	100	99
C.V. %		14	12	13	10
LSD 5%		11	14	15	12

[a]All treatments were applied with X77 nonionic surfactant at 0.25% v/v. 2,4-D was the dimethylamine salt.

Summary. Glyphosate controlled wheat and yellow foxtail better than did sulfosate. 2,4-D appeared to antagonize control with glyphosate but the antagonism was not observed at the latter evaluation.

Leafy spurge control with quinclorac applied with various adjuvants. Rodney G. Lym. Quinclorac is an auxin-type herbicide with moderate soil residual. Previous greenhouse research at North Dakota State University has shown that quinclorac will injure leafy spurge and may be more effective when applied with a seed-oil adjuvant rather than alone. The purpose of this research was to evaluate quinclorac applied alone and in combination with picloram or various spray adjuvants as an annual retreatment.

The experiment was established near West Fargo on September 14, 1990, when leafy spurge was in the fall regrowth stage, 20 to 30 inches tall with 2 to 3 inch long new fall growth on stems. Retreatments were applied on approximately the same date in 1991 and 1992. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 ft in a randomized complete block design with four replications. Evaluations were based on a visual estimate of percent stand reduction as compared to the control. Previous research has shown that quinclorac provided the best leafy spurge control when fall-applied.

		Evaluation date			
Treatment[a]	Rate	June 91	June 92	June 93	Sept 93
	— lb/A —	% control			
Quinclorac + BAS-090	1 + 1 qt	90	93	99	92
Quinclorac + Scoil	1 + 1 qt	74	95	99	94
Quinclorac	1	49	82	89	59
Quinclorac + picloram	1 + 0.5	85	97	97	94
Quinclorac + picloram + BAS-090	1 + 0.5 + 1 qt	91	99	99	97
Picloram + 2,4-D	0.5 + 1	81	92	94	90
Picloram + 2,4-D + Scoil	0.5 + 1 + 1 qt	43	69	92	61
Picloram + 2,4-D + BAS-090	0.5 + 1 + 1 qt	57	83	94	73
Picoram + Scoil	0.5 + 1 qt	71	82	95	60
Picloram	0.5	60	84	96	81
LSD (0.05)		28	14	6	28

[a]Treatments applied annually in September for 3 yr.

Quinclorac either alone or with Scoil provided better leafy spurge control in June 1992 following a second application compared to June 1991 (Table). Leafy spurge control in June 1993 following a third application averaged 92% or better with all treatments except when quinclorac was applied alone. Quinclorac at 1 lb/A plus BAS-090 or the methylated-seed-oil adjuvant Scoil provided better long-term leafy spurge control than quinclorac applied alone. Control in September 1993, which was 12 months after the third annual treatment averaged 93% with quinclorac plus an additive but only 59% when quinclorac was applied alone. Control with quinclorac plus BAS-090 or Scoil was similar to picloram plus 2,4-D at 0.5 plus 1 lb/A, the most commonly used fall-applied treatment. Quinclorac applied with picloram or picloram plus BAS-090 provided similar control to picloram plus 2,4-D and quinclorac plus BAS-090 or Scoil. Scoil applied with picloram did not improve leafy spurge control compared to picloram alone and both Scoil and BAS-090 reduced control when applied with picloram plus 2,4-D.

Quinclorac plus BAS-090 or Scoil fall-applied provided good leafy spurge control and may be an alternative to picloram plus 2,4-D. There was no grass injury with any treatment. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Leafy spurge control with imazethapyr, imazaquin, quinclorac, and nicosulfuron. Rodney G. Lym and Calvin G. Messersmith. Previous research at North Dakota State University has shown that fall-applied nicosulfuron at 1 to 2 oz/A, imazethapyr and imazaquin at 2 to 4 oz/A, and quinclorac at 16 to 24 oz/A provide good leafy spurge control. Also, control occasionally has been increased when these herbicides have been applied with an adjuvant. The purpose of this research was to evaluate imazethapyr, imazaquin, quinclorac, and nicosulfuron with several spray adjuvants fall-applied for leafy spurge control.

The experiment was established at Hunter and Chaffee, ND on September 2 and 6, 1991, respectively. Leafy spurge at Hunter was 16 to 20 inches tall with 4- to 6-inch long sparse fall regrowth on stems, red leaves and moisture stressed, while at Chaffee it was 28 to 36 inches tall, with lush, dense fall regrowth with green leaves and adequate soil moisture. The soil at Hunter was sandy with pH 7.4 and 2.3% organic matter and at Chaffee was a sandy loam with pH 7.8 and 6.7% organic matter. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. Plots were 10 by 30 ft, and each treatment was replicated four times in a randomized complete block design. A follow-up treatment of picloram plus 2,4-D at 8 + 16 oz/A was spring-applied on June 22, 1992 to the rear one-third of all plots, and the original treatment was reapplied to the whole plot in September 1992. Visual evaluations were based on percent stand reduction as compared to the control.

Quinclorac tended to provide the best leafy spurge control at both locations, and control, when averaged across rates and adjuvants, averaged 97 and 69% control 9 and 12 months after treatment (MAT), respectively (Table 1). Control 9 MAT, averaged over rate and adjuvant, was higher at Chaffee than Hunter with imazethapyr, imazaquin, and nicosulfuron averaging 27, 61 and 42% at Hunter and 85%, 93 and 74% at Chaffee, respectively. The quinclorac treatments and imazaquin plus Scoil (a methylated-seed oil adjuvant) were the only treatments to provide similar control at Chaffee and Hunter.

Nicosulfuron provided an average of 58 and 22% control 9 and 12 MAT, respectively, and control was similar regardless of rate or adjuvant (Table 1). Imazaquin and imazethapyr tended to provide better leafy spurge control when applied with Scoil than X-77 surfactant, especially at Hunter. However, control with quinclorac plus BAS-090 or Scoil was similar at both locations regardless of herbicide rates. Retreatment with picloram plus 2,4-D provided 90% control 2 MAT, averaged over both locations, and was similar regardless of the original treatment.

In general, quinclorac, following a second treatment in September 1992, provided better leafy spurge control than the other herbicides evaluated (Table 2). Quinclorac at 24 oz/A, which averaged 90% control in August 1993 (11 months after the second treatment), provided the best long-term control regardless of additive. This control of 90% was much better than 62% for the standard treatment of picloram plus 2,4-D in August 1993. No other herbicide evaluated provided long-term leafy spurge control comparable to picloram plus 2,4-D.

In summary, quinclorac had the most promise for consistent leafy spurge control of the new herbicides evaluated. Control was similar to or better than picloram plus 2,4-D at 8 + 16 oz/A, the standard fall-applied treatment. Nicosulfuron may be useful for leafy spurge control in cropland, but previous research has shown that this herbicide injures grass and would not be acceptable for pasture and rangeland use. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table 1. Leafy spurge control with various herbicides applied September 1991 alone and then retreated with picloram plus 2,4-D in June 1992 (Lym and Messersmith).

Treatment	Rate	Hunter May 92 Control	Hunter August 92 Control	Hunter August 92 Retreatment[a]	Chaffee May 92 Control	Chaffee August 92 Control	Chaffee August 92 Retreatment[a]	Mean May 92 Control	Mean August 92 Control	Mean August 92 Retreatment[a]
	— oz/A —					%				
Imazethapyr + X-77	2 + 0.5%	5	0	98	76	8	86	41	4	92
Imazethapyr + X-77	4 + 0.5%	36	6	99	85	14	71	61	10	85
Imazethapyr + Scoil	2 + 1 qt	20	1	97	90	29	82	55	15	89
Imazethapyr + Scoil	4 + 1 qt	47	9	93	88	43	86	68	26	89
Imazaquin + X-77	2 + 0.5%	34	3	94	85	10	90	60	6	92
Imazaquin + X-77	4 + 0.5%	38	6	92	98	36	91	69	21	91
Imazaquin + Scoil	2 + 1 qt	84	8	83	92	38	95	88	23	89
Imazaquin + Scoil	4 + 1 qt	87	13	89	96	49	82	92	31	85
Quinclorac + BAS-090	16 + 1 qt	91	38	97	100	82	97	95	60	97
Quinclorac + BAS-090	24 + 1 qt	95	65	99	100	93	98	97	79	99
Quinclorac + Scoil	16 + 1 qt	93	44	99	99	72	97	96	58	98
Quinclorac + Scoil	24 + 1 qt	97	67	99	100	94	96	98	80	98
Nicosulfuron + X-77	1 + 0.5%	34	5	98	72	28	83	53	17	91
Nicosulfuron + X-77	2 + 0.5%	27	26	98	75	15	81	51	20	89
Nicosulfuron + Scoil	1 + 1 qt	60	14	85	80	30	86	70	22	86
Nicosulfuron + Scoil	2 + 1 qt	46	42	87	70	12	74	58	27	81
Picloram + 2,4-D	8 + 16	88	70	97	82	35	87	85	53	92
LSD (0.05)		23	25	NS	14	22	17	14	34	NS

[a]Picloram plus 2,4-D at 8+16 oz/A applied to the rear one-third of each plot on June 22, 1992.

Table 2. Leafy spurge control with various herbicides applied September 1991 and 1992 alone, with the back one-third retreated with picloram plus 2,4-D in June 1992 (Lym and Messersmith).

Treatment	Rate	Hunter May 93 Control	Hunter May 93 Retreatment[a]	Hunter August 93 Control	Hunter August 93 Retreatment[a]	Chaffee May 93 Control	Chaffee May 93 Retreatment[a]	Chaffee August 93 Control	Chaffee August 93 Retreatment[a]	Mean May 93 Control	Mean May 93 Retreatment[a]	Mean August 93 Control	Mean August 93 Retreatment[a]
	– oz/A –						%						
Imazethapyr+X-77	2+0.5%	33	88	2	5	63	89	10	38	47	88	6	21
Imazethapyr+X-77	4+0.5%	69	99	10	53	77	83	18	21	73	91	14	37
Imazethapyr+Scoil	2+1 qt	61	88	4	49	89	97	35	39	75	92	19	44
Imazethapyr+Scoil	4+1 qt	95	100	22	25	96	100	26	22	95	100	24	23
Imazaquin+X-77	2+0.5%	56	81	2	17	74	93	13	14	65	87	7	15
Imazaquin+X-77	4+0.5%	88	100	4	41	71	94	12	40	79	97	8	41
Imazaquin+Scoil	2+1 qt	94	96	6	15	90	99	32	36	92	98	19	25
Imazaquin+Scoil	4+1 qt	99	100	16	18	98	99	25	32	98	99	20	25
Quinclorac+BAS-090	16+1 qt	99	100	75	85	100	100	77	78	99	100	76	82
Quinclorac+BAS-090	24+1 qt	100	100	92	99	100	100	81	73	100	100	86	86
Quinclorac+Scoil	16+1 qt	100	100	77	100	99	100	67	73	99	100	71	86
Quinclorac+Scoil	24+1 qt	100	100	94	100	100	100	92	84	100	100	93	92
Nicosulfuron+X-77	1+0.5%	84	99	19	57	95	98	42	35	90	98	30	46
Nicosulfuron+X-77	2+0.5%	97	100	45	89	87	99	41	54	92	99	43	71
Nicosulfuron+Scoil	1+1 qt	96	99	51	79	94	97	45	49	95	98	48	64
Nicosulfuron+Scoil	2+1 qt	86	91	33	54	93	97	32	34	89	94	32	44
Picloram+2,4-D	8+16	98	99	75	79	95	100	49	48	97	99	62	64
LSD (0.05)		18	13	27	40	15	10	30	36	11	8	20	27

[a]Retreatment: Picloram plus 2,4-D at 8+16 oz/A applied to the rear one-third of each plot on June 22, 1992, the original treatment was reapplied to the whole plot in September 1992.

Comparison of picloram amine, ester, and potassium salt formulations for leafy spurge control. Rodney G. Lym. Picloram formulated as the potassium (K) salt (Tordon 22K) has been the most effective herbicide for leafy spurge control. However, picloram is poorly absorbed into leafy spurge, so relatively high rates are used which means high treatment costs. The purpose of this research was to evaluate an amine and ester formulations of picloram for leafy spurge control.

The liquid picloram formulations evaluated included a triisopropanol amine, isooctyl ester, and K-salt. The amine formulation was commercially combined with 2,4-D triisopropanol amine at a ratio of 1:4 (Tordon 101) and the ester was commercially combined with triclopyr butoxyethyl ester at 1:2 (Access). Previous research at North Dakota State University has shown that triclopyr does not control leafy spurge so any control from the ester combination was assumed to be from only picloram.

A series of experiments was established during the true-flower, flower- to seed-set, and fall- regrowth growth stages of leafy spurge. Treatments were applied on June 8, 1992 near Valley City, June 26 near West Fargo, and September 9 near Hunter, ND for the true-flower, early-seed-set, and fall-regrowth growth stages, respectively. Treatments were reapplied on a similar date in 1993. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

Table. Comparison of picloram amine, ester, and potassium salt formulations for leafy spurge control, applied at three leafy spurge growth stages in 1992 (Lym).

		Growth stage — Months after first treatment						
		Flower[a]			Seed-set		Fall	
Treatment	Rate	3	12	15	2	11	9	12
	— oz/A —	% control						
Picloram amine + 2,4-D[b] + X-77	4 + 16 + 0.5%	96	76	97	96	12	82	2
Picloram amine + 2,4-D[b] + X-77	8 + 32 + 0.5%	99	92	97	98	6	94	25
Picloram[c] + 2,4-D amine + X-77	4 + 16 + 0.5%	92	69	93	95	9	87	2
Picloram[c] + 2,4-D amine + X-77	8 + 32 + 0.5%	98	80	97	98	9	97	49
Picloram ester + triclopyr[d] + picloram[c]	1 + 2 + 3	93	64	96	93	5	74	2
Picloram ester + triclopyr[d] + picloram[c]	1 + 2 + 7	97	81	95	96	7	..	..
Picloram ester + triclopyr[d] + picloram[c]	2 + 4 + 6	98	83	94	95	3	97	19
Picloram ester + triclopyr[d] + picloram[c] + 2,4-D amine	1 + 2 + 3 + 16	96	92	90	90	3	93	20
Picloram[c]	4	99	83	94	88	6	70	3
Picloram[c]	8	98	79	96	92	3	84	6
LSD (0.05)		NS	17	NS	5	NS	20	20

[a]Treatments were reapplied in June 1993.
[b]Picloram triisopropanol amine plus 2,4-D triisopropanol amine (1:4) - Tordon 101.
[c]Picloram potassium salt - Tordon 22K.
[d]Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2) - Access.

Leafy spurge control 12 months after treatment tended to be better with picloram amine plus 2,4-D than picloram K-salt plus 2,4-D when applied at the true flower growth stage (Table). However, control was similar with picloram amine or K-salt formulations when applied at the early-seed-set or fall-regrowth growth stages. Previous research at North Dakota State University has shown that picloram ester at 4 to 8 oz/A kills leafy spurge topgrowth rapidly and provides only short-term control. Picloram ester at 1 or 2 oz/A was applied with picloram K-salt in this study in an attempt to reduce initial leaf injury but still increase absorption and thus long-term control. However, leafy spurge control with treatments containing picloram ester were either similar to or less than treatments that contained picloram K-salt or amine formulations. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Comparison of liquid and powder picloram formulations applied alone or with glyphosate or adjuvants for leafy spurge control. Rodney G. Lym. Previous research at North Dakota State University has shown that the liquid picloram K-salt formulation provided better leafy spurge control than water-soluble powder (WSP) formulations. However, control from the picloram WSP formulations was improved when applied with 2,4-D or adjuvants compared to the dry formulation alone. The purpose of this research was to further evaluate various formulations of picloram alone and with additives for improved leafy spurge control compared to the picloram K-salt formulation.

A series of experiments was established in the spring or fall of 1992 at various locations in North Dakota. All treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi either in June or September when the plants were in the true-flower or fall- regrowth growth stages, respectively. The spring treatments were reapplied in June 1993. All experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

The first experiment evaluated picloram formulated as the K-salt, an acid WSP (XRM-5255), or a K-salt WSP (XRM-5173) applied either alone or with Scoil (a methylated crop oil adjuvant) or 2,4-D. Picloram K-salt applied as a liquid formulation provided better leafy spurge control than the acid WSP and tended to be better than the K-salt WSP (Table 1). Control with the K-salt liquid averaged over rates was 71 and 84% 12 and 15 months after the first treatment (MAFT), compared to 53 and 65% for XRM-5255, respectively, and 64 and 72% for XRM-5173, respectively. XRM-5255 or XRM-5173 at 0.5 lb/A applied with Scoil, or 2,4-D at 0.25 lb/A provided control similar to the comparable picloram K-salt liquid formulation treatment.

The second experiment evaluated the various picloram formulations applied alone or with various liquid or powder formulations of 2,4-D at two locations in North Dakota. In general, picloram liquid and powder formulations provided similar leafy spurge control at comparable rates (Table 2). However, leafy spurge control with picloram plus 2,4-D tended to be higher when at least one of the herbicides was a liquid formulation, compared to when both were WSP formulations. The 1993 retreatments at West Fargo were delayed by wet conditions until mid-July and all treatments provided near 100% control in September (data not shown).

Picloram liquid K-salt, acid powder (XRM-5255), and K-salt powder (XRM-5173) applied in the late-flower to early-seed-set growth stage provided similar leafy spurge control when applied with 2,4-D LVE or 2,4-D amine or a seed-oil adjuvant (Table 3). Glyphosate plus 2,4-D applied at 4 + 7 oz/A provided the most consistent control at both locations. Control averaged 78 and 99% 3 and 15 MAFT applied alone or with picloram. Retreatments were delayed by wet conditions at West Fargo and were not evaluated in 1993. There was no grass injury at either location.

Glyphosate plus 2,4-D at 4 + 7 oz/A applied in September did not provide satisfactory leafy spurge control the following growing season (Table 4). Control was similar with all picloram formulations, whether applied alone or with 2,4-D or a seed-oil adjuvant. No treatment provided satisfactory control 12 months after treatment.

In summary, picloram K-salt formulation provided better leafy spurge control than the acid powder formulation when applied in mid-June during the true-flower growth stage but all formulations applied later in the growing season provided similar control. XRM-5255 or XRM-5173 provided similar leafy spurge control as liquid picloram K-salt when applied with 2,4-D or a seed-oil adjuvant. Glyphosate plus 2,4-D provided good leafy spurge control when applied in late June but not when fall-applied (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table 1. Comparison of picloram liquid and water-soluble powder formulations for leafy spurge control applied in June 1992 and 1993, established near Valley City, ND. (Lym).

Treatment	Rate	Months after first treatment		
		3	12	15
	— lb/A —	— % control —		
Picloram[a]	0.25	67	48	68
XRM-5255[b]	0.25	36	45	61
XRM-5173[c]	0.25	51	38	52
Picloram[a]	0.5	96	73	85
XRM-5255[b]	0.5	46	37	57
XRM-5173[c]	0.5	85	70	71
Picloram[a]	1	100	92	98
XRM-5255[b]	1	97	78	76
XRM-5173[c]	1	99	84	92
XRM-5255[b] + Scoil	0.5 + 1 qt	98	88	75
XRM-5173[c] + Scoil	0.5 + 1 qt	97	88	83
Picloram[a] + 2,4-D	0.25 + 1	90	64	89
XRM-5255[b] + 2,4-D	0.25 + 1	91	57	93
XRM-5173[c] + 2,4-D	0.25 + 1	91	48	93
LSD (0.05)		17	25	13

[a]Picloram K-salt liquid - Tordon 22K.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.

Table 2. Comparison of picloram water-soluble acid powder, K-salt powder, and liquid K-salt formulations alone and with liquid and powder 2,4-D formulations for leafy spurge control when applied in June 1992 and 1993 at Valley City and West Fargo, ND.

Treatment	Rate	Months after first treatment					
		Valley City			West Fargo		Mean
		3	12	15	3	12	3
	– lb/A –	% control					
XRM-5255[a]	0.25	69	13	60	31	8	50
XRM-5173[b]	0.25	90	24	74	38	9	64
Picloram[c]	0.25	82	19	76	28	4	55
XRM-5238[d]	1	56	6	62	44	9	50
2,4-D amine WSP[e]	1	41	3	63	45	6	43
2,4-D amine liquid[f]	1	48	5	58	46	5	47
XRM-5255[a] + XRM-5238[d]	0.25 + 1	78	23	93	52	6	65
XRM-5173[b] + XRM-5238[d]	0.25 + 1	68	17	88	60	12	64
Picloram[c] + XRM-5238[d]	0.25 + 1	90	37	95	63	9	76
Picloram[c] + 2,4-D amine WSP[e]	0.25 + 1	83	20	95	62	19	72
Picloram[c] + 2,4-D amine liquid[f]	0.25 + 1	91	26	96	77	19	84
XRM-5255[a] + 2,4-D amine WSP[e]	0.25 + 1	90	30	96	68	18	78
XRM-5173[b] + 2,4-D amine WSP[e]	0.25 + 1	93	31	95	68	15	80
LSD (0.05)		22	12	18	17	9	27

[a]Picloram acid formulated as a water-soluble powder.
[b]Picloram K-salt formulated as a water-soluble powder.
[c]Picloram K-salt liquid - Tordon 22K.
[d]2,4-D amine water-soluble powder 85%.
[e]80% WSP (Savage)
[f]Dimethylamine (Weedar 64)

Table 3. Comparison of various picloram formulations alone or with additives and glyphosate plus 2,4-D applied during the late-flower to early seed set growth stage at Sheyenne and West Fargo, ND (Lym).

Treatment	Rate	Month after first treatment					
		Sheyenne			West Fargo		Mean
		3	12	15	3	12	3
	— oz/A —	% control					
Glyphosate + 2,4-D[a] + X-77	4+7+0.5%	99	69	99	91	80	74
Glyphosate + 2,4-D[a] + picloram + X-77	4+7+4+0.5%	99	87	97	96	76	81
XRM-5255[b]	4	97	42	26	18	12	27
XRM-5255[b] + 2,4-D LVE	4+16	97	36	98	85	21	28
XRM-5255[b] + 2,4-D amine	4+16	99	60	99	92	13	36
XRM-5173[c]	4	96	48	29	40	7	28
XRM-5173[c] + 2,4-D LVE	4+16	99	47	97	91	19	33
XRM-5173[c] + 2,4-D amine	4+16	99	41	78	96	22	32
Picloram[d]	4	99	60	51	74	12	39
Picloram[d] + 2,4-D amine	4+16	99	53	74	92	14	33
Picloram[d] + 2,4-D LVE	4+16	100	55	99	92	13	34
Picloram[d] + BAS-090	4+1 qt	100	63	99	95	28	45
Picloram[d] + 2,4-D + BAS-090	4+16+1 qt	99	56	99	90	12	31
Picloram[d] + Scoil	4+1 qt	99	41	96	90	17	29
Picloram[d] + 2,4-D + Scoil	4+16+1 qt	99	48	98	91	23	35
LSD (0.05)		2	NS	18	16	14	15

[a]Commercial formulation - Landmaster BW.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.
[d]Picloram K-salt liquid - Tordon 22K.

Table 4. Comparison of various picloram formulations alone or with additives and glyphosate plus 2,4-D applied in September 1992 near Hunter, ND (Lym).

Treatment	Rate	Months after treatment	
		9	12
	— oz/A —	% control	
Glyphosate + 2,4-D[a] + X-77	4+7+0.5%	30	0
Glyphosate + 2,4-D[a] + picloram + X-77	4+7+8+0.5%	98	32
XRM-5255[b]	8	92	15
XRM-5255[b] + 2,4-D LVE	8+16	96	33
XRM-5255[b] + 2,4-D amine	8+16	96	22
XRM-5173[c]	8	99	62
XRM-5173[c] + 2,4-D LVE	8+16	98	40
XRM-5173[c] + 2,4-D amine	8+16	95	33
Picloram[d]	8	83	11
Picloram[d] + 2,4-D amine	8+16	83	6
Picloram[d] + 2,4-D LVE	8+16	84	6
Picloram[d] + BAS-090	8+1 qt	87	20
Picloram[d] + 2,4-D + BAS-090	8+16+1 qt	90	31
Picloram[d] + Scoil	8+1 qt	86	5
Picloram[d] + 2,4-D amine + Scoil	8+16+1 qt	92	25
LSD (0.05)		14	35

[a]Commercial formulation - Landmaster BW.
[b]Picloram acid formulated as a water-soluble powder.
[c]Picloram K-salt formulated as a water-soluble powder.
[d]Picloram K-salt liquid - Tordon 22K.

Comparison of various liquid and powder 2,4-D formulations for leafy spurge control. Rodney G. Lym and Calvin G. Messersmith. The most cost-effective treatment for leafy spurge control is picloram plus 2,4-D. Previous research at North Dakota State University has shown that leafy spurge control is increased 15 to 25% when 2,4-D at 1 lb/A is applied with picloram at 0.5 lb/A or less compared to picloram alone. Control has been similar regardless of the 2,4-D formulation applied with picloram. Soon several formulations of 2,4-D will no longer be available because they will not be reregistered with the EPA. Also, several powder formulations of 2,4-D have been formulated to decrease the cost of container shipment and disposal. The purpose of this research was to evaluate several formulations of 2,4-D applied alone or with other herbicides for leafy spurge control.

The first experiment was established on June 7, 1990 near Valley City. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. Retreatments were applied in 1991 and 1992. All plots were 10 by 30 ft in a randomized complete block design with four replicates. Evaluations were based on visible percent stand reduction as compared to the control.

Leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 1). Control gradually increased as the number of retreatments increased. Picloram at 0.25 lb/A provided better leafy spurge control than either 2,4-D formulation alone even when 2,4-D was applied at 4 lb/A. Control was similar at equal 2,4-D rates applied with picloram regardless of 2,4-D formulation.

The second experiment was established September 9, 1991 near Valley City using the same methods previously described. Leafy spurge was in the fall regrowth stage with red stems and leaves.

As in the previous experiment with spring-applied treatments, leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 2). No treatment provided satisfactory control 12 months after treatment including picloram plus 2,4-D at 0.5 plus 1 lb/A, the standard fall-applied treatment for leafy spurge. Control increased with all picloram plus 2,4-D treatments following a second treatment. However, picloram plus 2,4-D at 0.5 + 1 lb/A provided 73% control, which was better than picloram applied with 2,4-D at 2 lb/A which averaged 52% control averaged across all picloram rates. Previous research has shown that picloram plus 2,4-D at 0.5 + 1 lb/A will provide 90% or better leafy spurge control following 3 to 4 annual retreatments.

The third experiment was established June 8, 1992 near Valley City, ND when leafy spurge was in the yellow bract to flowering growth stage with lush growth and 18 to 24 inches tall. The 2,4-D formulations were added to water immediately prior to application and no surfactants were used.

The water soluble powder CL-782 provided only 68% topgrowth control 1 month after the first treatment (MAFT) compared to 97% or better for all other 2,4-D formulations (Table 3). Control was similar for all 2,4-D formulations 3 and 12 MAFT, including CL-782, and averaged 20 and 13%, respectively. 2,4-D butoxyethyl ester following a second treatment in June 1993 tended to provide better leafy spurge control 15 MAFT than the other 2,4-D formulations.

A fourth experiment was established August 27, 1992 near Chaffee when leafy spurge was in the fall regrowth stage. Picloram plus 2,4-D dimethylamine provided better leafy spurge control than picloram plus 2,4-D mixed amine 12 MAFT (Table 4). Imazaquin or imazethapyr applied at 4 oz/A with Scoil (methylated crop oil adjuvant) provided control similar to picloram plus 2,4-D. Control was not improved when 2,4-D mixed amine was applied with either imazaquin or imazethapyr.

In general, leafy spurge control was similar with all 2,4-D formulations. Control was enhanced when 2,4-D was applied with picloram but not with imazethapyr or imazaquin. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

Table 1. Comparison of 2,4-D amine and mixed amine formulations applied alone and with picloram in June 1990 and 1991 and July 1992 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment				
		3	12	24	36	39
	— lb/A —	% control				
2,4-D mixed amine[a]	1	27	0	0	3	20
2,4-D mixed amine[a]	2	33	0	0	27	36
2,4-D mixed amine[a]	4	29	0	6	47	34
2,4-D alkanolamine	4	43	0	8	44	39
2,4-D mixed amine[a] + picloram	2 + 0.25	59	18	29	92	53
2,4-D alkanolamine + picloram	2 + 0.25	58	13	33	93	52
2,4-D mixed amine[a] + picloram	2 + 0.5	83	50	79	99	79
2,4-D alkanolamine + picloram	2 + 0.5	78	47	77	99	78
Picloram	0.25	62	4	22	88	45
Picloram	0.5	79	35	65	97	70
Picloram	1	96	89	100	100	99
2,4-D alkanolamine + picloram	1 + 0.5	77	29	78	99	75
LSD (0.05)		18	22	22	19	17

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-HiDep.

Table 2. Comparison of 2,4-D mixed amine and alkanolamine applied in September 1991 and 1992 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment			
		9	12	21	24
	— lb/A —	% control			
2,4-D mixed amine[a]	1	16	0	20	3
2,4-D mixed amine[a]	2	15	0	15	8
2,4-D mixed amine[a]	4	20	0	12	9
2,4-D mixed amine[a] + picloram	2 + 0.25	67	5	94	28
2,4-D mixed amine[a] + picloram	2 + 0.5	94	11	98	56
2,4-D alkanolamine + picloram	2 + 0.5	97	9	97	47
2,4-D alkanolamine + picloram	1 + 0.25	66	0	95	22
2,4-D alkanolamine + picloram	1 + 0.5	96	35	99	73
LSD (0.05)		30	6	15	20

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-Hi-Dep.

Table 3. Comparison of various 2,4-D formulations applied in June 1992 and 1993 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment			
		1	3	12	15
	lb/A	% control			
2,4-D dimethylamine (Weedar 64)	2	98	20	19	46
2,4-D dimethylamine + diethanolamine (Hi-Dep)	2	98	13	11	56
2,4-D butoxyethyl ester (Weedone LV4)	2	100	18	22	57
2,4-D acid + butoxyethyl ester (Weedone 638)	2	99	18	13	75
2,4-D isooctyl(2-ethylhexyl)ester (Esteron 99)	2	99	18	10	47
2,4-D triisopropanolamine + diethylamine (Formula 40)	2	97	17	6	43
2,4-D dimethylamine 80% WSP (CL-782)	2	68	28	13	53
2,4-D dimethylamine 85% WSP (Savage)	2	99	26	11	47
Picloram	0.5	99	89	65	94
LSD (0.05)		11	27	17	25

Table 4. Comparison of 2,4-D formulations applied with imazaquin or imazethapyr in the fall near Chaffee, ND (Lym and Messersmith).

Treatment	Rate	Months after treatment	
		9	12
	oz/A	% control	
2,4-D mixed amine[a]	32	81	8
Picloram	8	95	27
Picloram + 2,4-D mixed amine[a]	8 + 16	98	39
Picloram + 2,4-D dimethylamine	8 + 16	99	61
Imazaquin + Scoil	2 + 1 qt	93	23
Imazethapyr + Scoil	2 + 1 qt	93	18
Imazaquin + Scoil	4 + 1 qt	98	43
Imazethapyr + Scoil	4 + 1 qt	85	50
2,4-D mixed amine[a] + imazaquin + Scoil	8 + 2 + 1 qt	97	15
2,4-D mixed amine[a] + imazethapyr + Scoil	8 + 2 + 1 qt	97	43
LSD (0.05)		14	24

[a]Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine) - Hi-Dep.

Evaluation of several herbicides for fringed sagebrush control. Lym, Rodney G. Fringed sagebrush (*Artemisia frigida*) is the most widely distributed and abundant species of the *Artemisia* genus. It is found from Mexico throughout the western United States to Alaska in high plains, valleys, mountains, and grasslands. Fringed sagebrush is resistant to drought and overgrazing, and increased rapidly in North Dakota mixed- and short-grass rangelands following severe drought conditions in 1988. The purpose of this research was to evaluate imazethapyr, clopyralid and metsulfuron for fringed sagebrush control.

The experiment was established near Jamestown, ND in grazed pastureland on May 30, 1991. Fringed sagebrush was in the vegetative growth stage and actively growing. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 35 ft in a randomized complete block design with three replications. Fringed sagebrush control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

Treatment	Rate	Months after treatment			
		3	12	15	24
	– oz/A –	% control			
2,4-D LVE	8	56	33	28	20
2,4-D LVE	12	67	45	53	53
2,4-D LVE	16	78	79	93	85
2,4-D amine	12	41	37	30	30
2,4-D mixed amine[a]	12	44	51	56	54
Imazethapyr+Sun-It II	2+1 qt	3	5	3	3
Picloram	4	28	33	33	37
Picloram+2,4-D LVE	2+8	81	72	76	73
Picloram+2,4-D LVE	4+8	84	90	94	89
Picloram+2,4-D amine	4+8	58	60	73	79
Dicamba+X-77	8+0.25%	35	41	32	33
Dicamba+X-77	16+0.25%	70	79	47	64
Clopyralid+2,4-D	1.5+8	83	77	85	62
Clopyralid+2,4-D	3+16	92	95	98	93
Metsulfuron+X-77	0.10+0.25%	4	9	3	3
Metsulfuron+X-77	0.30+8+0.25%	17	24	23	23
Metsulfuron+2,4-D LVE+X-77	0.10+8+0.25%	65	45	53	43
LSD (0.05)		23	34	45	43

[a]Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-Hi-Dep.

Imazethapyr and metsulfuron did not control fringed sagebrush (Table). Clopyralid plus 2,4-D provided excellent long-term control especially when applied at 3 + 16 oz/A which averaged 93% control 24 months after treatment. However, 2,4-D LVE at 16 oz/A provided 85% control and would cost only \$3 to \$4/A compared to over \$25/A for clopyralid plus 2,4-D. Fringed sagebrush control at the same 2,4-D rate was better with the LVE and mixed amine formulations than with 2,4-D amine. Picloram plus 2,4-D LVE at 4 + 8 oz/A provided similar control to 2,4-D LVE at 16 oz/A alone but would have to maintain control much longer than 2,4-D LVE alone to be cost-effective. Dicamba provided similar control to 2,4-D amine. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

Evaluation of various grass species to control leafy spurge. Rodney G. Lym and Dwight Tober. Traditionally, herbicides have been used to control leafy spurge. Control has been relatively successful following a long-term program. However, the high cost of herbicides, potential for groundwater contamination and because of environmentally sensitive areas where herbicides cannot be used, non-chemical methods for control must be established. Recent research at the University of Wyoming has shown that several grass species are competitive with leafy spurge and have reduced the infestation density. The purpose of this research was to evaluate several grass species that may be competitive with leafy spurge in North Dakota.

The first experiment was established in a dense stand of leafy spurge (74 stems/m^2) on the NDSU experiment station at Fargo. The soil was a Fargo silty clay (fine, montmorillonitic, frigid, Vertic Haplaquolls; 3.5% organic matter and pH 8.0). Plots were 10 by 45 ft., and treatments were replicated four times in a completely random design. Initial leafy spurge stand counts were recorded on May 23, 1990, immediately before the first herbicide treatment. Glyphosate plus 2,4-D at 0.4 plus 0.6 lb/A was applied to all plots when leafy spurge was in the flowering growth stage and again on July 27, 1990, to regrowth that was reflowering. The glyphosate plus 2,4-D alone treatment was applied in September 1990 through 1993.

The soilbed was prepared for seeding on August 6 and 28, 1990, and the grass was planted on August 29. The experimental site was irrigated with 1 inch of water on September 13 and 25, 1990, and 1.25 inches of rain fell on October 7. Initial grass stand establishment was estimated by counting seedlings in three 20-cm by 1-m quadrats placed over the rows on October 30, 1990.

Leafy spurge and grass species density were recounted in May 1991 through 1993. Bromoxynil plus 2,4-D at 0.25 plus 0.75 lb/A were applied in May 1991 and 1992, to control annual broadleaf weeds. The plots were harvested in mid-July 1991 through 1993 by clipping four 0.25-m^2 quadrats per plot. Herbage was separated into seeded grass species, weedy grass species, leafy spurge, and forbs; then oven-dried at 140 F. Herbage data are reported on a dry weight basis.

'Arthur' Dahurian wildrye, 'Bozoisky' Russian wildrye, 'Hycrest' crested wheatgrass and 'Reliant' intermediate wheatgrass established rapidly despite the dry conditions in Fall 1990 (data not shown). 'Killdeer' sideoats grama was the only species that failed to have at least a 10% stand prior to winter.

'Hycrest' crested wheatgrass had the highest stand density counts in May 1991 and reduced the leafy spurge stand equal to the herbicide treatment 1 yr after planting (Table 1). 'Killdeer' sideoats grama failed to establish. All established grass species tended to reduce leafy spurge production compared to the control 1 yr after planting (Table 2). 'Reliant' intermediate wheatgrass had the highest grass production at 2290 lb/A.

All established grass species reduced leafy spurge production compared to the control 2 yr after planting and the reduction was similar to the herbicide treatment with all species except 'Rodan' western wheatgrass and T-17596 mountain rye (Table 2). 'Arthur' Dahurian wildrye, 'Rebound' smooth brome and 'Reliant' intermediate wheatgrass produced the most herbage and averaged 2830 lb/A. 'Rebound' smooth brome, 'Bozoisky' Russian wildrye, 'Arthur' Dahurian wildrye, and 'Hycrest' crested wheatgrass increased in production from 1991 to 1992.

'Rebound' smooth brome, 'Rodan' western wheatgrass, and 'Bozoisky' and 'Arthur' wildrye provided the highest leafy spurge control in 1993 and averaged 70, 60, 60 and 55%, respectively (Table 1). 'Rodan' western wheatgrass had the highest yield at 2560 lb/A (Table 2). Also, 'Rodan' western wheatgrass and 'Reliant' intermediate wheatgrass reduced leafy spurge production similar to the glyphosate plus 2,4-D treatments.

A second experiment was established near the Pipestem dam north of Jamestown to evaluate competitive grass species in a soil type more typical of North Dakota than Fargo clay. The initial leafy spurge stand counts were recorded on May 26, 1993 and averaged 83 stems/m^2. Glyphosate plus 2,4-D at 0.4 + 0.6 lb/A was applied to all plots but the control in June and again in July. The soilbed was then prepared for seeding and the grass was planted on August 24. No irrigation was necessary. The grass species planted were similar to the first study except 'Killdeer' sideoats grama and T-17596 intermediate wheatgrass were not reevaluated (Table 3). 'Pryor' slender wheatgrass, 'Lodorm' green needlegrass and 'Mankota' Russian wildrye were added to the evaluations.

All grass species evaluated at Fargo could be considered to be competitive with leafy spurge except 'Killdeer' sideoats grama. However, based on both herbage yield and leafy spurge reduction 'Rebound' smooth brome, 'Arthur' Dahurian wildrye and 'Reliant' intermediate wheatgrass would be the best species to plant into a leafy spurge infestation in a clay soil. Evaluations at Jamestown will indicate if the same species are competitive in a sandier soil.

Table 1. Evaluation of various grass species competitive with leafy spurge at Fargo (Lym and Tober).

Grass species/[a] herbicide	Stand count[b] Leafy spurge 1990	1991	1992	1993	Total leafy spurge reduction[c]
	no/0.25m^2				%
'Rebound' smooth brome	45	55	25	15	70
'Rodan' western wheatgrass	40	70	30	15	60
'Bozoisky' Russian wildrye	40	60	25	15	60
'Arthur' Dahurian wildrye	45	70	30	20	55
'Reliant' intermediate wheatgrass	40	50	35	30	25
T-17596 mountain rye	40	50	35	30	25
'Hycrest' crested wheatgrass	45	45	35	25	45
'Killdeer' sideoats grama	40	70	..	..	0
Glyphosate + 2,4-D	40	45	1	1	98
Control	40	100	65	40	0
LSD (0.05)	NS	24	12	12	26

[a]Bromoxynil + 2,4-D at 0.25 + 0.75 lb/A applied to all plots 24 May 91 and 26 May 92.
[b]Four 0.25 m^2 quadrats counted per plot in May of each year.
[c]Change in leafy spurge stand count from May 1990 until May 1993.

Table 2. Competitive grass species and leafy spurge production at Fargo (Lym and Tober).

Grass species/[a] herbicide	Yield [b]											
	Grass			Leafy spurge			Total[c]			Proportion[d] leafy spurge		
	1991	1992	1993	1991	1992	1993	1991	1992	1993	1991	1992	1993
	lb/A									%		
'Rebound' smooth brome	510	3070	2120	290	45	190	2035	3170	2420	14	2	8
'Rodan' western wheatgrass	945	3260	2560	270	140	600	1990	3440	3280	14	4	18
'Bozoisky' Russian wildrye	540	1260	1170	230	95	440	1915	1630	1770	12	8	25
'Arthur' Dahurian wildrye	1180	3240	1400	220	65	580	2045	3350	2460	11	2	24
'Reliant' intermediate wheatgrass	2290	2180	1560	215	40	210	2700	2225	1950	8	2	11
T-17596 mountain rye	355	250	410	145	130	570	1810	830	1490	8	16	38
'Hycrest' crested wheatgrass	1100	1740	1060	210	95	390	2075	1935	1810	10	5	22
'Killdeer' sideoats grama[e]	1	...	...	320	...	...	2005	...	...	16	...	...
Glyphosate + 2,4-D	0	0	0	505	10	10	2380	1100	1020	21	1	1
Control	0	0	0	505	235	630	1330	965	1480	38	24	43
LSD (0.05)	770	1415	1015	NS	85	330	NS	1420	1110	17	8	15

[a]Bromoxynil + 2,4-D at 0.25 + 0.75 lb/A applied to all plots 24 May 91 and 26 May 92.
[b]Four 0.25 m^2 quadrats harvested per plot 23-24 July 91 and July 92.
[c]Total yield includes weedy grasses and forbs.
[d]Percent of component in total yield.
[e]'Killdeer' sideoats grama did not establish and was not harvested in 1992.

Table 3. Evaluation of various grass species competitive with leafy spurge near Jamestown (Lym and Tober).

Grass species/cultivar	Plants seeded
	– lb/A –
'Rebound' smooth brome	10.5
'Rodan' western wheatgrass	18
'Bozoisky' Russian wildrye	11.3
'Arthur' Dahurian wildrye	15
'Mankota' Russian wildrye	11.3
'Reliant' intermediate wheatgrass	15
'Hycrest' crested wheatgrass	10.5
'Pryor' slender wheatgrass	9.8
'Lodorm' green needlegrass	10.7
'Manska' pubescent wheatgrass	15
LSD (0.05)	

[a]Three 20-cm by 1-m quadrats were counted on.