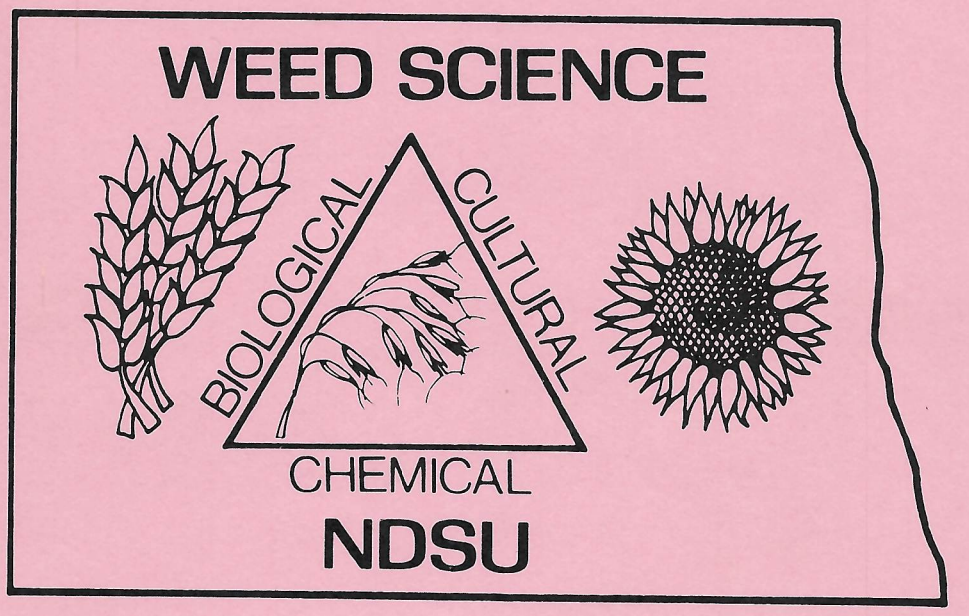
1991
NORTH DAKOTA WEED CONTROL RESEARCH



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

NOT FOR PUBLICATION

SUMMARY OF 1991

WEED CONTROL EXPERIMENTS

Crop and Weed Sciences Department
North Dakota State University
Fargo, North Dakota

W. H. Ahrens
R. G. Lym
C. G. Messersmith
J. D. Nalewaja

R. K. Zollinger - Crop and Weed Sciences Department - Extension
A. G. Dexter - Crop and Weed Sciences Department - Extension
North Dakota State University - University of Minnesota

Technicians

Cheryl Mihelich
K. M. Christianson
M. G. Ciernia
J. L. Luecke
R. F. Roach

Graduate Research Assistants

D. E. Bruns
L. M. Buss
G. J. Endres
P. J. Isakson
A. Obeidat
W. R. Panaram
S. R. Roehl
K. B. Thorsness

Experiments conducted in cooperation with:
John Lukach, Langdon Research Center
Neil Riveland, Williston Research Center
Blaine Schatz, Carrington Research Extension Center
Steve Zwinger, Carrington Research Extension Center
Tom Teigen, Agronomy Seed Farm at Casselton
Ben Hoag, North Central Research Extension Center at Minot
Anthony Thilmony North Central Research Extension Center at Minot
Eric Eriksmoen, Hettinger Research Center
Mark Bredehoeft, Southern Minnesota Beet Sugar Cooperative

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

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CLIMATIC DATA - CARRINGTON, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.63			64	27	41	31	81	57	74	54	85	53	89	55
2							76	30	38	27	76	49	72	43	77	55	89	52
3		.91			.31		75	43	36	29	83	48	71	55	72	55	87	43
4		.31	.22	.02			74	30	38	30	82	53	79	54	77	47	82	41
5				.31	.16		79	45	39	29	65	53	78	60	73	52	81	51
6		.01	.40		.05		75	41	44	30	74	58	82	55	73	56	79	41
7						.51	59	41	53	32	82	59	80	52	73	58	83	56
8						.09	58	29	67	38	79	59	77	48	79	52	93	63
9			.32			.02	57	27	80	38	75	57	80	55	82	47	90	60
10							62	25	80	59	79	51	83	53	84	51	72	43
11				1.58			57	26	85	61	85	58	82	63	85	51	63	52
12	.07			.02			49	30	90	57	87	62	82	59	85	51	72	56
13	.43	.01	.08	.08			38	30	88	45	91	64	76	50	88	51	76	50
14	.07					.27	39	31	85	50	80	60	86	54	90	59	83	59
15	T	.89	2.64			1.38	43	27	83	57	76	54	94	66	91	58	81	54
16					.19		54	31	75	49	82	51	92	65	88	62	74	44
17				.24		.10	60	29	75	46	82	56	92	63	80	55	64	28
18					T	T	56	30	69	38	75	53	88	66	77	53	57	30
19			.10				49	20	68	42	77	52	87	52	85	54	43	33
20			.35	.85	.08		58	20	79	55	73	57	87	61	91	52	53	32
21						.35	63	20	85	57	74	54	82	57	91	58	78	44
22		1.64		.55			56	35	86	57	74	52	76	51	90	59	77	37
23		1.45			.17	.03	59	28	75	59	72	49	77	49	89	56	69	32
24					.06		80	28	76	52	80	54	76	53	93	61	53	46
25							79	39	79	49	82	65	79	45	96	55	65	46
26		.05	.23				77	47	76	56	85	61	79	45	85	65	57	31
27	1.26				.01		66	43	72	48	82	58	79	56	97	60	64	31
28	.05		.43				54	42	76	52	80	56	79	50	100	60	62	32
29	.02			.03			49	34	79	56	75	56	80	58	96	59	70	42
30	.02		.55	.09			49	32	82	54	66	62	92	59	86	55	69	36
31		.03							82	58			89	45	84	47		

CLIMATIC DATA - CASSELTON, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		.25	T	.86			59	22	42	35	82	61	75	63	88	55	77	57
2				.05	.02		61	26	42	31	78	58	79	60	81	54	88	62
3				T	.15	.93	67	26	40	31	75	56	70	59	84	49	93	51
4	.12	1.22		.07			74	32	40	35	85	59	71	60	74	49	76	46
5			.71	.08			75	37	40	30	63	56	77	61	80	51	82	47
6		.02	.09		.05		83	42	47	33	70	60	84	61	80	51	69	42
7							83	44	48	35	79	60	85	57	78	61	83	45
8						.43	60	37	55	35	83	65	79	49	77	57	85	64
9			.18	.40		.09	60	35	65	41	80	58	79	53	85	49	82	65
10							60	22	78	52	80	60	79	55	86	54	77	54
11							63	23	83	59	81	53	84	62	87	54	67	55
12	T			.25		T	55	33	85	60	88	56	79	60	90	53	73	57
13	.23	.06		.06			39	31	91	51	93	67	76	60	88	54	82	57
14	.36		.46			.02	38	34	81	51	93	69	79	53	92	64	82	62
15	.01	.20	1.15			.14	42	28	93	51	83	64	85	58	93	64	81	55
16	.03				.50		50	30	77	56	76	50	94	65	96	65	77	51
17					.59		55	25	80	51	83	59	96	59	74	61	68	43
18			.03	.96		T	53	29	75	39	85	57	86	65	83	56	57	36
19						T	53	24	74	50	81	54	87	60	75	47	57	32
20			.88	T			53	19	75	54	78	61	87	65	80	47	53	32
21			.17				58	23	82	58	73	60	84	62	85	60	76	38
22	.11	.70		.78	.05		64	37	88	60	72	45	87	62	89	60	75	44
23	.04	.19				.04	42	31	88	64	71	50	79	54	91	61	58	33
24		.19				.05	53	25	77	54	74	56	80	53	85	63	56	35
25					.56		81	33	76	54	81	64	75	47	90	67	66	37
26		.06	.05				79	50	82	58	87	67	77	47	91	68	63	27
27							72	53	75	55	86	58	81	47	97	68	57	29
28	.12						58	42	78	54	88	58	74	56	96	68	61	29
29		.14	.46		.02		62	34	82	60	67	56	82	52	98	69	70	45
30	1.32		.31			.01	54	34	82	54	73	62	74	59	98	58	67	45
31		.53							82	59			91	47	91	47		

CLIMATIC DATA - CROOKSTON, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.04			60	47	38	30	74	53	78	58	81	53	83	56
2				.51	.57	.15	67	47	38	31	75	60	65	59	76	57	91	49
3	T	1.24		.03			76	35	43	36	81	58	69	59	74	47	75	50
4						.04	72	42	46	32	76	53	77	57	78	51	75	51
5		.01					80	49	43	34	77	61	82	59	77	61	67	38
6	T	.07		.26	.02	.27	81	44	45	34	81	61	84	59	77	51	79	50
7				.04		.03	54	31	54	37	84	61	70	51	78	53	84	61
8			.02			1.01	58	33	66	46	82	59	73	60	81	51	78	64
9			1.52				54	20	80	54	79	53	78	50	86	56	65	51
10							61	27	82	63	79	59	83	60	88	54	64	51
11				.03			58	32	86	63	84	59	77	62	88	56	72	56
12		.18	.18	.17			49	33	90	59	92	66	74	55	90	58	77	57
13	.37		.13			.13	42	32	80	55	90	64	82	60	92	59	81	59
14	.64	T	.48				36	22	88	59	76	62	83	68	90	67	75	53
15					.27	.93	45	27	74	56	77	53	94	72	93	63	76	49
16					T	.04	46	30	79	49	83	59	94	62	71	58	62	40
17						.47	55	33	71	36	84	53	93	66	80	50	56	34
18						.03	50	23	72	44	79	50	85	60	74	48	45	37
19			.75	1.25			51	25	74	55	80	60	88	62	79	54	49	34
20			.02				55	29	83	60	70	60	80	58	85	61	68	35
21	.21	.35		.35		.07	61	35	83	67	74	47	83	58	83	54	71	44
22		.92			.08	.02	39	30	84	66	73	52	83	58	91	59	54	32
23		.22					40	28	70	55	75	61	85	57	81	61	58	33
24					T	.07	79	33	75	53	80	60	72	49	83	63	64	37
25			.07				72	52	81	55	86	63	76	50	92	68	54	31
26	.24						75	52	79	59	85	57	79	54	89	67	52	31
27	.37						56	45	74	54	87	53	77	54	97	67	60	30
28		.13	.73				54	34	79	58	65	59	79	60	96	67	66	39
29	1.27	T	.46			.02	53	32	81	52	74	60	78	59	95	57	64	42
30	.19	.43	.19				33	30	81	57	70	59	88	55	84	47	60	42
31		T							80	62					84	51		

CLIMATIC DATA - FARGO, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		T	T	.05	.01		58	23	42	34	79	61	79	64	83	55	84	54
2		T		T	.04	.59	65	40	39	32	75	57	68	61	83	54	93	65
3	T	.84		.16	1.28		74	45	41	32	85	55	72	60	74	57	75	51
4	.03	.01	.36	T			74	38	49	35	69	56	77	61	77	50	79	47
5		.01		.04			80	50	44	31	70	60	84	62	79	58	69	49
6		.04		T	T		82	52	45	35	79	63	85	57	76	64	80	47
7				T			61	47	52	38	83	65	75	55	72	63	84	62
8			.15	T		.46	59	39	65	38	82	61	79	52	81	58	81	66
9			T	.43		T	56	34	78	51	83	60	79	60	85	53	75	56
10							61	30	82	63	80	54	83	60	87	58	66	54
11	T		.18	.40		T	53	39	84	62	86	55	78	66	88	58	72	56
12	.15	.69		.04			44	33	89	66	95	67	77	60	88	60	78	61
13	.18		1.15				42	35	79	54	93	66	81	58	92	64	80	60
14	.31		.01			.03	40	29	91	61	83	64	83	61	90	64	79	63
15	T	.01	.69			.06	49	29	78	60	76	57	92	67	94	66	78	55
16					.04	T	52	34	81	57	86	53	94	70	74	61	66	51
17				.30		.05	62	26	71	52	89	65	87	63	82	56	60	38
18			.03	.05		.02	53	32	70	40	80	59	88	66	75	50	48	37
19			T				53	23	72	46	80	56	86	60	80	51	51	33
20			.70	.01			57	28	80	59	71	63	85	67	84	62	73	36
21			.05	.38			63	34	86	62	72	59	84	63	88	61	73	49
22	.13	.22		T	T	T	50	33	88	66	74	48	79	57	89	60	60	40
23	T	.01					47	29	77	58	74	56	79	52	85	63	56	33
24					.46	.06	80	27	77	53	81	60	74	53	89	70	65	39
25			.03				78	47	82	54	88	66	78	47	89	72	65	34
26	.14	.03					73	54	81	63	86	69	81	53	96	68	57	29
27	.60						58	47	77	55	87	63	72	61	94	69	57	33
28		.02	.58				64	46	81	56	71	59	82	56	96	73	68	36
29	.60	.22		T	.04	.01	53	36	81	60	73	61	75	57	96	68	64	51
30	1.01	.20	2.33				45	33	75	57	77	62	88	61	88	57	64	44
31		.08							82	60			86	51	80	49		

CLIMATIC DATA - HETTINGER, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1							66	30	41	25	72	48	79	56	89	61	93	63
2					.04		71	26	45	22	74	48	74	56	71	56	94	59
3		.30					75	32	42	26	76	53	72	55	73	53	86	50
4			.26				65	30	33	25	74	56	76	51	69	48	74	39
5			.04				74	42	38	25	71	56	87	57	78	58	80	46
6							81	46	40	24	71	57	78	51	79	58	71	52
7				.23			70	41	55	33	75	59	86	55	84	60	92	60
8			.49				59	39	60	38	71	59	69	45	82	55	92	63
9	T		.05			.20	48	29	68	42	75	54	73	51	82	57	70	55
10							57	30	79	57	75	48	82	61	85	54	65	48
11	.22	.03		1.09		.02	61	32	78	54	77	54	86	58	84	62	65	53
12	.35	.04					34	29	78	57	89	59	77	55	83	56	77	45
13	.32						30	28	69	39	80	55	75	50	83	56	79	48
14	.03						35	21	76	41	78	56	81	59	86	56	79	50
15		.72			.65		35	22	77	54	78	44	96	61	92	55	77	49
16		.10			.09	.18	40	25	62	50	74	47	93	69	77	55	57	40
17						.05	48	32	68	51	88	55	95	59	78	54	66	44
18			.12				50	38	66	40	78	51	99	65	84	49	49	25
19			.02				59	32	62	46	75	54	81	54	84	49	45	19
20			.50				49	30	66	48	78	53	88	60	95	54	61	30
21				.16			56	28	83	54	78	53	87	61	96	53	83	38
22				.01			62	29	82	55	69	54	82	58	94	56	70	40
23			2.36				58	21	75	48	69	55	78	47	96	56	59	31
24			.95			.18	69	39	77	48	77	54	78	45	86	56	48	35
25							76	35	76	50	80	57	79	49	90	57	70	43
26	.18	.19	.35				75	44	64	55	81	52	81	57	102	63	62	33
27	.14		.08				50	38	63	50	77	53	85	60	92	62	75	44
28	.28	.52					47	34	62	49	78	60	81	55	102	69	65	35
29							49	33	68	42	73	53	86	55	91	51	79	44
30		.06					43	34	74	50	83	53	95	65	93	52	76	33
31		.85							71	45			92	52	95	63		

CLIMATIC DATA - LANGDON, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		.07	.12	.57			49	23	35	25	70	56	61	57	80	48	78	53
2		.02		.10			59	33	33	26	65	52	68	55	75	52	86	66
3		T		.38	.16		65	41	33	26	69	55	60	55	64	54	80	45
4		.65		.05			70	29	32	29	80	54	63	55	70	47	71	45
5		T		.02		.13	70	40	37	30	71	53	70	57	77	52	69	45
6		.10		.20	1.46		72	46	36	30	73	53	75	52	69	55	60	39
7			.12	.16			70	35	38	30	72	59	79	53	72	51	78	48
8				.64			53	25	47	32	82	59	67	47	74	52	83	60
9			.57			.23	53	26	64	40	75	56	73	55	79	53	66	61
10			.30			.04	54	29	77	48	70	50	77	54	81	53	64	40
11			.07	.12			60	25	79	59	80	57	80	62	82	55	63	43
12		.08		.67			55	33	73	52	85	60	71	57	85	58	73	50
13		.27	.73	.10			49	21	88	49	88	61	66	49	85	56	73	49
14	.33		.06			T	39	27	73	50	85	55	71	54	91	56	78	53
15	.41	.08	1.12		.02	.03	38	27	84	55	76	57	80	62	88	58	66	47
16		.46			.17	.60	39	31	62	45	71	49	90	63	83	59	69	46
17						.01	45	27	72	43	82	55	87	64	76	54	61	39
18	.03			.09		.37	52	24	65	40	80	51	86	61	71	47	47	31
19				.01			40	17	66	40	73	46	79	53	73	50	40	31
20				.15			43	23	70	50	76	56	81	59	83	57	48	33
21			.78				53	28	82	55	61	47	77	55	89	56	68	33
22	.28	.08		.28		.94	61	31	81	61	68	47	80	58	82	53	64	38
23	.02	.02			.13	.12	34	25	81	58	69	50	73	51	85	50	50	30
24			.03				36	25	77	50	68	56	74	52	72	53	56	31
25			.02		T	.05	76	27	74	54	78	60	68	40	85	58	62	33
26			.08				76	48	79	55	80	60	74	49	94	62	53	28
27	.27	.02					69	49	78	48	79	55	76	52	83	59	53	30
28	.27						52	38	73	50	72	49	77	52	96	62	57	32
29	.04		.05				52	32	77	52	60	55	79	58	98	55	60	35
30	.41		1.20			.37	52	29	78	52	72	58	77	58	91	54	60	36
31		.96							82	52			89	44	79	44		

CLIMATIC DATA - MINOT 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1			.56	.64			54	29	38	30	62	52	69	57	82	53	88	60
2		0.1		.06	.35	T	67	35	38	26	75	52	69	55	77	56	92	62
3		T		T	.55		75	38	40	28	80	52	65	55	67	54	79	50
4		.63	.93	T			66	35	33	28	80	57	74	54	74	51	73	45
5		.03	.06	.23	1.29		74	38	36	29	65	55	85	54	79	52	76	46
6			.02	T	.76		74	51	38	31	65	57	78	55	78	54	64	45
7			.03	.62			66	42	44	26	79	61	80	55	78	60	83	45
8			.04			T	58	29	52	31	81	63	70	48	73	56	86	62
9			.09			.07	56	28	65	45	80	58	76	53	78	56	71	59
10			.26				57	28	82	45	71	50	82	58	83	58	62	49
11		.12		.08		.02	64	38	74	58	78	55	78	61	82	55	60	50
12	.03	.07		.03		.02	52	35	78	58	88	55	77	58	83	54	70	50
13		.89		.01			49	31	82	47	83	59	77	53	85	55	76	52
14	.52					.51	31	29	76	47	76	53	81	59	86	61	80	52
15	.02	.05	.25	T	.04	.02	38	29	74	54	78	49	91	64	88	60	80	56
16	.02	.09			.89	.79	43	31	69	49	73	50	92	62	83	61	57	40
17					.04	.03	53	37	74	45	85	55	95	68	88	61	60	42
18	.15			.17		.06	54	31	69	40	76	49	97	61	77	52	43	30
19	T						35	22	70	47	74	52	81	55	80	53	36	25
20			.19		.19		49	23	65	49	77	56	88	59	87	61	54	26
21			1.05				61	36	80	56	60	47	86	63	94	55	77	38
22				.13		.33	65	31	86	58	75	50	90	56	87	59	65	39
23							50	22	78	56	73	58	77	49	87	55	52	36
24			.08			T	58	26	79	55	82	59	78	52	89	57	53	37
25		.34	.04				80	31	70	51	83	62	76	48	94	58	67	39
26	T	.09	.02				80	52	80	53	76	56	80	49	95	63	57	43
27	.91	.13					57	42	71	50	83	55	84	54	87	62	57	38
28	.09						43	35	71	53	79	55	76	55	95	65	58	33
29	.03		.09	.62			53	35	72	49	79	55	86	58	93	59	67	35
30	.02		.78			.09	47	33	77	49	82	60	90	63	91	56	56	37
31		.92							82	33			83	49	88	51		

CLIMATIC DATA - OLIVIA, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		.07	.49	.71	.08		54	31	47	39	83	64	86	67	81	64	83	57
2					1.73		55	35	46	34	83	64	82	64	83	64	82	59
3					.07		64	39	47	36	83	67	80	63	77	62	81	64
4		.87	.73	.08			67	43	45	42	84	60	72	61	77	58	82	59
5			.18				74	51	48	38	65	56	76	59	76	57	81	64
6				.18	.11		83	54	41	36	74	56	90	66	75	57	79	52
7		.01				.09	87	58	45	36	76	59	84	64	65	59	79	53
8				.18	.82	3.63	77	45	55	42	78	61	78	55	66	61	79	67
9		.02				.10	51	35	60	45	83	61	77	56	72	55	78	65
10			.24	.07			41	29	74	58	86	65	78	63	78	59	78	58
11				.31		.48	56	32	75	58	80	58	83	67	82	62	67	56
12	.11			3.76		.16	42	32	83	61	84	68	78	62	83	52	62	57
13	1.03	.08				.01	35	33	83	60	91	73	78	63	85	61	70	59
14	.92		.50			1.17	40	33	84	58	84	66	80	59	86	62	68	61
15	.48	.02	.14			.02	45	33	90	64	82	65	80	61	83	55	78	60
16	.02		.09	.17	.71		46	33	76	62	83	60	89	68	80	66	80	50
17		.36			.26		54	33	83	51	82	57	94	74	78	61	66	53
18		.41	.19	.51		.02	59	38	53	41	85	62	94	72	82	63	64	38
19	.25		.08	.05			59	37	53	45	85	62	94	68	79	50	45	37
20			.17		.06		56	29	60	52	87	65	87	70	72	51	51	34
21			1.42	.07			53	31	71	58	77	63	88	70	76	57	68	37
22	.02			.96			58	46	80	64	70	46	87	70	84	59	67	47
23							54	33	84	69	72	49	82	57	83	61	58	37
24		.08				.32	53	31	84	63	74	55	78	56	84	62	55	38
25					.11		71	45	80	62	78	65	77	54	87	70	59	45
26		.33					68	38	71	59	89	71	75	53	90	71	61	36
27	.47	1.10		.63			67	50	80	60	92	71	76	56	91	69	59	37
28			.96	1.39			66	44	80	66	92	69	69	54	89	70	59	38
29	.42	.71					73	51	79	62	91	69	71	56	89	67	66	41
30	.62	.02	.34			.01	58	42	80	62	75	62	72	56	91	57	70	48
31		.25							79	66			81	58	78	51		

CLIMATIC DATA - PROSPER, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1							59	22	41	34	80	61	78	64	84	51	87	52
2						.59	66	36	39	32	75	58	68	60	82	54	96	64
3		1.02		.04	.16		74	42	41	32	86	58	70	60	75	52	76	50
4		.04	.39				74	32	46	33	66	57	80	59	78	47	81	47
5				.04			80	44	45	32	70	56	83	57	77	53	69	47
6							82	42	45	34	81	62	86	54	78	60	83	42
7							56	44	53	36	85	61	75	52	71	60	87	60
8			.08			.67	59	37	67	38	81	58	80	48	83	54	81	65
9				.67			57	29	81	50	80	58	79	59	86	48	73	55
10							61	25	85	62	80	54	82	55	89	53	66	54
11				.51			52	36	85	60	87	51	78	61	89	52	74	55
12	.04	.43					43	32	92	62	96	65	75	60	89	52	80	60
13	.28		.47				40	34	81	54	94	66	83	57	93	61	82	57
14	.08					.08	41	30	93	54	79	64	82	56	92	56	81	63
15		.08	.28			.04	47	29	79	60	76	54	94	64	96	62	79	53
16					.04		54	30	81	57	85	50	94	66	74	60	67	52
17				.16		.04	62	27	73	50	86	60	87	60	82	57	58	37
18						.04	52	31	71	39	81	56	86	63	75	50	47	36
19			.04				53	23	74	42	77	32	88	56	81	42	52	32
20			.67				58	22	85	58	72	62	83	61	86	61	76	31
21				.91			64	25	89	60	72	56	85	58	89	58	76	47
22	.08	.98					48	33	86	65	73	48	77	56	91	57	58	38
23		.04			.56		49	27	71	59	73	52	78	50	85	61	58	33
24					.05	.12	82	24	74	56	81	55	72	52	90	68	64	35
25							80	42	83	54	87	64	78	46	92	70	66	33
26	.31		.04				74	53	78	59	85	65	80	45	95	68	56	29
27	.51						57	44	76	55	87	58	72	55	98	68	61	30
28			.35				61	42	80	54	66	58	81	54	100	71	70	30
29	.55	.12					55	35	81	58	72	59	75	50	97	66	64	47
30	.91	.08	.51				45	33	76	53	74	62	90	59	88	58	64	44
31		.04							82	59			86	49	83	48		

CLIMATIC DATA - WILLISTON 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		T		.37			72	31	44	30	80	49	74	59	88	57	99	63
2				.57	.13		77	37	44	26	81	53	70	57	74	56	97	65
3	T	.30			.03		76	46	41	29	83	55	78	56	72	50	75	48
4	.03	.16	.03	.25			73	35	38	28	78	61	85	60	82	47	80	48
5			.15	.28	.42		78	45	43	30	70	58	78	59	79	58	78	46
6				.02			76	46	55	26	83	59	80	57	81	56	89	48
7							59	36	62	37	83	60	80	51	88	60	91	58
8		.02	.15			.56	59	34	74	44	83	56	78	50	88	61	92	62
9			.05			.02	58	29	75	50	81	56	81	55	91	59	67	52
10		.03		.17		.11	64	31	76	53	82	51	81	58	90	56	58	48
11	.04					.26	64	40	81	54	93	56	73	59	87	61	68	57
12	T	.39					53	33	81	57	93	55	79	55	88	61	77	50
13	.20	.31	.18			.01	51	30	71	43	78	52	83	55	91	60	77	53
14	T		.32		.35		42	30	73	45	76	53	90	60	90	62	74	57
15	.05	.42	.14	.27	.06	1.51	44	32	73	49	74	49	93	62	77	59	71	47
16				.03	.38		54	30	74	42	90	46	92	64	80	58	57	41
17	T		.03			.04	51	39	73	51	85	52	98	70	80	60	58	36
18	.11			.03			50	34	69	45	75	47	98	62	85	54	42	32
19	T		T				43	32	69	44	77	51	84	54	94	59	61	26
20		.24	1.02				61	29	81	56	78	57	84	58	95	59	78	37
21						.42	67	36	88	58	73	53	94	66	95	57	77	38
22		.34				.05	62	32	88	59	70	52	90	53	95	59	56	36
23			.33			.22	71	29	78	50	80	58	79	48	95	54	55	41
24		.33	.46				80	35	78	53	82	58	81	52	93	64	70	36
25			1.08				80	48	80	55	83	56	84	52	98	63	70	44
26	.62		.63				76	46	78	52	76	53	87	56	97	64	72	43
27	.70			.02			49	34	69	51	77	56	84	62	99	63	71	41
28	.28	.27	.50				46	35	70	53	77	60	90	59	98	74	74	38
29			.34			.11	45	34	74	45	83	56	95	58	92	58	74	49
30		.03	1.19				43	32	75	53	82	61	95	60	97	58	57	36
31									76	55			85	52	99	68		

CLIMATIC DATA - WILLMAR, 1991

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	Septemper	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		.08	.62	1.05	.05		51	27	44	38	82	64	76	62	81	64	76	50
2			.32		2.10		53	35	44	33	79	65	80	65	78	64	77	56
3					.01		62	38	47	35	83	67	75	62	73	59	82	64
4		.63					66	43	46	42	81	59	72	61	72	56	74	47
5		.14	.14				72	44	47	39	67	54	76	57	74	56	79	53
6					.05		79	47	42	36	74	57	90	60	75	60	76	52
7		.03					83	52	45	34	76	57	84	62	66	60	79	56
8				.17	.48	4.25	72	44	54	39	79	60	78	57	66	60	74	65
9				.02		2.38	52	34	53	44	78	66	77	61	74	55	78	64
10	.04		.16				42	27	73	53	86	65	78	61	82	56	76	57
11						.06	55	30	72	58	79	55	81	67	82	56	70	56
12	.20			.81		.18	42	32	84	61	85	66	76	62	82	58	64	57
13	.85	.03					34	32	86	56	91	71	76	63	85	59	71	58
14	.66		2.21			1.04	38	33	83	54	77	65	81	58	83	60	71	60
15	.74		.53				42	31	90	62	81	65	80	64	82	63	81	62
16	.02	.17			.36		46	31	77	60	74	54	89	69	77	65	77	53
17		.12			.46	.01	51	31	83	49	82	60	95	73	76	59	65	53
18		.10				.08	58	36	56	41	85	66	92	71	83	58	63	39
19				.28			55	38	59	42	83	62	94	66	74	50	44	37
20			.38				55	27	65	49	82	64	85	71	71	55	51	33
21			1.12				52	28	71	59	76	62	89	69	76	57	67	37
22	.04			.12			58	34	81	65	67	47	85	68	84	58	67	45
23							51	33	85	67	71	53	80	58	80	64	57	38
24		.41				.05	53	28	85	64	73	57	78	58	79	66	56	37
25					.45		71	39	80	59	78	65	76	56	85	68	59	43
26		.04					70	48	71	59	88	71	73	51	89	70	58	35
27	.59	.26		.65			68	50	80	58	91	67	77	59	91	68	55	33
28		.25		.94			61	43	82	64	85	69	63	59	89	69	58	35
29	.46	.91					73	50	79	62	90	69	75	56	87	70	66	40
30	.88		.19				56	41	79	62	80	61	72	55	87	64	71	48
31		.20							77	65			81	60	92	57		

SOIL TEST RESULTS AT VARIOUS WEED EXPERIMENT LOCATIONS

	Soil Texture	Organic matter	pH	lb/A N	P	K
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	Silt loam	3.8	7.9	81	23	250
Fargo, ND (Sec. 22)	Silty clay	6.0	7.5	190	26	1095
Hillsboro, ND	Silt loam	3.9	7.0	64	34	470
Hunter, ND	Sand	7.4	6.8	14		
Langdon, ND	Clay loam	4.6	7.8	Fertilized by test		
Minot, ND	Loam	2.7	7.0	Fertilized by test		
Mooreton, ND	Silty clay	4.8	7.5	67	52	830
Renville, MN	Silt loam	8.5	7.8	134	47	150
St. Thomas, ND	Silt loam	4.6	7.7	403	19	700
Valley City, ND (Sec 22)	Stony loam	9.4	6.7	5	5	1415
West Fargo, ND	Silty clay	3.2	7.5	137	25	850
Williston, ND	Silty clay	3.6	7.2	8	42	1460
Cavalier, ND	Loam	2.3	6.8	Fertilized by test		
Argyle, MN	Loam	5.9	7.6	164	28	805
Casselton (sugarbeets)	Silty clay loam	4.6	7.7	433	48	615
Moorhead, MN (Canada thistle)	Silty clay	4.5	8.0	101	56	590
	Silty clay		7.8	193	29	340

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
Barl (Bar) = Barley
Bdlf = Broadleaf
Bygr = Barnyardgrass
Cath = Canada thistle
Cocb = Common cocklebur
Colq = Common lambsquarters
Coma = Common mallow
Copu = Common purslane
Cosf = Volunteer sunflower
Dobr = Downy brome
Fach = False chamomile
Fibw = Field bindweed
Fipc = Field pennycress
Flwe (Flix) = Flixweed
Foba - Foxtail barley
Fxtl = Foxtail species
Grft = Green foxtail
Gfpw = Greenflower pepperweed
Girw = Giant ragweed
Howe = Horseweed
KOCZ = Kochia
Latu = Ladysthumb
Lent = Lentils
Lesp = Leafy spurge
Llsa = Lanceleaf sage
Mael = Marshelder
Mesa = Meadow salsify
Mil (Ftmi) = Foxtail millet
Nabe = Navy beans
Nfcf = Nightflowering catchfly
Pest = Perennial sowthistle
Pesw = Pennsylvania smartweed
Powe = Pondweed
Prle = Prickly lettuce
Prpw = Prostrate pigweed
Qugr = Quackgrass
Rrpw = Redroot pigweed
Ruth = Russian thistle
Soyb (Sobe) = Soybean
Spkw = Spotted knapweed
Sugb =(Sgbt) = Sugarbeet
Sunfl (Sufl, Cosf) = Sunflower
Tamu = Tansy mustard
Taoa = Tame oats
Tumu = Tumble mustard
Tymu = Tame yellow mustard
Vowh = Volunteer wheat
Vele = velvetleaf
Wesa = Western salsify
Wht = Wheat
Wibw = Wild buckwheat
Wimu = Wild mustard
Wioa = Wild oats
Wipm = Wild proso millet
Yeft = Yellow foxtail

Methods

PPI = Preplant incorporated
PEI = Preemergence incorporated
PRE, PE = Preemergence
P, PO, POST = Postemergence

Miscellaneous

DF = Dry flowable
F = Fall
FL = F = Flowable
S = Spring
L = Liquid
G = Granules or gallon/A
Inc = I = Incorporation
%ir = inju = Percent injury rating
%sr = %std, strd = Percent stand reduction
HT = Plant height
alk = alkanolamine
dma = dimethylamine
bee = butoxyethyl ester
dea = diethanolamine
ioe = isoactyl ester
PO, OC = petroleum oil concentrate (17% emulsifier)
SPK = spike stage
SURF = S = Surfactant
Tswt = TW = Test weight
WP = Wettable powder
X-77 = Surfactant by Valent
Yld = Yield

LIST OF HERBICIDES TESTED IN 1991

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
AC-182227	AC-182227	American Cyanamid	75%	None
Acetochlor	Acet	Monsanto	7.5 lb/gal	Harness
Acifluorfen	Acif	BASF	2 lb/gal E,S	Blazer
Alachlor	Alac	Monsanto	4 lb/gal E 4 lb/gal MT, 15% G	Lasso
Amitrole	Amit	Rhone-Poulenc	2 lb/gal S	Amitrole T
Atrazine	Atra	Various	80% WP, 90% DF, 4 lb/gal F	Numerous
BAS-51400H	BAS514	BASF	75%	Facet
Bentazon	Bent	BASF	4 lb/gal S	Basagran
Bromoxynil	Brox	Rhone-Poulenc	2 lb/gal E	Buctril
Butylate + Safener	Buty	ICI	6.7 lb/gal L 10% G	Sutan+
C 4243	C4243	Uniroyal	0.83 lb/gal E	None
CGA-131036	CGA131	Ciba Geigy	75% WP	Amber
CGA-144155	CGA144	Ciba Geigy	3.3 lb/gal F	None
Chlorimuron	Clim	DuPont	25% DF	Classic
Clethodim	Clet	Valent	2 lb/gal	Select
Clomazone	Clom	FMC	4 lb/gal E	Command
Clopyralid	Clpy, Clop	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	ICI	6 lb/gal E	Ro-Neet
Desmedipham	Desm	Nor-Am	1.3 lb/gal E	Betanex
Desmedipham + Phenmedipham	Des & Phen	Nor-Am	0.65+0.65 lb/gal E	Betamix

Common Name or Code Name	Abbre-viation[a]	Company	Formulation	Trade Name
Dicamba	Dica	Sandoz	4 lb/gal S	Banvel
Dichlorprop	Dich	Rhone-Poulenc	4 lb/gal EC	2,4-DP
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
DPX-66037	DPX-66	DuPont	50% DF	None
DPX-A7881	DPX-A7	DuPont	75% DF	Muster
Endothall	Endo	Pennwalt	3 lb/gal S	Herbicide 273
EPTC	EPTC	ICI	7 lb/gal E 25% G	Eptam
Ethalfluralin	Etha	DowElanco	3 lb/gal E 10% G	Sonalan
Ethofumesate	Etho	Nor-Am	4 lb/gal F 1.5 lb/gal E	Nortron
Fenoxaprop	Fenx	Hoechst-Roussel	1.5 lb/gal E	Whip
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		Cheyenne
Fluazifop-P	Flfp-P	ICI	1 lb/gal E	Fusilade 2000
Fluroxypyr	Flox	DowElanco	1.7 lb/gal	Starane
Fomesafen	Fome	ICI	2 lb/gal	Reflex
Fosamine	Fosa	DuPont	4 lb/gal S	Krenite
Glyphosate	Glyt	Monsanto	3 lb/gal S	Roundup
Glyphosate & 2,4-D	Glyt & 2,4-D	Monsanto	0.9 + 0.8 lb/gal S	Landmaster II
Glyphosate & dicamba	Glyt & Dica	Monsanto	1.1 + 0.5 lb/gal S	Fallowmaster
Haloxyfop	Halx	DowElanco	2 lb/gal	Verdict
HOE-6001	HOE6001	ICI	0.58 lb/gal	Puma

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
ICIA-5676	ICIA5676	ICI	6.4 lb/gal	Surpass
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
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
Nicosulfuron	Nico	DuPont	75% DF	Accent
Oryzalin	Oryz	DowElanco	4 lb/gal F	Surflan
Paraquat	Para	ICI	1.5 lb/gal S 2 lb/gal S	Gramoxone Super Cyclone
Pendimethalin	Pend	American Cyanamid	4 lb/gal E 3.3 lb/gal E	Prowl
Picloram	Picl	DowElanco	2 lb/gal S	Tordon 22K
Primisulfuron	Prim	Ciba Geigy	75% DF	Beacon
Propachlor	Prcl	Monsanto	4 lb/gal F	Ramrod
Propanil & MCPA	Prnl & MCPA	Rohm & Haas	3 + 1.4 lb/gal E	Stampede CM
Pyrazon	Pyra	BASF	4.2 lb/gal F	Pyramin
Quincloral	Qucr BAS-514	BASF		
Quizalofop-P	Qufp	DuPont	0.75 lb/gal EC	Assure
Quizalofop-UB	Qufp-UB	Uniroyal	1 lb/gal	Pantera
R-25788, Dichlormid	Dcmd	ICI	6 lb/gal E	None

Common Name or Code Name	Abbre-viation[a]	Company	Formulation	Trade Name
Sethoxydim	Seth, Sth	BASF	1.5 lb/gal E	Poast
Sulfometuron	Sume	DuPont	75% DF	Oust
Thifensulfuron	Thif	DuPont	25% DF	Pinnacle
Thifensulfuron & Tribenuron	Thif & Trib	DuPont	75% DF	Harmony Extra
Tribenuron	Trib	DuPont	75% DF	Express
Triallate	Tria	Monsanto	4 lb/gal E, 10% G	Far-go
Triclopyr	Trcp	DowElanco	4 lb/gal	Garlon
Tridiphane	Trid	DowElanco	4 lb/gal E	Tandem
Trifluralin	Trif	DowElanco	4 lb/gal E 10% G	Treflan
2,4-D	2,4-D	Various	Various E, S	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.

Effect of fall and spring soil applied herbicides on weed free sugarbeet, Casselton, 1990-1991. Fall treatments were applied 12:15 pm October 23, 1990 when the air temperature was 57F, soil temperature at six inches was 39F, wind was 20 to 25 mph, and soil moisture was good. Spring treatments were applied 8:00 pm May 9, 1991 when the air temperature was 75F, soil temperature at six inches was 54F, relative humidity was 59%, wind was 25 mph, and the soil moisture was good. Soil applied treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Treatments containing EPTC or cycloate were incorporated with a rototiller set four inches deep. All other treatments were incorporated with a rototiller set two inches deep. 'Van Der Have 66140' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 10, 1991. Counter 15G insecticide was applied modified in-furrow at planting at 12 pounds product per acre. Sugarbeet injury from herbicides was evaluated June 7, 1991. Sugarbeet was thinned to an 8 inch spacing June 10. The entire experiment was cultivated June 3 and June 19. Plots were maintained weed free by hand weeding throughout the growing season. Ten sugarbeets from each plot were rated for root maggot damage September 3, 1991 using a 0 to 5 scale where 0=no damage, 1=1-4 small scars, 2=5-10 small scars or up to 3 larger scars, 3=more than 3 larger scars, 4=50-75% of root blackened by scars, and 5=more than 75% of root blackened or a dead sugarbeet. The mean of these ten ratings is the sugarbeet damage rating for each plot. Sugarbeet from the center two rows of each 35 foot plot were harvested and counted September 20, 1991.

Treatment	Rate	Sgbt inj	Maggot damg ratg	Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extrac Sucros
	(lb/A)	(%)	(0-5)	(#/70')	(%)	(%)	(ton/A)		(lb/A)
Cycloate (fall)	4	0	2.9	79	16.6	2.0	21.1	868	6089
EPTC+Cycloate (fall)	1.5+2.5	0	2.8	78	16.8	1.9	20.8	824	6134
EPTC+Cycloate (fall)	2.5+2.5	3	2.8	75	16.9	1.9	19.7	823	5823
Diethatyl (fall)	6	0	2.6	70	15.8	2.1	19.2	963	5191
EPTC+Cycl+Diet (fall)	1.5+2.5+4	0	2.3	74	16.5	2.0	20.0	879	5722
Untreated Check	0	0	2.8	79	16.6	2.0	22.1	877	6364
Cycloate (spring)	4	30	2.5	72	16.7	2.0	18.3	872	5305
EPTC+Cycloate (spring)	1+2.5	30	2.5	88	16.3	1.8	21.1	815	6042
EPTC+Cycloate (spring)	2+2	30	2.7	79	16.8	1.8	19.2	760	5727
Diethatyl (spring)	6	30	2.6	76	16.8	2.0	20.3	856	5910
EPTC+Cycl+Diet (spring)	1+2.5+4	40	2.3	77	15.8	2.1	18.6	986	5034
HIGH MEAN		40	2.9	88	16.9	2.1	22.1	986	6364
LOW MEAN		0	2.3	70	15.8	1.8	18.3	760	5034
EXP MEAN		15	2.6	77	16.5	1.9	20.0	866	5758
C.V. %		6	13.6	7	3.3	7.2	7.3	9	7
LSD 5%		1	NS	8	NS	0.2	2.1	113	575
LSD 1%		2	NS	11	NS	NS	NS	NS	774
# OF REPS		4	4	4	4	4	4	4	4

Summary

Spring-applied herbicides caused more sugarbeet injury than fall-applied herbicides. Root maggot damage to sugarbeet was similar regardless of herbicide suggesting that herbicide injury had no effect on damage from root maggot. Average extractable sucrose was 5792 pounds per acre from the five fall treatments and 5604 pounds per acre from the five spring treatments, not a significant difference.

Fall and spring soil applied herbicides plus desmedipham&phenmedipham, Fargo (NW section 22), 1990-1991. Fall treatments were applied 3:45 pm October 25, 1990 when the air temperature was 60F, soil temperature at six inches was 41F, wind was 18 to 20 mph, and soil moisture was good. Spring treatments were applied 2:30 pm May 23, 1991 when the air temperature was 70F, soil temperature at six inches was 63F, relative humidity was 77%, wind was 15 to 18 mph, and the soil moisture was good. Soil applied treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Fall treatments containing EPTC or cycloate were incorporated with a rototiller set four inches deep. All other fall treatments were incorporated with a rototiller set two inches deep. Spring treatments were incorporated twice with a 'Kongskilde Triple K' field cultivator operated three inches deep. 'Van Der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 23, 1991. Desmedipham&phenmedipham at 0.25 lb ai/A was applied across half of each 40 foot long plot 11:30 am June 7, 1991 when the air temperature was 75F, soil temperature at six inches was 65F, relative humidity was 60%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the cotyledon to 2 leaf stage, redroot pigweed was in the cotyledon to 1 leaf stage, and kochia was emerging to 0.25 inch rosette diameter. Desmedipham&phenmedipham at 0.33 lb ai/A was applied as the second postemergence split 10:00 am June 17, 1991 when the air temperature was 72F, soil temperature at six inches was 67F, relative humidity was 57%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, redroot pigweed was in the 4 leaf stage, and kochia had a 0.5 to 1 inch rosette diameter. Postemergence applications were in 8.5 gpa water at 38 psi through 8001 nozzles. Sugarbeet injury and redroot pigweed and kochia control were evaluated June 24, 1991.

		No Post. Herbicide			Post des&phen 2X		
Soil-applied Treatment	Rate	Sgbt inj	Rrpw cntl	Kocz cntl	Sgbt inj	Rrpw cntl	Kocz cntl
	(lb/A)	----------	----------	(%)	----------	----------	----------
Cycloate (fall)	4	0	0	0	0	64	36
EPTC+Cycloate (fall)	1.5+2.5	0	0	0	0	61	45
EPTC+Cycloate (fall)	2.5+2.5	0	0	0	0	61	48
Diethatyl (fall)	6	0	0	0	0	55	35
EPTC+Cycloate+Diet (fall)	1.5+2.5+4	0	13	0	0	79	48
Untreated Check	0	0	0	0	0	45	29
Cycloate (spring)	4	0	63	0	0	90	63
EPTC+Cycloate (spring)	1+2.5	0	73	0	0	93	66
EPTC+Cycloate (spring)	2+2	0	75	0	0	100	61
Diethatyl (spring)	6	0	86	0	0	100	73
EPTC+Cycloate+Diet (spring)	1+2.5+4	0	94	0	0	100	71
C.V. %		0	20	0	0	10	22
LSD 5%		NS	11	NS	NS	12	17
LSD 1%		NS	14	NS	NS	16	22
# OF REPS		4	4	4	4	4	4

Summary

Spring soil-applied herbicides gave better control of redroot pigweed than fall soil-applied herbicides. Postemergence desmedipham&phenmedipham split applied to an area previously treated with any spring soil-applied herbicide gave better weed control than desmedipham&phenmedipham alone or the soil-applied herbicide alone. Fall-applied diethatyl did not significantly improve redroot pigweed control from desmedipham&phenmedipham but all other fall-applied treatments did improve control. Desmedipham&phenmedipham over fall-applied EPTC+cycloate at 2.5+2.5 lb/A or over fall-applied EPTC + cycloate + diethatyl gave better kochia control than desmedipham & phenmedipham alone even though the soil-applied herbicides gave no visible kochia control. The best weed control was from spring soil-applied herbicides followed by desmedipham&phenmedipham postemergence.

Fall and spring soil applied herbicides plus desmedipham&phenmedipham, Crookston, 1990-1991. Fall treatments were applied 12:30 pm October 26, 1990 when the air temperature was 62F, soil temperature at six inches was 47F, wind was 5 to 10 mph, and soil moisture was poor. Spring treatments were applied 2:00 pm April 25, 1991 when the air temperature was 77F, soil temperature at six inches was 49F, relative humidity was 36%, wind was 20 to 25 mph, and the soil moisture was fair. Soil applied treatments were in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Soil applied treatments containing EPTC or cycloate were incorporated with a rototiller set four inches deep. All other soil applied treatments were incorporated with a rototiller set two inches deep. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25, 1991. Desmedipham & phenmedipham at 0.25 lb ai/A was applied across half of each 40 foot long plot 5:10 pm May 20, 1991 when the air temperature was 84F, soil temperature at six inches was 69F, relative humidity was 44%, wind velocity was 20 to 25 mph, soil moisture was fair, sugarbeet was in the cotyledon to early 2 leaf stage, prostrate pigweed was in the cotyledon to 2 leaf stage, green and yellow foxtail was emerging to 1 inch tall, and wild buckwheat was in the cotyledon to 1 leaf stage. Desmedipham&phenmedipham at 0.33 lb ai/A was applied as the second postemergence split 1:00 pm May 27, 1991 when the air temperature was 75F, soil temperature at six inches was 69F, relative humidity was 51%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, prostrate pigweed was in the 4 leaf stage to 1.5 inch diameter, green and yellow foxtail was 0.5 to 2.5 inches tall, and wild buckwheat was in the 2 to 4 leaf stage. Postemergence applications were in 8.5 gpa water at 38 psi through 8001 nozzles. Green and yellow foxtail, wild buckwheat, and prostrate pigweed control were evaluated June 19, 1991.

Soil-applied Treatment	Rate	No Post. Herbicide			Post Des&Phen 2X		
		Gr&Ye Fxtl	Wibw	Prpw	Gr&Ye Fxtl	Wibw	Prpw
	(lb/A)	(percent control)					
Cycloate (fall)	4	53	33	25	94	98	99
EPTC+Cycloate (fall)	1.5+2.5	66	20	23	96	99	98
EPTC+Cycloate (fall)	2.5+2.5	58	21	38	93	99	100
Diethatyl (fall)	6	15	0	11	88	99	96
EPTC+Cycloate+Diet (fall)	1.5+2.5+4	64	1	57	96	99	98
Untreated Check	0	0	0	0	67	64	94
Cycloate (spring)	4	88	43	44	98	98	99
EPTC+Cycloate (spring)	1+2.5	89	60	96	99	100	98
EPTC+Cycloate (spring)	2+2	87	44	49	99	100	98
Diethatyl (spring)	6	79	9	35	96	100	99
EPTC+Cycloate+Diet (spring)	1+2.5+4	94	66	92	99	100	100
C.V. %		12	44	36	3	2	2
LSD 5%		11	17	22	4	3	3
LSD 1%		15	23	30	5	5	4
# OF REPS		4	4	4	4	4	4

Summary

Sugarbeet stands were insufficient for evaluation. Spring soil-applied herbicides generally gave better weed control than fall soil-applied herbicides. Soil-applied herbicides plus postemergence desmedipham & phenmedipham gave weed control superior to soil-applied herbicides alone or desmedipham&phenmedipham alone.

New formulations of desmedipham&phenmedipham with adjuvants, Crookston, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. The first half of split applications was applied 5:10 pm May 20 when the air temperature was 84F, soil temperature at six inches was 69F, relative humidity was 44%, wind velocity was 20 to 25 mph, soil moisture was fair, sugarbeet was in the cotyledon to early 2 leaf stage, green foxtail was emerging to 1 inch tall, prostrate pigweed was in the cotyledon to 2 leaf stage, and kochia had a 0.5 to 1 inch rosette diameter. The second half of split applications was applied 1:00 pm May 27 when the air temperature was 75F, soil temperature at six inches was 69F, relative humidity was 51%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, green foxtail was 0.5 to 2.5 inches tall, prostrate pigweed was in the 4 leaf stage to 1.5 inches in diameter, and kochia had a 1 inch rosette diameter to 1.5 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A June 11. Sugarbeet injury and green foxtail, prostrate pigweed and kochia control were evaluated June 19.

Treatment*	Rate	Sgbt inj	Grft cntl	Prpw cntl	Kocz cntl
	(lb/A)		(%)		
Des&Phen/Des&Phen	0.5/0.5	20	98	92	57
Des&Phen/Des&Phen	0.25/0.33	4	85	91	27
CQ1232/CQ1232	0.25/0.33	0	5	18	0
CQ1232+X-77/CQ1232+X-77	0.25+1%/0.33+1%	9	89	80	23
CQ1232+Sylg/CQ1232+Sylg	0.25+0.4%/0.33+0.4%	0	48	60	0
CQ1232+Stoll/CQ1232+Stoll	0.25+0.25G/0.33+0.25G	20	93	91	37
CQ1232+Scoil/CQ1232+Scoil	0.25+0.19G/0.33+0.19G	10	87	84	40
CQ1232+Scoil/CQ1232+Scoil	0.5+0.19G/0.5+0.19G	15	96	89	53
CQ1232+SunItII/CQ+SunItII	0.25+0.25G/0.33+0.25G	3	78	86	23
CQ1232+Dash/CQ1232+Dash	0.25+0.25G/0.33+0.25G	11	87	81	23
CQ1232+Herbimax/CQ1232+Herb	0.25+0.25G/.33+.25G	0	59	68	7
CQ1232+AMS/CQ1232+AMS	0.25+2.5/0.33+2.5	0	8	20	0
CQ1232+10-34-0/1232+10-34-0	0.25+.25G/0.33+0.25G	0	5	8	0
CQ1232+28%N/CQ1232+28%N	0.25+1G/0.33+1G	0	25	25	0
CQ1232+Tween20/CQ1232+Tween20	0.25+1%/0.33+1%	4	77	87	22
De&Ph+Cycloate/De&Ph+Cycl	0.25+0.75/0.33+0.75	13	96	92	43
De&Ph+Cycloate/De&Ph+Cycl	0.5+0.75/0.5+0.75	30	98	98	50
D&P+FoamBuster/D&P+FB	0.25+0.063G/0.33+0.063G	6	95	88	43
D&P+FoamBuster/D&P+FB	0.5+0.063G/0.5+0.063G	11	96	94	53

(table continued on next page)

New formulations of desmedipham&phenmedipham with adjuvants, Crookston, 1991. (continued)

Treatment*	Rate (lb/A)	Sgbt inj	Grft cntl	Prpw cntl	Kocz cntl
		----------	(%)		----------
HIGH MEAN		30	98	98	57
LOW MEAN		0	5	8	0
EXP MEAN		8	69	71	27
C.V. %		101	13	11	55
LSD 5%		12	13	11	24
LSD 1%		16	17	15	32
# OF REPS		4	4	4	3

* CompAd at 10 mls/liter spray solution was added to spray solution before adding Scoil or Sun-It II.
CQ1232 = desmedipham&phenmedipham, 1:1 ratio, WP
X-77 = non-ionic surfactant from Valent; Sylgard 309 = surfactant from Dow Corning; Scoil = methylated seed oil from Agsco; Sun-It II = methylated seed oil from Agsco; Stoller = vegetable oil from Stoller; Dash = adjuvant from BASF; FoamBuster = anti-foaming agent from Ostlund; 28%N = 28% N solution containing urea and NH_4NO_3; Herbimax = petroleum oil from Loveland; AMS = ammonium sulfate; 10-34-0 = liquid fertilizer; Tween 20 = non-ionic surfactant from ICI

Summary

CQ1232+Stoller at 0.25/0.33 lb/A caused more sugarbeet injury than desmedipham&phenmedipham at 0.25/0.33 lb/A. CQ1232 without an adjuvant gave very little weed control. Desmedipham&phenmedipham at 0.5/0.5 lb/A alone or + adjuvants and CQ1232+Scoil at 0.5/0.5 lb/A gave similar sugarbeet injury and weed control. CQ1232 with the adjuvants X-77, Sylgard 309, Herbimax, ammonium sulfate, 10-34-0, or 28% nitrogen solution gave less control of one or more weed species than desmedipham&phenmedipham at 0.25/0.33 lb/A. CQ1232 with the adjuvants Stoller, Scoil, Sun-It II, Dash, or Tween 20 gave weed control similar to desmedipham&phenmedipham at 0.25/0.33 lb/A. Neither cycloate nor Foam Buster significantly improved weed control when used as an adjuvant with desmedipham&phenmedipham.

New formulations of desmedipham and desmedipham&phenmedipham with surfactants and oil additives, Crookston, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. The first half of split applications were applied 5:10 pm May 20 when the air temperature was 84F, soil temperature at six inches was 69F, relative humidity was 44%, wind velocity was 20 to 25 mph, soil moisture was fair, sugarbeet was in the cotyledon to early 2 leaf stage, prostrate pigweed was in the cotyledon to 2 leaf stage, wild buckwheat was in the cotyledon to 1 leaf stage, and kochia had a 0.5 to 1 inch rosette diameter. The second half of split applications were applied 1:00 pm May 27 when the air temperature was 75F, soil temperature at six inches was 69F, relative humidity was 51%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, prostrate pigweed was in the 4 leaf stage to 1.5 inches in diameter, wild buckwheat was in the 2 to 4 leaf stage, and kochia had a 1 inch rosette diameter to 1.5 inches tall. The single application treatments were applied 3:00 pm June 3 when the air temperature was 81F, soil temperature at six inches was 74F, relative humidity was 69%, wind velocity was 15 to 20 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, prostrate pigweed was in the 2 leaf stage to 4 inches in diameter, wild buckwheat was 2 to 3 inches tall, and kochia was 3 to 6 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A June 11. Sugarbeet injury and prostrate pigweed, wild buckwheat, and kochia control were evaluated June 19.

Treatment*	Rate (lb/A)	Sgbt inj	Prpw cntl	Wibw cntl	Kocz cntl
		(%)			
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	0	86	86	51
Desmedipham/Desmedipham	0.25/0.33	0	89	63	16
CQ1232+X-77/CQ1232+X-77	0.25+1%/0.33+1%	3	68	73	15
CQ1232+Sylgard/CQ1232+Sylg	0.25+0.4%/0.33+0.4%	0	76	66	9
CQ1232+Herb/CQ1232+Herb	0.25+0.25G/0.33+0.25G	0	76	64	15
CQ1232+Scoil/CQ1232+Scoil	0.25+0.19G/0.33+.19G	7	85	78	32
CQ1256+X-77/CQ1256+X-77	0.25+1%/0.33+1%	0	74	45	20
CQ1256+Sylgard/CQ1256+Sylg	0.25+0.4%/0.33+0.4%	0	73	36	11
CQ1256+Herb/CQ1256+Herb	0.25+0.25G/0.33+0.25G	0	56	46	5
CQ1256+Scoil/CQ1256+Scoil	0.25+0.19G/0.33+.19G	10	83	71	29
SN38584+X-77/SN38584+X-77	0.25+1%/0.33+1%	0	69	60	3
SN38584+Sylgard/SN38584+Sylg	0.25+0.4%/.33+.4%	0	68	55	9
SN38584+Herb/SN38584+Herb	0.25+0.25G/0.33+0.25G	0	73	38	8
SN38584+Scoil/SN38584+Scoil	0.25+.19G/.33+.19G	7	89	85	56
SN38107+X-77/SN38107+X-77	0.25+1%/0.33+1%	0	58	45	4
SN38107+Sylgard/SN38107+Sylg	0.25+0.4%/.33+.4%	0	53	31	5
SN38107+Herb/SN38107+Herb	0.25+0.25G/0.33+0.25G	0	66	45	8
SN38107+Scoil/SN38107+Scoil	0.25+.19G/.33+.19G	0	85	64	12

(table continued on next page)

New formulations of desmedipham and desmedipham&phenmedipham with surfactants and oil additives, Crookston, 1991. (continued)

Treatment*	Rate	Sgbt inj	Prpw cntl	Wibw cntl	Kocz cntl
	(lb/A)	----------	(%)	----------	
Desmedipham&Phenmedipham	0.75	0	75	73	8
Desmedipham	0.75	0	84	43	18
CQ1232+X-77	0.75+1%	0	41	20	10
CQ1232+Sylgard 309	0.75+0.4%	0	45	23	5
CQ1232+Herbimax	0.75+0.25G	0	50	38	5
CQ1232+Scoil	0.75+0.19G	0	65	44	10
CQ1256+X-77	0.75+1%	0	34	14	5
CQ1256+Sylgard 309	0.75+0.4%	0	30	5	5
CQ1256+Herbimax	0.75+0.25G	0	38	29	3
CQ1256+Scoil	0.75+0.19G	0	68	43	18
SN38584+X-77	0.75+1%	0	40	28	5
SN38584+Sylgard 309	0.75+0.4%	0	35	28	8
SN38584+Herbimax	0.75+0.25G	0	40	20	3
SN38584+Scoil	0.75+0.19G	0	65	65	6
SN38107+X-77	0.75+1%	0	45	23	3
SN38107+Sylgard 309	0.75+0.4%	0	19	15	0
SN38107+Herbimax	0.75+0.25G	0	35	13	5
SN38107+Scoil	0.75+0.19G	0	59	48	11
HIGH MEAN		10	89	86	56
LOW MEAN		0	19	5	0
EXP MEAN		1	61	45	12
C.V. %		456	21	37	82
LSD 5%		NS	18	23	14
LSD 1%		NS	24	31	18
# OF REPS		3	4	4	4

* CompAd at 10 mls/liter spray solution was added to spray solution before adding Scoil.
CQ1232 = desmedipham&phenmedipham, 1:1 ratio, WP; CQ1256 = desmedipham, WP
SN38584 = desmedipham&phenmedipham, 1:1 ratio, WG; SN38107 = desmedipham, WG
X-77 = non-ionic surfactant from Valent; Sylgard 309 = surfactant from Dow Corning; Scoil = methylated seed oil from Agsco; Herbimax = petroleum oil from Loveland

Summary

CQ1232 split applied gave less kochia control than desmedipham & phenmedipham and CQ1232 applied once gave less wild buckwheat control than desmedipham&phenmedipham regardless of adjuvant. CQ1256 gave weed control similar to desmedipham when Scoil was the adjuvant. All other adjuvants plus CQ1256 gave less control than desmedipham with one or more weeds. SN38584 + Scoil gave weed control similar to desmedipham&phenmedipham. SN38584 + other adjuvants gave less control than desmedipham&phenmedipham with one or more weeds. SN38107 + Scoil gave weed control similar to desmedipham. SN38107 + other adjuvants gave less control than desmedipham with one or more weeds.

Broadleaf weed control with postemergence herbicides, Argyle, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. The first half of split applications was applied 12:45 pm May 21 when the air temperature was 76F, soil temperature at six inches was 64F, relative humidity was 67%, wind velocity was 15 to 20 mph, soil moisture was good, sugarbeet, prostrate pigweed, and redroot pigweed were in the cotyledon to 2 leaf stage and wild buckwheat was in the 1 to 2 leaf stage. The second half of split applications and the single application treatments were applied 11:00 am May 28 when the air temperature was 74F, soil temperature at six inches was 63F, relative humidity was 51%, wind velocity was 5 to 8 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, prostrate pigweed was in the 2 leaf stage to 1.5 inches in diameter, and wild buckwheat was in the 3 leaf stage to 2 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A June 11. Sugarbeet injury and prostrate pigweed, redroot pigweed, and wild buckwheat control were evaluated June 18.

Treatment*	Rate (lb/A)	Sgbt inj	Prpw cntl	Rrpw cntl	Wibw cntl
			(%)		
Desmedipham/Desmedipham	0.25/0.33	0	93	96	17
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	0	89	98	97
Desm/Desm+Clopyralid	0.25/0.33+0.09	0	90	98	55
--/Clopyralid	--/0.19	0	10	10	90
--/Clopyralid+Endothall	--/0.09+0.5	0	8	13	100
--/Clopyralid+Endothall	--/0.19+0.5	0	13	16	100
--/Endothall	--/0.5	0	3	3	74
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	0	55	63	10
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	0	65	76	23
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	0	93	98	25
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	0	98	100	33
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	0	98	99	40
HIGH MEAN		0	98	100	100
LOW MEAN		0	3	3	10
EXP MEAN		0	59	64	55
C.V. %		0	8	9	18
LSD 5%		NS	7	8	14
LSD 1%		NS	10	11	19
# OF REPS		4	4	4	4

* X-77 = non-ionic surfactant from Valent

Summary

DPX-66037, clopyralid and endothall gave less control of prostrate pigweed and redroot pigweed than treatments that included desmedipham. All desmedipham treatments gave similar control of redroot pigweed but desmedipham + DPX-66037 at the two higher rates of DPX-66037 gave or tended to give better prostrate pigweed control than desmedipham alone or desmedipham+clopyralid. Desmedipham+clopyralid split applied, clopyralid at 0.19 lb/A, and clopyralid + endothall gave better control of wild buckwheat than other tested treatments.

Broadleaf weed control with postemergence herbicides, Bird Island, 1991. 'ACH 198' sugarbeet was seeded May 5. The first half of split applications was applied 10:00 am May 30 when the air temperature was 70F, relative humidity was 65%, wind velocity was 5 to 10 mph, and redroot pigweed and common lambsquarters were in the cotyledon stage. The second half of split applications and the single application treatments were applied 9:00 am June 11 when the air temperature was 70F, relative humidity was 60%, wind velocity was 0 to 5 mph, and redroot pigweed and common lambsquarters were 2 to 4 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles.

Treatment*	Rate	Common Lambsquarters	Redroot Pigweed
	(lb/A)	----- (%) control ----	
Desmedipham/Desmedipham	0.25/0.33	75	64
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	85	84
Desm/Desm+Clopyralid	0.25/0.33+0.09	85	86
--/Clopyralid	--/0.19	88	16
--/Clopyralid+Endothall	--/0.09+0.5	85	5
--/Clopyralid+Endothall	--/0.19+0.5	24	25
--/Endothall	--/0.5	38	9
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	46	10
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	50	31
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	75	88
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	91	91
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	93	95
HIGH MEAN		93	95
LOW MEAN		24	5
EXP MEAN		70	50
C.V. %		12	14
LSD 5%		12	10
LSD 1%		16	14
# OF REPS		4	4

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+clopyralid, clopyralid, clopyralid+endothall at 0.09+0.5 lb/A, and desmedipham+DPX-66037 at the two higher rates gave or tended to give better control of common lambsquarters than other tested treatments. The reason for poor control of common lambsquarter by clopyralid+endothall at 0.19+0.5 lb/A is not known. Desmediphan+clopyralid and desmedipham+DPX-66037 gave better redroot pigweed control than desmedipham alone.

Broadleaf weed control with postemergence herbicides, Cavalier, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. The first half of split applications was applied 3:45 pm May 21 when the air temperature was 76F, soil temperature at six inches was 59F, relative humidity was 67%, wind velocity was 15 to 20 mph, soil moisture was fair, sugarbeet was in the cotyledon stage, ladysthumb was in the cotyledon to 2 leaf stage, common lambsquarters was in the cotyledon to 4 leaf stage, and wild buckwheat was in the cotyledon to 1 leaf stage. The second half of split applications and the single application treatments were applied 2:45 pm May 28 when the air temperature was 79F, soil temperature at six inches was 64F, relative humidity was 35%, wind velocity was 5 to 8 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, ladysthumb was in the 2 to 4 leaf stage, common lambsquarters was in the 6 to 8 leaf stage, and wild buckwheat was in the 2 to 3 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.3 lb ai/A + 1 quart/A June 12. Sugarbeet injury and ladysthumb, common lambsquarters, and wild buckwheat control were evaluated June 27.

Treatment*	Rate (lb/A)	Lath cntl	Sgbt inj	Colq cntl	Wibw cntl
			(%)		
Desmedipham/Desmedipham	0.25/0.33	11	0	75	16
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	90	0	94	95
Desm/Desm+Clopyralid	0.25/0.33+0.09	50	0	91	74
--/Clopyralid	--/0.19	50	0	74	86
--/Clopyralid+Endothall	--/0.09+0.5	71	0	43	89
--/Clopyralid+Endothall	--/0.19+0.5	88	0	73	93
--/Endothall	--/0.5	70	0	3	65
DPX-66+X77/DPX-66+X77	0.0156+0.25%/0.0156+0.25%	70	0	16	8
DPX-66+X77/DPX-66+X77	0.031+0.25%/0.031+0.25%	88	0	25	18
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	75	0	74	28
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	88	0	87	35
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	85	0	73	38
HIGH MEAN		90	0	94	95
LOW MEAN		11	0	3	8
EXP MEAN		70	0	60	54
C.V. %		19	0	21	21
LSD 5%		19	NS	18	17
LSD 1%		26	NS	24	22
# OF REPS		4	4	4	4

* X77 = non-ionic surfactant from Valent

Summary

Desmedipham+clopyralid split applied gave better control of ladysthumb and common lambsquarters than desmedipham alone or clopyralid alone. Clopyralid, clopyralid+endothall and desmedipham+clopyralid split applied gave wild buckwheat control similar to one another but superior to other treatments tested. Treatments including DPX-66037 gave ladysthumb control similar to desmedipham+clopyralid split applied except DPX-66037 at 0.0156 lb/A split applied gave less control. DPX-66037 alone gave poor control of common lambsquarters and wild buckwheat. Desmedipham+DPX-66037 gave good control of common lambsquarters but poor control of wild buckwheat.

Broadleaf weed control with postemergence herbicides, Clara City, 1991. 'KW 2249' sugarbeet was seeded April 28. The first half of split applications was applied 2:00 pm May 24 when the air temperature was 80F, relative humidity was 75%, and wind velocity was 5 to 10 mph. The second half of split applications and the single application treatments were applied 6:00 pm May 30 when the air temperature was 75F, relative humidity was 70%, and wind velocity was 0 to 5 mph. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles.

Treatment*	Rate	Buffalo Bur	Gr & Ye Foxtail
	(lb/A)	--- (%) control ---	
Desmedipham/Desmedipham	0.25/0.33	64	40
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	81	60
Desm/Desm+Clopyralid	0.25/0.33+0.09	80	50
--/Clopyralid	--/0.19	65	9
--/Clopyralid+Endothall	--/0.09+0.5	65	24
--/Clopyralid+Endothall	--/0.19+0.5	83	38
--/Endothall	--/0.5	0	59
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	76	69
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	74	76
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	94	86
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	96	78
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	93	86
HIGH MEAN		96	86
LOW MEAN		0	9
EXP MEAN		73	56
C.V. %		12	19
LSD 5%		12	15
LSD 1%		16	20
# OF REPS		4	4

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+DPX-66037 gave or tended to give better buffalo bur and foxtail spp. control than other tested treatments.

Broadleaf weed control in sugarbeets, Crookston, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. The first half of split applications beginning when sugarbeets and weeds were in the cotyledon stage was applied 5:10 pm May 20 when the air temperature was 84F, soil temperature at six inches was 69F, relative humidity was 44%, wind velocity was 20 to 25 mph, soil moisture was fair, sugarbeet was in the cotyledon to early 2 leaf stage, prostrate pigweed was in the cotyledon to 2 leaf stage, and kochia had a 0.5 to 1 inch rosette diameter. The second half of split applications beginning in the cotyledon stage and the first half of split applications beginning in the two leaf stage were applied 1:00 pm May 27 when the air temperature was 75F, soil temperature at six inches was 69F, relative humidity was 51%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, prostrate pigweed was in the 4 leaf stage to 1.5 inches in diameter, and kochia had a 1 inch rosette diameter to 1.5 inches tall. The second half of split applications beginning in the two leaf stage was applied 3:00 pm June 3 when the air temperature was 81F, soil temperature at six inches was 74F, relative humidity was 69%, wind velocity was 15 to 20 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, prostrate pigweed was in the 2 leaf stage to 4 inches in diameter, and kochia was 3 to 6 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with Sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A June 11. Sugarbeet injury and prostrate pigweed and kochia control were evaluated July 10.

Treatment*	Rate (lb/A)	Sgbt inj	Prpw cntl	Kochia cntl
		--------	(%)	--------
Des&Phen/Des&Phen (cot)	0.5/0.5	0	77	25
Des&Phen/Des&Phen (cot)	0.33/0.33	0	67	13
Des&Phen/Des&Phen (cot)	0.25/0.25	0	75	5
Des&Phen/Des&Phen (cot)	0.33/0.5	0	79	8
NA252/NA252 (cot)	0.25+0.125/0.25+0.125	0	58	25
NA276/NA276 (cot)	0.25+0.06/0.25+0.06	0	61	6
NA277/NA277 (cot)	0.25+0.19/0.25+0.19	0	73	8
D&P+Etho-SC/D&P+Etho (cot)	0.25+0.35/0.25+0.125	0	80	45
D&P+Etho-SC/D&P+Etho (cot)	0.25+0.17/0.25+0.06	0	71	8
D&P+Etho-SC/D&P+Etho (cot)	0.25+0.53/0.25+0.19	0	83	25
DPX-66+D&P/DPX-66+D&P (cot)	0.0078+0.33/0.0078+0.33	0	75	90
DPX-66+D&P/DPX-66+D&P (cot)	0.0078+0.33/0.0078+0.5	0	69	51
DPX-66+D&P/DPX-66+D&P (cot)	0.0078+0.5/0.0078+0.5	0	81	74
DPX-66+D&P/DPX-66+D&P (cot)	0.0156+0.33/0.0156+0.33	0	89	91
DPX-66+D&P/DPX-66+D&P (cot)	0.0156+0.33/0.0156+0.5	0	78	92
DPX-66+D&P/DPX-66+D&P (cot)	0.0156+0.5/0.0156+0.5	0	92	98
DPX-66+D&P/DPX-66+D&P (cot)	0.031+1/0.031+1	0	84	91
DPX66+X77/DPX66+X-77(cot)	0.0078+0.25%/0.0078+0.25%	0	24	64
DPX66+X77/DPX66+X-77(cot)	0.0156+0.25%/0.0156+0.25%	0	33	85
DPX66+X77/DPX66+X-77 (cot)	0.031+0.25%/0.031+0.25%	0	48	96
Des&Phen/-- (21f)	0.5/--	0	60	5
Des&Phen+Clopyralid/-- (21f)	0.5/0.09/--	0	60	10
Des&Phen+Clopyralid/-- (21f)	0.5+0.19/--	0	70	13
Clopyralid/-- (21f)	0.09/--	0	5	0
Clopyralid/-- (21f)	0.19/--	0	8	0

(table continued on next page)

Broadleaf weed control in sugarbeets, Crookston, 1991. (continued)

Treatment*	Rate (lb/A)	Sgbt inj	Prpw cntl	Kochia cntl
		--------	(%)	--------
DPX-66+D&P/DPX-66+D&P (21f)	0.0078+0.33/0.0078+0.33	0	75	76
DPX-66+D&P/DPX-66+D&P (21f)	0.0078+0.33/0.0078+0.5	0	81	76
DPX-66+D&P/DPX-66+D&P (21f)	0.0078+0.5/0.0078+0.5	0	81	88
DPX-66+D&P/DPX-66+D&P (21f)	0.0156+0.33/0.0156+0.33	0	86	93
DPX-66+D&P/DPX-66+D&P (21f)	0.0156+0.33/0.0156+0.5	0	87	83
DPX-66+D&P/DPX-66+D&P (21f)	0.0156+0.5/0.0156+0.5	0	87	88
DPX-66+D&P/DPX-66+D&P (21f)	0.031+1/0.031+1	0	99	99
DPX66+X77/DPX66+X77 (21f)	0.0078+0.25%/0.0078+0.25%	0	30	31
DPX66+X77/DPX66+X77 (21f)	0.0156+0.25%/0.0156+0.25%	0	25	73
Des&Phen/Des&Phen (21f)	0.33/0.33	0	76	25
Des&Phen/Des&Phen (21f)	0.33/0.5	0	75	35
Des&Phen/Des&Phen (21f)	0.5/0.5	0	83	38
Endothall+Clopyralid/-- (21f)	0.5+0.09/--	0	0	0
Endothall+Clopyralid/-- (21f)	0.5+0.19/--	0	13	0
Endothall+Clopyralid/-- (21f)	0.75+0.19/--	0	10	0
HIGH MEAN		0	99	99
LOW MEAN		0	0	0
EXP MEAN		0	63	46
C.V. %		0	18	27
LSD 5%		NS	16	17
LSD 1%		NS	21	23
# OF REPS		4	4	4

* NA252 = desmedipham&phenmedipham + ethofumesate, 2:1 ratio.
NA276 = desmedipham&phenmedipham + ethofumesate, 4:1 ratio.
NA277 = desmedipham&phenmedipham + ethofumesate, 2:1.5 ratio.
X-77 = non-ionic surfactant from Valent

Summary

NA252, NA276, and NA277 split applied gave prostrate pigweed control similar to or less than desmedipham&phenmedipham split applied. Treatments that included DPX-66037 gave or tended to give better control of kochia than other treatments. DPX-66037 alone gave poor control of prostrate pigweed.

Broadleaf weed control with postemergence herbicides, Gluek, 1991. 'KW 2398' sugarbeet was seeded April 23. The first half of split applications was applied 3:00 pm May 22 when the air temperature was 80F, relative humidity was 75%, wind velocity was 10 to 15 mph, and common cocklebur was in the cotyledon stage. The second half of split applications and the single application treatments were applied 12:00 pm May 29 when the air temperature was 75F, relative humidity was 70%, wind velocity was 5 mph, and common cocklebur was 2 to 5 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles.

Treatment*	Rate (lb/A)	Common Cocklebur (%) control
Desmedipham/Desmedipham	0.25/0.33	30
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	100
Desm/Desm+Clopyralid	0.25/0.33+0.09	98
--/Clopyralid	--/0.19	93
--/Clopyralid+Endothall	--/0.09+0.5	100
--/Clopyralid+Endothall	--/0.19+0.5	97
--/Endothall	--/0.5	0
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	0
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	0
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	20
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	25
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	35
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		50
C.V. %		15
LSD 5%		13
LSD 1%		17
# OF REPS		3

* X-77 = non-ionic surfactant from Valent

Summary

Treatments which included clopyralid gave common cocklebur control similar to one another but superior to other tested treatments. DPX-66037 gave no control of common cocklebur.

Broadleaf weed control with postemergence herbicides, Hillsboro, 1991. 'KW 3265' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 9. The first half of split applications was applied 6:30 pm May 28 when the air temperature was 75F, soil temperature at six inches was 78F, relative humidity was 48%, wind velocity was 0 to 5 mph, soil moisture was fair, sugarbeet was in the cotyledon to 2 leaf stage, and redroot pigweed was in the cotyledon to 6 leaf stage. The second half of split applications and the single application treatments were applied 6:30 pm June 3 when the air temperature was 82F, soil temperature at six inches was 78F, relative humidity was 59%, wind velocity was 20 mph, soil moisture was fair, sugarbeet was in the 2 to 4 leaf stage, and redroot pigweed was in the 2 leaf stage to 3 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A May 28 after applying the broadleaf herbicide treatments. Sugarbeet injury and redroot pigweed control were evaluated June 13.

Treatment*	Rate	Sugarbeet injury	Redroot Pigweed control
	(lb/A)	-------- (%)	-------
Desmedipham/Desmedipham	0.25/0.33	0	99
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	0	99
Desm/Desm+Clopyralid	0.25/0.33+0.09	0	99
--/Clopyralid	--/0.19	0	3
--/Clopyralid+Endothall	--/0.09+0.5	0	3
--/Clopyralid+Endothall	--/0.19+0.5	0	5
--/Endothall	--/0.5	0	5
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	0	50
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	0	65
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	0	99
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	0	100
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	0	100
HIGH MEAN		0	100
LOW MEAN		0	3
EXP MEAN		0	60
C.V. %		0	7
LSD 5%		NS	6
LSD 1%		NS	8
# OF REPS		4	4

* X-77 = non-ionic surfactant from Valent

Summary

DPX-66037 gave poor control and desmedipham gave excellent control of redroot pigweed. A portion of the first replication of this experiment was infested with purslane. Desmedipham+clopyralid gave good purslane control, better than desmedipham alone or clopyralid alone.

Broadleaf weed control with postemergence herbicides, Mooreton, 1991. 'Van Der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 15. The first half of split applications was applied 4:30 pm June 6 when the air temperature was 78F, soil temperature at six inches was 68F, relative humidity was 53%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the cotyledon to 4 leaf stage, and redroot pigweed and common lambsquarters were in the cotyledon to 2 leaf stage. The second half of split applications and the single application treatments were applied 9:15 am June 13 when the air temperature was 81F, soil temperature at six inches was 71F, relative humidity was 69%, wind velocity was 15 mph, soil moisture was good, and sugarbeet, redroot pigweed, and common lambsquarters were in the 2 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury, redroot pigweed control, and common lambsquarters control were evaluated July 9.

Treatment*	Rate (lb/A)	Sgbt inj (%)	Rrpw cntl (%)	Colq cntl (%)
Desmedipham/Desmedipham	0.25/0.33	0	81	78
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	0	86	94
Desm/Desm+Clopyralid	0.25/0.33+0.09	0	90	93
--/Clopyralid	--/0.19	0	0	55
--/Clopyralid+Endothall	--/0.09+0.5	0	0	5
--/Clopyralid+Endothall	--/0.19+0.5	0	0	31
--/Endothall	--/0.5	0	0	0
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	0	45	6
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	0	58	18
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	0	93	86
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	0	95	88
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	0	95	91
HIGH MEAN		0	95	94
LOW MEAN		0	0	0
EXP MEAN		0	54	54
C.V. %		0	11	15
LSD 5%		NS	9	12
LSD 1%		NS	12	16
# OF REPS		4	4	4

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+clopyralid gave better control of common lambsquarters than desmedipham alone or clopyralid alone. DPX-66037+desmedipham gave better control of redroot pigweed than desmedipham alone or DPX-66037 alone.

Broadleaf weed control with postemergence herbicides, Renville, 1991. 'Van Der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 14. The first half of split applications was applied 7:00 pm May 30 when the air temperature was 75F, relative humidity was 70%, wind velocity was 5 mph, and wild buckwheat was in the cotyledon stage to one inch tall. The second half of split applications and the single application treatments were applied 6:00 pm June 6 when the air temperature was 75F, relative humidity was 70%, wind velocity was 0 to 5 mph, and wild buckwheat was 1.5 to 3 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots.

Treatment*	Rate (lb/A)	Wild Buckwheat control ----- (%) ----
Desmedipham/Desmedipham	0.25/0.33	33
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	95
Desm/Desm+Clopyralid	0.25/0.33+0.09	89
--/Clopyralid	--/0.19	94
--/Clopyralid+Endothall	--/0.09+0.5	97
--/Clopyralid+Endothall	--/0.19+0.5	98
--/Endothall	--/0.5	93
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	35
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	45
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	54
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	49
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	69
HIGH MEAN		98
LOW MEAN		33
EXP MEAN		71
C.V. %		12
LSD 5%		12
LSD 1%		17
# OF REPS		4

* X-77 = non-ionic surfactant from Valent

Summary

Treatments which included clopyralid or endothall gave wild buckwheat control similar to one another but superior to other tested treatments. DPX-66037 gave poor control of wild buckwheat.

Russian thistle control with postemergence herbicides, Crookston, 1991. Experimental test plots 11 feet wide and 30 feet long were established in a wheat field with a dense population of Russian thistle. The first half of split applications was applied 11:00 am June 4 when the air temperature was 70F, soil temperature at six inches was 63F, relative humidity was 64%, wind velocity was 10 mph, soil moisture was fair, and Russian thistle was 1 to 3 inches tall. The second half of split applications and the single application treatments were applied 5:00 pm June 11 when the air temperature was 79F, soil temperature at six inches was 72F, relative humidity was 44%, wind velocity was 5 mph, soil moisture was good, and Russian thistle was 2 to 4 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center seven feet of eleven foot plots. Russian thistle control was evaluated July 10.

Treatment*	Rate (lb/A)	Russian Thistle control ----- (%) -----
Desmedipham/Desmedipham	0.25/0.33	13
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	82
Desm/Desm+Clopyralid	0.25/0.33+0.09	48
--/Clopyralid	--/0.19	51
--/Clopyralid+Endothall	--/0.09+0.5	26
--/Clopyralid+Endothall	--/0.19+0.5	48
--/Endothall	--/0.5	0
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	24
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	33
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	8
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	11
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	25
HIGH MEAN		82
LOW MEAN		0
EXP MEAN		31
C.V. %		23
LSD 5%		10
LSD 1%		14
# OF REPS		4

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+clopyralid split applied gave Russian thistle control superior to the other tested treatments.

Kochia control with postemergence herbicides, Fargo, 1991. Experimental test plots 11 feet wide and 30 feet long were established in a dense population of kochia May 24. The first half of split applications was applied 4:30 pm May 24 when the air temperature was 77F, soil temperature at six inches was 68F, relative humidity was 49%, wind velocity was 8 to 10 mph, soil moisture was good, and kochia was emerging to 0.5 inch rosette diameter. The second half of split applications and the single application treatments were applied 10:00 am June 3 when the air temperature was 77F, soil temperature at six inches was 65F, relative humidity was 75%, wind velocity was 0 to 4 mph, soil moisture was good, and kochia was 0.5 to 2 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center seven feet of eleven foot plots. The entire plot area was treated with clopyralid at 0.19 lb ai/A May 23. Kochia control was evaluated June 3 and June 24.

Treatment*	Rate	June 3 Kochia control	June 24 Kochia control
	(lb/A)	------- (%)	------
Desmedipham/Desmedipham	0.25/0.33	38	36
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	40	30
Desm/Desm+Clopyralid	0.25/0.33+0.09	45	25
--/Clopyralid	--/0.19	0	0
--/Clopyralid+Endothall	--/0.09+0.5	0	0
--/Clopyralid+Endothall	--/0.19+0.5	0	0
--/Endothall	--/0.5	0	0
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	98	94
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	99	93
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	97	94
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	99	97
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	99	99
HIGH MEAN		99	99
LOW MEAN		0	0
EXP MEAN		51	47
C.V. %		8	11
LSD 5%		6	8
LSD 1%		8	10
# OF REPS		4	4

* X-77 = non-ionic surfactant from Valent

Summary

All applied rates of DPX-66037 gave 93% or greater control of kochia. Clopyralid and endothall gave no kochia control and desmedipham gave poor kochia control.

Lanceleaf sage control with postemergence herbicides, Wendell, 1991. Experimental test plots 6 rows wide and 30 feet long were established in a commercial sugarbeet field with a moderate population of lanceleaf sage. The first half of split applications was applied 8:15 pm June 6 when the air temperature was 74F, soil temperature at six inches was 70F, relative humidity was 54%, wind velocity was 5 to 10 mph, soil moisture was good, and lanceleaf sage was in the 2 leaf stage to 5 inches tall. The second half of split applications and the single application treatments were applied 11:30 am June 13 when the air temperature was 86F, soil temperature at six inches was 74F, relative humidity was 57%, wind velocity was 25 mph, soil moisture was good, and lanceleaf sage was in the 4 leaf stage to 6 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Lanceleaf sage control was evaluated June 26.

Treatment*	Rate (lb/A)	Lanceleaf Sage control ----- (%) -----
Desmedipham/Desmedipham	0.25/0.33	5
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	65
Desm/Desm+Clopyralid	0.25/0.33+0.09	28
--/Clopyralid	--/0.19	28
--/Clopyralid+Endothall	--/0.09+0.5	5
--/Clopyralid+Endothall	--/0.19+0.5	10
--/Endothall	--/0.5	30
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	3
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	13
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+0.0078	0
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+0.0156	15
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	20
HIGH MEAN		65
LOW MEAN		0
EXP MEAN		18
C.V. %		107
LSD 5%		28
LSD 1%		38
# OF REPS		4

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+clopyralid split applied tended to give better control of lanceleaf sage than the other treatments but the level of control would not be commercially satisfactory. DPX-66037 gave poor control of lanceleaf sage.

Canada thistle control, Fargo, 1989-1991. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12, 1989. Plots 34 feet long and nine rows wide were established in a dense population of Canada thistle. The single application treatments and the first half of split application treatments were applied May 31, 1989 when Canada thistle was emerging to six inches tall. The second half of split treatments was applied June 14, 1989 when Canada thistle was 5 to 10 inches tall. The bud stage treatments were applied June 26, 1989. Sugarbeets were cultivated June 8, June 14, and June 29, 1989. Ethofumesate at 5.0 lb/A was applied to the whole plot area and incorporated October 17, 1989. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 20, 1990. Desmedipham&phenmedipham at 0.16 lb/A was applied to the whole plot area May 23, 1990. Treatments were applied June 12, 1990 when Canada thistle was 3 to 10 inches tall. The second half of split application treatments and bud stage treatments were applied July 6, 1990 when Canada thistle was 16 to 28 inches tall. All treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to eight rows of nine row plots. Sugarbeet was cultivated June 26, 1990. Plots were hand weeded throughout the 1989 and 1990 growing season to remove all weeds except Canada thistle. Canada thistle control was evaluated September 18, 1989 and June 9, 1990 after treatments had been applied once. After the second application of treatments, Canada thistle was counted in 40 square feet of each plot July 19, 1990 and Canada thistle control was evaluated September 12, 1990 and June 25, 1991.

		Evaluation after one application		Evaluation after two applications		
		9/18/89	6/9/90	9/12/90	7/19/90	6/25/91
Treatment*	Rate	CATH cntl	CATH cntl	CATH cntl	CATH Plants	CATH cntl
	(lb/A)	--- (%) ---			(40ft^2)	(%)
Untreated Check	0	0	0	0	83	0
Clopyralid	0.09	66	68	98	6	90
Clopyralid	0.19	84	95	100	2	95
Clopyralid	0.25	64	67	100	3	97
Clopyralid+Desmedipham	0.19+0.5	82	87	100	3	98
Clopyralid+Desmedipham	0.25+0.5	87	87	100	3	96
Clopyralid+Dash	0.09+0.25G	53	68	100	9	89
Clopyralid+Dash	0.19+0.25G	88	83	100	1	92
Clopyralid+Dash	0.25+0.25G	86	88	98	3	99
Clopyralid+Endothall	0.19+0.75	79	87	100	3	92
Clopyralid+Sun-It	0.19+0.25G	74	92	99	2	98
Clopyralid+OC	0.19+0.25G	81	85	99	2	97
Clopyralid/Clopyralid	0.095/0.095	79	80	100	0	99
Clopyralid/Clopyralid	0.125/0.125	88	90	100	1	99
Glyphosate+X-77 (budding)	1.5+0.25%	59	85	97	4	77
Glyt+Dicamba+X-77(budding)	1+0.25+0.25%	64	80	99	11	83
Glyt+Clpy+X-77 (budding)	1+0.19+0.25%	60	72	96	19	76
Untreated Check	0	0	0	13	81	10
C.V. %		22	18	6	87	12
LSD 5%		20	22	9	19	17
# OF REPS		4	3	3	3	3

* Dash=BASF adjuvant; Sun-It=sunflower methyl ester from Agsco; OC=Mor-Act petroleum oil concentrate from Wilbur-Ellis; X-77 = non-ionic surfactant from Valent; Each treatment was applied in 1989 and again in 1990.

SUMMARY: All treatments including clopyralid gave 90% or greater control when applied in 1989 and 1990. The cultivation of sugarbeet may have improved the control of Canada thistle. Canada thistle control from glyphosate was less than from clopyralid. However, glyphosate killed sugarbeet while clopyralid did not injure sugarbeet. Sugarbeet competition with Canada thistle in the clopyralid treated plots may have improved Canada thistle control compared to the glyphosate treated plots where sugarbeet was not present.

Canada thistle control, Moorhead, 1990-1991. Plots 40 feet long and 15 feet wide were established in a very dense population of Canada thistle. Herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center 10 feet of each plot. All single application treatments except those containing glyphosate and the first half of split application treatments were applied 10:00 pm May 29, 1990 when the air temperature was 67F, relative humidity was 50%, wind was 2-4 mph, soil moisture was good, and Canada thistle was emerging to 6 inches tall. The second half of split treatments and treatments containing glyphosate were applied 8:00 pm June 12 when the air temperature was 76F, soil temperature at six inches was 76F, relative humidity was 52%, wind was 0-2 mph, soil moisture was good, and Canada thistle was 2 to 20 inches tall and budding. A rototiller set four inches deep was used to till plots 3, 9, and 14 days after Canada thistle was treated with clopyralid at 0.19 lb/A. Canada thistle control was evaluated July 14, 1990 and May 18 and July 24, 1991.

		1990	1991	
1990 Treatment*	Rate	July 14 Canada Thistle control	May 18 Canada Thistle control	July 24 Canada Thistle control
	(lb/A)	(%)		
Clopyralid	0.09	55	11	0
Clopyralid	0.19	79	9	5
Clopyralid	0.25	85	49	20
Clopyralid+Dash	0.19+0.25G	70	30	23
Clopyralid+Sun-It	0.19+0.25G	76	49	20
Clopyralid/Clopyralid	0.095/0.095	95	45	35
Clopyralid/Clopyralid	0.125/0.125	96	74	49
--/Glyphosate+X-77	1.5+0.25%	93	60	78
--/Glyt+Clpy+X-77	1+0.19+0.25%	98	73	60
DPX-L5300+X-77	0.015+0.25%	51	3	0
Clopyralid+2,4-D	0.09+0.5	65	14	6
Clopyralid+Desmedipham	0.19+0.5	80	40	18
Dicamba+MCPA	0.12+0.25	38	8	3
Clopyralid (tilled 3 DAT)	0.19	70	25	9
Clopyralid (tilled 9 DAT)	0.19	69	21	6
Clopyralid (tilled 14 DAT)	0.19	83	42	13
C.V. %		10	48	70
LSD 5%		10	24	21
LSD 1%		14	32	28
# OF REPS		4	4	4

* X-77 = non-ionic surfactant from Valent; Dash = adjuvant from BASF; Sun-It = methylated seed oil from Agsco

Summary

In general, the level of Canada thistle control at this location was less than in the experiment at Fargo started in 1989. Sugarbeet was not seeded in this experiment while sugarbeet was seeded in Fargo. Perhaps competition from the sugarbeet and the row crop cultivation at Fargo assisted in controlling the Canada thistle. Glyphosate gave better Canada thistle control than clopyralid on July 24, 1991, 13 months after treatment. Split application of clopyralid tended to give better Canada thistle control than a single application.

Canada thistle control with tillage and herbicides, Moorhead, 1990-1991. Experimental test plots 40 feet long and 15 feet wide were established in a very dense population of Canada thistle. The entire plot area was tilled with a tandem disk once a week during the first three weeks of August, 1990. Herbicide treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzle tips to the center 10 feet of 15 foot wide plots 5:15 pm September 7, 1990 when the air temperature was 78F, soil temperature at six inches was 76F, relative humidity was 50%, wind velocity was 3 to 5 mph, soil moisture was fair, and Canada thistle was in the 4 leaf stage (1 inch tall) to 6 inches tall. Canada thistle control was evaluated July 24, 1991.

Treatment*	Rate (lb/A)	Canada thistle control (%)
Dicamba	0.5	0
Dicamba	1	0
Clopyralid	0.09	0
Clopyralid	0.19	0
Clopyralid	0.25	0
2,4-D	1	0
2,4-D	2	0
Clopyralid+2,4-D	0.09+0.5	0
DPX-L5300+X-77	0.015+0.25%	0
C.V. %		0
LSD 5%		NS
LSD 1%		NS
# OF REPS		4

* X-77 = non-ionic surfactant from Valent

Summary

None of the treatments provided visible control of Canada thistle.

Multispecies evaluation of postemergence broadleaf herbicides, Renville, 1991. 'Van Der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows and weeds were seeded with a grain drill across the plots on May 14. The first half of split applications was applied 5:00 pm May 31 when the air temperature was 70F, relative humidity was 70%, wind velocity was 5 to 10 mph, velvetleaf was 1 to 1.5 inches tall, kochia was emerging to 1 inch tall, redroot pigweed was in the cotyledon stage to 1 inch tall, and wild mustard was 1 to 2 inches tall. The second half of split applications and the single application treatments were applied 3:00 pm June 6 when the air temperature was 75F, relative humidity was 70%, wind velocity was 0 to 5 mph, velvetleaf was 1.5 to 2 inches tall, kochia was 1 to 1.5 inches tall, redroot pigweed was 0.5 to 1 inch tall, and wild mustard was 2 to 3 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles.

Treatment*	Rate (lb/A)	Vele	Kocz	Rrpw	Wimu
		------	(%)	control	------
Desmedipham/Desmedipham	0.25/0.33	8	5	72	83
Des&Phen/Des&Phen	0.25/0.33	20	12	45	93
Desm/Desm+Clopyralid	0.25/0.33+0.09	13	18	87	90
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.09	3	8	57	85
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	0	12	77	90
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	0	3	3	90
--/Clopyralid	--/0.19	15	0	0	19
--/Clopyralid+Endothall	--/0.09+0.5	20	7	15	15
--/Clopyralid+Endothall	--/0.19+0.5	17	15	38	32
--/Endothall	--/0.5	5	10	43	7
DPX-66+X-77/DPX-66+X-77	0.0156+0.25%/0.0156+0.25%	25	7	15	100
DPX-66+X-77/DPX-66+X-77	0.031+0.25%/0.031+0.25%	48	27	77	100
Des+DPX-66/Des+DPX-66	0.25+0.0078/0.33+.0078	17	17	72	100
D&P+DPX-66/D&P+DPX-66	0.25+0.0078/0.33+.0078	23	12	62	100
Des+DPX-66/Des+DPX-66	0.25+0.0156/0.33+.0156	53	18	78	100
D&P+DPX-66/D&P+DPX-66	0.25+0.0156/0.33+.0156	88	12	68	100
Des+DPX-66/Des+DPX-66	0.25+0.031/0.33+0.031	100	38	88	100
D&P+DPX-66/D&P+DPX-66	0.25+0.031/0.33+0.031	100	53	77	100
HIGH MEAN		100	53	88	100
LOW MEAN		0	0	0	7
EXP MEAN		31	15	54	78
C.V. %		44	71	15	11
LSD 5%		23	18	13	14
LSD 1%		31	24	18	18
# OF REPS		3	3	3	3

* X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+DPX-66037 or desmedipham&phenmedipham+DPX-66037 split applied at the highest rate of DPX-66037 gave total control of velvetleaf. None of the treatments gave good control of kochia. This contradicts observations at Fargo and Crookston where DPX-66037 gave good kochia control. The reason for poor kochia control at this location is not known. Treatments including desmedipham gave better control of redroot pigweed than treatments including desmedipham&phenmedipham. Treatments including DPX-66037 gave total control of wild mustard.

Simulated spray drift, Casselton, 1991. 'Van Der Have 6692' sugarbeet was seeded 1.25 inches deep in 22 inch rows June 13. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Sugarbeet was maintained weed free by hand weeding throughout the growing season. Treatments were applied 11:00 am July 23 when the air temperature was 75F, relative humidity was 70%, wind velocity was 10 to 15 mph, soil moisture was good, and sugarbeet was in the 8 to 12 leaf stage. Herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet was hand thinned to an 8 inch spacing July 24. Sugarbeet injury was evaluated July 31. The center two rows of 25 foot long plots were harvested and counted September 30.

Treatment	Rate	Sgbt inj	Sgbt Popul	Sucrose	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	(lb/A)	(%)	(#/50ft)	(%)	(%)	(ton/A)		(lb/A)
Thifen&Triben	0.00025	4	58	16.4	2.0	14.8	911	4185
Thifen&Triben	0.0005	8	58	16.4	2.1	13.5	951	3779
Thifen&Triben	0.001	24	37	15.5	2.2	8.6	1053	2253
Imazethapyr	0.0005	0	64	16.3	2.2	15.7	983	4358
Imazethapyr	0.001	5	57	16.7	2.0	15.1	861	4412
Imazethapyr	0.0025	11	55	15.9	2.2	12.0	1009	3231
Imazethapyr	0.005	29	43	15.7	2.3	9.0	1074	2355
DPX-V9360	0.0025	5	57	16.3	2.2	14.5	973	4052
DPX-V9360	0.005	5	56	16.1	2.2	13.1	985	3596
DPX-V9360	0.01	8	50	16.2	2.1	11.1	935	3099
DPX-V9360	0.02	16	34	15.8	2.2	6.4	1005	1708
2,4-D (amine)	0.06	15	56	16.1	2.4	15.2	1070	4119
Untreated	0	0	63	17.0	2.0	15.5	864	4576
HIGH MEAN		29	64	17.0	2.4	15.7	1074	4576
LOW MEAN		0	34	15.5	2.0	6.4	861	1708
EXP MEAN		10	53	16.2	2.1	12.7	975	3517
C.V. %		47	9	2.6	6.3	7.0	8	6
LSD 5%		7	7	0.6	0.2	1.3	108	325
LSD 1%		9	9	0.8	0.3	1.7	145	437
# OF REPS		4	4	4	4	4	4	4

Summary

All treatments except imazethapyr at 0.0005 and 0.001 lb/A caused a significant reduction in extractable sucrose. The herbicides generally reduced tons per acre more than percent surcose.

Herbicides on hand weeded sugarbeet, Casselton, 1991. 'Van Der Have 6692' sugarbeet was seeded 1.25 inches deep in 22 inch rows June 13. Counter 15G at 12 pounds product per acre was applied modified in-furrow at planting. The first half of split application treatments and single application treatments were applied 8:15 pm July 9 when the air temperature was 77F, soil temperature at six inches was 75F, relative humidity was 67%, wind velocity was 0 to 2 mph, soil moisture was good, and sugarbeet was in the 4 to 6 leaf stage. The second half of split application treatments were applied 5:00 pm July 15 when the air temperature was 95F, soil temperature at six inches was 77F, relative humidity was 44%, wind velocity was 20 mph, soil moisture was good, and sugarbeet was in the 6 to 8 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet was hand thinned to an 8 inch spacing July 24. Sugarbeet was maintained weed free by hand weeding throughout the growing season. Sugarbeet injury was evaluated July 31. The center two rows of 25 foot long plots were harvested and counted September 30.

Treatment*	Rate	Sgbt inj	Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	(lb/A)	(%)	(50ft)	(%)	(%)	(ton/A)		(lb/A)
Untreated	0	0	60	16.9	2.2	16.1	962	4657
Des&Phen/Des&Phen	0.33/0.5	3	58	16.5	2.3	15.7	1004	4426
CQ1232/CQ1232	0.33/0.5	1	58	16.4	2.2	17.0	953	4763
CQ1232+X-77/CQ1232+X-77	0.33+1%/.5+1%	0	60	16.9	2.1	15.6	928	4551
CQ1232+Sylg/CQ1232+Sylg	0.33+0.4%/.5+.4%	1	62	17.2	2.1	17.3	898	5136
CQ+Herbimax/CQ+Herbimax	0.33+.25G/.5+.25G	8	58	16.7	2.0	16.4	865	4759
CQ1232+Dash/CQ1232+Dash	0.33+.25G/.5+.25G	6	59	16.0	2.2	16.5	1011	4494
CQ+Scoil/CQ+Scoil	0.33+0.19G/0.5+0.19G	6	61	16.3	2.3	16.1	1045	4443
CQ+SunItII/CQ+SunItII	0.33+0.19G/.5+.19G	4	55	16.9	2.2	14.7	979	4235
Clopyralid	0.1	6	60	16.9	2.2	17.1	933	4965
Clopyralid	0.2	1	62	16.3	2.4	17.8	1085	4891
Clopyralid	0.4	11	63	16.0	2.3	18.0	1053	4839
Clopyralid+Scoil	0.4+0.19G	14	58	16.1	2.3	16.7	1053	4515
Clopyralid/Clopyralid	0.1/0.1	4	57	16.8	2.2	16.5	938	4767
Clopyralid/Clopyralid	0.2/0.2	10	60	15.9	2.5	16.9	1137	4468
Clopyralid/Clopyralid	0.4/0.4	28	59	15.8	2.3	16.4	1078	4343
Clpy+Scoil/Clpy+Scoil	0.4+0.19G/0.4+0.19G	33	58	15.4	2.6	14.9	1220	3750
Clopyralid+Dash	0.4+0.25G	13	63	15.9	2.4	16.3	1093	4320
Clpy+Seth+Scoil	0.4+0.2+0.19G	8	61	15.6	2.5	17.0	1202	4336
Clpy+Seth+Dash	0.4+0.2+0.25G	14	60	15.9	2.4	16.3	1114	4335
Sethoxydim+Dash	0.2+0.25G	0	57	16.3	2.2	16.7	972	4664
Sethoxydim+Dash	0.4+0.25G	1	57	16.6	2.2	15.3	977	4339
Sethoxydim+Dash	0.4+2G	3	56	16.6	2.2	15.6	973	4414
Sethoxydim+Scoil	0.4+0.19G	0	58	16.4	2.4	16.6	1082	4571
Seth+AMS+Scoil	0.4+2.5+0.19G	0	62	17.0	2.1	16.9	914	4928
Clpy+Seth+AMS+Scoil	0.4+0.4+2.5+0.19G	18	58	16.0	2.3	15.8	1080	4237
Des&Phen/Des&Phen	0.25/0.33	3	57	16.4	2.3	15.8	1020	4381
DPX-66+D&P/DPX-66+D&P	.0156+.25/.0156+.33	0	60	16.6	2.3	17.3	993	4868
DPX-66+D&P/DPX-66+D&P	0.031+.25/.031+.33	0	61	16.7	2.1	18.4	918	5282
Untreated	0	0	59	16.5	2.2	17.3	948	4908

(table continued on next page)

Herbicides on hand weeded sugarbeet, Casselton, 1991. (continued)

Treatment*	Rate	Sgbt inj	Sgbt Popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	(lb/A)	(%)	(50ft)	(%)	(%)	(ton/A)		(lb/A)
HIGH MEAN		33	63	17.2	2.6	18.4	1220	5282
LOW MEAN		0	55	15.4	2.0	14.7	865	3750
EXP MEAN		6	59	16.4	2.3	16.5	1014	4586
C.V. %		55	7	4.2	8.2	6.7	11	9
LSD 5%		5	NS	1.0	0.3	1.6	159	581
LSD 1%		7	NS	NS	0.3	2.1	211	769
# OF REPS		4	4	4	4	4	4	4

* CompAd at 10mls/liter spray solution was added to spray solutions containing CQ1232 before adding Scoil or Sun-It II.
CQ1232 = desmedipham&phenmedipham, 1:1 ratio, WP; AMS = ammonium sulfate; X-77 = non-ionic surfactant from Valent; Sylg = Sylgard 309 surfactant from Dow Corning; Scoil = methylated seed oil from Agsco; Herbimax = petroleum oil from Loveland; Sun-It II = methylated seed oil from Agsco; Dash = adjuvant from BASF

Summary

Clopyralid+Scoil at 0.4 lb/A+1.5 pt/A applied twice was the only treatment which significantly reduced sugarbeet extractable sucrose per acre as compared to the mean of the two untreated checks.

Bivert and herbicide antagonism, St. Thomas, 1991. 'NewDak' oats at 32 lb/A and 'Siberian' foxtail millet at 15 lb/A were seeded in 6 foot strips across herbicide plots April 23. 'Hilleshog 5135' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 24. Lorsban 15G was applied at 10 lb/A product using a modified in-furrow system at planting. Herbicides and additives were added to the spray solution in groups. Chemicals to the left of the first parenthesis were added first, then chemicals to the left of the second parenthesis, and finally chemicals to the left of the third parenthesis. The spray solution was mixed thoroughly after each group of chemicals was added and allowed to set 1 to 3 hours before adding the next group of chemicals. Herbicides were applied 4:00 pm May 31 when the air temperature was 79F, soil temperature at six inches was 72F, relative humidity was 54%, wind velocity was 10 to 15 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, oats was 12 inches tall, and foxtail millet was 8 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Heavy rain began to fall as the last plot was being treated. Oats, foxtail millet, and prostrate pigweed control were evaluated June 27.

Treatment (rate)*	Oats	Foxtail Millet	Prostrate Pigweed
	------- % control ------		
Sethoxydim+Scoil(0.1+0.19G)	90	99	3
Clopyralid+Sethoxydim+Scoil(0.19+0.1+0.19G)	85	98	25
Desmedipham+Seth+Scoil(0.5+0.1+0.19G)	40	58	75
Seth+Bivert(0.1+0.031G)+Scoil(0.19G)+Des(0.5)	88	95	64
Bentazon+Sethoxydim+Scoil(1+0.1+0.19G)	15	84	18
Seth+Bivert(0.1+0.031G)+Scoil(0.19G)+Bent(1)	15	80	46
Endothall+Seth+Scoil(0.5+0.1+0.19G)	73	81	25
Seth+Bivert(0.1+0.031G)+Scoil(0.19G)	85	97	1
Thifensulfuron+Seth+Scoil(0.004+0.1+0.19G)	93	97	100
Seth+Bivt(0.1+0.031G)+Scoil(0.19G)+Thif(0.004)	96	99	100
Acifluorfen+Seth+Scoil(0.38+0.1+0.19G)	59	66	91
Seth+Bivert(0.1+0.031G)+Scoil(0.19G)+Acif(0.38)	46	46	87
Fluazifop-P+Scoil(0.1+0.19G)	99	37	0
Clopyralid+Flfp-P+Scoil(0.19+0.1+0.19G)	100	20	0
Desmed+Flfp-P+Scoil(0.5+0.1+0.19G)	94	23	71
Flfp-P+Bivrt(0.1+0.031G)+Scoil(0.19G)+Des(0.5)	96	20	77
Bentazon+Flfp-P+Scoil(1+0.1+0.19G)	100	16	31
Flfp-P+Bivert(0.1+0.031G)+Scoil(0.19G)+Bent(1)	100	18	13
Thifensulfuron+Flfp-P+Scoil(0.004+0.1+0.19G)	100	20	95
Flfp-P+Bivert(.1+.031G)+Scoil(.19G)+Thif(.004)	100	18	99
Acifluorfen+Flfp-P+Scoil(0.38+0.1+0.19G)	93	60	91
Flfp-P+Bivert(0.1+0.031G)+Scoil(0.19G)+Acif(0.38)	98	63	99
Quizalofop+Scoil(0.06+0.19G)	99	100	0
Clopyralid+Qufp+Scoil(0.19+0.06+0.19G)	99	100	0
Desmed+Qufp+Scoil(0.5+0.06+0.19G)	85	99	7
Qufp+Bivert(0.06+0.031G)+Scoil(0.19G)+Des(0.5)	85	100	59
Bentazon+Qufp+Scoil(1+0.06+0.19G)	96	99	25
Qufp+Bivert(0.06+0.031G)+Scoil(0.19G)+Bent(1)	98	100	23
Thifensulfuron+Qufp+Scoil(0.004+0.06+0.19G)	99	99	98
Qufp+Bivert(.06+.031G)+Scoil(.19G)+Thif(.004)	99	100	97
Acifluorfen+Qufp+Scoil(0.38+0.06+0.19G)	93	99	88
Qufp+Bivert(0.06+0.031G)+Scoil(0.19G)+Acif(0.38)	98	97	97

(table continued on next page)

Bivert and herbicide antagonism, St. Thomas, 1991. (continued)

Treatment (rate)*	Oats	Foxtail Millet	Prostrate Pigweed
	-------	% control	------
Fenoxaprop+Scoil(0.1+0.19G)	76	99	0
Clopyralid+Fenoxaprop+Scoil(0.19+0.1+0.19G)	83	99	0
Desmed+Fenoxaprop+Scoil(0.5+0.1+0.19G)	25	94	13
Fenx+Bivert(0.1+0.031G)+Scoil(0.19G)+Desm(0.5)	20	98	26
Bentazon+Fenoxaprop+Scoil(1+0.1+0.19G)	74	96	13
Fenx+Bivert(0.1+0.031G)+Scoil(0.19G)+Bent(1)	76	99	7
Thifensulfuron+Fenx+Scoil(0.004+0.1+0.19G)	65	98	93
Fenx+Bivert(0.1+.031G)+Scoil(.19G)+Thif(.004)	84	99	85
Acifluorfen+Fenoxaprop+Scoil(0.38+0.1+0.19G)	36	95	96
Fenx+Bivert(0.1+0.031G)+Scoil(0.19G)+Acif(0.38)	44	99	97
Clopyralid+Sethoxydim(0.19+0.1)	19	85	1
Desmedipham+Sethoxydim(0.5+0.1)	6	39	16
Endothall+Sethoxydim(0.5+0.1)	16	48	0
Thifensulfuron+Sethoxydim(0.004+0.1)	18	68	73
Clopyralid+Quizalofop(0.19+0.06)	51	98	28
Desmedipham+Quizalofop(0.5+0.06)	89	98	1
Endothall+Quizalofop(0.5+0.06)	38	67	0
Thifensulfuron+Quizalofop(0.004+0.06)	65	100	0
Desmedipham+Cycloate+Sethoxydim(0.5+0.75+0.1)	6	33	20
HIGH MEAN	100	100	100
LOW MEAN	6	16	0
EXP MEAN	71	76	44
C.V. %	9	10	31
LSD 5%	8	10	19
LSD 1%	11	13	25
# OF REPS	4	4	4

* Rates are listed as pounds active ingredient per acre or as the portion of a gallon of product per acre as signified by "G". Bivert = adjuvant from Stull Chemical Co. Scoil = methylated seed oil from Agsco

Summary

Bivert overcame the antagonism between sethoxydim and desmedipham and between thifensulfuron and fenoxaprop. Sethoxydim + broadleaf herbicides generally gave less grass control than sethoxydim+Scoil+broadleaf herbicides. Desmedipham+quizalofop gave grass control similar to desmedipham + quizalofop + Scoil. Quizalofop+other broadleaf herbicides gave less grass control than quizalofop+other broadleaf herbicides+Scoil.

Soil residual from soybean herbicides, Fargo (NW section 22), 1987-1991. 'McCall' soybeans were solid seeded at 69 pounds per acre June 2, 1987. Herbicide treatments were applied 3:00 pm June 24, 1987 when the air temp. was 73F, soil temperature at six inches was 71F, relative humidity was 54%, wind was northwest at 3-5 mph, soil was dry at 0-1 inch, moist at 1-2 inches, wet at 2-4 inches, and soybeans were in the cotyledon to two trifoliolate stage (1-4 inches tall). Herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center 7 feet of plots 14 feet wide and 45 feet long. Wheat, corn, sugarbeet, and flax bioassay strips were seeded across herbicide plots in 1988. A field cultivator was used for tillage in the spring and fall of each growing season. Sugarbeet was seeded 1.25 inches deep in 22 inch rows June 2, 1989, May 21, 1990 and May 23, 1991. 'Van der Have Puressa II' sugarbeet was seeded in 1990 and 1991. Sugarbeet was seeded parallel and perpendicular to herbicide plots to provide a dense population of sugarbeet for evaluation. Sugarbeet injury was evaluated June 30, 1989, June 25, 1990 and throughout the growing season in 1991.

1987 Treatment	Rate (lb/A)	Sugarbeet injury 1989 (%)	1990 (%)	1991 (%)
Imazethapyr	0.06	93	5	0
Imazethapyr	0.12	100	75	0
Fomesafen	0.25	0	0	0
Fomesafen	0.5	0	0	0
Lactofen	0.2	0	0	0
Lactofen	0.4	0	0	0
Acifluorfen	0.38	0	0	0
Acifluorfen	0.75	0	0	0
Untreated Check	0	0	0	0
HIGH MEAN		100	75	0
LOW MEAN		0	0	0
EXP MEAN		21	9	0
C.V. %		5	36	0
LSD 5%		1	5	NS
LSD 1%		2	6	NS
# OF REPS		4	4	4

Summary

Imazethapyr applied at the normal application rate of 0.06 lb/A in 1987 caused severe sugarbeet injury in 1989 but very little sugarbeet injury in 1990. However, the double rate of 0.12 lb/A still caused severe injury. This suggests that imazethapyr which had been overlapped during application could cause severe sugarbeet injury three years after application. None of the treatments caused visible injury to sugarbeet in 1991.

Herbicide soil residual, Fargo (NW section 22), 1989-1991. '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 soybeans were 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. All tillage of the plot area was with a field cultivator 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.

Treatment*	Rate (lb/A)	Sugarbeet injury (%)
Imazethapyr+X-77	0.12+0.25%	85
Imazethapyr+X-77	0.06+0.25%	58
Imazethapyr+X-77	0.03+0.25%	14
Imazethapyr+X-77	0.015+0.25%	0
Imazamethabenz	0.6	0
Imazamethabenz	0.3	3
Imazamethabenz	0.15	0
Metribuzin-DF	1	0
Metribuzin-DF	0.5	0
Metribuzin-DF	0.25	0
Nicosulfuron	0.125	3
Nicosulfuron	0.06	5
Nicosulfuron	0.03	5
DPX-E9636+Nicosulfuron	0.062+0.062	4
DPX-E9636+Nicosulfuron	0.03+0.03	3
DPX-E9636+Nicosulfuron	0.015+0.015	0
Primisulfuron	0.06	91
Primisulfuron	0.03	59
Primisulfuron	0.015	24
HIGH MEAN		91
LOW MEAN		0
EXP MEAN		18
C.V. %		31
LSD 5%		8
LSD 1%		11
# OF REPS		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. Other herbicides caused no significant injury.

Carryover of soybean herbicides, Fargo (NW section 22), 1990-1991. '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 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.

		----- June 24, 1991 ----					--- July 8, 1991 --			
Treatment	Rate	Sgbt	Wht	Oats	Sufl	Kocz	Sgbt	Wht	Oats	Sufl
	(lb/A)	---------- (% injury) ----------								
Chlorimuron	0.004	94	30	31	54	98	91	30	19	48
Chlorimuron	0.008	98	33	18	69	97	98	46	15	74
Nicosulfuron	0.125	63	10	23	31	80	59	21	20	19
Nicosulfuron	0.06	30	10	3	10	40	33	18	8	8
Nicosulfuron	0.03	14	0	0	3	20	18	10	3	8
DPX-E9636+Nico	0.062+0.062	39	5	20	38	65	38	23	15	20
Primisulfuron	0.06	100	84	84	98	99	100	97	73	99
HIGH MEAN		100	84	84	98	99	100	97	73	99
LOW MEAN		14	0	0	3	20	18	10	3	8
EXP MEAN		62	24	25	43	71	62	35	22	39
C.V. %		23	61	92	30	16	25	36	49	34
LSD 5%		22	22	35	19	17	24	18	16	20
LSD 1%		29	30	48	26	24	32	25	21	27
# OF REPS		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.

Insecticide influence on simulated spray drift, Casselton, 1991. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Sugarbeet was hand thinned to a 9.5 inch spacing June 3. Plots were cultivated June 3 and June 18 and maintained weed free by hand weeding throughout the growing season. The simulated herbicide drift treatments were applied to sugarbeet treated with Counter 15G insecticide at 12 pounds product per acre applied modified in-furrow at planting and to sugarbeet not treated with insecticide. Simulated drift treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots at 10:45 am June 19 when the air temperature was 75F, soil temperature at six inches was 67F, relative humidity was 66%, wind velocity was 5 mph, soil moisture was good, and sugarbeet was in the 8 to 12 leaf stage. Sugarbeet was harvested and counted from the center two rows of 35 foot long plots September 24.

Table 1. Influence of root maggot and simulated herbicide drift on sugarbeet plant population, Casselton.

Herbicide	Rate	Insecticide		
		Counter	No Counter	Counter minus no Counter
	(lb/A)	----------(plants/70 ft)----------		
Nicosulfuron	0.0025	78	66	12
Nicosulfuron	0.005	78	57*	21**
Nicosulfuron	0.01	78	64	14*
Nicosulfuron	0.02	76	64	12
Imazethapyr	0.0005	75	64	11
Imazethapyr	0.001	79	64	15**
Imazethapyr	0.0025	83**	64	19**
Imazethapyr	0.005	76	50**	26**
Thifensulfuron+tribenuron	0.00025	77	64	13*
Thifensulfuron+tribenuron	0.0005	78	64	14*
Thifensulfuron+tribenuron	0.001	76	65	11
2,4-D	0.06	75	64	11
Untreated	--	73	67	6
LSD (0.05)		9	9	9
LSD (0.10)		7	7	7

Table 2. Influence of root maggot and simulated herbicide drift on sugarbeet yield in tons/A, Casselton.

Herbicide	Rate	Insecticide		Counter minus no Counter
		Counter	None	
	(lb/A)	(Yield, Ton/A)		
Nicosulfuron	0.0025	24.6	20.0	4.6
Nicosulfuron	0.005	24.4	18.7*	5.7**
Nicosulfuron	0.01	24.4	20.1	4.3
Nicosulfuron	0.02	23.8	18.8	5.0*
Imazethapyr	0.0005	24.4	20.7	3.7
Imazethapyr	0.001	25.5	21.2	4.3
Imazethapyr	0.0025	26.1*	20.8	5.3**
Imazethapyr	0.005	24.3	16.0**	8.3**
Thifensulfuron+tribenuron	0.00025	24.4	20.1	4.3
Thifensulfuron+tribenuron	0.0005	25.6	19.6	6.0**
Thifensulfuron+tribenuron	0.001	24.4	20.2	4.2
2,4-D	0.06	22.8	18.1**	4.7*
Untreated	--	23.4	21.2	2.2
LSD (0.05)		NS	3.0	3.0
LSD (0.10)		2.5	2.5	2.5

Table 3. Influence of root maggot and simulated herbicide drift on sugarbeet percent sucrose, Casselton.

Herbicide	Rate	Insecticide		Counter minus no Counter
		Counter	No Counter	
	(lb/A)	(Sugar, %)		
Nicosulfuron	0.0025	16.8	16.5	0.3*
Nicosulfuron	0.005	16.7	16.0**	0.7**
Nicosulfuron	0.01	16.5	16.3	0.2
Nicosulfuron	0.02	16.7	16.3	0.4**
Imazethapyr	0.0005	16.8	16.2	0.6**
Imazethapyr	0.001	16.9	16.5	0.4**
Imazethapyr	0.0025	16.9	16.3	0.6**
Imazethapyr	0.005	16.7	16.2	0.5**
Thifensulfuron+tribenuron	0.00025	16.5	16.1*	0.4**
Thifensulfuron+tribenuron	0.0005	16.6	16.0**	0.6**
Thifensulfuron+tribenuron	0.001	16.5	16.4	0.1
2,4-D	0.06	16.3	16.1*	0.2
Untreated	--	16.4	16.7	(-0.3)
LSD (0.05)		NS	0.7	0.7
LSD (0.10)		NS	0.6	0.6

Table 4. Influence of root maggot and simulated herbicide drift on sugarbeet extractable sucrose/A Casselton.

Herbicide	Rate	Insecticide		Counter minus none
		Counter	None	
	(lb/A)	----------(Extrac. sucrose, lb/A)----------		
Nicosulfuron	0.0025	7290	5721	1569**
Nicosulfuron	0.005	7161	5160**	2001**
Nicosulfuron	0.01	7099	5703	1396*
Nicosulfuron	0.02	6948	5328*	1620**
Imazethapyr	0.0005	7206	5802	1404*
Imazethapyr	0.001	7629	6112	1517*
Imazethapyr	0.0025	7839	5845	1994**
Imazethapyr	0.005	7153	4514**	2639**
Thifensulfuron+tribenuron	0.00025	7118	5589	1529*
Thifensulfuron+tribenuron	0.0005	7517	5425	2092**
Thifensulfuron+tribenuron	0.001	7101	5733	1368*
2,4-D	0.06	6451	5026**	1425*
Untreated	--	6756	6219	537
LSD (0.05)		997	997	997
LSD (0.10)		832	832	832

Summary

The original objective of this experiment was to determine if insecticide-treated sugarbeet were more susceptible to herbicides which may drift onto sugarbeet. The plots were cultivated and hand weeded to maintain nearly total weed control throughout the season. Visible symptoms of herbicide injury were slight in the Counter treated and untreated portions of the experiment (data not shown). However, sugarbeet in the non-Counter-treated area was visibly damaged by sugarbeet root maggot while Counter-treated sugarbeet was not visibly damaged. This presented the opportunity to determine if the combination of herbicide injury and root maggot injury caused greater loss in sugarbeet yield than root maggot injury alone. Data on sugarbeet population, tons/A, and percent sucrose is presented in Tables 1,2, and 3 respectively. Extractable sucrose per acre, presented in Table 4, will be discussed.

None of the herbicides caused a significant reduction in yield of Counter-treated sugarbeet (Table 4) compared to the non-herbicide-treated check. Several of the herbicide treatments reduced the yield of non-Counter-treated sugarbeet as compared to the non-herbicide-treated check. The yield of the non-Counter-treated sugarbeet was subtracted from the Counter-treated sugarbeet for each herbicide and the non-herbicide-treated check. The difference was greater for all the herbicide-treated comparisons than for the non-herbicide-treated check. This suggests that the root maggot injury reduced the ability of the sugarbeet to recover from herbicide injury, the herbicide injury reduced the ability of the sugarbeet to recover from root maggot injury or perhaps a little of each.

Rotary hoe, cultivation, and herbicide on sugarbeet, Casselton, 1991. 'Seedex Monahikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. A 'John Deere 2-bar rotary hoe' was operated at 5 mph zero, one, two, or four times to appropriate plots. Plots with one rotary hoe treatment were treated June 10 when sugarbeet was in the 2 to 6 leaf stage. Plots with two rotary hoe treatments were treated June 10 and June 17 when sugarbeet was in the 6 to 10 and 8 to 12 leaf stage respectively. Plots with four rotary hoe treatments were treated June 2, June 10, June 17, and June 26 when sugarbeet were in the 2 to 6, 6 to 10, 8 to 12, and 10 to 14 leaf stage respectively. Desmedipham at 0.25 lb/A and desmedipham + clopyralid 0.25 + 0.09 lb/A were applied 10:15 am on May 30 when the air temperature was 68F, soil temperature at six inches was 62F, relative humidity was 81%, wind velocity was 0 to 3 mph, soil moisture was good, and sugarbeet was in the cotyledon to early 4 leaf stage. Desmedipham + clopyralid at 0.33 + 0.19 lb/A was applied 10:30 pm June 6 when the air temperature was 75F, soil temperature at six inches was 62F, relative humidity was 74%, wind velocity was 15 mph, soil moisture was good, and sugarbeet was in the 2 to 8 leaf stage. Desmedipham + clopyralid at 0.5 to 0.09 lb/A was applied 11:00 am June 10 when the air temperature was 78F, soil temperature at six inches was 65F, relative humidity was 37%, wind velocity was 5 to 10 mph, soil moisture was good, and sugarbeet was in the 6 to 10 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. All herbicide and rotary hoe treatments were applied to sugarbeet receiving one cultivation June 17 and to sugarbeet receiving three cultivations June 3, June 18, and June 25. Sugarbeet in the center two rows of 32 foot long plots were harvested and counted September 27.

Table 1. Influence of weed control treatment on sugarbeet stand and yield averaged over rotary hoeing and cultivation, Casselton.

Weed Control	Rate	Sugb harvest stand	Sugb sucrose	Sugb yield	Sugb extrac. sucrose
	(lb/A)	(plts/70 ft)	(%)	(T/A)	(lb/A)
Des/Des+clop(2X)/seth	0.25/0.33+0.09/0.5+0.09/0.2	85	16.3	21.6	6079
Des+clop/Des+clop/seth+OC*	0.25+0.09/0.33+0.09/0.2	80	16.2	21.1	5942
Des+clop/seth+OC	0.33+0.19/0.2	86	16.1	22.4	6260
Hand weeded	--	84	16.5	22.4	6426
None	--	87	16.2	22.9	6417
Sethoxydim+OC	0.2	84	16.4	22.3	6360
LSD (0.05)		NS	NS	1.1	340

* OC = Dash at 1 qt/A.

Table 2. Influence of cultivation on sugarbeet stand and yield averaged over rotary hoeing and weed control treatment, Casselton.

Row crop cultivation	Sugb harvest stand	Sugb sucrose	Sugb yield	Sugb extrac. sucrose
	(plts/70 ft)	(%)	(T/A)	(lb/A)
One	87	16.5	21.6	6170
Three	82	16.1	22.7	6324
LSD (0.05)	3	0.2	0.6	NS

Table 3. Influence of rotary hoeing on sugarbeet stand and yield averaged over cultivation and weed control treatment, Casselton.

Rotary hoeing	Sugb harvest stand	Sugb sucrose	Sugb yield	Sugb extrac. sucrose
	(plts/70 ft)	(%)	(T/A)	(lb/A)
None	86	16.0	22.6	6263
One	83	16.3	22.0	6201
Two	84	16.3	21.8	6164
Four	84	16.5	22.1	6361
LSD (0.05)	NS	0.3	NS	NS

Summary

Weed populations were not sufficient for evaluation. None of the interactions were significant so the data is presented as the main effects averaged over the other factors.

Sugarbeet treated with desmedipham plus clopyralid twice yielded less or tended to yield less than untreated or sethoxydim treated sugarbeet (Table 1). Sugarbeet cultivated once had slightly greater sucrose percent, lower tons per acre and similar extractable sucrose per acre compared to sugarbeet cultivated three times (Table 2). Sugarbeet that were rotary hoed had higher % sucrose than non-rotary hoed but all other parameters were similar across rotary hoeing treatments (Table 3).

Tillage practices with soil applied herbicides, Casselton, 1990-1991. Tillage plots 35 feet long and 35 feet wide were established in wheat stubble from the 1990 growing season. Tillage before herbicides was done September 11, 1990. Each tillage block was divided into 3 herbicide plots treated with cycloate broadcast at 4 lb ai/acre, cycloate at 4 lb ai/acre impregnated on 34-0-0 fertilizer, or no herbicide. Cycloate broadcast plots and no herbicide plots were treated with equivalent dry fertilizer as the impregnated cycloate plots. Herbicide treatments were applied 5:30 pm October 30, 1990 when the air temperature was 58F, soil temperature at six inches was 42F, and wind velocity was 2-4 mph. Tillage after herbicide treatments was October 30, 1990. Conventional tillage was chisel plowing twice September 11, field cultivator October 10, and herbicide incorporation with a rototiller October 30, 1990. All plots were worked lightly with a "Kongskilde Triple K" field cultivator before seeding 'Seedex Monohikari' sugarbeet 1.25 inches deep in 22 inch rows May 9, 1991. Counter 15G insecticide was applied modified in-furrow at planting at 12 pounds product per acre. Percent residue was evaluated using the line transect method April 29 and May 24. Sugarbeet stand counts were taken in the center two rows of each plot June 17. Sugarbeet was thinned by hand to an eight inch spacing July 11. All plots were cultivated June 3 and June 19. Plots were maintained weed free throughout the growing season by hand weeding. Sugarbeet from the center two rows of 35 foot long plots was counted and harvested September 20, 1991.

Table 1. Influence of tillage system on wheat residue on the soil surface averaged over herbicide treatment, Casselton.

Fall tillage[a] (date)	Wheat residue on soil surface		
	4/29/91 Before spring tillage & planting	5/9/91 Spring tillage[a]	5/24/91 After spring tillage & planting
	(%)		(%)
None	89	FC + RC	45
Chisel plow (9/11/90)	50	FC + RC	25
Chisel plow (10/30/90)	54	FC + RC	33
Disc (9/11/90)	39	FC + RC	22
Disc (10/30/90)	51	FC + RC	32
Chisel plow 2X (9/11/90)/ FC + harrow (10/10/90)/ Rototiller (10/30/90)	19	FC + RC	12
LSD (0.05)	10		7

[a] FC = field cultivator, RC = rolling crumbler, planted 5/9/91.

Table 2. Influence of tillage system in wheat stubble on sugarbeet stand and yield averaged over herbicide treatment, Casselton.

Tillage[a] (date)	6/17/91 Sugb stand	Sugb harvest stand	Sugb sucrose	Sugb yield	Sugb extrac. sucrose
	(plts/100 ft)	(plts/100 ft)	(%)	(T/A)	(lb/A)
FC + RC (5/9/91)	86	86	14.7	21.8	5370
Chisel plow (9/11/90/FC+RC (5/9/91)	112	86	14.7	19.4	4735
Chisel plow (10/30/90)/FC+RC (5/9/91)	113	94	14.7	20.7	5086
Disc (9/11/90)/FC+RC (5/9/91)	118	87	14.7	18.4	4444
Disc (10/30/90)/FC+RC (5/9/91)	125	101	14.8	22.9	5713
Chisel plow 2X (9/11/90)/ FC + harrow (10/10/90)/ Rototiller (10/30/90)/ FC + rolling crumbler (5/9/91)	107	90	14.7	18.3	4465
LSD (0.05)	16	9	NS	1.5	397

[a] FC = field cultivator, RC = rolling crumbler

Summary

Weed populations were not sufficient for evaluation. None of the measured parameters were affected by herbicide treatment so the data presented is averaged over herbicide treatment.

All reduced tillage treatments left more wheat residue on the soil surface than the "conventional" extensive tillage system (Table 1). Chisel plowing or discing on October 30 left more after planting residue on the soil surface than September 11 tillage.

Sugarbeet stands on June 17 were lower when seeding was into the high surface residue treatment (spring field cultivator + rolling crumbler, no fall tillage) as compared to more intensive tillage (Table 2). However, harvested stands were all similar except that plots disced October 30 had higher harvested stands than the other plots. The high surface residue plots did not lose stand from June 17 until harvest while all other treatments lost stand. Hand thinning was on July 11 so most stand loss was due to the thinning. Plots with greater than 30% residue on the soil surface yielded more or tended to yield more T/A and extractable sucrose/A than plots with less residue.

Wild oat control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded April 19. Treatments (2lf) were applied to 1- to 3-leaf wheat and wild oats on May 20 with 66 F, 50% RH, partly cloudy sky, and 15- to 20-mph wind. Treatments (4lf) were applied to 5-leaf wheat and 3.5- to 4-leaf wild oat May 28 with 65 F, 68% RH, clear sky, and 10- to 15-mph wind. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 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 13 and July 15. Wild oat density exceeded 900 per square meter.

Treatment	Rate	6/13		7/15	
		Wheat inj	Wioa	Wheat inj	Wioa
	oz/A	--------- % ---------			
Diclofop(2lf)	12	0	70	0	58
Diclofop+Sun-itII(2lf)	12+0.12G	0	84	0	81
Diclofop+PO(2lf)	12+0.12G	0	88	0	83
Imazamethabenz(NS)+X-77(2lf)	4+0.25%	0	71	0	65
Imazamethabenz(NS)+X-77(2lf)	5+0.25%	0	84	0	81
Imazamethabenz(NS)+Sun-itII(2lf)	4+0.18G	0	90	0	90
Cheyenne+Thif&Trib(2lf)	7.4+0.22	1	96	0	95
Diclofop(4lf)	16	0	46	18	95
Diclofop+Sun-itII(4lf)	16+0.18G	0	48	23	93
Diclofop+PO(4lf)	16+0.18G	0	45	8	94
Cheyenne+Thif&Trib(4lf)	7.4+0.22	4	93	5	99
Imazamethabenz(NS)+X-77(4lf)	4+0.25%	0	52	0	30
Imazamethabenz(NS)+X-77(4lf)	5+0.25%	1	60	0	38
Imazamethabenz(NS)+Sun-itII(4lf)	4+0.18G	0	74	0	66
Difenzoquat(4lf)	10	0	71	0	78
Difenzoquat+Immb(NS)+X-77	6+2.5+.25%	1	67	0	49
Tiller(4lf)	10.6	3	84	8	99
Tiller+Bromoxynil(4lf)	10.6+4	1	81	8	98
Tiller50(4lf)	9.5	4	84	8	99
Cheyenne+Thif&Trib(4lf)	7.4+0.22	5	90	5	99
C.V. %		166	7	128	11
LSD 5%		2	7	7	12
# OF REPS		4	4	4	4

Summary

None of the herbicides caused important injury to wheat. The wild oat density was high and caused poor emergence of wheat so yields were not taken. Sunit II and petroleum oil adjuvants were similar in their enhancement of wild oat control for diclofop. Imazamethabenz at 4 oz/A applied with Sunit II gave equal or greater wild oats control than at 5 oz/A applied with X-77.

Wild oat control in wheat, Hettinger. 'Grandin' hard red spring wheat was seeded April 26. All treatments were applied May 21 to 2.5-leaf wheat and 2-leaf wild oats with 81 F, 80% RH, partly sunny 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was averaged between July 5 and August 1. Harvest for yield was on August 1.

Treatment	Rate	Wheat ht	Wioa	Yield
	oz/A	cm	%	lb/bu
Diclofop(2lf)	12	65	54	22.4
Diclofop+Sun-itII(2lf)	12+0.12G	62	61	25.8
Diclofop+PO(2lf)	12+0.12G	65	79	23.6
Imazamethabenz(NS)+X-77(2lf)	4+0.25%	66	76	25.4
Imazamethabenz(NS)+X-77(2lf)	5+0.25%	62	80	25.3
Imazamethabenz(NS)+Sun-itII(2lf)	4+0.18G	60	90	24.2
Cheyenne+Thif&Trib(2lf)	7.4+0.22	66	77	26.0
Diclofop(4lf)	16	63	54	26.4
Diclofop+Sun-itII(4lf)	16+0.18G	65	88	24.2
Diclofop+PO(4lf)	16+0.18G	67	71	25.9
Cheyenne+Thif&Trib(4lf)	7.4+0.22	64	77	29.4
Imazamethabenz(NS)+X-77(4lf)	4+0.25%	62	80	27.2
Imazamethabenz(NS)+X-77(4lf)	5+0.25%	62	84	27.6
Imazamethabenz(NS)+Sun-itII(4lf)	4+0.18G	63	86	25.9
Difenzoquat(4lf)	10	66	49	26.2
Difenzoquat+Immb(NS)+X-77	6+2.5+.25%	66	83	25.9
Tiller(4lf)	10.6	64	18	25.8
Tiller+Bromoxynil(4lf)	10.6+4	63	21	28.3
Tiller50(4lf)	9.5	64	88	27.1
Cheyenne+Thif&Trib(4lf)	7.4+0.22	68	49	29.6
Untreated	0	68	0	22.3
C.V. %		6	36	15.9
LSD 5%		NS	34	NS
# OF REPS		4	4	4

Summary

None of the herbicide treatments cause any important injury to wheat. Wild oats densities were light so yield increase for control did not occur. Imazamethabenz at 4 oz/A plus Sun-it II was the only treatment to give 90% wild oat control.

Wild oat control in wheat, Minot. 'Amidon' hard red spring wheat was seeded April 24. All treatments were applied June 10 to 5.5- to 6-leaf wheat and wild oats, 1- to 4-leaf green foxtail, 2- to 3.5-inch kochia, and 2- to 4-inch redroot pigweed. Conditions at treatment were: 72 F, 35% RH, clear sky, and 6 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 8 ft wide area the length of 10 by 20 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 10 and harvest for yield was on August 8.

Treatment		Wheat inj	Wioa	Grft	KOCZ	Rrpw	Wheat ht	Test wt	Yield
		%					cm	lb/bu	bu/A
Diclofop	12	0	91	88	0	13	100	426.3	45.9
Diclofop+Sun-itII	12+0.12G	0	94	94	0	13	100	429.3	48.4
Diclofop+PO	12+0.12G	0	93	94	0	0	95	427.4	45.1
Immb(NS)+X-77	4+0.25%	1	99	0	0	0	104	429.0	51.8
Immb(NS)+X-77	5+0.25%	1	99	17	0	30	102	437.7	57.9
Immb(NS)+Sun-itII	4+0.18G	1	99	24	40	30	101	427.4	53.4
Cheyenne+Thif&Trib	7.4+0.22	44	99	99	99	99	91	416.0	38.9
Diclofop	16	0	92	93	10	13	101	422.4	47.1
Diclofop+Sun-itII	16+0.18G	0	92	92	0	20	101	424.1	44.9
Diclofop+PO	16+0.18G	0	73	95	0	0	93	420.3	45.8
Cheyenne+Thif&Trib	7.4+0.22	33	99	99	99	99	89	413.5	43.9
Immb(NS)+X-77	4+0.25%	1	99	11	0	40	101	426.2	53.6
Immb(NS)+X-77	5+0.25%	3	99	0	13	13	100	427.4	48.0
Immb(NS)+Sun-itII	4+0.18G	3	99	6	30	42	100	431.1	48.5
Difenzoquat	10	16	99	0	32	25	96	422.3	46.7
Dife+Immb(NS)+X-77	6+2.5+.25%	7	99	8	17	10	92	422.6	47.8
Tiller	10.6	7	99	99	80	85	98	433.1	48.3
Tiller+Bromoxynil	10.6+4	6	99	99	94	98	95	436.0	53.2
Tiller50	9.5	28	99	99	85	98	95	427.5	49.3
Cheyenne+Thif&Trib	7.4+0.22	34	99	99	99	99	92	422.6	43.7
Untreated	0	0	0	0	0	0	100	424.4	48.1
C.V. %		68	99	99	99	99	7	1.5	14.6
LSD 5%		8	11	16	35	39	NS	9.2	NS
# OF REPS		4	4	4	3	3	4	4	4

Summary

Cheyenne and Tiller 50 caused severe injury to wheat, but the injury did not reduce wheat yield. Wild oat density was less than one plant per square meter, green foxtail greater than 20 and kochia and redroot pigweed less than five plants per square meter. Wild oat control was greater than 90% with all tiller and cheyenne treatments and most diclofop treatments. Treatments containing thifensulfuron & tribenuron or bromoxynil gave more than 90% kochia and redroot pigweed control.

Wild oat control in wheat, Williston. 'Amidon' hard red spring wheat was seeded April 17. Treatments (2lf) were applied to 3-leaf wheat, 2- to 3-leaf wild oat, 1- to 1.5-inch Russian thistle, less than 1-inch wild buckwheat, and emerging- to 2-leaf green foxtail on May 18 with 53 F, 75% RH, clear sky, 8 mph wind, and dry soil and plant surfaces. Treatments (4lf) were applied to 5.5-leaf wheat, 4.5- to 5-leaf wild oats, 1- to 3-inch Russian thistle, 1-inch wild buckwheat, and 2- to 5-leaf green foxtail on May 29 with 63 F, 68% RH, clear sky, 9 mph wind, and damp soil and plant surface. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 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 11 and harvest for yield on August 19.

Treatment	Rate	Wheat inj	Wioa	Ruth	KOCZ	Grft	Test wt	Yield
	oz/A	---------- % ----------					lb/bu	bu/A
Diclofop(2lf)	12	0	97	0	0	96	59.4	42.1
Diclofop+Sun-itII(2lf)	12+0.12G	0	97	0	0	99	59.5	41.9
Diclofop+PO(2lf)	12+0.12G	1	96	0	0	99	59.2	41.2
Immb(NS)+X-77(2lf)	4+0.25%	1	81	23	3	18	59.7	39.5
Immb(NS)+X-77(2lf)	5+0.25%	9	79	54	9	0	59.3	41.6
Immb(NS)+Sun-itII(2lf)	4+0.18G	1	97	35	19	6	59.7	41.7
Cheyenne+Thif&Trib(2lf)	7.4+0.22	1	99	99	99	99	59.8	40.6
Diclofop(4lf)	16	0	97	10	1	96	59.7	40.5
Diclofop+Sun-itII(4lf)	16+0.18G	4	95	0	1	99	59.8	36.7
Diclofop+PO(4lf)	16+0.18G	15	93	0	0	58	59.6	35.2
Cheyenne+Thif&Trib(4lf)	7.4+0.22	1	99	99	99	99	59.7	37.9
Immb(NS)+X-77(4lf)	4+0.25%	0	93	0	0	10	59.9	38.6
Immb(NS)+X-77(4lf)	5+0.25%	1	88	13	13	18	59.6	41.2
Immb(NS)+Sun-itII(4lf)	4+0.18G	4	92	55	59	23	59.7	40.2
Difenzoquat(4lf)	10	4	88	15	1	3	59.8	34.4
Difenzoquat+Immb(NS)+X-77	6+2.5+.25%	3	91	37	7	20	59.7	39.0
Tiller(4lf)	10.6	0	94	96	90	99	59.5	38.3
Tiller+Bromoxynil(4lf)	10.6+4	28	60	99	99	99	58.7	24.2
Tiller50(4lf)	9.5	5	99	89	97	99	59.6	36.6
Cheyenne+Thif&Trib(4lf)	7.4+0.22	5	99	99	99	99	59.6	42.4
Untreated	0	0	0	0	0	0	59.3	36.1
C.V. %		166	10	52	43	22	.5	4.8
LSD 5%		9	12	29	20	19	NS	6.4
# OF REPS		4	4	4	4	4	2	4

Summary

Tiller applied with bromoxynil injured wheat with a corresponding yield reduction. However, wild oats control was only 60% with tiller plus bromoxynil. Wild oat density was sparse so the low yield is not from competition. Further, the yield of untreated wheat was only slightly lower than for wheat with effective wild oat control. All other herbicide treatments gave 85% or more wild oats control except imazamethabenz at 4 oz/A + X-77 applied at the 2 leaf stage. Wild oat control with imazamethabenz at 4 oz/A + Sun-it II was equal to that at 5 oz/A applied with X-77. Treatments with thifensulfuron & tribenuron or bromoxynil gave complete control of Russian thistle and kochia. Wheat yield for comparable treatment tended to be greater for the 2 leaf than the 4 leaf applications indicating the benefit of controlling weeds early.

Wild oats control with herbicides mixture, Fargo. An experiment was conducted to determine the influence of herbicide mixtures on wild oats control. 'Butte 86' hard red spring wheat was seeded on April 19. Treatments were applied to 3-leaf wheat, 2- to 3-leaf wild oats, and 3-leaf wild mustard on May 20 with 66 F, 50% RH, partly cloudy sky, and 15- to 20-mph wind. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 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 13 and July 15. Wild oat density exceeded 500 plants/ sq meter. Wheat yield was not taken because of variability in emergence from excessive wild oat competition.

Treatment[a]	Rate	6/13		7/15	
		Wheat inj	Wioa	Wheat inj	Wioa
	(oz/A)	---------- % ----------			
Imazamethabenz	5	0	30	0	8
Imazamethabenz-NS+Sun-itII	5+0.25G	0	88	0	88
Imazamethabenz-AC-182227+Sun-itII	5+2.4+0.25G	0	70	0	73
Imazamethabenz-AC-182227+Sun-itII	5+3.2+0.25G	0	69	0	71
Imazamethabenz-NS+Bromoxynil+X-77	5+2+0.25%	1	70	0	60
Imazamethabenz-NS+Bromoxynil+X-77	5+4+0.25%	0	72	0	60
Imazamethabenz-NS+Thif&Trib+Sun-itII	5+.0.11+0.25G	1	91	0	89
Imazamethabenz-NS+Thif&Trib+Sun-itII	5+0.22+0.25G	4	91	4	86
Immb-NS+Thif&Trib+AC-182227+Sun-itII	5+.0.11+2.4+0.25G	0	67	0	63
Immb-NS+Bromoxynil&MCPA+X-77	5+6+0.25%	0	70	0	71
Immb-NS+Bromoxynil&MCPA+Sun-itII	5+6+0.25G	1	78	0	70
Difenzoquat	12	1	79	0	80
Difenzoquat+AC-182227+Sun-itII	12+2.4+0.25G	0	83	0	80
Difenzoquat+AC-182227+Sun-itII	12+3.2+0.25G	1	78	0	74
Diclofop	16	0	57	0	65
Diclofop+Bromoxynil	16+4	0	50	0	67
Fenoxaprop&2,4-D&MCPA+Bromoxynil	7.5+3	1	73	3	79
Fenoxaprop&2,4-D&MCPA+Bromoxynil	7.5+4	0	63	0	64
Fenoxaprop&2,4-D&MCPA+Bromoxynil	9.5+3	1	84	0	86
Fenoxaprop&2,4-D&MCPA+Bromoxynil	10.5+3	3	83	8	88
Fenoxaprop&2,4-D&MCPA	7.5	3	88	1	87
Fenoxaprop&2,4-D&MCPA	9.3	4	87	5	90
Fenoxaprop&2,4-D&MCPA	10.5	3	89	6	91
AC-182227+Sun-itII	2.4+0.25G	0	0	0	6
AC-182227+Sun-itII	3.2+0.25G	0	0	0	6
AC-182227+Sun-itII	4.8+0.25G	0	0	0	9
Untreated	0	0	4	0	0
C.V. %		249	10	278	14
LSD 5%		NS	9	4	13
# OF REPS		4	4	4	4

[a]Fenoxaprop&2,4-D&MCPA=0.75:0.58:1.75.

Summary

None of the treatment caused important injury to wheat. Wild oats control was much less with imazamethabenz (1990 formulation) than imazamethabenz-NS + Sun-it which indicates that the old formulation remaining from last year may have lasting activity. Thifensulfuron & tribenuron in combination with imazamethabenz did not reduce wild oats control, bromoxynil & MCPA, and BAS-514 tended to reduce wild oats control. Bromoxynil also tended to reduce wild oats control with fenoxaprop & 2,4-D & MCPA.

Wild oat control in barley, Fargo. This experiment was conducted to determine wild oat control in barley. 'Robust' barley was seeded April 19. Treatments were applied to 3-leaf barley, 2- to 3-leaf wild oats and 3-leaf wild mustard on May 24 with 65 F, 65% RH, clear sky, and 5- to 10-mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa qt 35 psi to an 8 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 15. Harvest for yield August 2. Wild oat density was about 250 plants per square meter.

Treatment	Rate	Barley inj	Wioa	Yield
	oz/A	----- %	----	bu/A
Imazamethabenz	5	0	64	31.0
Imazamethabenz-NS+Exp S	5+2%	4	73	30.6
Imazamethabenz-NS+Sun-itII	5+0.18G	8	88	38.2
Imazamethabenz-NS+Sun-itII	15+0.18G	10	99	41.6
Imazamethabenz-DF+X-77	5+0.25%	4	86	35.3
Imazamethabenz-DF+X-77	15+0.25%	19	96	36.5
Imazamethabenz-DF+Sun-itII	5+0.25G	8	95	38.1
Imazamethabenz-DF+Sun-itII	15+0.25G	14	99	38.9
Imazamethabenz-NS+Dife+X-77	2.5+6+0.25%	3	85	30.5
Immb-DF+MCPAioe(ester)+X-77	5+8+0.25%	4	91	37.9
Imazamethabenz-DF+Brox+X-77	5+8+0.25%	4	83	36.7
Imazamethabenz-DF+2,4-Dbee+X-77	5+8+0.25%	5	88	35.1
Imazamethabenz-DF+Thif&Trib+X-77	5+.5+0.25%	9	88	37.2
Immb-DF+Thif&Trib+Sun-itII	5+.5+0.25G	6	96	41.4
Fenoxaprop&2,4-D&MCPA	2.6&2&6.1	1	92	38.1
Difenzoquate	12	5	94	41.4
Diclofop	12	1	75	30.1
Untreated		0	0	18.2
C.V. %		72	5	11.6
LSD 5%		6	6	5.8
# OF REPS		4	4	4

Summary

Imazamethabenz at 15 oz/A cause slight injury to barley, but yields were not reduced. Barley yield was doubled by treatments which controlled wild oats. The DF forumulation was equally as effective in control of wild oats as the NS formulation. The DF formulation was more effective when applied with Sun-itII than X-77. Sun-itII was more effective than Exp S with imazamethabenz-NS for wild oat control. MCPA ester, bromoxynil, 2,4-D bee, and thifensulfuron & tribenuron applied with imazamethabenz-DF generally did not influence wild oat control.

Imazamethabenz for wild oat control, Fargo. 'Butte 86' hard red spring wheat was seeded April 19. Treatments were applied to 2-leaf wheat and wild mustard, and 3-leaf wild oats on May 22 with 90 F, 85% 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 an 8 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 12 and July 15. Wild oat density was 500 per square meter.

Treatment	Rate	6/12 Wheat inj	6/12 Wioa	7/15 Wheat inj	7/15 Wioa
		%		%	
Imazamethabenz	3	0	44	0	31
Imazamethabenz(SC)+NaHSO4	3+3	0	71	0	63
Imazamethabenz(SC)+NH4HSO4	3+3	0	68	0	60
Imazamethabenz+NaHCO3	3+2	0	45	0	41
Imazamethabenz+CaCl2	3+2.5	0	42	0	26
Imazamethabenz+CaCl2+ExpS	3+2.5+2%	1	78	0	71
Imazamethabenz+CaCl2+ExpN	3+2.5+2%	0	77	0	65
Imazamethabenz+CaCl2+Sun-itII	3+2.5+.18G	0	91	0	84
Imazamethabenz(SC)+ExpS	3+2%	0	83	0	81
Imazamethabenz(SC)+ExpN	3+2%	0	82	0	75
Untreated	0	0	0	0	0
C.V. %		663	8	0	21
LSD 5%		NS	7	NS	17
# OF REPS		4	4	4	4

Summary

None of the imazamethabenz treatments injured wheat. The SC formulation of imazamethabenz gave equal control of wild oats when applied with sodium or ammonium bisulfate, but wild oat control was enhanced when applied with Exp S or Exp N. Wild oat control with old commercial formulations also was endhanced by Exp S and N, but to a lesser degree than when appled with Sun-it II.

Broadleaf and grass control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded April 26. Treatments were applied to 4.5- to 5-leaf wheat, 0.5- to 6-inch kochia, and 0.5- to 4-inch wild mustard on May 28 with 77 F, 39% 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 an 8001 flat fan nozzle to an 8 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 5 and July 24. Harvest for yield was on August 5. Kochia infestation was more than 20 plants per square yard and wild mustard less than one plant per square yard.

		6/05			7/24		
		Wheat			Wheat		
Treatment[a]	Rate	inj	KOCZ	Wimu	inj	KOCZ	Yield
	oz/A	---------- %			--------		bu/A
2,4-D-dma	6	1	43	99	0	40	21.2
2,4-D-bee	6	1	78	99	1	34	23.2
MCPA-dma	6	0	5	99	0	3	20.2
Dicamba-Na+MCPA-dma	1.5+4	8	82	99	4	91	23.3
Bromoxynil-oae+MCPA-ioe	4+4	1	99	99	4	98	28.2
Bromoxynil-oae+2,4-D-bee	3+6	0	93	99	1	81	29.7
Clpy&2,4-D-alk	1.5&8	0	30	99	1	26	15.8
Clpy-acd&MCPA-ioe	1.5&8	1	63	99	0	27	22.3
Thif&Trib+X-77	0.07&0.14+0.25%	3	97	99	0	94	33.4
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	1	99	99	2	99	32.6
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	13	90	99	0	97	29.7
Thif&Trib+Brox-oae	0.07&0.14+3	4	99	99	1	96	32.2
Tribenuron+X-77	0.2+0.25%	1	98	99	1	99	31.0
Trib+2,4-D-bee+X-77	0.2+4+0.25%	8	99	99	4	99	29.1
Triasulfuron+X-77	0.2+0.25%	0	94	99	0	92	33.1
Tria+2,4-D-bee+X-77	0.2+4+25%	0	99	99	1	99	35.7
Thif&Trib+Clpy&2,4-D-alk+X-77	0.07&0.14+6.3+0.25%	3	96	99	2	86	32.3
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	7	99	99	2	99	28.9
Fenoxaprop-P&MCPA-ioe (Dakota)	0.9+5.7	10	64	99	0	26	20.5
Fenx-P&2,4-D-ioe&MCPA-ioe(Tiller)	0.9&1.4&4.2	14	70	99	0	21	22.2
Propanil-DF+MCPA-ioe	17+4	1	45	92	0	11	20.1
Untreated	0	0	0	0	0	0	19.0
C.V. %		123	12	3	185	20	13.8
LSD 5%		6	12	4	3	18	5.2
# OF REPS		4	4	4	4	4	4

[a] alk=alkanolamine

Summary

None of the herbicide treatments caused important injury to wheat. Wheat yield generally related to the degree of kochia control. Kochia control was greater with bromoxynil at 4 oz/A + MCPA at 4 oz/A than with bromoxynil at 3 oz/A + 2,4-D at 6 oz/A. All sulfonylureas, except when with clopyralid + 2,4-D, bromoxynil at 4 oz/A + MCPA at 4 oz/A and dicamba + MCPA gave 90% or greater season long kochia control.

Broadleaf and grass control in wheat, Carrington. 'Stoa' hard red spring wheat was seeded April 25. Treatments were applied to 3- to 4-leaf wheat, 4-leaf prostrate pigweed and foxtail, 1-inch redroot pigweed, 2-inch kochia, 6-leaf common lambsquarter, and 3-leaf wild buckwheat on May 31 with 74 F, 69%, clear sky, and 6 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 8 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 9. Weed densities were sparse and variable.

Treatment	Rate	Wheat inj	KOCZ	Wibu	Fxtl
	oz/A		%		
2,4-D-dma	6	0	78	29	15
2,4-D-bee	6	0	54	10	10
MCPA-dma	6	0	50	0	0
Dicamba-Na+MCPA-dma	1.5+4	0	84	74	13
Bromoxynil-oae+MCPA-ioe	4+4	5	99	99	0
Bromoxynil-oae+2,4-D-bee	3+6	0	93	99	9
Clopyralid&2,4-D-alk	1.5&8	0	73	99	0
Clopyralid-acd&MCPA-ioe	1.5&8	0	84	86	0
Thif&Trib+X-77	0.07&0.14+0.25%	3	99	99	0
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	0	99	99	15
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	0	88	88	10
Thif&Trib+Bromoxynil-oae	0.07&0.14+3	0	99	99	15
Tribenuron+X-77	0.2+0.25%	0	74	50	0
Tribenuron+2,4-D-bee+X-77	0.2+4+0.25%	0	99	99	33
Triasulfuron+X-77	0.2+0.25%	0	67	99	10
Triasulfuron+2,4-D-bee+X-77	0.2+4+25%	1	72	99	18
Thif&Trib+Clpy&2,4D-alk+X-77	0.07&0.14+6.3+0.25%	0	74	74	13
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	0	99	99	26
Fenoxaprop-P&MCPA-ioe	0.9+5.7	0	92	64	57
Fenx-P&2,4-D-ioe&MCPA-ioe	0.9&1.4&4.2	0	45	25	85
Propanil-DF+MCPA-ioe	17+4	0	35	63	15
Untreated	0	0	17	0	0
C.V. %		621	38	40	140
LSD 5%		NS	41	40	31
# OF REPS		4	4	4	4

Summary

None of the herbicide treatments injured wheat. Thifensulfuron & tribenuron applied alone or with 2,4-D, dicamba, or bromoxynil; bromoxynil + MCPA; tribenuron + 2,4-D, and metsulfuron + 2,4-D all gave complete control for both kochia and Russian thistle. Triasulfuron alone or with 2,4-D gave 67 to 72% kochia control but 99% wild buckwheat control. Tribenuron alone gave 50% wild buckwheat control.

Broadleaf and grass control in wheat, Hettinger. 'Grandin' hard red spring wheat was seeded April 25. Treatments were applied to 3.5-leaf wheat and foxtail, 0.25- to 0.5-inch kochia, and seedling- to 1-leaf field bindweed on May 23 with 78 F, 60% 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 a 8001 flat fan nozzle to an 8 ft wide area the length of 10 by 30 ft plots. Evaluation was done on an average between July 5 and August 1 ratings. Harvest for yield was on August 6.

Treatment	Rate	Wheat ht	Brwd[a]	Grft	Yield
	oz/A	cm	--- % ---		bu/A
2,4-D-dma	6	85	0	32	50.1
2,4-D-bee	6	93	78	62	55.7
MCPA-dma	6	91	32	84	56.3
Dicamba-Na+MCPA-dma	1.5+4	89	65	57	58.4
Bromoxynil-oae+MCPA-ioe	4+4	85	98	31	53.5
Bromoxynil-oae+2,4-D-bee	3+6	85	97	18	54.8
Clopyralid&2,4-D-alk	1.5&8	89	30	55	59.6
Clopyralid-acd&MCPA-ioe	1.5&8	85	77	44	50.7
Thifensulfuron&Trib+X-77	0.07&0.14+0.25%	86	93	8	55.1
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	86	98	29	51.9
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	91	72	13	57.5
Thif&Trib+Bromoxynil-oae	0.07&0.14+3	88	97	32	60.4
Tribenuron+X-77	0.2+0.25%	82	80	36	58.1
Tribenuron+2,4-D-bee+X-77	0.2+4+0.25%	89	94	22	56.7
Triasulfuron+X-77	0.2+0.25%	78	91	18	45.9
Triasulfuron+2,4-D-bee+X-77	0.2+4+25%	87	95	17	56.9
Thif&Trib+Cl&D-alk+X-77	0.07&0.14+6.3+0.25%	90	98	51	57.8
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	84	80	27	52.9
Fenoxaprop-P&MCPA-ioe (Dakota)	0.9+5.7	84	35	87	58.7
Fenoxaprop-P&2,4-D-ioe&MCPA-ioe(Tiller)	0.9&1.4&4.2	84	96	72	52.3
Propanil-DF+MCPA-ioe	17+4	81	82	86	52.2
Untreated	0	86	0	0	52.0
C.V.%		6	38	75	10.6
LSD 5%		NS	40	43	NS
# of Reps		4	4	4	4

[a]Blwd=Broadleaf weed of mainly kochia with minor infestation of field bindweed and field pennycress.

Summary

None of the herbicide treatments injured wheat (data not presented). Broadleaf weed control was 90% or more with bromoxynil at 4 oz/A, thifensulfuron and tribenuron mixtures except when with dicamba, tribenuron plus 2,4-D, triasulfuron and tiller. Weed densities were sparse so yield was not increased by weed control.

Broadleaf and grass control in barley, Langdon. 'Excel' barley was seeded May 15. Treatments were applied to aproximately 5.5-leaf barley, 4-inch tall volunteer flax, emerging- to 3-inch tall kochia, up to 3-inch tall wild mustard and 2-inch tall wild buckwheat on June 14 with 75 F, 60+ RH, and clear 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 8 ft wide are the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was July 18. Weed densities were sparse.

Treatment	Rate	Barley inj	Wibu	KOCZ	Wimu	Grft
	oz/A			%		
2,4-D-dma	6	0	38	67	99	0
2,4-D-bee	6	0	39	60	99	0
MCPA-dma	6	0	28	30	99	0
Dicamba-Na+MCPA-dma	1.5+4	0	91	94	99	0
Bromoxynil-oae+MCPA-ioe	4+4	0	98	99	99	0
Bromoxynil-oae+2,4-D-bee	3+6	0	94	99	99	0
Clopyralid&2,4-D-alk	1.5&8	1	82	44	99	0
Clopyralid-acd&MCPA-ioe	1.5&8	0	89	66	99	0
Thifensulfuron&Trib+X-77	0.07&0.14+0.25%	0	63	91	99	0
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	2	83	85	99	0
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	0	83	87	99	0
Thif&Trib+Bromoxynil-oae	0.07&0.14+3	0	99	86	99	0
Tribenuron+X-77	0.2+0.25%	0	85	93	99	0
Tribenuron+2,4-D-bee+X-77	0.2+4+0.25%	3	76	82	99	0
Triasulfuron+X-77	0.2+0.25%	3	66	64	99	0
Triasulfuron+2,4-D-bee+X-77	0.2+4+25%	3	92	65	99	0
Thif&Trib+Cl&D-alk+X-77	0.07&0.14+6.3+0.25%	0	86	85	99	0
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	5	80	94	99	2
Fenoxaprop-P&MCPA-ioe (Dakota)	0.9+5.7	1	0	29	99	99
Fenx-P&2,4-D-ioe&MCPA-ioe(Tiller)	0.9&1.4&4.2	4	33	23	99	99
Propanil-DF+MCPA-ioe	17+4	2	32	18	99	72
Untreated	0	1	0	0	0	0
C.V. %		212	28	28	0	54
LSD 5%		NS	26	26	NS	9
# OF REPS		4	4	4	4	4

Summary

None of the herbicide treatments injured barley. The barley growth was excellent causing severe competition to weeds so herbicide treatments were effective and surviving weed would not have reduced yield. Kochia control was not as great with sulfonylureas as at other locations indicating that the surviviing plants may have been resistant. Dicamba and bromoxynil treatments gave the greatest control of all broadleaf weeds. Fenoxaprop treatments controlled green foxtail.

Broadleaf and grass control in wheat, Minot. 'Amidon' hard red spring wheat was seeded April 24. Treatments were applied to 5.5- to 6-leaf wheat, 2- to 6- inch wild buckwheat, 1- to 4-leaf green foxtail, 1- to 3.5-inch kochia, and 2- to 4-inch redroot pigweed on June 10 with 72 F, 35% RH, clear sky, and 6 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 8 ft wide area the length of 10 by 20 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 10 and a harvest for yield August 12.

Treatment	Rate	Wheat inj	KOCZ	Grft	Rrpw	Yield
	oz/A	---- % ----				bu/A
2,4-D-dma	6	2	91	79	96	48.5
2,4-D-bee	6	2	98	91	97	45.5
MCPA-dma	6	1	93	79	99	48.3
Dicamba-Na+MCPA-dma	1.5+4	25	98	75	96	45.9
Bromoxynil-oae+MCPA-ioe	4+4	7	99	69	86	45.6
Bromoxynil-oae+2,4-D-bee	3+6	4	99	89	99	45.9
Clopyralid&2,4-D-alk	1.5&8	1	95	81	91	43.2
Clopyralid-acd&MCPA-ioe	1.5&8	0	94	74	91	46.0
Thif&Trib+X-77	0.07&0.14+0.25%	0	99	76	82	45.7
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	0	97	84	94	47.4
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	31	99	71	99	45.8
Thif&Trib+Bromoxynil-oae	0.07&0.14+3	0	99	76	98	50.0
Tribenuron+X-77	0.2+0.25%	1	99	78	89	48.9
Tribenuron+2,4-D-bee+X-77	0.2+4+0.25%	1	94	74	88	45.2
Triasulfuron+X-77	0.2+0.25%	0	99	78	98	48.0
Triasulfuron+2,4-D-bee+X-77	0.2+4+25%	3	99	78	96	45.9
Thif&Trib+Cl&D-alk+X-77	0.07&0.14+6.3+0.25%	2	99	79	99	46.9
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	2	99	78	95	46.2
Fenoxaprop-P&MCPA-ioe	0.9+5.7	13	74	98	46	43.6
Fenx-P&2,4-D-ioe&MCPA-ioe	0.9&1.4&4.2	16	90	97	83	46.0
Propanil-DF+MCPA-ioe	17+4	11	75	80	82	42.0
Untreated	0	0	0	0	0	47.8
C.V. %		61	7	15	14	7.0
LSD 5%		5	9	16	18	NS
# OF REPS		4	4	4	4	4

Summary

Dicamba and fenoxaprop treatment injured wheat, probably because of the late stage at treatment. However, the observed injury did not reduce wheat yield. Weed densities were sparse so no yield increases occurred from herbicide treatment. Weed control generally was excellent because of the sparse infestation and favorable growing condition at treatment. The high foxtail control ratings occurred because of the sparce density.

Broadleaf and gras control in wheat, Williston. 'Amidon' hard red spring wheat was seeded April 22. Treatments were applied to 5-leaf wheat, 1-to 3 inch Russian thistle, 2-to 5-leaf green foxtail, 1-inch wild buckwheat, 2- to 6-inch tame mustard, and more than 1-inch tall kochia on May 29 with 70 F, 50% RH, clear sky, dry soil and plant surface, soil temperature 72 F and 10 mph wind. Treatments were applied with a tractor-mounted plot sprayer with a wind screen delivering 8.5 gpa at 32 psi through a 8001 flat fan nozzle to an 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 11. Harvest for yield was August 20. Weed densities Russian thistle 4 per square ft, green foxtail 15 per square ft and other weeds less than 1 per square meter.

Treatment	Rate	Wheat inj	Grft	Ruth	Rrpw	KOCZ	Wibw	Test wt	8/20 Yield
	oz/A	----------			%		----------	lb/bu	bu/A
2,4-D-dma	6	0	0	92	96	72	10	59.8	46.3
2,4-D-bee	6	0	0	99	94	73	23	59.7	39.4
MCPA-dma	6	0	0	28	46	34	0	59.8	42.4
Dicamba-Na+MCPA-dma	1.5+4	0	3	93	97	97	99	59.8	31.0
Bromoxynil-oae+MCPA-ioe	4+4	0	0	99	99	99	99	59.7	37.2
Bromoxynil-oae+2,4-D-bee	3+6	0	0	99	98	98	99	59.8	41.0
Clopyralid&2,4-D-alk	1.5&8	0	0	99	99	69	99	59.6	41.0
Clopyralid-acd&MCPA-ioe	1.5&8	0	0	99	99	49	99	59.9	36.5
Thif&Trib+X-77	0.07&0.14+0.25%	0	0	99	99	99	93	59.7	43.8
Thif&Trib+2,4-D-bee+X-77	0.07&0.14+4+0.25%	0	0	99	99	99	99	59.5	44.5
Thif&Trib+Dica-Na+X-77	0.07&0.14+1.5+0.25%	0	10	99	99	99	84	59.5	39.4
Thif&Trib+Bromoxynil-oae	0.07&0.14+3	1	0	99	99	99	99	59.6	38.5
Tribenuron+X-77	0.2+0.25%	0	0	99	99	99	40	59.9	42.5
Tribenuron+2,4-D-bee+X-77	0.2+4+0.25%	0	0	99	99	99	80	59.4	38.2
Triasulfuron+X-77	0.2+0.25%	0	0	99	99	99	80	60.0	43.7
Triasulfuron+2,4-D-bee+X-77	0.2+4+25%	0	0	99	99	99	72	59.7	44.0
Thif&Trib+Cl&D-alk+X-77	0.07&0.14+6.3+0.25%	0	0	99	99	99	74	59.8	42.1
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.25%	0	10	99	99	99	92	59.9	42.9
Fenoxaprop-P&MCPA-ioe	0.9+5.7	1	96	28	10	0	8	60.1	51.4
Fenx-P&2,4-D-ioe&MCPA-ioe	0.9&1.4&4.2	0	99	88	81	28	9	60.0	49.4
Propanil-DF+MCPA-ioe	17+4	1	41	10	99	82	59	59.0	35.5
Untreated	0	0	0	0	0	0	0	59.8	41.0
C.V.%		539	65	13	12	17	38	0.5	11.7
LSD 5%		NS	11	15	15	19	35	NS	6.8
# of REPS		4	4	4	4	4	4	4	4

Summary

None of the herbicides injured wheat. Fenoxaprop gave 96% or more green foxtail control. Russian thistle and redroot pigweed exceeded 80% for all treatment except when MCPA was the main broadleaf control herbicide. All sulfonylurea, dicamba and bromoxynil treatments gave greater than 95% kochia control. Wild buckwheat control ratings were quite variable, but tribenuron in mixtures with other broadleaf control herbicides was more effect than tribenuron alone. Yield was greatest when green foxtail was controlled in addition to the broadleaf weeds.

Thifensulfuron and tribenuron with NaHCO3, Fargo. 'Butte 86' hard red spring wheat was seeded April 26. Treatments were applied to 3- to 4-leaf wheat, 2- to 4-inch wild mustard, 0.5- to 3-inch kochia, and 2- to 3-inch common lambsquarters on May 24 with 75 F, 65% RH, clear sky, 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 an 8 ft wide area the length of 10 by 30 ft plots. Harvest for yield was on August 5. Yellow foxtail ratings were a percentage of spikes above the wheat and does ot indicate control of vegetation.

		6/07					7/24	
		Wheat					Wheat	
Treatment	Rate	inj	KOCZ	Wimu	KOCZ	Yeft	Inj	Yield
	oz/A	-------- % control --------						bu/A
Thif&Trib+X-77(dw)[a]	0.2+0.25%	0	46	99	0	0	0	18.9
Thif&Trib+Scoil(dw)	0.2+1%	0	99	99	99	85	0	36.8
Thif&Trib+ExpN(dw)	0.2+1%	1	98	99	96	40	1	35.8
Thif&Trib+X-77(Na)	0.2+0.25%	0	99	99	98	63	0	39.0
Thif&Trib+2,4-Ddma+X-77(Na)	0.2+4+0.25%	1	99	99	99	73	1	38.1
Thif&Trib+2,4-Dbee+X-77(Na)	0.2+4+0.25%	2	99	99	98	36	3	36.3
Thif&Trib+Dica-dma+X-77(Na)	0.2+1.5+0.25%	13	99	99	99	0	3	36.3
Thif&Trib+Dica-Na+X-77(Na)	0.2+1.5+0.25%	11	99	99	99	35	1	38.2
Thif&Trib+Brox+X-77(Na)	0.2+3+0.25%	4	99	99	98	25	3	36.8
Thif&Trib+Scoil(Na)	0.2+1%	5	99	99	98	65	1	38.5
Thif&Trib+2,4-Ddma+Scoil(Na)	0.2+4+1%	3	99	99	99	26	1	37.9
Thif&Trib+2,4-Dbee+Scoil(Na)	0.2+4+1%	5	99	99	99	16	2	36.5
Thif&Trib+Dica-dma+Scoil(Na)	0.2+1.5+1%	8	99	99	99	36	3	40.5
Thif&Trib+Dica-Na+Scoil(Na)	0.2+1.5+1%	7	99	99	99	20	1	36.8
Thif&Trib+Brox+Scoil(Na)	0.2+3+1%	6	99	99	97	3	5	34.6
Thif&Trib+ExpN	0.2+1	2	98	99	96	60	2	37.5
Thif&Trib+2,4-Ddma+ExpN	0.2+4+1%	6	99	99	98	18	3	36.1
Thif&Trib+2,4-Dbee+ExpN	0.2+4+1%	3	99	99	98	44	1	37.1
Thif&Trib+Dica-dma+ExpN(Na)	0.2+1.5+1%	6	99	99	98	33	1	39.0
Thif&Trib+Dica-Na+ExpN(Na)	0.2+1.5+1%	8	99	99	98	25	3	38.8
Thif&Trib+Brox+ExpN(Na)	0.2+3+1%	10	99	99	96	59	6	37.4
Thif&Trib+ExpN+Scoil(Na)	0.2+1%+1%	6	99	99	96	20	1	36.8
Thif&Trib+ExpN+X-77(Na)	0.2+1%+0.25%	7	99	99	97	48	1	36.8
Untreated	0	0	8	23	0	0	0	14.1
C.V. %		78	5	10	2	81	144	13.3
LSD 5%		5	7	13	3	39	NS	6.7
# OF REPS		4	4	4	4	4	4	4

[a]The inadequate kochia control indicates missapplication. The surfactant may not have been included as previous research has indicated that surfactant was essential for kochia control, but not for wild mustard.

Summary

None of the treatments caused important injury to wheat. Broadleaf weeds were completely controlled by all treatments. The excellent broadleaf weed control probably occurred because moisture was adequate for rapid plant growth. The high level of control masked any influence of sodium bicarbonate adjuvants, or herbicide combinations. Foxtail spikes reduction was variable, but spike reduction was greatest when thifensulfuron & tribenuron were applied without other broadleaf herbicides. Wheat yield was doubled from effective kochia control.

Broadleaf weed control with BAS-514-34, Fargo. 'Butte 86' hard red spring wheat was seeded April 26. Treatments were applied to 3- to 4-leaf wheat, 2- to 4- inch wild mustard, 0.5- to 3-inch kochia, and 2- to 3-inch common lambsquarter on May 24 with 75 F, 65% RH, clear sky, 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/03 Wheat inj	6/03 KOCZ	6/03 Wimu	7/24 Wheat Inj	7/24 KOCZ
	oz/A	---------- % ----------				
BAS-514-34+Sun-itII	3.2+.25G	1	54	45	3	78
2,4-Dbee	4	1	77	99	0	39
MCPA-ioe	4	3	43	99	0	39
Thif&Trib+X-77	0.3+.25%	10	99	99	1	99
Dicamba-Na	2	8	93	97	1	98
BAS-514-34+24-Dbee+Sun-itII	3.2+4+.25G	4	92	99	0	75
BAS-514-34+MCPA-ioe+Sun-itII	3.2+4+.25G	4	85	97	0	67
BAS-514-34+Thif&Trib+Sun-itII	3.2+.2+.25G	1	99	99	4	97
BAS-514-34+Thif&Trib+Sun-itII	3.2+.3+.25G	1	99	99	1	99
BAS-514-34+Dica-Na+Sun-itII	3.2+2+.25G	13	99	96	1	99
Propanil-wdg	19	8	62	96	0	0
BAS-514-34+24-Dbee+Sun-itII	2.4+4.8+0.25G	8	94	99	1	84
Bromoxynil+Diclofop	4+12	0	84	97	0	56
Dakota+Thif&Trib	9.3+0.13	4	99	99	1	99
Untreated	0	0	0	0	0	5
C.V. %		115	12	10	210	16
LSD 5%		7	14	13	NS	15
# OF REPS		4	4	4	4	4

Summary

None of the herbicide treatments caused important injury to wheat. The area did not have a foxtail infestation, but the kochia infestation exceeded three plants per square foot. Kochia control was nearly complete when thifensulfuron & tribenuron or dicamba were a component of the herbicide treatment, 2,4-D or MCPA in combination with BAS-514-34 did not increase late season kochia control beyond that of 2,4-D or MCPA alone.

Broadleaf weed control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded April 26. Treatments (2-4lf) were applied to 3- to 4-leaf wheat, 2- to 4-inch wild mustard, 0.5- to 3-inch kochia, and 2- to 3-inch common lambsquarters on May 24 with 75 F, 65% RH, clear sky, and 10- to 15-mph wind. Treatments (5lf) were applied to 5- to 6-leaf wheat, 1- to 6-inch wild mustard, 0.5- to 5-inch kochia, and 1- to 3-inch common lambsquarter on May 30 with 67 F, 81% RH, cloudy sky, 5 mph wind and rain (0.37 inch) occurred 2 hours after treatment. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 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 5.

		6/07			7/24			
		Wheat					Wheat	8/05
Treatment	Rate	inj	KOCZ	Wimu	Kocz	Yeft	inj	Yield
	oz/A	---------- % ----------						bu/A
2,4-Dbee(2-4lf)	6	2	87	99	44	0	0	24.7
Bromoxynil+Trib(2-4lf)	3+0.06	1	97	99	74	0	0	29.7
Bromoxynil+Dica-Na(2-4lf)	3+0.5	5	93	98	74	0	0	27.7
Bromoxynil&MCPA(2-4lf)	8	4	95	99	79	0	0	29.1
Bromoxynil&MCPA+MCPA-ioe	6+2	1	92	99	70	0	0	27.9
Bromoxynil+2,4-Dbee(2-4lf)	2+4	5	94	99	65	0	0	25.6
V-23031+PO(2-4lf)	0.28+0.12G	1	86	99	43	9	0	26.7
V-23031+PO(2-4lf)	0.42+0.12G	3	88	25	58	9	0	24.0
V-23031+Scoil(2-4lf)	0.28+0.12G	24	81	20	40	13	1	18.9
V-23031+MCPA-dma+PO(2-4lf)	0.28+4+0.12G	0	58	99	31	10	1	23.9
V-23031+MCPA-dma+Scoil(2-4lf)	0.28+4+0.12G	0	46	99	8	8	0	17.8
Bromoxynil+2,4-Dbee(5lf)	3+6	5	96	99	84	0	1	30.3
2,4-Ddma(5lf)	4	0	33	90	10	0	0	5.6
2,4-Dws(5lf)	4	0	16	92	4	0	0	15.3
2,4-Ddma+X-77(5lf)	4+0.25%	1	55	96	31	0	0	14.6
2,4-Dws+X-77(5lf)	4+0.25%	1	55	91	38	0	0	17.1
2,4-Ddma+Li-700(5lf)	4+0.25%	0	41	93	11	0	0	11.1
2,4-Ddma+ExpS(5lf)	4+1%	1	41	93	13	0	0	6.4
2,4-Ddma+AMS+X-77(5lf)	4+22+0.25%	7	79	96	48	0	1	22.4
2,4-Ddma+Cayuse(5lf)	4+1%	2	55	94	30	0	0	21.6
2,4-Ddma+Scoil(5lf)	4+1%	3	74	99	48	0	1	21.4
Thif&Trib+X-77(5lf)	0.25+0.25%	8	99	99	96	15	0	30.0
Thif&Trib+Scoil(5lf)	0.25+1%	7	99	99	99	90	2	32.4
Untreated	0	0	0	0	0	0	0	14.0
C.V. %		259	15	13	30	153	383	29.9
LSD 5%		NS	14	16	20	14	NS	9.1
# OF REPS		4	4	4	4	4	4	4

Summary

V-23031 applied with scoil caused 24% injury to wheat at the early evaluation, but injury was not evident prior to harvest. However, the wheat yield for wheat treatment with V-23031 plus Scoil tended to be less than for other treatments with similar weed control. Wheat yield generally reflected kochia control. Kochia control tended to be less with the ws formulation than with 2,4-D dma without adjuvants; but similar when with X-77. 2,4-Ddma enhancement of kochia control by adjuvant was Scoil = AMS + X-77 greater than cayuse = X-77 greater than Exp S or Li-700. Late season kochia control only exceeded 95% when treated with thifensulfuron & tribenuron.

Variety response to BAS-514-34, Fargo. Crops were seeded in 20 ft wide adjacent strips on April 24. Treatments were applied to 3- to 4-leaf crops, 1- to 2-inch kochia, 2-leaf foxtail, 3-leaf redroot pigweed, and 4-leaf common lambsquarters on May 22 with 84 F, 85% RH, cloudy sky, and 10 to 15 mph wind. The plot area was treated with bromoxynil at 4 oz/A plus MCPA at 4 oz/A on June 6 for control of broadleaf weeds. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gap at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Evalution was on June 5 and 20; July 3 and 15. Harvest for yields was on August 7.

		Barley				HRS wheat				Durum wheat				Oats	
		Robust		Bowman		Stoa		Butte 86		Renville		Monroe		Valley	
Treatment	Rate	Inj	Yield	Inj	Yield	Inj	Yield	Inj	Yield	Inj	Yield	Inj	Yield	Inj	Yield
	oz/A	%	bu/A	%	bu/A	%	bu/A	%	bu/A	%	bu/A	%	lb/bu	%	lb/bu
BAS-514-34+Sun-itII	2.4+.25G	4	48.8	0	40.7	1	20.5	1	27.3	0	29.9	0	35.2	23	50.8
BAS-514-34+Sun-itII	4.8+.25G	9	44.5	4	38.6	2	20.8	0	32.8	0	28.9	0	33.2	29	40.4
Untreated	0	0	50.1	0	41.0	0	16.3	0	31.8	0	31.4	0	30.8	0	54.4
C.V. %		96	12.7	115	8.6	270	23.9	346	14.7	0	6.6	0	4.8	11	10.4
LSD 5%		NS	NS	3	NS	NS	NS	NS	NS	NS	NS	NS	2.7	3	8.8
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4	4

Summary

BAS-514 injured Valley oats and tended to injure Robust barley both when considering visual evaluations and harvested grain yield. Visual evaluations after the June 5 date did not indicate any injury to any crop or variety (data not presented).

Broadleaf control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded April 26. Treatments were applied to 3- to 4-leaf wheat, 0.5- to 3-inch kochia, and 2- to 4-inch wild mustard on May 22 with 90 F, 85% 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 an 8 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 5.

		6/07			7/23		
Treatment	Rate	Wheat inj	KOCZ	Wimu	Wheat inj	KOCZ	Wheat yield
	oz/A	----------%----------					bu/A
BAS-514-34+Sun-itII	2.4+.25G	1	55	20	2	43	23.3
BAS-514-34+Sun-itII	3.6+.25G	3	56	21	4	66	22.5
BAS-514-34+Sun-itII	4.8+.25G	3	61	0	4	65	23.0
BAS-514-34+Sun-itII	2.4+.12G	0	60	1	2	46	24.5
BAS-514-34+Scoil	2.4+.12G	0	60	10	6	65	24.0
BAS-514-34+Thif&Trib+Scoil	2.4+0.13+.12G	0	99	99	2	99	34.0
Diclofop	12	0	10	25	1	5	20.3
Dakota+Thifensulfuron	9.3+0.13	3	99	99	2	96	34.0
Dakota+Dicamba	9.3+2	4	99	99	4	99	33.8
Dakota+Bromoxynil	9.3+4	0	99	99	6	93	34.8
Dakota+Thif&Trib	9.3+0.13	1	99	99	5	99	35.8
Tiller	5.85	1	69	99	0	26	25.8
Tiller+Bromoxynil	5.85+4	3	97	99	2	85	35.3
Untreated	0	0	0	0	3	5	14.3
C.V. %		169	19	36	107	20	12.9
LSD 5%		NS	19	28	NS	18	5.1
# OF REPS		4	4	4	4	4	4

Summary

None of the herbicides injured wheat. BAS-514-34 gave less than 65% kochia control, except for 96% control when applied with thifensulfuron & tribenuron. All treatments with thifensulfuron & tribenuron, dicamba, bromoxynil, or thifensulfuron & tribenuron with Dakota. Wheat yield related to degree of kochia control.

Foxtail control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded on May 11. Treatments were applied to 3- to 4-leaf crops, 1-to 2-inch kochia, 2 leaf foxtail, 3 leaf redroot pigweed, and 4 leaf common lambsquarters on May 22 with 84 F, 85% RH, cloudy sky, 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 an 8 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 12.

		6/11			7/24				
Treatment	Rate	Wheat inj	KOCZ	Yeft	Wheat inj	Grft	Yeft	KOCZ	Yield[a]
		%							bu/A
BAS-514-34+Sun-itII	2.4+.25G	3	29	56	2	92	85	44	.0
BAS-514-34+Sun-itII	3.6+.25G	1	51	76	0	98	89	54	17.5
BAS-514-34+Sun-itII	4.8+.25G	1	60	83	5	98	93	58	16.4
BAS-514-34+Sun-itII	2.4+.12G	0	3	47	3	80	84	0	.0
BAS-514-34+Scoil	2.4+.12G	3	51	63	0	87	80	25	.0
BAS-514-34+Thif&Trib+Scoil	2.4+0.13+.12G	6	98	77	1	67	74	84	16.8
Diclofop	12	4	20	51	3	65	40	0	.0
Dakota+Thifensulfuron	9.3+0.13	4	97	83	1	95	61	75	17.5
Dakota+Dicamba	9.3+2	3	98	92	15	49	63	96	12.7
Dakota+Bromoxynil	9.3+4	99	99	64	99	53	54	80	.0
Dakota+Thif&Trib	9.3+0.13	3	99	84	0	77	69	89	14.2
Tiller	5.85	4	29	86	16	73	87	16	.0
Tiller+Bromoxynil	5.85+4	6	90	69	3	93	11	83	11.9
Untreated	0	0	0	0	0	0	0	0	.0
C.V. %		33	28	14	43	18	22	26	25.7
LSD 5%		5	24	13	6	19	20	19	2.8
# OF REPS		4	4	4	4	4	4	4	4

[a]The 0 yield indicates that the wheat on two or more of the replications were not harvested because of excessive weeds or the wheat was killed by the herbicide treatment.

Summary

Dakota applied with bromoxynil caused severe injury which was a stand loss. None of the other treatments caused important injury to wheat. Green and Yellow foxtail control from BAS-514-34 tended to be reduced when applied with thifensulfuron & tribenuron at the late but not at the early evaluation. Kochia control at the late evaluation exceeded 80% only with thifensulfuron & tribenuron, dicamba, and bromoxynil treatments.

Imazamethabenz for foxtail control in wheat, Fargo. 'Butte 86' hard red spring wheat was seeded May 11. Treatments (S1) were applied to 2.5-leaf wheat, 2-leaf redroot pigweed, emerging- to 1.5-inch foxtail, and 0.5- to 0.75-inch kochia on May 23 with 70 F, 75% RH, cloudy sky and 25 mph wind. Treatments (S2) were applied to 4- to 4.5-leaf wheat, foxtail 2- to 4.5-leaf, 0.5- to 2-inch kochia, and 2- to 4-leaf redroot pigweed on May 30 with 67 F, 81% RH, cloudy sky and 0.37 rain occurred 3 hours after application. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 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 as on August 12.

		6/12		7/23			
		Wheat		Wheat			
Treatment	Rate	inj	Yeft	inj	Yeft	KOCZ	yield
	oz/A	---	--- % ---		--- % ---		bu/A
Imazamethabenz-NS+X-77(S1)	3.7+.25%	0	0	0	17	35	21.5
Imazamethabenz-NS+Sun-itII(S1)	3.7+.25G	0	5	0	25	76	25.0
Imazamethabenz-NS+Sun-itII(S1)	7.2+.25G	0	16	0	34	99	23.3
Imazamethabenz(SC)+NaHSO4(S1)	3.7+3.7	0	13	0	15	63	22.5
Imazamethabenz(SC)+NaHSO4(S1)	7.2+7.2	0	15	0	26	71	22.5
Imazamethabenz-DF+X-77(S1)	3.7+.25%	0	3	3	21	42	21.8
Imazamethabenz-DF+X-77(S1)	7.2+.25%	0	15	3	29	30	19.5
Imazamethabenz-DF+Sun-itII(S1)	3.7+.25G	0	5	3	34	59	24.3
Imazamethabenz-DF+Sun-itII(S1)	7.2+.25G	0	11	0	31	90	21.8
AC-182227+Sun-itII(S1)	1.6+.25G	0	49	0	49	86	23.0
AC-182227+Sun-itII(S1)	3.2+.25G	0	88	3	88	57	26.8
Immb-NS+AC-182227+Sun-itII(S1)	3.7+1.6+.25G	1	44	0	67	69	25.8
Immb-NS+AC-182227+X-77(S1)	3.7+1.6+.25%	0	24	2	49	13	23.5
Immb-DF+AC-182227+X-77(S1)	5+1.6+.25%	0	21	1	44	46	22.3
Immb(SC)+Tiller+NaHSO4(S1)	5+5.8+5	1	81	18	85	59	21.3
Immb(SC)+AC-182227+NaHSO4(S1)	5+1.6+5	0	33	0	57	55	23.3
Immb-NS+Thif&Trib+X-77(S1)	5+.5+.25%	4	36	1	76	82	26.0
Immb-NS+Thif&Trib+Sun-itII(S1)	5+.5+.25G	5	51	4	91	99	25.5
Tiller(S2)	10.3	3	97	5	98	70	26.8
Immb-NS+Tiller+Sunit(S2)	5+3+.25G	1	60	8	41	64	25.5
Immb-NS+Tiller+X-77(S2)	5+3+.25%	0	59	5	60	68	25.3
Immb-DF+Tiller+X-77(S2)	5+5.8+.25%	4	66	4	58	29	25.0
Diclofop	12	0	81	5	87	0	26.5
Untreated	0	0	4	0	3	0	21.0
C.V. %		240	33	125	26	52	10.8
LSD 5%		3	17	5	18	42	3.6
# OF REPS		4	4	4	4	4	4

Summary

None of the treatments injured wheat. Wheat yield generally related to weed control. Kochia control ratings were variable mainly because of a sparse and variable stand. However, control generally tended to e greater when imazamethabenz formulations were applied with Sun-it II than the other adjuvants. Yellow foxtail control on 6/12 represent vegetation control, but on 7/23 mainly are a reduction in spikes. AC-182227 at 3.2 oz/A + Sun-it II (S1), and tiller (S2) were the only treatments to provide more than 80% control of foxtail vegetation and spike production. Thifensulfuron & Tribenuron reduced foxtail spikes, especially when applied with Sun-it II.

Imazamethabenz on weed free wheat varieties, Fargo. Crops were seeded in 20 ft wide adjacent strips on April 24. Treatment was applied to 3- to 4-leaf crops on May 22 with 84 F, 85% RH, partly sunny sky, and 10- to 15 mph wind. Treatment was applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates. Harvest for crop yields was on August 7.

		Barley			HRSW		
					Butte	Durum wheat	
Treatment	Rate	Robust	Bowman	Stoa	86	Monroe	Renville
	oz/A	----------	----------	----------	%	----------	----------
Imazamethabenz-NS+X-77	5+.25%	58.1	45.6	24.3	37.4	41.2	33.3
Untreated	0	57.7	46.3	23.5	37.2	37.1	30.6
C.V. %		13.2	5.9	4.8	6.6	10.8	1.3
LSD 5%		NS	NS	NS	NS	NS	.9
# OF REPS		4	4	4	4	4	4

Summary

The experiment was treated with bromoxynil & MCPA for broadleaf control. Green and yellow foxtail were present in the area and not controlled by the imazamethabenz so their influence on yield should have been the same for treated and untreated crops. Valley oats were also seeded in the experiment and was completely controlled by imazamethabenz. Imazamethabenz did not influence the yield of any of the crop varieties, except for Renville durum wheat.

Weed control in flax, Fargo 1991. Experiments were conducted to evaluate broadspectrum weed control in flax. 'Neche' flax was seeded May 15. Treatments were applied to 1- to 4-inch flax, cotyledon- to 4-leaf wild mustard, 1- to 3-inch kochia on June 3 with 78 F, 71% RH, partly 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 an 8 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 September 4.

		6-07	7-15				
		Flax					Flax
Treatment	Rate	inj	Inj	Fxtl	KOCZ	Wimu	yield
	oz/A	----------		%	----------		bu/A
MCPA+Seth+Scoil	4+3+.18G	1	3	99	44	97	22.1
Brox+Seth+Scoil	4+3+.18G	14	6	99	88	87	23.2
Thif+Seth+Scoil	.06+3+.18G	11	10	99	99	97	21.5
Thif+Seth+Scoil	.12+3+.18G	20	18	99	99	98	23.8
Thif+Seth+Moract	.06+3+.18G	5	8	99	98	96	23.0
Thif+Seth+Moract	.12+3+.18G	18	18	99	99	98	21.1
Thif+MCPA	.06+4	3	3	0	99	99	23.7
Thif+Brox	.06+4	21	18	0	99	99	18.0
Thif+MCPA+Seth+Scoil	.06+4+3+.18G	10	5	99	99	99	20.4
Thif+MCPA+Seth+Moract	.06+4+3+.18G	8	6	99	99	99	25.1
Thif+MCPA+Seth+Scoil	.12+4+3+.18G	7	5	99	99	99	24.2
Thif+Brox+Seth+Scoil	.06+4+3+.18G	28	15	13	98	95	17.2
Thif+Brox+Seth+Moract	.06+4+3+.18G	22	15	20	99	95	17.7
Thif+Brox+Seth+Scoil	.12+4+3+.18G	24	24	0	99	96	19.4
Seth+Scoil	3+.18G	1	0	99	0	0	15.1
Brox+Difp+Moract	4+12+.18G	20	15	76	84	95	23.2
Imep+MCPA+Seth+SunitII	.1+4+3+.18G	5	18	99	91	99	20.1
Imep+Brox+Seth+SunitII	.1+4+3+.18G	17	16	99	99	98	23.0
Imep+MCPA+Seth+SunitII	.2+4+3+.18G	1	12	99	99	99	20.9
Bent+MCPA-dma+Seth+Scoil	8+4+3+.18G	41	14	99	93	98	22.4
Untreated	0	0	0	0	0	0	8.4
C.V. %		64	63	17	7	4	19.2
LSD 5%		12	10	16	8	5	5.6
# OF REPS		4	4	4	4	4	4

Summary

Thifensulfuron + bromoxynil treatments injured flax which appeared to reduce yield. Bentazon + MCPA with sethoxydim and scoil caused early injury but plants recovered and yield was not reduced. Control of kochia and wild mustard greatly increased flax yield. Foxtail density was sparse and variable so the lack of foxtail control with sethoxydim may indicate variability in density, date of emergence, or antagonism from bromoxynil applied with thifensulfuron. Thifensulfuron treatments gave 95% or more kochia control.

Weed control in flax, Carrington 1991. The experiment was one of several locations throughout North Dakota to determine broadspectrum weed control in flax. 'Linton' flax was seeded on May 10. Treatments were applied to 6-inch flax, 6-leaf common lambsquarters, 2-inch redroot pigweed, 2- to 3-inch wild mustard, and tillering- to 5-inch foxtail on June 6 with 69 F, 85 RH, overcast sky, and 9 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 8 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 19. Green and yellow foxtail was at 10 and redroot pigweed at 3 plants/ft.

Treatment	Rate	Flax inj	Fxtl	Rrpw
	oz/A		%	
MCPA+Sethoxydim+Scoil	4+3+0.18G	1	88	82
Bromoxynil+Sethoxydim+Scoil	4+3+0.18G	2	83	97
Thifensulfuron+Seth+Scoil	0.06+3+0.18G	11	99	83
Thifensulfuron+Seth+Scoil	0.12+3+0.18G	11	97	99
Thifensulfuron+Seth+Moract	0.06+3+0.18G	9	97	99
Thifensulfuron+Seth+Moract	0.12+3+0.18G	9	90	99
Thifensulfuron+MCPA	0.06+4	5	61	96
Thifensulfuron+Bromoxynil	0.06+4	16	54	99
Thif+MCPA+Seth+Scoil	0.06+4+3+0.18G	13	99	99
Thif+MCPA+Seth+Moract	0.06+4+3+0.18G	11	93	99
Thif+MCPA+Seth+Scoil	0.12+4+3+0.18G	4	98	97
Thif+Brox+Seth+Scoil	0.06+4+3+0.18G	4	99	99
Thif+Brox+Seth+Moract	0.06+4+3+0.18G	10	99	99
Thif+Brox+Seth+Scoil	0.12+4+3+0.18G	9	99	99
Sethoxydim+Scoil	3+0.18G	3	99	57
Bromoxynil+Diclofop+Moract	4+12+0.18G	5	90	83
Imep+MCPA+Seth+Sun-itII	0.1+4+3+0.18G	1	98	97
Imep+Brox+Seth+Sun-itII	0.1+4+3+0.18G	5	99	99
Imep+MCPA+Seth+Sun-itII	0.2+4+3+0.18G	1	98	99
Bent+MCPA-dma+Seth+Scoil	8+4+3+0.18G	9	98	98
Untreated	0	0	0	0
C.V. %		65	14	11
LSD 5%		6	17	14
# OF REPS		4	4	4

Summary

None of the treatments caused important injury to flax. Thifensulfuron + sethoxydim treatments all gave satisfactory (> 8%) control of redroot pigweed and green and yellow foxtail. The redroot pigweed control from sethoxydim and foxtail control from thifensulfuron without sethoxydim indicates sprayer contamination.

Weed control in flax, Hettinger 1991. The experiment was one of several locations to evaluate broadspectrum weed control in flax. 'Neche' flax was seeded May 9. Treatments were applied to 5-inch flax, 6.5-leaf foxtail, and 3-inch kochia on June 10 with 73 F, 80% RH, clear sky, and 3 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 3.5 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	KOCZ	Fxtl
	oz/A	---- % -----	
MCPA+Sethoxydim+Scoil	4+3+0.18G	27	92
Bromoxynil+Sethoxydim+Scoil	4+3+0.18G	26	91
Thifensulfuron+Seth+Scoil	0.06+3+0.18G	32	96
Thifensulfuron+Seth+Scoil	0.12+3+0.18G	65	87
Thifensulfuron+Seth+Moract	0.06+3+0.18G	64	90
Thifensulfuron+Seth+Moract	0.12+3+0.18G	50	92
Thifensulfuron+MCPA	0.06+4	70	0
Thifensulfuron+Brox	0.06+4	87	0
Thifensulfuron+MCPA+Seth+Scoil	0.06+4+3+0.18G	65	89
Thifensulfuron+MCPA+Seth+Moract	0.06+4+3+0.18G	66	79
Thifensulfuron+MCPA+Seth+Scoil	0.12+4+3+0.18G	74	91
Thifensulfuron+Brox+Seth+Scoil	0.06+4+3+0.18G	80	78
Thifensulfuron+Brox+Seth+Moract	0.06+4+3+0.18G	78	88
Thifensulfuron+Brox+Seth+Scoil	0.12+4+3+0.18G	91	87
Sethoxydim+Scoil	3+0.18G	0	96
Bromoxynil+Diclofop+Moract	4+12+0.18G	84	6
Imazethapyr+MCPA+Seth+Sun-itII	0.1+4+3+0.18G	21	81
Imazethapyr+Brox+Seth+Sun-itII	0.1+4+3+0.18G	90	72
Imazethapyr+MCPA+Seth+Sun-itII	0.2+4+3+0.18G	68	50
Bentazon+MCPA-dma+Seth+Scoil	8+4+3+0.18G	44	74
Untreated	0	0	0
C.V. %		47	16
LSD 5%		37	15
# OF REPS		4	4

Summary

None of the treatments caused important injury to flax so the data was not recorded. The greatest kochia control was from imazethapyr + bromoxynil and thifensulfuron + bromoxynil. The lack of kochia control from thifensulfuron indicates presence of resistant types or a response to the dry conditions.

Weed control in flax, Langdon 1991. 'Neche' flax was seeded May 28. Treatments were applied to 3 inch tall flax, 5 leaf barley, and 5 leaf foxtail on June 19 with 75 F, and partly cloudy sky. Treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Flax inj	barley	Grft	Colq
	oz/A		%		
MCPA+Sethoxydim+Scoil	4+3+0.18G	10	96	99	99
Bromoxynil+Seth+Scoil	4+3+0.18G	1	99	99	99
Thifensulfuron+Seth+Scoil	0.06+3+0.18G	6	99	98	99
Thifensulfuron+Seth+Scoil	0.12+3+0.18G	15	99	97	99
Thifensulfuron+Seth+Moract	0.06+3+0.18G	8	99	98	99
Thifensulfuron+Seth+Moract	0.12+3+0.18G	14	99	97	97
Thifensulfuron+MCPA	0.06+4	8	25	32	99
Thifensulfuron+Brox	0.06+4	11	0	0	99
Thifensulfuron+MCPA+Seth+Scoil	0.06+4+3+0.18G	11	99	99	99
Thifensulfuron+MCPA+Seth+Moract	0.06+4+3+0.18G	10	99	99	99
Thifensulfuron+MCPA+Seth+Scoil	0.12+4+3+0.18G	14	99	99	99
Thifensulfuron+Brox+Seth+Scoil	0.06+4+3+0.18G	16	99	97	99
Thifensulfuron+Brox+Seth+Moract	0.06+4+3+0.18G	12	99	99	74
Thifensulfuron+Brox+Seth+Scoil	0.12+4+3+0.18G	19	99	97	99
Sethoxydim+Scoil	3+0.18G	8	99	99	50
Bromoxynil+Diclofop+Moract	4+12+0.18G	1	18	97	95
Imazethapyr+MCPA+Seth+Sun-itII	0.1+4+3+0.18G	5	99	99	99
Imep+Brox+Seth+Sun-itII	0.1+4+3+0.18G	2	99	96	98
Imep+MCPA+Seth+Sun-itII	0.2+4+3+0.18G	7	99	99	99
Bent+MCPA-dma+Seth+Scoil	8+4+3+0.18G	5	99	99	99
Untreated	0	0	0	0	0
C.V. %		57	22	12	19
LSD 5%		7	26	15	24
# OF REPS		4	4	4	4

Summary

None of the treatments caused important injury to flax. Weed densities were extremly sparse making evaluation difficult. Volunteer barley and green foxtail were controlled by sethoxydim.

Weed control in flax, Minot 1991. 'Linton' flax was seeded May 17. Treatments were applied to 12- to 18-inch flax, 6- to 9-inch green foxtail, 6 inch wild buckwheat, 6- to 18-inch kochia, and 4 inch prostrate pigweed on July 3 with 70 F, 80% RH, partly cloudy sky, and 3 to 6 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 8 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 September 4.

		7-10			8-03	
Treatment	Rate	Flax inj	Fxtl	KOCZ	Flax inj	8-04 Yield
	oz/A	----		%	----	bu/A
MCPA+Sethoxydim+Scoil	4+3+0.18G	0	94	30	0	6.9
Brox+Sethxoydim+Scoil	4+3+0.18G	0	94	37	0	9.1
Thifensulfuron+Seth+Scoil	0.06+3+0.18G	21	63	75	6	7.1
Thifensulfuron+Seth+Scoil	0.12+3+0.18G	23	78	76	1	6.9
Thifensulfuron+Seth+Moract	0.06+3+0.18G	20	86	72	1	7.3
Thifensulfuron+Seth+Moract	0.12+3+0.18G	26	93	79	4	8.2
Thifensulfuron+MCPA	0.06+4	15	0	63	6	6.9
Thifensulfuron+Brox	0.06+4	9	0	46	0	6.1
Thif+MCPA+Seth+Scoil	0.06+4+3+0.18G	18	76	52	3	6.1
Thif+MCPA+Seth+Moract	0.06+4+3+0.18G	24	70	91	5	6.6
Thif+MCPA+Seth+Scoil	0.12+4+3+0.18G	23	96	96	3	7.5
Thif+Brox+Seth+Scoil	0.06+4+3+0.18G	21	92	80	2	7.2
Thif+Brox+Seth+Moract	0.06+4+3+0.18G	21	86	83	3	7.8
Thif+Brox+Seth+Scoil	0.12+4+3+0.18G	20	84	71	3	8.0
Sethoxydim+Scoil	3+0.18G	0	99	0	0	8.1
Bromoxynil+Difp+Moract	4+12+0.18G	0	58	65	0	9.0
Imep+MCPA+Seth+Sun-itII	0.1+4+3+0.18G	0	71	57	3	8.2
Imep+Brox+Seth+Sun-itII	0.1+4+3+0.18G	0	62	68	1	8.4
Imep+MCPA+Seth+Sun-itII	0.2+4+3+0.18G	19	56	71	9	6.7
Bent+MCPA-dma+Seth+Scoil	8+4+3+0.18G	1	80	23	3	8.3
Untreated	0	0	0	0	0	8.5
C.V. %		69	36	43	167	27.2
LSD 5%		12	41	36	NS	NS
# OF REPS		4	3	4	4	4

Summary

Injury to flax occurred shortly after application of many treatments, but flax recovered from injury and yield was not reduced. The low percentage control of weed probably is because of their advanced size and dry condition at treatment.

Weed control in flax, Williston 1991. 'Flor' flax was seeded April 22. Treatments were applied to 4 inch tall flax, 1- to 3-inch Russian thistle, 2- to 5-inch green foxtail, 2- to 6-inch tame mustard, less than 1 inch redroot pigweed, and rosette kochia on May 30 with 64 F, 49% RH, clear sky, and 5 mph wind. Treatment applied with a plot sprayer mounted on G-Allis Chalmers with wind screen delivering 8.5 gpa at 32 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was on August 13.

Treatment[a]	Rate	Flax inj	Ruth	Grft	Tamu	Rrpw	Test wt	Yield
	oz/A	---------- % --------					lb/b	bu/A
MCPA+Seth+Scoil	4+3+0.18G	0	10	0	99	15	53	16.8
Brox+Seth+Scoil	4+3+0.18G	0	99	0	99	80	54	17.0
Thifensulfuron+Seth+Scoil	0.06+3+0.18G	11	99	99	8	99	53	20.5
Thifensulfuron+Seth+Scoil	0.12+3+0.18G	8	99	99	11	99	53	21.7
Thifensulfuron+Seth+Moract	0.06+3+0.18G	3	99	94	0	99	53	24.4
Thifensulfuron+Seth+Moract	0.12+3+0.18G	10	99	98	25	74	53	22.8
Thifensulfuron+MCPA	0.06+4	8	98	0	99	99	55	19.0
Thifensulfuron+Brox	0.06+4	8	99	0	99	99	54	17.1
Thif+MCPA+Seth+Scoil	0.06+4+3+0.18G	9	99	99	99	99	53	19.9
Thif+MCPA+Seth+Moract	0.06+4+3+0.18G	9	98	99	99	99	53	23.4
Thif+MCPA+Seth+Scoil	0.12+4+3+0.18G	10	98	98	72	98	53	22.8
Thif+Brox+Seth+Scoil	0.06+4+3+0.18G	11	99	98	99	98	53	19.7
Thif+Brox+Seth+Moract	0.06+4+3+0.18G	11	98	97	99	99	53	21.7
Thif+Brox+Seth+Scoil	0.12+4+3+0.18G	13	99	97	71	99	53	20.4
Sethoxydim+Scoil	3+0.18G	0	0	99	0	0	54	23.4
Brox+Difp+Moract	4+12+0.18G	0	96	66	85	55	54	19.6
Imep+MCPA+Seth+Sun-itII	0.1+4+3+0.18G	5	66	94	99	88	54	23.6
Imep+Brox+Seth+Sun-itII	0.1+4+3+0.18G	4	99	96	97	98	54	26.4
Imep+MCPA+Seth+Sun-itII	0.2+4+3+0.18G	4	65	92	87	90	53	21.2
Bent+MCPA-dma+Seth+Scoil	8+4+3+0.18G	0	99	98	99	40	54	22.8
Untreated	0	0	0	0	0	0	54	22.7
C.V. %		125	3	6	29	17	1	14.1
LSD 5%		NS	9	6	28	19	1	4.3
# OF REPS		4	4	4	4	4	4	4

[a]The MCPA and bromoxynil treatments with sethoxydim did not control sethoxydim indicating a possible omission of the sethoxydim.

Summary

None of the treatments caused important injury to flax. Flax yield generally related to weed control. Tame mustard was seeded to represent wild mustard and was tolerant to thifensulfuron. Russian thistle was controlled by all treatments containing thifensulfuron or bromoxynil. Thifensulfuron with MCPA or bromoxynil and sethoxydim gave good broadspectrum weed control without important injury to flax.

Herbicide evaluation in flax, Fargo 1991. 'Neche' flax was seeded May 15. Treatments were applied to 2- to 4-inch flax, 4 leaf wild mustard, and 1- to 3-inch kochia on June 3 with 78 F, 71% RH, partly cloudy sky, and 5 mph wind. Split treatments were applied June 10 to 3- to 6-inch flax and 4- to 7-leaf foxtail with 60 F, 65% 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 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		6/07	7/15				8/04
		Flax	Flax				Flax
Treatment	Rate	inj	inj	Fxtl	KOCZ	Wimu	yield
	oz/A	----------		%		----------	bu/A
Thifensulfuron+Sethoxydim+Scoil	0.12+3+0.18G	20	14	99	99	85	19.1
Thifensulfuron+Sethoxydim+DASH	0.12+3+0.25G	20	11	99	98	92	29.0
Thifensulfuron+Diclofop+Scoil	0.12+12+0.18G	26	20	41	99	93	20.0
Thifensulfuron+Quizalofop+Scoil	0.12+1+0.18G	27	24	89	99	97	20.3
Thifensulfuron+Quizalofop+PO	0.12+1+0.25G	16	13	99	99	83	19.7
Thifensulfuron+UBI-1956+Scoil	0.12+1+0.18G	15	22	94	99	98	19.4
Thifensulfuron+UBI-1956+PO	0.12+1+0.25G	20	21	94	99	91	26.3
Thif+MCPA-ioe+UBI-1956+Scoil	0.12+4+1+0.18G	15	7	90	99	99	22.0
Thif+Brox+UBI-1956+Scoil	0.12+4+1+0.18G	46	26	97	99	94	20.7
Thif+MCPA-ioe+UBI-1956+Scoil	0.06+4+1+0.18G	20	18	93	99	98	20.5
Thif+MCPA-ioe+UBI-1956+PO	0.06+4+1+0.25G	16	14	86	99	98	22.4
Thif+Brox+UBI-1956+PO	0.06+4+1+0.25G	66	45	99	97	68	16.7
Bent+MCPA-dma+DASH/Seth+DASH	8+2+.25G/2.4+0.25G	26	11	99	95	99	21.9
Bent+MCPA-dma+DASH/Seth+DASH	8+4+.25G/2.4+0.25G	28	17	99	97	98	21.2
Bent+MCPA-dma+DASH/Seth+DASH	12+2+.25G/2.4+0.25G	26	3	99	97	99	23.7
Bent+MCPA-dma+DASH/Seth+DASH	12+4+.25G/2.4+0.25G	37	21	99	98	97	15.9
Bent+MCPA-dma+Seth+DASH	8+4+3+0.25G	39	11	99	90	99	22.4
MCPA-ioe+Seth+DASH	4+3+0.25G	9	3	98	46	98	16.2
Untreated	0	0	0	0	0	0	8.2
C.V. %		37	54	8	9	12	28.9
LSD 5%		13	12	10	11	14	NS
# OF REPS		4	4	4	4	4	4

Summary

Flax was injured severely when thifensulfuron was applied with bromoxynil and UBI-1956, or sethoxydim. Kochia control exceeded 95% except when treated with MCPA + sethoxydim.

Bromoxynil with nicosulfuron in corn, Casselton. 'Interstate 343A' corn was seeded May 16. Treatments were applied to 4- to 5-leaf corn, 3-inch green and yellow foxtail, 2- to 6-inch kochia, 2- to 4-leaf redroot pigweed, and 3-inch wild mustard on June 7 with 70 F, 50% RH, clear 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 an 8 ft wide area the length of 10 by 30 ft plots. Experiment was a randomized complete block design with four replicates. Evaluations were on July 2 and August 13. Weed densities were foxtail more than 10 plants per sq ft and kochia 5 plants per sq meter.

Treatment	Rate	7/02			8/13		
		Coin	Fxtl	KOCZ	Fxtl	KOCZ	Colq
	oz/A	%					
Nicosulfuron+Bromoxynil+X-77	0.5+3+0.25%	2	83	99	54	90	79
Nicosulfuron+Bromoxynil+X-77	0.5+6+0.25%	0	77	98	42	97	98
Nicosulfuron+Brox+28N+X-77	0.5+6+4%+0.25%	5	86	98	54	83	89
Nicosulfuron+Bromoxynil+COC	0.5+3+1%	1	88	99	60	91	78
Nicosulfuron+Bromoxynil+COC	0.5+6+1%	4	79	98	50	97	83
Nicosulfuron+Brox+28N+COC	0.5+6+4%+1%	7	89	99	59	95	82
Nicosulfuron+Brox+Scoil	0.5+3+1%	2	91	99	60	92	63
Nicosulfuron+Brox+Scoil	0.5+6+1%	6	93	99	62	78	73
Nicosulfuron+Brox+28N+Scoil	0.5+6+4%+1%	9	91	99	55	88	67
Nicosulfuron+X-77	0.5+0.25%	0	79	99	63	89	28
Nicosulfuron+28N+X-77	0.5+4%+0.25%	0	90	99	72	76	25
Nicosulfuron+28N+COC	0.5+4%+1%	0	95	99	72	93	68
Nicosulfuron+Scoil	0.5+1%	1	95	99	66	92	62
Nicosulfuron+28N+Scoil	0.5+4%+1%	0	96	99	75	83	67
Bromoxynil	3	1	0	99	0	95	82
Bromoxynil	6	0	0	97	0	93	97
Bromoxynil+X-77	6+0.25%	2	0	99	25	99	99
Bromoxynil+28N+X-77	6+4%+0.25%	4	0	99	0	94	99
Bromoxynil+COC	6+1%	4	0	99	0	99	99
Bromoxynil+28N+COC	6+4%+1%	3	0	99	14	97	99
Bromoxynil+Scoil	6+1%	3	3	98	0	98	99
Bromoxymil+28N+Scoil	6+4%+1%	3	0	50	0	69	74
C.V. %		93	5	13	37	14	25
LSD 5%		3	4	17	20	18	27
OF REPS		4	4	4	4	4	4

Summary

None of the treatments cause important injury to corn, but injury was usually greatest with treatments containing 28% liquid nitrogen fertilizer. Bromoxynil did not reduce foxtail control from nicosulfuron in the presence of X-77. Foxtail control with nicosulfuron was increased by 28% nitrogen when with X-77 or Scoil, but not when bromoxynil was in combination with nicosulfuron. Petroleum oil adjuvant with nicosulfuron alone was not included, but as with X-77 the 28% nitrogen adjuvant did not increase foxtail control from nicosulfuron plus bromoxynil. These data indicate that 28% nitrogen with surfactant and oil adjuvants enhances foxtail control from nicosulfuron, but not when in the presence of bromoxynil.

Nicosulfuron with broadleaf herbicides in corn, Casselton. 'Interstate 343A' corn was seeded on May 16. Treatments were applied to 5-leaf corn, 8.5-inch kochia, 4- to 8-inch foxtail, 6-inch wild mustard, and 2.5- to 3-inch redroot pigweed on June 14 with 80 F, 70% relative humidity, partly cloudy sky and 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 35 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replicates. Foxtail, green and yellow, density was greater than 50 per square meter and broadleaf weeds less than 5 per square meter.

Treatment	Rate (oz/A)	6/26 Fxtl	Rrpw	Colq	KOCZ	Coin	8/02 Fxtl
		(%)					
Nicosulfuron+X-77	0.25+ 0.25%	84	98	72	77	0	87
Nicosulfuron+Scoil	0.25+1%	91	99	73	94	0	97
Nicosulfuron+Dica-dma+X-77	0.25+4+0.25%	83	99	99	97	1	81
Nicosulfuron+Dica-dma+Scoil	0.25+4+1%	84	99	99	98	2	93
Nicosulfuron+Dica-Na+X-77	0.25+4+0.25%	78	99	99	96	1	82
Nicosulfuron+Dica-Na+Scoil	0.25+4+1%	78	99	99	96	1	81
Nicosulfuron+2,4-D-dma+X-77	0.25+4+0.25%	72	97	99	86	5	80
Nicosulfuron+2,4-D-dma+Scoil	0.25+4+1%	80	99	99	96	3	91
Nicosulfuron+2,4-D-bee+X-77	0.25+4+0.25%	74	98	99	92	5	77
Nicosulfuron+2,4-D-bee+Scoil	0.25+4+1%	82	99	99	93	2	91
Nicosulfuron+Dica-dma+X-77	0.25+8+0.25%	82	99	99	96	2	81
Nicosulfuron+Dica-dma+Scoil	0.25+8+1%	84	99	99	99	3	92
Nicosulfuron+Dica-Na+X-77	0.25+8+0.25%	78	99	99	98	3	81
Nicosulfuron+Dica-Na+Scoil	0.25+8+1%	77	99	99	97	4	82
Nicosulfuron+2,4-D-dma+X-77	0.25+8+0.25%	75	98	99	95	6	73
Nicosulfuron+2,4-D-dma+Scoil	0.25+8+1%	83	99	99	96	9	91
Nicosulfuron+2,4-D-bee+X-77	0.25+8+0.25%	60	99	99	93	5	58
Nicosulfuron+2,4-D-bee+Scoil	0.25+8+1%	69	98	99	91	8	69
Dicamba-dma+X-77	8+0.25%	0	99	99	99	5	0
Dicamba-dma+Scoil	8+1%	0	99	99	99	8	0
Dicamba-Na+X-77	8+0.25%	0	99	99	99	6	0
Dicamba-Na+Scoil	8+1%	0	99	99	99	6	0
2,4-Ddma+X-77	8+0.25%	0	94	99	89	7	0
2,4-Ddma+Scoil	8+1%	0	99	99	95	9	10
2,4-Dbee+X-77	8+0.25%	0	92	99	93	9	0
2,4-Dbee+Scoil	8+1%	0	97	99	92	5	0
C.V. %		6	3	2	6	85	9
LSD 5%		4	4	3	8	5	7

Summary

None of the herbicide treatments caused important injury to corn. Dicamba or 2,4-D in mixture with nicosulfuron generally reduced green and yellow foxtail control and increased common lambsquarters control compared to nicosulfuron applied alone. Wild mustard was completely controlled by all herbicides (data not presented). Foxtail control with nicosulfuron was antagonized more by 2,4-D-bee at 8 oz/A than at 4 oz/A. However, rate of 2,4-D-dma generally did not influence antagonism of nicosulfuron. Foxtail control with nicosulfuron was less when applied with dicamba-Na than dicamba-dma when with Scoil adjuvant but not with the nonionic surfactant X-77. Foxtail control was greater when nicosulfuron was applied with Scoil than X-77 adjuvant, except when with dicamba-Na. These results indicate that nicosulfuron mixtures with 2,4-D and dicamba increase spectrum of weeds controlled and that formulation of broadleaf control herbicides and adjuvant all influence level of weed control.

Wild proso millet control in corn with nicosulfuron, Leonard. The experiment was conducted on the Lyle and Roger Olson farm northwest of Leonard ND. 'Dahlgren 440' corn was seeded on May 10. Early treatments (EP) were applied to 4-leaf corn and 2- to 3 -leaf wild proso millet on May 31 with 75 F, 85% RH, clearing sky, no wind, and a light rain that occurred leaving some moisture on the leaves. Late treatments (Post) were applied to 5- to 6-leaf corn and wild proso millet on June 10 with 75 F, 50% RH, partly cloudy sky, and 10 mph wind. Treatment were applied with a bicycle wheel type plot sprayer delivering 20 gpa at 35 psi through 8002 flat fan nozzles, except treatments designated at 8.5 gpa with 8001 flat fan nozzles, to an 8 ft wide area the length of 8 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation for porso millet control were on June 26 and August 15. Stand counts were on July 2, and 26. Fresh weight of wild proso millet for 4 ft^2 was determined on August 15.

Treatment[a]	Rate	7/02	7/26	7/26	8/15
		Wild proso millet			
		pl/4ft^2	ht	frwt	control
	oz/A	-- No --	cm	g	-- % --
Untreated	0	118	105	122	635	0	0
Nicosulfuron+X-77(EP)	0.5+0.25%	12	11	95	60	81	74
Nicosulfuron+X-77+28N(EP)	0.5+0.25%+4%	6	7	90	93	86	77
Nicosulfuron+PrimeOil(EP)	0.5+1%	18	5	88	76	87	81
Nico+PrimeOil+28N(EP)	0.5+1%+4%	21	19	98	276	79	57
Nicosulfuron+Scoil(EP)	0.5+1%	5	7	77	57	88	86
Nico+PrimeOil+28N(EP)	0.75+1%+4%	3	4	99	34	86	86
Nico+PrimeOil+28N(EP)	1.0+1%+4%	3	4	104	40	90	88
Nico+PrimeOil+28N(Post)	0.5+1%+4%	47	2	16	32	69	97
Nico+PrimeOil+28N(Post)	0.75+1%+4%	44	2	25	50	76	97
Nico+PrimeOil+28N(Post)	1.0+1%+4%	32	1	9	22	73	99
N+POil+28N/N+POil+28N(EP/P)	0.5+1%+4%/0.5+1%+4%	1	0	1	1	98	99
Nico+PrimeOil(Post)	0.5+1%	47	8	37	20	67	93
Nico+Scoil(Post)	0.5+1%	44	1	35	15	72	97
Nico+X-77(8.5gpa)(EP)	0.5+0.25%	10	10	78	144	87	84
Nicosulfuron+ExpN(EP)	0.5+2%	4	3	91	120	86	83
Nico+Scoil(8.5gpa)(EP)	0.5+1%	21	11	77	91	82	73
Nico+Scoil+28N(EP)	0.5+1%+4%	3	3	81	54	90	87
Nico+Scoil+28N(Post)	0.5+1%+4%	14	1	19	15	81	97
C.V. %		107	134	31	84	6	10
LSD 5%		36	20	29	115	7	11
# OF REPS		4	4	4	4	4	4

[a]N=Nicosulfuron and POil=PrimeOil.

Summary

None of the treatments injured corn, data not presented. At the early application, 28% N fertilizer enhanced wild proso millet control with nicosulfuron applied with X-77, reduced control with prime oil, and did not influence control when with soil. At the late application control of wild proso millet was to great for expression of differences among treatments. None of the early nicosulfuron applications exceed 88% wild proso millet control at the August 15 evaluation indicating that some plants emerged after treatment.

Nicosulfuron with 28% nitrogen and adjuvants, Fargo. 'Interstate 343A' corn was seeded May 17. Treatments were applied to 4-leaf corn, 4- to 8 -inch proso and foxtail millet, 4- to 6 -inch redroot pigweed, 2- to 6 -inch yellow foxtail and 2- to 4 -inch kochia on June 19 with 67 F, 60% RH, partly cloudy sky, and 2- to 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with a factorial arrangement with four replicates.

Treatment	Rate	7/15			8/02			
		Prmi	Fxmi	Yeft	Prmi	Fxmi	Yeft	KOCZ
	oz/A	%						
Nico+AMS+PO(DW)	0.5+32+1%	67	77	69	71	69	54	56
Nico+AMS+SCOIL(DW)	0.5+32+1%	77	80	79	79	72	81	63
Nico+AMS+X-77(DW)	0.5+32+0.25%	67	77	79	71	66	74	21
Nico+PO(DW)	0.5+1%	65	77	67	69	69	49	59
Nico+SCOIL(DW)	0.5+1%	79	80	76	81	74	72	66
Nico+X-77(DW)	0.5+0.25%	64	75	73	68	60	68	44
Nico+28N+PO(DW)	0.5+4%+1%	82	82	85	89	88	85	63
Nico+28N+SCOIL(DW)	0.5+4%+1%	84	87	90	96	93	93	86
Nico+28N+X-77(DW)	0.5+4%+0.25%	83	86	88	94	91	91	79
Nico+AMS+PO(DW)	0.25+32+1%	57	75	65	60	62	60	47
Nico+AMS+SCOIL(DW)	0.25+32+1%	63	72	65	66	59	40	59
Nico+AMS+X-77(DW)	0.25+32+0.25%	53	71	63	50	57	49	33
Nico+PO(DW)	0.25+1%	50	67	48	42	52	30	52
Nico+SCOIL(DW)	0.25+1%	65	73	74	68	57	69	71
Nico+X-77(DW)	0.25+0.25%	45	65	53	38	51	42	42
Nico+28N+PO(DW)	0.25+4%+1%	72	80	77	79	76	81	61
Nico+28N+SCOIL(DW)	0.25+4%+1%	84	85	87	94	86	83	84
Nico+28N+X-77(DW)	0.25+4%+0.25%	72	81	72	81	79	86	77
LSD 5%		8	4	14	10	8	23	17
# OF REPS		4	4	4	4	4	4	4

Summary

The spray carrier was distilled water to determine the influence of adjuvants independent of salts. Corn was not injured by any treatments so the data is included. Further, redroot pigweed was completely controlled with all treatments so the data is not included. Control of all weed species at both evaluation dates generally was greatest when nicosulfuron was applied with Scoil followed by petroleum oil and X-77 adjuvants, regardless of rate or salt adjuvants. Nicosulfuron control of all species generally was greater when applied with 28% liquid nitrogen fertilizer than alone or with diammonium sulfate (AMS), regardless of other adjuvants.

Adjuvants with nicosulfuron, Fargo. 'Interstate 343A'corn, white proso millet, and Siberian foxtail were seeded in adjacent 6 to 10 ft wide strips as bioassay species on May 17. The area contained a natural infestation of yellow foxtail, kochia, and common lambsquarters. Treatments were applied to 5-leaf corn, 6- to 12-inch proso millet, 4- to 12-inch foxtail millet, 4- to 12-inch kochia, 1- to 3- inch common lambsquarters, and 2- to 6-inch tall yellow foxtail on June 18 with 80 F, 55 RH, and 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Adjuvants with nicosulfuron at 0.25 oz/A	Rate	7/12				7/31				
		Colq	KOCZ	Prmi	Fxmi	Prmi	Fxmi	Colq	Yeft	KOCZ
	oz/A	%								
Agridex	1%	39	58	69	80	61	76	8	38	55
Ammonium hydroxide	2%	20	27	53	62	54	66	9	37	30
DC-5309,	0.25%	38	67	67	80	61	73	11	34	40
Exp N	2.0%	63	71	78	84	81	84	11	74	58
Exp PD	2.6%	62	82	81	87	81	85	6	63	68
Exp PM	2.0%	39	67	69	81	68	77	5	34	56
Exp S	2.0%	45	59	81	87	84	86	8	67	58
Herbimax	1%	51	60	63	73	60	71	10	36	57
Li-700	0.25%	30	30	46	60	54	69	13	39	20
Trisert-C13	2%	24	48	71	81	76	79	10	56	40
PO,Moract	1%	49	68	81	87	81	83	11	57	63
R-11	0.25%	35	30	57	66	66	63	9	34	25
Scoil	1%	69	79	83	87	85	85	16	83	67
Silowett	0.25%	48	61	76	80	69	76	8	54	51
MSO	1%	67	81	87	88	86	85	9	64	66
X-77	0.25%	36	54	65	76	68	74	9	46	41
LSD 0.5%		23	20	10	7	9	7	8	17	19

Summary

White proso millet control exceeded 80% when nicosulfuron was applied with Exp PD, Exp S, Mor-act, Scoil, and MSO, but yellow foxtail control only exceeded 80% when nicosulfuron was applied with Scoil. Kochia control with nicosulfuron was enhanced the most by Scoil, MSO, and petroleum oil adjuvants. Surfactants which were included at 0.25% (v/v) generally were less effective adjuvants than the oil adjuvants applied at 1%.

Nicosulfuron with dicamba in corn, Casselton. 'Interstate 343A' corn was seeded May 16. Treatments were applied to 4-leaf corn, 3- to 7-leaf foxtail, 2- to 5-inch kochia, 4- to 6-leaf redroot pigweed, and 3- to 8-inch common lambsquarters on June 11 with 75 F, 60% RH, clear sky, 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

			7/02				8/14			
Treatment	Rate	Corn inj	Fxtl	KOCZ	Rrpw	Colq	Fxtl	Rrpw	KOCZ	Colq
	oz/A	---------- % ----------								
Nicosulfuron+X-77	0.12+0.25%	0	43	64	94	29	27	72	41	25
Nicosulfuron+X-77	0.25+0.25%	0	64	80	98	40	46	98	42	8
Nicosulfuron+X-77	0.5+0.25%	0	75	96	99	54	55	99	68	26
Nicosulfuron+Scoil	0.12+1%	0	76	99	98	49	61	99	77	5
Nicosulfuron+Scoil	0.25+1%	0	90	99	99	79	78	99	93	46
Nicosulfuron+Scoil	0.5+1%	0	96	99	99	95	91	99	97	67
Nico+Dica-dma+X-77	0.12+1+0.25%	0	57	99	98	99	39	99	99	95
Nico+Dica-dma+X-77	0.12+2+0.25%	0	48	99	99	99	29	99	99	99
Nico+Dica-dma+X-77	0.12+4+0.25%	0	51	99	99	99	26	99	99	97
Nico+Dica-dma+X-77	0.25+1+0.25%	0	75	99	99	99	67	99	99	99
Nico+Dica-dma+X-77	0.25+2+0.25%	0	71	99	98	99	52	99	99	99
Nico+Dica-dma+X-77	0.25+4+0.25%	0	74	99	99	99	52	99	99	99
Nico+Dica-dma+X-77	0.5+1+0.25%	0	74	99	99	99	70	99	99	99
Nico+Dica-dma+X-77	0.5+2+0.25%	0	83	99	99	99	72	99	99	99
Nico+Dica-dma+X-77	0.5+4+0.25%	0	80	99	99	99	72	99	99	99
Nico+Dica-dma+Scoil	0.12+1+1%	0	79	99	99	98	66	99	98	99
Nico+Dica-dma+Scoil	0.12+2+1%	0	76	99	99	99	59	99	99	98
Nico+Dica-dma+Scoil	0.12+4+1%	0	74	99	99	99	59	99	99	99
Nico+Dica-dma+Scoil	0.25+1+1%	0	91	99	99	99	86	99	98	97
Nico+Dica-dma+Scoil	0.25+2+1%	0	88	99	99	99	81	99	99	99
Nico+Dica-dma+Scoil	0.25+4+1%	0	89	99	93	99	82	99	99	99
Nico+Dica-dma+Scoil	0.5+1+1%	0	95	99	99	99	92	99	99	99
Nico+Dica-dma+Scoil	0.5+2+1%	0	94	99	99	99	94	99	99	99
Nico+Dica-dma+Scoil	0.5+4+1%	0	93	99	99	99	90	99	99	99
Dica-dma+X-77	1+0.25%	0	0	99	64	99	0	99	99	99
Dica-dma+X-77	2+0.25%	0	0	99	96	99	0	99	99	99
Dica-dma+X-77	4+0.25%	0	0	99	99	99	0	99	99	99
Dica-dma+Scoil	1+1%	0	0	99	81	99	0	99	99	99
Dica-dma+Scoil	2+1%	0	0	99	97	99	0	99	99	99
Dica-dma+Scoil	4+1%	0	3	99	99	99	0	99	99	99
Untreated	0	0	0	0	0	0	0	0	0	0
LSD 5%			7	5	11	10	11	12	12	16
# OF REPS		4	4	4	4	4	4	4	4	4

Summary

None of the treatments cause any injury to corn. Dicamba in combination with nicosulfuron and either X-77 or Scoil gave similar foxtail control to nicosulfuron applied without dicamba. The nicosulfuron and dicamba mixtures nearly all gave complete control of kochia and redroot pigweed. Foxtail control was always greater when nicosulfuron was applied with Scoil than when with X-77. These data generally indicate that dicamba-dma did not antagonize weed control by nicosulfuron and that weed control was enhanced more by Scoil than X-77 adjuvant.

Nicosulfuron with dicamba in corn, Fargo. 'Interstate 343A' corn was seeded May 22. Treatments were applied to 4-leaf corn, 4- to 8-inch proso and Siberian millet, 2- to 4-inch kochia, 4- to 6-inch redroot pigweed, and 2- to 6-inch yellow foxtail on June 19 with 67 F, 60% RH, partly cloudy sky, adn 2- to 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		7/12						8/01					
Treatment	Rate	Corn inj	Prmi	Sift	KOCZ	Rrpw	Yeft	Corn inj	Prmi	Sift	KOCZ	Rrpw	Yeft
	oz/A	%											
Nicosulfuron+X-77	0.12+0.25%	0	37	71	18	82	44	0	28	44	16	92	30
Nicosulfuron+X-77	0.25+0.25%	0	63	82	47	88	54	0	51	67	26	95	48
Nicosulfuron+X-77	0.5+0.25%	0	79	87	65	91	82	0	71	85	51	97	53
Nicosulfuron+Scoil	0.12+1%	0	77	85	72	92	86	0	65	74	56	92	59
Nicosulfuron+Scoil	0.25+1%	0	88	94	89	94	93	0	84	92	60	99	81
Nicosulfuron+Scoil	0.5+1%	0	87	96	94	94	94	0	96	98	81	99	90
Nico+Dica-dma+X-77	0.12+1+0.25%	0	29	57	88	89	23	0	22	31	97	96	23
Nico+Dica-dma+X-77	0.12+2+0.25%	0	14	26	98	93	25	0	8	8	99	99	11
Nico+Dica-dma+X-77	0.12+4+0.25%	0	29	44	99	96	15	0	9	3	99	99	5
Nico+Dica-dma+X-77	0.25+1+0.25%	0	71	83	96	92	60	0	46	54	93	98	41
Nico+Dica-dma+X-77	0.25+2+0.25%	0	68	82	96	94	67	0	41	47	99	98	44
Nico+Dica-dma+X-77	0.25+4+0.25%	0	60	78	98	98	55	0	37	48	99	99	39
Nico+Dica-dma+X-77	0.5+1+0.25%	0	81	86	91	93	83	0	69	76	85	99	51
Nico+Dica-dma+X-77	0.5+2+0.25%	0	79	87	94	94	71	0	70	72	96	99	52
Nico+Dica-dma+X-77	0.5+4+0.25%	0	87	87	99	97	80	0	84	69	99	99	50
Nico+Dica-dma+Scoil	0.12+1+1%	0	76	84	97	92	78	0	63	59	98	95	52
Nico+Dica-dma+Scoil	0.12+2+1%	0	78	84	98	95	86	0	60	56	99	99	60
Nico+Dica-dma+Scoil	0.12+4+1%	0	77	82	99	98	76	0	69	57	99	99	46
Nico+Dica-dma+Scoil	0.25+1+1%	0	87	90	96	96	92	0	87	87	92	99	77
Nico+Dica-dma+Scoil	0.25+2+1%	0	85	88	98	98	88	0	88	80	99	99	72
Nico+Dica-dma+Scoil	0.25+4+1%	0	87	89	99	98	87	0	89	80	99	99	68
Nico+Dica-dma+Scoil	0.5+1+1%	0	89	96	98	98	97	0	97	99	95	99	88
Nico+Dica-dma+Scoil	0.5+2+1%	0	88	93	98	98	97	0	96	97	99	99	88
Nico+Dica-dma+Scoil	0.5+4+1%	1	91	95	99	99	96	0	98	96	99	99	90
Dicamba-dma+X-77	1+0.25%	0	0	0	97	80	0	0	0	0	99	94	0
Dicamba-dma+X-77	2+0.25%	0	1	5	99	88	0	1	1	0	99	98	0
Dicamba-dma+X-77	4+0.25%	0	0	0	99	98	0	0	3	0	99	99	0
Dicamba-dma+Scoil	1+1%	0	0	0	99	80	0	0	0	0	99	96	0
Dicamba-dma+Scoil	2+1%	1	0	0	99	94	0	1	0	0	99	98	0
Dicamba-dma+Scoil	4+1%	0	0	0	99	98	0	1	3	0	99	95	0
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD 5%			9	7	5	5	16		10	9	8	3	19
OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

Summary

None of th herbicide treatments injured corn. Dicamba-dma in combination with nicosulfuron at 0.12 oz/A applied with surfactant X-77 was generally antagonistic to proso millet, Siberian foxtail, and yellow foxtail control compared to nicosulfuron alone with X-77. The antagonism was not evident at the higher nicosulfuron rates or when applied with Scoil at the early evaluation. At the late evaluation the antagonism of nicosulfuron for grass weed control was also evident with the nicosulfuron at 0.12 oz/A applied with Scoil. Kochia and redroot pigweed were effectively controlled when dicamba at 1 to 4 oz/A was included in the treatment. These results indicate that dicamba maybe antagonistic to grass weed control with nicosulfuron when control levels are low and are contrary to resultrs at Casselton. Dicamba was not antagonistic to yellow foxtail control at Casselton.

Nicosulfuron with dicamba and 28% nitrogen in corn, Fargo. 'Interstate 343A' corn was seeded on May 16. Treatments were applied to 5-leaf corn, 5- to 12-inch yellow foxtail, 4- to 12-inch redroot pigweed, 5- to 10-inch common lambsquarters, and 6- to 15-inch kochia on June 17 with 89 F, 70% RH, partly cloudy sky, 5- to 20-mph wind, and a light rain occurred 45 minutes after first 24 treatments were applied and remaining 12 treatments were applied 45 minutes after rain. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a RBCD with four replicates.

		7/09					8/14				
Treatment[a]	Rate	Coin	Yeft	Rrpw	Colq	KOCZ	Coin	Yeft	Rrpw	KOCZ	Colq
	oz/A	%									
Nicosulfuron+X-77(DW)	0.5+0.25%	0	65	80	45	53	0	61	94	50	29
Nicosulfuron+PO(DW)	0.5+1%	0	66	78	33	48	0	64	94	42	19
Nicosulfuron+Scoil(DW)	0.5+1%	0	73	86	58	76	0	79	97	65	45
Nicosulfuron+28N+X-77(DW)	0.5+4%+0.25%	0	87	88	73	81	0	94	98	71	49
Nicosulfuron+28N+PO(DW)	0.5+4%+1%	0	80	86	45	62	0	88	98	47	29
Nicosulfuron+28N+Scoil	0.5+4%+1%	0	89	91	80	92	0	98	99	89	73
Nicosulfuron+X-77(NW)	0.5+0.25%	0	83	85	67	67	0	92	99	58	58
Nicosulfuron+PO(NW)	0.5+1%	0	81	87	58	79	0	90	99	70	46
Nicosulfuron+Scoil(NW)	0.5+1%	0	84	89	71	85	0	93	99	73	61
Nicosulfuron+28N+X-77(NW)	0.5+4%+0.25%	0	88	85	71	90	0	91	99	89	62
Nicosulfuron+28N+PO(NW)	0.5+4%+1%	0	84	88	75	86	0	94	99	75	62
Nicosulfuron+28N+Scoil(NW)	0.5+4%+1%	0	94	92	81	93	0	98	99	87	75
Nico+Dica-dma+X-77(DW)	0.5+4+0.25%	0	67	92	94	94	0	66	99	97	99
Nico+Dica-dma+PO(DW)	0.5+4+1%	0	67	87	96	94	0	64	99	98	99
Nico+Dica-dma+Scoil(DW)	0.5+4+1%	0	82	91	97	96	1	83	98	99	99
Nico+Dica-dma+28N+X-77(DW)	0.5+4+4%+0.25%	0	83	89	97	94	0	92	98	97	99
Nico+Dica-dma+28N+PO(DW)	0.5+4+4%+1%	0	84	91	97	95	0	87	99	98	99
Nico+Dica-dma+28N+Scoil(DW)	0.5+4+4%+1%	0	89	91	98	96	0	97	99	99	99
Nico+Dica-dma+X-77(NW)	0.5+4+0.25%	0	84	89	98	97	0	90	99	97	99
Nico+Dica-dma+PO(NW)	0.5+4+1%	0	81	90	95	95	0	89	99	98	99
Nico+Dica-dma+Scoil(NW)	0.5+4+1%	0	82	88	99	97	0	93	99	99	99
Nico+Dica-dma+28N+X-77(NW)	0.5+4+4%+0.25%	0	82	90	99	98	0	90	99	97	99
Nico+Dica-dma+28N+PO(NW)	0.5+4+4%+1%	1	82	91	97	95	0	93	99	98	99
Nico+Dica-dma+28N+Scoil(NW)	0.5+4+4%+1%	2	87	88	99	98	2	98	98	98	99
Dicamba-dma+X-77(DW)	4+0.25%	0	0	93	99	98	1	0	99	99	99
Dicamba-dma+PO(DW)	4+1%	0	0	96	99	98	2	0	99	99	99
Dicamba-dma+Scoil(DW)	4+1%	0	0	92	99	99	1	0	99	99	99
Dicamba-dma+28N+X-77(DW)	4+4%+0.25%	0	0	90	99	99	1	0	99	99	99
Dicamba-dma+28N+PO(DW)	4+4%+1%	0	0	95	99	99	1	0	99	99	99
Dicamba-dma+28N+Scoil(DW)	4+4%+1%	0	0	94	99	99	1	0	99	99	99
Dicamba-dma+X-77(NW)	4+0.25%	1	0	99	99	99	1	0	99	99	99
Dicamba-dma+PO(NW)	4+1%	0	0	98	99	99	0	0	99	99	97
Dicamba-dma+Scoil(NW)	4+1%	0	0	98	99	99	1	0	99	99	99
Dicamba-dma+28N+X-77(NW)	4+4%+0.25%	0	0	99	99	99	1	0	99	99	99
Dicamba-dma+28N+PO(NW)	4+4%+1%	0	0	99	99	99	0	0	99	99	99
Dicamba-dma+28N+Scoil(NW)	4+4%+1%	0	0	96	99	99	5	0	99	99	99
Untreated	0	0	0	0	0	0	0	0	0	0	0
LSD 5%		1	5	8	9	10	2	7	1	10	11

[a] DW=Distilled water and NW=water carrier with 3.6 g/L sodium bicarbonate.

Summary

Nicosulfuron control of all weeds was generally greater with Scoil than the X-77 or petroleum oil adjuvants. The inclusion of 28% nitrogen in addition to the surfactant X-77, petroleum oil, or Scoil adjuvants enhanced weed control from nicosulfuron. The sodium bicarbonate in the spray carrier generally increased weed control with nicosulfuron. Sodium bicarbonate along with 28% nitrogen tended to further increase nicosulfruon phytotoxicity to foxtail and some broadleaf weeds. Dicamba was not antagonistic to foxtail control with nicosulfuron and sodium bicarbonate was equally as effective as 28% nitrogen in enhancing foxtail control from nicosulfuron-dicamba treatments.

Nicosulfuron applied to corn at various stages, Casselton. 'Interstate 343A' Corn was seeded on May 16. Treatments were applied on June 14, 19, and 26 to V4, V5, V6, and V6-7 stage corn; 2 to 4, 3 to 8, 3 to 12, and 5 to 15 inch tall weeds, respectively. Treatment was nicosulfuron at 0.5 oz/A + petroleum oil with 17% Atplus 300F emulsifier + 28% N at 4%. Treatments were applied with a bicycle wheel plot type sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with six replicates. First hand weeding was on June 6 and as needed thereafter. Foxtail density was > 3 plants/ft^2 and broadleaf weeds < 5/yd^2.

Treatment, wks after seeding	Fxtl	Colq	Rrpw	KOCZ	Fxtl	Colq	KOCZ	Corn yield Wet wt	Corn yield Dry wt
	%							-g/25 ft row-	
3	72	3	99	57	65	12	58	1809	1596
4	96	26	99	72	88	52	75	2312	2030
5	89	44	99	53	67	75	60	2081	1793
6	72	25	99	53	30	61	50	1990	1669
Handweeded	99	99	99	99	99	99	99	2175	1955
Untreated	0	0	0	0	0	0	0	664	542
LSD 5%	13	12	0	16	10	35	16	377	348
# OF REPS	6	6	6	6	6	6	6	6	6

Summary

Weeds were not completely controlled by the treatments so the influence of treatment time was confounded by level of weed control. Treatments of corn 4 and 5 weeks after seeding gave corn yields equal to the hand weeded corn. Corn treated 3 weeks after emergence yield less than the hand weeded corn because of weed competition with the lower weed control from this application. Corn treated 6 weeks after planting tended to yield less than hand weeded corn because of early competition and reduced level of weed control.

Nicosulfuron plus Dicamba-dma and 28% N nitrogen, Fargo. 'Interstate 343A' corn was seeded May 17. Treatments were applied to 4-leaf corn, 4- to 8-inch Siberian and proso millet, 2- to 4-inch kochia, 4- to 6 -inch redroot pigweed, and 2- to 6-inch yellow foxtail on June 19 with 67 F, 60% RH, partly cloudy sky, and 2- to 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 an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		7/11						8/01					
Treatment	Rate	Corn inj	Prmi	Sift	KOCZ	Rrpw	Yeft	Corn inj	Prmi	Sift	KOCZ	Rrpw	Yeft
	oz/A	%						%					
Nicosulfuron+X-77(DW)	0.25+0.25%	0	36	68	49	88	57	0	28	39	34	95	28
Nicosulfuron+Scoil(DW)	0.25+0.18G	0	74	84	79	91	91	0	78	76	77	97	80
Nicosulfuron+28N+X-77(DW)	0.25+4%+0.25%	0	73	84	78	92	93	0	83	86	69	98	78
Nicosulfuron+28N+Scoil(DW)	0.25+4%+0.18G	1	83	89	93	93	96	1	92	96	91	99	86
Nicosulfuron+AMS+X-77(DW)	0.25+32+0.25%	1	65	81	61	92	77	1	64	73	59	97	56
Nico+AMS+Scoil(DW)	0.25+32+0.18G	0	76	84	72	91	88	0	81	81	74	97	68
Nico+Dica+X-77(DW)	0.25+4+0.25%	4	61	80	99	98	77	1	45	57	99	99	54
Nico+Dica+Scoil(DW)	0.25+4+0.18G	2	80	85	99	99	90	2	83	72	99	99	79
Nico+Dica+28N+X-77(DW)	0.25+4+4%+0.25%	3	72	84	98	98	93	2	81	80	99	99	78
Nico+Dica+28N+Scoil(DW)	0.25+4+4%+0.18G	3	85	89	98	99	96	3	97	95	99	99	91
Nico+Dica+AMS+X-77(DW)	0.25+4+32+0.25%	2	56	76	98	97	55	2	46	48	99	99	68
Nico+Dica+AMS+Scoil(DW)	0.25+4+32+0.18G	1	77	86	99	99	93	1	84	82	99	99	77
LSD 5%		2	9	6	6	3	12	2	8	9	11	2	16
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

Summary

In general 28% nitrogen adjuvant enhanced nicosulfuron toxicity to weed more than the diammonium sulfate adjuvant. Surfactant X-77 plus 28% nitrogen nearly enhanced nicosulfuron equal to the Scoil adjuvant alone, but when comparing similar treatments nicosulfuron toxicity to weeds was always greater with Scoil than X-77 adjuvant. Dicamba generally did not influence weed control with nicosulfuron regardless of adjuvants, except when with X-77 and diammonium sulfate.

Weed control in corn with soil applied herbicides, Casselton 1991. Preplant incorporated (ppi) herbicides were applied and twice field cultivated plus harrow incorporated the same day as planting. "Interstate 343A' variety corn was planted and preemergence (PE) herbicides were applied on May 16. Conditions were 67 F, clear sky, and moist soil with a dry surface. Postemergence treatments were applied June 16 to 4- to 5-leaf corn, 1 to 6 inch kochia, 1 to 4 inch redroot pigweed, 1 to 4 inch common lambsquarters, and 1 to 3 inch wild mustard. Conditions were 71 F, 65% H, 60% cloudy sky, wind 3 to 8 mph. All soil applied treatments were applied at 17 gpa, 35 psi, through 8002 flat fan nozzles and postemergence treatments at 8.5 gpa , 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates. Evaluation was on July 24.

Treatments	Rate	Fxtl	KOCZ	Rrpw	Wimu	CI
	lb/A			%		
EPTC&S&E (PPI)	5	91	74	95	80	0
EPTC&S&E + Cyanazine-DF (PPI)	4+1.5	97	93	97	98	0
Alachlor (PE)	3.5	95	83	96	80	0
Alachlor + Cyanazine-DF (PE)	3.5+1.5	98	96	98	97	0
Metolachlor (PE)	3	90	23	92	58	0
Metolachlor + Cyanazine-DF (PE)	3+1.5	94	97	98	99	0
Metolachlor + Cyanazine (Cycle) (PE)	4	93	95	95	91	0
Cyanazine-DF (PE)	3	69	97	86	89	0
Primisulfuron (PE)	0.018	84	99	99	97	9
Primisulfuron + Metolachlor (PE)	0.009+1.5	94	97	99	99	4
Primisulfuron + Metolachlor (PE)	0.018+3	97	99	99	99	16
Propachlor (PE)	4	94	88	91	76	0
Propachlor + Cyanazine-DF (PE)	4+1.5	95	97	94	91	0
ICIA5676 (PE)	1.75	94	94	98	89	0
ICIA5676 (PE)	2	95	98	97	87	0
ICIA5676 (PE)	2.25	97	97	98	86	0
ICIA5676 (PE)	2.4	97	92	99	87	0
ICIA5676 + Cyanazine-DF (PE)	1.75+1.5	92	97	97	96	0
ICIA5676 + Cyanazine-DF (PE)	2+1.5	93	98	99	95	0
ICIA5676 + Cyanazine-DF (PE)	2.25+1.5	98	93	94	91	0
Pendimethalin + Cyanazine-DF (PE)	1.25+1.5	66	92	89	89	0
Propachlor (PE)/Dicamba (POST)	4/0.25	98	99	99	99	24
Propachlor (PE)/2,4-D (Salvo) (POST)	4/0.19	94	95	96	93	3
Propachlor (PE)/2,4-D (Savage) (POST)	4/0.53	91	92	96	97	3
Untreated	0	0	0	0	0	0
C.V. %		8	10	6	12	86
LSD 5%		10	8	7	7	5

S=dichlormid safener; E=dietholate extender; PO=Petroleum oil with 17% emulsifier; DF=dry flowable formulation.

Summary

Generally adaquate weed control was observed for most treatments. A factor which contributed to this is over seven inches of precipitation was recorded for the month following application. Weed control was adaquate from ICIA5676 at all rates tested and was equal to or greater than other acetanilide herbicides. Addition of cyanazine usually increased weed control of most species. Primisulfuron applied alone or with metolachlor gave adaquate of all broadleaved weeds and foxtail. Injury rating of 16% was observed at evaluation, however, visable injury diminished through out the growing season. Savage (dry crystalline formulation of 2,4-D) controlled broadleaved weeds equal to Salvo (ester formulation of 2,4-D).

Weed control in corn with postemergence herbicides, Casselton 1991. "Interstate 343A' variety corn was planted on May 16. Postemergence treatments were applied June 15 to 4- to 5-leaf corn, 1 to 6 inch foxtail that had 4 to 5 leaves and 1 to 3 tillers, 1 to 5 inch kochia, 1 to 2 inch redroot pigweed, 0.5 to 1.5 inch common lambsquarters, 4 to 10 inch commom cocklebur, and 1 to 4 inch wild mustard. Conditions were 74 F, 57% H, clear sky, wind 0 to 3 mph. Postemergence directed treatments were made June 25 to 5- to 6-leaf corn, 3 to 8 inch foxtail, 3 to 8 inch kochia, 3 to 5 inch redroot pigweed, 2 to 4 inch common lambsquarters, 5 to 11 inch common cocklebur, and 2 to 5 inch wild mustard. Conditions were 76 F, 67% H, 60% cloudy sky,, and wind 0 to 5 mph. All postemergence treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates. Evaluation was on July 24.

Treatments	Rate	Fxtl	Rrpw	Colq	KOCZ	Wimu	Cocb	CI
	oz/A			%				
Metribuzin-DF+2,4-Ddma	1.5+4	11	99	99	84	99	92	6
Metribuzin-DF+2,4-Ddma	1.5+2.7	4	99	99	91	99	94	4
Thifensulfuron + X-77	0.063+0.125%	0	75	65	92	99	30	0
Thifensulfuron + X-77	0.063+0.25%	0	95	70	75	99	30	0
Thifensulfuron + PO	0.063+0.5%	0	83	70	73	99	28	0
Thifensulfuron + Scoil	0.063+0.5%	0	90	80	95	99	28	0
Thifensulfuron + X-77	0.125+0.125%	0	95	75	95	99	45	0
Thifensulfuron + X-77	0.125+0.25%	0	90	67	95	99	45	0
Thifensulfuron + PO	0.125+0.5%	0	99	80	90	97	25	0
Thifensulfuron + Scoil	0.125+0.5%	0	99	80	97	99	45	0
Thifensulfuron + Dicamba + X-77	0.063+4+0.25%	0	99	99	99	99	99	0
Thifensulfuron + Dicamba + X-77	0.063+6+0.25%	0	99	99	99	99	99	0
Thifensulfuron + Bromoxynil + X-77	0.063+4+0.25%	8	99	99	99	99	99	5
Thifensulfuron + Bromoxynil + X-77	0.063+6+0.25%	8	99	99	99	99	99	8
Thifensulfuron + Cyanazine-DF	0.063+6	55	99	99	99	99	95	0
Nicosulfuron + X-77	0.5+0.25%	75	99	30	83	99	0	0
Nicosulfuron + PO	0.5+1%	88	99	30	78	99	0	0
Nicosulfuron + MSO Plus	0.5+1%	93	99	55	97	99	44	0
Nicosulfuron + Scoil	0.5+1%	94	99	80	99	99	50	0
Nicosulfuron + Scoil	0.38+1%	93	99	65	96	99	40	0
Nicosulfuron + Scoil	0.25+1%	95	99	50	92	99	25	0
Nicosulfuron + Dicamba + X-77	0.5+4+0.125%	93	99	99	99	99	99	0
Nicosulfuron + Bromoxynil + X-77	0.5+4+0.125%	80	99	99	99	99	99	0
Nicosulfuron + 2,4-Ddma + X-77	0.5+6+0.25%	85	99	99	99	99	99	0
Bromoxynil	4	10	99	99	99	99	99	0
Bromoxynil & Atrazine	9	40	99	99	99	99	99	0
Bromoxynil & Atrazine	12	40	99	99	99	99	99	0
Bromoxynil + Atrazine + 2,4-Ddma (EP)	3+8+2	40	99	99	99	99	99	0
Pendimethalin + Cyanazine-DF (EP)	16+32	80	99	99	99	99	99	0
Ametryn + X-77 (PD)	1.6+0.5%	99	99	99	99	99	99	25
Paraquat + X-77 (PD)	4+0.25%	97	99	99	99	99	99	30
Untreated	0	0	0	0	0	0	0	0
C.V. %		18	5	24	5	6	19	118
LSD 5%		10	7	11	7	5	17	4

PO=petroleum oil with 17% emulsifier; DF=dry flowable formulation; X-77=nonionic surfactant; PD=postemergence directed.

Summary

A low rate of metribuzin with 2,4-D adequately controlled broadleaved weeds. This is a very cost effective treatment. Thifensulfuron applied alone with adjuvant did not injure corn. Some injury was observed when tank-mixed with bromoxynil. Scoil gave equal or greater control of broadleaved weeds than petroleum oil or X-77. No antagonism was observed from thifensulfuron/cyanazine tank-mix. Foxtail and broadleaf weed control from nicosulfuron with methylated seed oil adjuvants were equal or greater than petroleum oil or X-77. Nicosulfuron at 0.25 oz/A with Scoil gave equal or greater weed control than higher rates of nicosulfuron with other adjuvants used. Nicosulfuron tank-mixed with other broadleaf herbicides gave good to excellent control of all weeds. Bromoxynil alone or with atrazine gave excellent control of all broadleaved weeds.

Weed control in corn with postemergence herbicides, Carrington 1991. "Top Farm 1185' variety corn was planted on June 3. Preplant treatments were applied on May 29 and preemergence treatments applied June 5. Postemergence treatments were applied June 21 to 3- to 4-leaf corn, 1 to 4 inch foxtail that had 4 to 5 leaves and 1 to 2 tillers, 1 to 3 inch Russian thistle, 1 to 2 inch redroot pigweed, 0.5 to 1 inch common lambsquarters, 1 to 3 inch wild buckwheat, and 1 to 3 inch mustard spp. Mustard species include wild mustard, shepherdspurse, and field pennycress. Conditions were 77 F, 52% H, clear sky, wind 3 to 7 mph. All postemergence treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates. Evaluation was on July 24.

Treatments	Rate	Fxtl	Must	Rrpw	Ruth	Wibw	Colq	CI
	oz/A	---------- % ----------						
EPTC&S&E (PPI)	80	99	5	48	10	15	20	0
EPTC&S&E + Cyanazine-DF (PPI)	64+24	98	74	91	48	50	94	0
Alachlor + Cyanazine-DF (PE)	56+24	99	97	99	75	87	96	0
Metolachlor + Cyanazine-DF (PE)	48+24	98	84	99	35	55	99	0
Propachlor + Cyanazine-DF (PE)	64+24	94	99	87	49	67	94	0
ICIA5676 + Cyanazine-DF (PE)	32+24	99	97	99	72	99	99	0
Pendimethalin + Cyanazine-DF (PE)	20+24	91	99	97	82	96	94	0
Primisulfuron (PE)	0.29	92	99	97	48	61	84	12
Primisulfuron + Metolachlor (PE)	0.143+24	99	99	99	50	81	98	6
Primisulfuron + Metolachlor (PE)	0.29+48	99	99	99	69	87	99	12
Metribuzin-DF+2,4-Ddma	56/0.063+0.25%	85	99	99	65	85	90	0
Alachlor (PE)/Thifensulfuron + X-77	1.5+4	87	87	97	65	76	70	0
Thifensulfuron + Cyanazine-DF	0.063+6	92	99	99	46	82	18	0
Nicosulfuron + X-77	0.5+0.25%	99	99	99	49	41	41	0
Nicosulfuron + PO	0.5+1%	99	97	97	60	87	51	0
Nicosulfuron + MSO Plus	0.5+1%	96	99	99	56	85	62	0
Nicosulfuron + Scoil	0.5+1%	96	99	99	61	92	78	0
Nicosulfuron + Scoil	0.38+1%	99	99	99	65	66	64	0
Nicosulfuron + Scoil	0.25+1%	99	94	99	43	59	51	0
Nicosulfuron + Dicamba + X-77	0.5+4+0.125%	99	99	99	99	99	99	0
Nicosulfuron + Bromoxynil + X-77	0.5+4+0.125%	99	99	99	99	92	99	0
Nicosulfuron + 2,4-Ddma + X-77	0.5+6+0.25%	99	99	99	97	97	92	0
Cyanazine-DF + PO	20+0.25G	95	99	80	73	98	98	0
Pendimethalin + Cyanazine-DF (EP)	16+32	81	99	86	96	99	99	0
Dicamba + Atrazine-DF (EP)	6.6+12.6	82	99	99	99	99	99	0
Untreated		0	0	0	0	0	0	0
C.V. %		7	8	16	11	14	14	103
LSD 5%		9	7	9	10	9	15	3

S=dichlormid safener; E=dietholate extender; PO=petroleum oil with 17% emulsifier; DF=dry flowable formulation; X-77=nonionic surfactant.

Summary

ICIA5676 with cyanazine gave equal or greater weed control than other acetalinide herbicides tank-mixed with cyanazine. The highest rate of primisulfuron with metolachlor controlled all weeds except Russian thistle. Nicosulfuron with Scoil gave equal or greater control than nicosulfuron with other adjuvants. Nicosulfuron at 0.38 oz/A with Scoil gave greater equal or greater weed control than nicosulfuron at 0.50 oz/A with X-77.

Postemergence wild proso millet control in corn, Leonard 1991. "Dahlgren 440' variety corn was seeded in 30 inch rows May 13. Preemergence treatments were applied June 6 after existing proso millet was eliminated by hoeing the center two rows. Postemergence treatments were applied June 6 to corn in the V1 stage (1 to 4 inches tall) and wild proso millet in the 3 leaf stage (1.5 inches tall) to the 7 leaf stage (8 inches tall). Conditions were 72 F, 67% H, 50% cloudy sky, wind 7 to 10 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	June 27 Wipm	July 15 Wipm
	oz/A	%	
Propachlor + Cyanazine-DF (PE)	64+24	51	36
ICIA5676 + Cyanazine-DF (PE)	32+24	91	63
Pendimethalin + Cyanazine (PE)	20+24	92	80
Nicosulfuron + X-77	0.5+0.25%	53	48
Nicosulfuron + PO	0.5+1%	70	62
Nicosulfuron + MSO Plus	0.5+1%	92	83
Nicosulfuron + Scoil	0.5+1%	97	94
Nicosulfuron + Scoil	0.38+1%	90	83
Nicosulfuron + Cyanazine-DF	0.5+32	5	0
Pendimethalin + Cyanazine-DF (EP)	16+32	53	36
Untreated	0	0	0
C.V. %		15	10
LSD 5%		13	10

Summary

ICIA5676 with cyanazine gave greater wild proso millet control than propachlor with cyanazine. Methylated seed oil adjuvants gave better wild prosomillet control than other adjuvants used. Nicosulfuron at 0.38 oz/A with Scoil gave greater wild proso millet control than nicosulfuron with petroleum oil or X-77. Pendimethalin plus cyanazine (EP) did not provide good burndown of existing wild proso millet or residual control.

Postemergence quackgrass control in corn, Edgely 1991. "Pioneer 3787' variety corn was planted on May 8. Early postemergence treatments were applied May 20 to V1 stage corn, 4 to 8 inch quackgrass. Conditions were 72 F, 72% H, clear sky, wind 5 to 12 mph. Postemergence treatments were made June 13 to V4 to V5 corn and 4 to 10 inch quackgrass. Conditions were 78 F, 71% H, clear sky, and wind 6 to 12 mph. All postemergence treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 3 Qugr	July 24 Qugr
	oz/A	-------- % --------	
Primisulfuron + Scoil	0.38+1%	48	74
Primisulfuron + Scoil	0.76+1%	59	84
Primisulfuron + Scoil	1.52+1%	68	96
Nicosulfuron + Scoil	0.25+1%	52	85
Nicosulfuron + Scoil	0.5+1%	65	93
Nicosulfuron + Scoil	1+1%	74	98
Primisulfuron + Scoil (EP)/ Primisulfuron + Scoil (POST)	0.38+1% 0.38+1%	78	99
Primisulfuron + Scoil (EP)/ Primisulfuron + Scoil (POST)	0.76+1% 0.76+1%	92	99
Nicosulfuron + Scoil (EP)/ Nicosulfuron + Scoil (POST)	0.25+1% 0.25+1%	83	99
Nicosulfuron + Scoil (EP)/ Nicosulfuron + Scoil (POST)	0.5+1% 0.5+1%	95	99
Untreated		0	0
C.V. %		14	16
LSD 5%		8	10

Summary

The study was established along the edge of a non-till field where dense populations of grassgrass had become well established. All treatments provided adaquate quackgrass control at the July 24 evaluation except primisulfuron at 0.38 oz/A with Scoil. Sequential applications may not be needed to acheive adaquate quackgrass control with primisulfuron or nicosulfuron when Scoil is used.

Postemergence quackgrass control in corn, Edgely 1991. "Pioneer 3787' variety corn was planted on May 8. Postemergence treatments were made June 13 to V4 to V5 corn and 4 to 10 inch quackgrass. Conditions were 78 F, 71% H, clear sky, and wind 6 to 12 mph. All treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 3 Qugr	July 24 Qugr
	oz/A	%	
Primisulfuron + X-77	0.57+0.25%	60	65
Primisulfuron + PO	0.57+1%	71	72
Primisulfuron + MSO Plus	0.57+1%	74	88
Primisulfuron + Scoil	0.57+1%	79	93
Primisulfuron + X-77 + 28% N	0.57+0.25%+0.25G	69	88
Primisulfuron + PO + 28% N	0.57+1%+0.25G	76	93
Primisulfuron + MSO Plus + 28% N	0.57+1%+0.25G	82	95
Primisulfuron + Scoil + 28% N	0.57+1%+0.25G	84	97
Nicosulfuron + X-77	0.5+0.25%	54	73
Nicosulfuron + PO	0.5+1%	68	82
Nicosulfuron + MSO Plus	0.5+1%	75	88
Nicosulfuron + Scoil	0.5+1%	86	96
Nicosulfuron + X-77 + 28% N	0.5+1%+0.25G	56	86
Nicosulfuron + PO + 28% N	0.25+1%+0.25G	61	89
Nicosulfuron + MSO Plus + 28% N	0.5+1%+0.25G	83	96
Nicosulfuron + Scoil + 28% N	0.5+1%+0.25G	85	98
Untreated		0	0
C.V. %		7	11
LSD 5%		11	9

Summary

The study was established along the edge of a no-till field where dense populations of quackgrass had become well established. Addition of 28% N with X-77 or petroleum oil increased quackgrass control. Methylated seed oil adjuvants generally increased quackgrass control over other adjuvants used. There is no difference in control between primisulfuron and nicosulfuron at comparable rates with identical adjuvants.

Postemergence quackgrass control in corn, Edgely 1991. "Pioneer 3787' variety corn was planted on May 8. Postemergence treatments were made June 13 to V4 to V5 corn and 4 to 10 inch quackgrass. Conditions were 78 F, 71% H, clear sky, and wind 6 to 12 mph. All treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 3 Qugr	July 24 Qugr
	oz/A	%	
Primisulfuron + X-77	0.57+0.25%	60	65
Primisulfuron + PO	0.57+1%	71	72
Primisulfuron + MSO Plus	0.57+1%	74	88
Primisulfuron + Scoil	0.57+1%	79	93
Primisulfuron + X-77 + 28% N	0.57+0.25%+0.25G	69	88
Primisulfuron + PO + 28% N	0.57+1%+0.25G	76	93
Primisulfuron + MSO Plus + 28% N	0.57+1%+0.25G	82	95
Primisulfuron + Scoil + 28% N	0.57+1%+0.25G	84	97
Nicosulfuron + X-77	0.5+0.25%	54	73
Nicosulfuron + PO	0.5+1%	68	82
Nicosulfuron + MSO Plus	0.5+1%	75	88
Nicosulfuron + Scoil	0.5+1%	86	96
Nicosulfuron + X-77 + 28% N	0.5+1%+0.25G	56	86
Nicosulfuron + PO + 28% N	0.25+1%+0.25G	61	89
Nicosulfuron + MSO Plus + 28% N	0.5+1%+0.25G	83	96
Nicosulfuron + Scoil + 28% N	0.5+1%+0.25G	85	98
Untreated		0	0
C.V. %		7	11
LSD 5%		11	9

Summary

The study was established along the edge of a no-till field where dense populations of quackgrass had become well established. Addition of 28% N with X-77 or petroleum oil increased quackgrass control. Methylated seed oil adjuvants generally increased quackgrass control over other adjuvants used. There is no difference in quackgrass control between primisulfuron and nicosulfuron at comparable rates with identical adjuvants.

Postemergence quackgrass control in corn, Chaffee 1991. "DK-415' variety corn was planted on May 9. Early postemergence treatments were applied May 27 to V1 to V2 corn, 2 to 6 inch quackgrass. Conditions were 72 F, 69% H, clear sky, wind 5 to 10 mph. Postemergence treatments were made June 3 to V4 to V5 corn and 1 to 10 inch quackgrass. Conditions were 83 F, 76% H, cloudy sky, and wind 0 to 5 mph. All postemergence treatments were applied at 8.5 gpa , 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 3 Qugr	July 24 Qugr
	oz/A	------- % -------	
Primisulfuron + Scoil	0.38+1%	51	78
Primisulfuron + Scoil	0.76+1%	58	91
Primisulfuron + Scoil	1.52+1%	66	96
Nicosulfuron + Scoil	0.25+1%	55	85
Nicosulfuron + Scoil	0.5+1%	67	94
Nicosulfuron + Scoil	1+1%	76	97
Primisulfuron + Scoil (EP)/ Primisulfuron + Scoil (POST)	0.38+1% 0.38+1%	88	98
Primisulfuron + Scoil (EP)/ Primisulfuron + Scoil (POST)	0.76+1% 0.76+1%	91	99
Nicosulfuron + Scoil (EP)/ Nicosulfuron + Scoil (POST)	0.25+1% 0.25+1%	85	99
Nicosulfuron + Scoil (EP)/ Nicosulfuron + Scoil (POST)	0.5+1% 0.5+1%	94	99
Untreated		0	0
C.V. %		12	7
LSD 5%		11	8

Summary

The study was established in a field where light to moderate infestations of quackgrass had developed. All treatments controlled quackgrass at the July 24 evaluation except primisulfuron at 0.38 oz/A. Sequential applications may not be needed to control quackgrass with primisulfuron or nicosulfuron when Scoil is used.

Postemergence quackgrass control in corn, Chaffee 1991. "DK-415' variety corn was planted on May 9. Postemergence treatments were made June 3 to V4 to V5 corn and 1 to 10 inch quackgrass. Conditions were 83 F, 76% H, cloudy sky, and wind 0 to 5 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 3 Qugr	July 24 Qugr
	oz/A	-------- % --------	
Primisulfuron + X-77	0.57+0.25%	68	73
Primisulfuron + PO	0.57+1%	72	81
Primisulfuron + MSO Plus	0.57+1%	76	92
Primisulfuron + Scoil	0.57+1%	85	96
Primisulfuron + X-77 + 28% N	0.57+0.25%+0.25G	76	92
Primisulfuron + PO + 28% N	0.57+1%+0.25G	79	93
Primisulfuron + MSO Plus + 28% N	0.57+1%+0.25G	92	96
Primisulfuron + Scoil + 28% N	0.57+1%+0.25G	92	97
Nicosulfuron + X-77	0.5+0.25%	75	86
Nicosulfuron + PO	0.5+1%	86	89
Nicosulfuron + MSO Plus	0.5+1%	85	88
Nicosulfuron + Scoil	0.5+1%	95	96
Nicosulfuron + X-77 + 28% N	0.5+1%+0.25G	68	86
Nicosulfuron + PO + 28% N	0.25+1%+0.25G	73	89
Nicosulfuron + MSO Plus + 28% N	0.5+1%+0.25G	92	96
Nicosulfuron + Scoil + 28% N	0.5+1%+0.25G	95	98
Untreated		0	0
C.V. %		6	6
LSD 5%		7	7

Summary

The study was established in a field where light to moderate infestations of quackgrass had developed. Addition of 28% nitrogen with X-77 or petroleum oil increased quackgrass control. Methylated seed oil adjuvants generally increased control over other adjuvants used. There appears to be no difference in quackgrass control between primisulfuron and nicosulfuron at comparable rates with identical adjuvants.

Fall herbicides for weed control in drybeans, Fargo. Fall (PPI) treatments were applied to dry soil with large clods on October 16, 1990 with 50 F, 40% RH, and no wind. Spring (PPI) treatments were applied in mallow moist soil on May 16, 1991 with 60 F, 60% RH, clear sky, and 5- to 10 mph wind. All treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi through 8002 flat fan nozzles to a 10 ft wide area the length of 12 by 30 ft plots. Treatments were incorporated twice in opposite directions with a field cultivator plus harrow at a depth of 3 inches. 'Othello' drybeans were seeded on May 17. The experiment was a randomized complete block design with four replicates. Evaluation was on July 16.

Treatment	Rate	Drybean inj	Yeft	KOCZ	Rrpw	Wimu
	oz/A			%		
EPTC (Fall)	4.5	0	57	13	33	0
EPTC (Spring)	4	0	98	0	21	19
EPTC+Trif (Fall)	3+1	0	99	88	99	30
EPTC+Trif (Spring)	3+.75	0	99	80	88	61
Trifluralin (Fall)	1	0	99	90	99	44
Trifluralin (Spring)	.75	0	99	64	83	40
Ethalfluralin (Spring)	1	0	97	76	92	64
EPTC+Etha (Spring)	3+.75	0	96	74	86	41
EPTC+Etha (Fall)	3+.75	0	99	69	74	10
Ethalfluralin (Fall)	1	0	99	88	99	5
Untreated	0	0	0	0	10	0
C.V. %		0	18	29	30	90
LSD 5%		NS	22	24	31	37
# OF REPS		4	4	4	4	4

Summary

None of the herbicides injured drybeans. Wild mustard was not adequately controlled by any of the treatments. The fall applied EPTC did not give adequate weed control which may be from inadequate incorporation in the cloddy soil.

Bentazon + Acifluorfen in soybeans, Casselton. 'McCall' soybeans were seeded May 17. The plot area was treated with Sethoxydim at 3 oz/A + Scoil at 1 qt/A to first trifoliolate beans, 1- to 3-inch wild mustard, 2- to 3-inch redroot pigweed, 1- to 2-inch common lambsquarters, and 2- to 5-inch kochia on June 7 with 70 F, 50% RH, partly cloudy sky, and 20 mph wind. Treatments were applied to 2nd trifolilate beans, 8.5 inch kochia, 6 inch wild mustard, and 2.5 to 3 inch redroot pigweed on June 14 with 78 F, 62% RH, cloudy sky, and 0- to 5- mph wind. Treatments following (/) were applied to 3rd trifoliolate beans, 4- to 10-inch kochia, 3- to 4-inch common lambsquarters, 4- to 6-inch redroot pigweed, and 2- to 5-inch wild mustard on June 17 with 85 F, 70% RH, clear sky, and 5- to 15 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 an 8 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 16.

Treatment	Rate	Sobe inj	KOCZ	Rrpw	Colq	Wimu
	oz/A	---------- % ----------				
Bentazon	12/	0	64	61	36	95
Bentazon+28N	12+4%/	18	58	66	43	91
Bentazon+28N/Bent+28N	8+4%/8+1G/	1	55	62	43	82
Bentazon+DASH/Bent+DASH	8+.25G/8+.25G/	1	96	70	73	94
Bent&Acif+28N/Bent+28N	11+4%/8+1G/	3	81	99	82	98
Bentazon&Acif+28N	14+1G/	3	89	98	86	99
Bentazon&Acif+PO	14+.25G/	1	96	92	88	99
Bentazon&Acif+PO+28N	14+.25G+.5G/	19	99	99	95	99
Bentazon&Acif+Scoil	14+.18G/	7	99	94	89	99
Bentazon&Acif+Scoil+28N	14+.18G+.5G/	15	99	99	92	99
Bentazon&Acif+X-77+28N	14+.25%+1G/	5	96	99	96	99
Bentazon+Thif+X-77+28N	8+.03+.12%+4%/	0	95	99	94	94
Bentazon+Thif+X-77+28N	8+.06+.12%+4%/	1	99	99	99	97
Bent&Acif+Thif+X-77+28N	11+.03+.12%+4%/	1	95	97	92	96
Acif+Thif+X-77+28N	4+.03+.12%+4%/	4	63	99	80	92
Thifensulfuron+X-77+28N	.06+.12%+4%/	2	92	95	94	87
Untreated	0	0	0	0	0	0
C.V. %		191	15	12	13	5
LSD 5%		13	17	14	14	6
# OF REPS		4	4	4	4	4

Summary

The inclusion of 28% liquid nitrogen fertilizer to bentazon or bentazon & acifluorfen at the higher rates or with oil adjuvants injured soybean without an increase in control of all weed species. In general control of all broadleaf weeds was greater with bentazon mixtures with acifluorfen or thifensulfuron than bentazon applied alone as one or a split application. Bentazon split application with DASH gave better weed control than when applied with 28N.

Kochia control with bentazon in soybeans, Fargo. 'McCall' soybeans, 'Valley, oats and Siberian foxtail millet were seeded in adjacent strips on May 24. Treatments were applied to 3rd trifoliolate soybeans, 6-leaf oats, 8- to 10- inch redroot pigweed, 8- to 14-inch kochia, blooming wild mustard, 6-inch common lambsquarters, and 6-leaf foxtail millet on June 25 with 80 F, 60% RH, cloudy sky, 15- to 20-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 an 8 ft wide area the length of 10 by 30 ft plots. the experiment was a randomized complete block design with three replicates.

		7/15				
					Sobe	8/02
Treatment	Rate	KOCZ	Rrpw	Fxmi	inj	KOCZ
	oz/A	---------- % ----------				
Bentazon	8	47	25	5	2	66
Bentazon+X-77	8+0.25%	62	28	12	3	80
Bentazon+DC-5309	8+0.12G	50	25	10	2	64
Bentazon+PO	8+0.18G	72	28	8	2	88
Bentazon+Li-700	8+0.25%	62	15	8	2	77
Bentazon+Li-700	8+0.25G	53	18	8	3	75
Bentazon+Scoil	8+0.18G	76	42	10	3	78
Bentazon+AMOH	8+2%	60	25	3	2	69
Bentazon+AMN	8+18	48	17	12	7	57
Bentazon+AMS	8+22	45	23	10	5	68
Bentazon+$CaCl_2$	8+0.22%	37	10	7	2	63
Bentazon+$CaCl_2$+AMOH	8+0.22%+2%	58	28	7	7	80
Bentazon+$CaCl_2$+AMN	8+0.22%+26	43	25	3	3	61
Bentazon+$CaCl_2$+AMS	8+0.22%+22	37	15	7	3	52
Bentazon+AMOH+Scoil	8+2%+0.18G	50	35	7	5	74
Bentazon+AMN+Scoil	8+18+0.18G	47	24	10	2	59
Bentazon+AMS+Scoil	8+22+0.18G	47	7	3	3	68
Bentazon+$CaCl_2$+Scoil	8+0.22%+0.18G	52	10	13	0	68
Bentazon+$CaCl_2$+AMOH+Scoil	8+0.22%+2%+18G	42	15	10	0	70
Bentazon+$CaCl_2$+AMN+Scoil	8+0.22%+18+0.18G	43	5	12	2	61
Bentazon+$CaCl_2$+AMS+Scoil	8+0.22%+22+0.18G	60	25	12	3	59
Untreated	0	0	0	0	0	0
C.V. %		30	69	90	113	25
LSD 5%		24	NS	NS	NS	27
# OF REPS		3	3	3	3	3

Summary

Bentazon did not injure soybean regardless of the adjuvants. Kochia and redroot pigweed control was difficult to evaluate because of the competition from the oats and foxtail millet which were not controlled by any treatment. X-77, petroleum oil (PO), and Scoil adjuvants tended to be more effective in enhancement of bentazon for kochia control than the other adjuvants, including the nitrogen salts. The data only indicated an antagonist of kochia control from calcium chloride at the first evaluation, and for bentazon applied without any other adjuvants.

Imazethapyr with salts, Casselton. 'McCall' soybeans were seeded May 17. Treatments were applied to 4th trifoliolate soybeans, 16-inch volunteer corn, 6- to 10 inch foxtail, 4- to 10-inch wild mustard, 2- to 4- inch redroot pigweed, and 5-inch common lambsquarter on June 19 with 74 F, 50% RH, overcast sky, and 10 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8 gpa at 35 psi through 8001 flat fan nozzles to an 8 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 July 16, August 8, and August 22.

		7/16				
Treatment[a]	Rate	Sobe inj	Fxtl	Colq	8/02 Fxtl	8/22 Fxtl
	oz/A			%		
Imep+X-77	0.3+0.25%	0	63	52	68	57
Imep+Sun-itII	0.3+0.18G	0	85	55	89	86
Imep+AMS+X-77	0.3+19+0.25%	0	70	49	81	77
Imep+AMN+X-77	0.3+23+0.25%	0	66	60	68	65
Imep+AMS+Sun-itII	0.3+19+0.25G	0	86	63	88	89
Imep+AMN+Sun-itII	0.3+23+0.25G	2	80	69	83	89
Imep+X-77(NaHCO3)	0.3+0.25%	3	61	43	67	58
Imep+Sun-itII(NaHCO3)	0.3+0.18G	1	66	55	76	58
Imep+AMS+X-77(NaHCO3)	0.3+19+0.25%	0	68	56	71	69
Imep+AMN+X-77(NaHCO3)	0.3+23+0.25%	1	75	70	81	86
Imep+AMS+Sun-itII(NaHCO3)	0.3+19+0.25G	1	63	48	71	70
Imep+AMN+Sun-itII(NaHCO3)	0.3+23+0.25G	2	81	80	85	83
Imep+X-77(CaCl2)	0.3+0.25%	0	64	46	65	63
Imep+Sun-itII(CaCl2)	0.3+0.18G	1	84	65	90	84
Imep+AMS+X-77(CaCl2)	0.3+19+0.25%	1	67	59	76	62
Imep+AMN+X-77(CaCl2)	0.3+23+0.25%	0	68	54	66	55
Imep+AMS+Sun-itII(CaCl2)	0.3+19+0.25G	0	87	48	89	80
Imep+AMN+Sun-itII(CaCl2)	0.3+23+0.25G	1	84	51	85	78
Imep+Bent+X-77	0.3+12+0.25%	1	35	55	50	30
Imep+Bent+Sun-itII	0.3+12+0.18G	1	39	73	56	35
Imep+Bent+AMS+X-77	0.3+12+19+0.25%	0	43	72	59	37
Imep+Bent+AMN+X-77	0.3+12+23+0.25%	0	54	71	65	48
Imep+Bent+AMS+Sun-itII	0.3+12+19+0.25G	0	71	82	72	48
Imep+Bent+AMN+Sun-itII	0.3+12+23+0.25G	3	65	84	62	40
Untreated	0	0	0	0	0	0
C.V. %		200	11	40	14	22
LSD 5%		2	10	33	14	22
# OF REPS		4	4	4	4	3

[a] $NaHCO_3$ was at 3.6 g/L (1000 ppm sodium) and $CaCl_2$ at 1.7 g/L (600 ppm calcium).

Summary

Bentazon was antagonistic to foxtail control with Imazethapyr and none of the adjuvants overcame the antagonism. Foxtail control with imazethapyr was generally greater when applied with Sun-it II than nonionic surfactant X-77, alone or in the presence of calcium chloride or bentazon. Imazethapyr control of foxtail was similar with Sun-it II or X-77 when sodium bicarbonate was present in the spray carrier. Diammonium sulfate or ammonium nitrate did not enhance foxtail control with imazethapyr beyond that with Sun-it II as the only adjuvant, except in the presence of antagonism from bentazon.

Soybean weed control from dinitroaniline herbicides, NW-22 1991. "McCall' variety soybean was planted on June 3. Preplant incorporated herbicides were applied and incorporated with a rototiller on May 23. Postemergence treatment was applied June 24. Conditions were 72 F, 67% H, 80% cloudy sky, wind 0 to 5 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

		June 6					
Treatments	Rate	Fxtl	KOCZ	Wimu	Rrpw	Cocb	CI
	oz/A	%					
Treflan MTF (DowElanco)	0.75	99	99	41	99	71	0
Treflan TR-10 (DowElanco)	0.75	99	97	48	99	63	0
Trifluralin 4EC (Ostlund)	0.75	97	99	39	99	51	0
Trifluralin 4AT (Terra)	0.75	99	99	58	99	48	0
Trific 60DF (Terra)	0.75	99	99	55	99	68	0
Trific/	0.75	99	99	99	99	99	0
Basagran + PO	0.75+1qt						
Class-Trust (Cenex LoL)	0.75	99	99	57	99	56	0
Trifluralin 10G (Griffin)	0.75	99	99	57	99	46	7
Tri-4 (American Cyanamid)	0.75	99	99	61	99	72	0
PCC-129-358A (26%S)(UAP)	0.75	99	99	48	99	82	0
PCC-128 (10G) (UAP)	0.75	71	65	12	99	28	0
Sonalan 3EC (DowElanco)	0.75	99	99	52	99	79	0
Sonalan 10G (DowElanco)	0.75	99	99	46	99	59	6
Prowl 4EC (American Cyanamid)	0.75	99	99	85	99	79	0
Prowl 3.3EC (American Cyanamid)	0.75	99	99	78	99	89	0
Cannon (Monsanto)	3	99	99	89	99	91	0
Freedom (Monsanto)	3	99	99	95	99	87	0
Untreated	0	0	0	0	0	0	0
C.V. %		9	8	11	8	49	54
LSD 5%		3	3	10	7	9	3

		June 20					
Treatments	Rate	Fxtl	KOCZ	Wimu	Rrpw	Cocb	CI
	oz/A	%					
Treflan MTF (DowElanco)	0.75	99	99	36	99	63	0
Treflan TR-10 (DowElanco)	0.75	99	96	40	99	59	0
Trifluralin 4EC (Ostlund)	0.75	96	99	24	99	35	0
Trifluralin 4AT (Terra)	0.75	99	99	46	99	38	0
Trific 60DF (Terra)	0.75	99	99	40	99	35	0
Trific/	0.75	99	99	96	99	93	0
Basagran + PO	0.75+1qt						
Class-Trust (Cenex LoL)	0.75	99	99	45	99	35	0
Trifluralin 10G (Griffin)	0.75	99	99	39	99	31	3
Tri-4 (American Cyanamid)	0.75	99	99	33	99	60	0
PCC-129-358A (26%S)(UAP)	0.75	99	99	33	99	65	0
PCC-128 (10G) (UAP)	0.75	88	89	26	99	44	0
Sonalan 3EC (DowElanco)	0.75	99	99	38	99	57	0
Sonalan 10G (DowElanco)	0.75	99	99	31	99	41	12
Prowl 4EC (American Cyanamid)	0.75	99	99	35	99	50	0
Prowl 3.3EC (American Cyanamid)	0.75	99	99	40	99	76	0
Cannon (Monsanto)	3	99	99	75	99	84	0
Freedom (Monsanto)	3	99	99	89	99	73	0
Untreated	0	0	0	0	0	0	0
C.V. %		6	7	9	7	36	7
LSD 5%		4	6	9	5	8	4

Treatments	Rate	July 18					
		Fxtl	KOCZ	Wimu	Rrpw	Cocb	CI
	oz/A	%					
Treflan MTF (DowElanco)	0.75	99	99	24	99	53	0
Treflan TR-10 (DowElanco)	0.75	99	96	45	99	43	0
Trifluralin 4EC (Ostlund)	0.75	96	99	24	99	25	0
Trifluralin 4AT (Terra)	0.75	99	99	38	99	39	0
Trific 60DF (Terra)	0.75	99	99	38	99	29	0
Trific/ Basagran + PO	0.75+1qt	99	99	88	99	85	0
Class-Trust (Cenex LoL)	0.75	99	99	37	99	19	0
Trifluralin 10G (Griffin)	0.75	99	99	28	99	25	3
Tri-4 (American Cyanamid)	0.75	99	99	43	99	48	0
PCC-129-358A (26%S)(UAP)	0.75	99	99	27	99	51	0
PCC-128 (10G) (UAP)	0.75	85	83	15	95	29	0
Sonalan 3EC (DowElanco)	0.75	99	99	29	99	48	0
Sonalan 10G (DowElanco)	0.75	99	99	27	99	32	12
Prowl 4EC (American Cyanamid)	0.75	99	99	46	99	58	0
Prowl 3.3EC (American Cyanamid)	0.75	99	99	56	99	71	0
Cannon (Monsanto)	3	99	99	88	99	81	0
Freedom (Monsanto)	3	99	99	83	99	81	0
Untreated	0	0	0	0	0	0	0
C.V. %		7	7	11	7	25	8
LSD 5%		4	4	11	4	9	4

Summary

All forms of trifluralin responded similarly except for PCC-128 which yielded lower weed control than other trifluralin treatments. All treatments except PCC-128 controlled foxtail, kochia and redroot pigweed. Trific followed by bentazon controlled all weeds. Population of common cocklebur was not consistent throughout the study. Prowl usually gave equal or greater wild mustard and common cocklebur control than other trifluralin treatments. Granular formulations of trifluralin (Trifluralin 10G) and ethalfluralin (Sonalan 10G) gave greater crop injury than other treatments. Cannon and Freedom, which premixes of trifluralin and alachlor gave adaquate control of all weeds.

Soybean weed control from dinitroaniline herbicides, Mooreton 91. "Evans' variety soybean was planted on May 17. Preplant incorporated herbicides were applied and incorporated with a rototiller on May 17. Postemergence treatment was applied June 20. Conditions were 71 F, 55% H, 10% cloudy sky, wind 0 to 9 mph. All ppi treatements were applied at 17 gpa and postemergence treatments applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

		May 31			June 14			July 12		
Treatments	Rate	Fxtl	Rrpw	CI	Fxtl	Rrpw	CI	Fxtl	Rrpw	CI
	oz/A	---------- % ----------								
Treflan MTF (DowElanco)	0.75	99	99	0	99	96	3	99	92	0
Treflan TR-10 (DowElanco)	0.75	99	87	0	99	96	0	99	97	0
Trifluralin 4EC (Ostlund)	0.75	99	91	0	99	90	0	99	92	0
Trifluralin 4AT (Terra)	0.75	99	93	0	99	96	0	99	97	0
Trific 60DF (Terra)	0.75	99	95	0	99	97	0	99	97	0
Trific/	0.75	99	94	0	99	97	3	99	97	0
Basagran + PO	0.75+1qt									
Class-Trust (Cenex LoL)	0.75	99	90	0	99	92	0	99	95	0
Trifluralin 10G (Griffin)	0.75	99	93	4	99	95	15	99	98	0
Tri-4 (American Cyanamid)	0.75	99	93	0	99	96	1	99	97	0
PCC-129-358A (26%S)(UAP)	0.75	99	84	0	99	93	0	99	95	0
PCC-128 (10G) (UAP)	0.75	99	62	2	90	70	4	99	83	0
Sonalan 3EC (DowElanco)	0.75	99	93	0	99	91	0	99	95	0
Sonalan 10G (DowElanco)	0.75	99	99	6	99	99	15	99	99	5
Prowl 4EC (American Cyanamid)	0.75	99	90	0	99	93	0	99	95	0
Prowl 3.3EC (American Cyanamid)	0.75	99	86	0	99	91	0	99	94	0
Cannon (Monsanto)	3	99	94	0	99	97	0	99	99	0
Freedom (Monsanto)	3	99	99	0	99	98	0	99	99	0
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		8	7	3	4	6	5	4	6	4
LSD 5%		5	5	4	4	4	3	3	3	3

Summary

All forms of trifluralin responded similarly except for PCC compounds. Most treatments controlled foxtail, kochia and redroot pigweed. Trific followed by bentazon controlled all weeds. Some granular formulations of trifluralin and ethalfluralin gave greater crop injury than other treatments. Cannon and Freedom, which premixes of trifluralin and alachlor, gave adaquate control of all weeds.

Postemergence weed control in soybean, Casselton 1991. "McCall' variety soybean was planted on May 17. Postemergence treatments were applied June 17 to soybean in the V2 - V3 stage, foxtail 1 to 3 inches tall, redroot pigweed 1 to 3 inches tall, common lambsquarters 1 to 3 inches tall, wild mustard 1 to 4 inches tall and kochia 0.5 to 2 inches tall. Conditions were 81 F, 73% H, 60% cloudy sky, wind 0 to 3 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 12					
		Fxtl	Rrpw	Colq	Wimu	KOCZ	CI
	oz/A	%					
Bentazon + PO	8+0.5%	0	49	41	95	95	0
Bentazon + Scoil	8+0.5%	0	61	38	97	99	0
Acifluorfen + X-77	4+0.5%	10	99	66	99	99	19
Bentazon + Acifluorfen + PO	8+4+0.5%	60	99	70	99	99	15
Bentazon + Acifluorfen + Scoil	8+4+0.5%	44	99	74	99	99	11
Bentazon + Acifluorfen + 28%N	8+4+1G	42	99	49	99	99	14
Thifensulfuron + X-77	0.063+ 0.125%	0	99	65	99	99	0
Thifen + Bentazon + X-77	0.063+8+0.125%	0	99	60	99	99	0
Thifen + Bent + X-77 + 28%N	0.063+8+0.125%+4%	0	99	85	99	99	0
Thifen + Bentazon + Scoil	0.063+8+0.5%	0	99	54	99	99	0
Thifen + Acifluorfen + X-77	0.063+4+0.125%	45	99	51	99	99	3
Thifen + Acifl + X-77 + 28% N	0.063+4+0.125%+4%	65	99	56	99	99	4
Lactofen + PO	3.2+0.5%	30	99	62	99	99	33
Lactofen + PO	2.4+0.5%	15	99	61	99	99	24
Lactofen + Sun-It II	2.4+0.5%	16	99	58	99	99	26
Lactofen + Bentazon + PO	2.4+8+0.5%	21	99	52	99	99	32
Lactofen + Bentazon + Sun-It II	2.4+8+0.5%	11	99	55	99	99	34
Lactofen + Thifen + X-77	2.4+ 0.063+0.125%	8	99	48	99	99	28
Lactofen + Thifen + X-77 + 28%N	2.4+0.63+0.125%+4%	7	99	67	99	99	13
Untreated	0	0	0	0	0	0	0
C.V. %		12	8	10	6	6	8
LSD 5%		9	5	9	7	8	8

Summary

Most treatments controlled redroot pigweed, wild mustard, and kochia. Grass injury was noted with treatments containing acifluorfen and lactofen. 28% nitrogen increased grass injury when applied with X-77. The greatest common lambsquarters control was from thifensulfuron + bentazon + X-77 + 28% nitrogen. Crop injury was noted in treatments containing acifluorfen and lactofen. Thifensulfuron in some treatments decreased crop injury from these compounds.

Postemergence weed control in soybean, Mooreton 1991. "Evans' variety soybean was planted on May 24. Postemergence treatments were applied June 17 to soybean in the V2 - V3 stage, redroot pigweed 1 to 6 inches tall, common lambsquarters 1 to 3 inches tall, and common cocklebur 1 to 4 inches tall. Conditions were 81 F, 71% H, 80% cloudy sky, wind 0 to 7 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 2			
		Rrpw	Colq	Wimu	CI
	oz/A	---------- % ----------			
Bentazon + PO	8+0.5%	38	45	90	0
Bentazon + Scoil	8+0.5%	38	30	90	0
Acifluorfen + X-77	4+0.5%	98	95	85	18
Bentazon + Acifluorfen + PO	8+4+0.5%	99	85	84	15
Bentazon + Acifluorfen + Scoil	8+4+0.5%	98	65	68	18
Bentazon + Acifluorfen + 28%N	8+4+1G	99	85	92	16
Thifensulfuron + X-77	0.063+ 0.125%	93	89	56	0
Thifen + Bentazon + X-77	0.063+8+0.125%	84	84	79	0
Thifen + Bent + X-77 + 28%N	0.063+8+0.125%+4%	93	90	85	0
Thifen + Bentazon + Scoil	0.063+8+0.5%	94	90	76	0
Thifen + Acifluorfen + X-77	0.063+4+0.125%	95	91	84	1
Thifen + Acifl + X-77 + 28% N	0.063+4+0.125%+4%	99	75	93	6
Lactofen + PO	3.2+0.5%	99	71	89	40
Lactofen + PO	2.4+0.5%	99	60	73	24
Lactofen + Sun-It II	2.4+0.5%	99	70	73	38
Lactofen + Bentazon + PO	2.4+8+0.5%	99	99	88	20
Lactofen + Bentazon + Sun-It II	2.4+8+0.5%	99	96	91	36
Lactofen + Thifen + X-77	2.4+ 0.063+0.125%	99	81	76	24
Lactofen + Thifen + X-77 + 28%N	2.4+0.63+0.125%+4%	99	87	88	31
Untreated	0	0	0	0	0
C.V. %		9	7	9	14
LSD 5%		4	10	11	8

Summary

Most treatments controlled redroot pigweed. The greatest common lambsquarters control usually occured with treatment contaning bentazon. Crop injury was noted in treatments containing acifluorfen and lactofen. Thifensulfuron in some treatments decreased crop injury from these compounds.

Venice mallow control in soybean, Great Bend 1991. 'Evans' variety soybean was planted on May 31. Postemergence treatments were applied June 24 to soybean in the V1 - V3 stage (4 to 9 inches tall) and venice mallow 1 leaf to bud stage . Conditions were 72 F, 72% H, cloudy sky, wind 3 to 9 mph. All postemergence treatments were applied at 8.5 gpa, 35 psi, through 8001 flat fan nozzles. All treatments were applied with a bicycle wheel type plot sprayer equiped with a sheild to a plot area 8 ft wide by 30 feet long. The experiment was a complete randomized block design with four replicates.

Treatments	Rate	July 15 Venice mallow
	oz/A	%
Bentazon + PO	8+0.5%	92
Bentazon + Scoil	8+0.5%	71
Acifluorfen + X-77	4+0.5%	60
Bentazon + Acifluorfen + PO	8+4+0.5%	83
Bentazon + Acifluorfen + Scoil	8+4+0.5%	90
Bentazon + Acifluorfen + 28%N	8+4+1G	99
Thifensulfuron + X-77	0.063+ 0.125%	64
Thifen + Bentazon + X-77	0.063+8+0.125%	95
Thifen + Bent + X-77 + 28%N	0.063+8+0.125%+4%	95
Thifen + Bentazon + Scoil	0.063+8+0.5%	66
Thifen + Acifluorfen + X-77	0.063+4+0.125%	53
Thifen + Acifl + X-77 + 28% N	0.063+4+0.125%+4%	59
Lactofen + PO	3.2+0.5%	65
Lactofen + PO	2.4+0.5%	66
Lactofen + Sun-It II	2.4+0.5%	54
Lactofen + Bentazon + PO	2.4+8+0.5%	96
Lactofen + Bentazon + Sun-It II	2.4+8+0.5%	76
Lactofen + Thifen + X-77	2.4+ 0.063+0.125%	48
Lactofen + Thifen + X-77 + 28%N	2.4+0.63+0.125%+4%	55
Imazethapyr + NIS + 28% N	0.75+0.25%+0.5%	36
Imazethapyr + NIS + 28% N	1+0.25%+0.5%	18
Imazethapyr + Dash	0.75+0.5%	28
Imazethapyr + Dash	1+0.5%	43
Imazethapyr + Sun-It II	0.75+0.5%	34
Imazethapyr + Sun-It II	1+0.5%	28
Imazeth + Bentazon + Sun-It II	0.75+8+0.5%	91
Imazeth + Bentazon + Sun-It II	0.75+4+0.5%	60
Untreated		0
C.V. %		14
LSD 5%		9

Summary

Venice mallow appears resistant to most row crop herbicides. Lactofen, acifluorfen, thifensulfuron and imazethapyr applied alone or in combination gave poor venice mallow control regardless of adjuvant used or addition of 28% nitrogen. Basagran shows the most activity resulting in 92% control applied with petroleum oil. No antagonism was observed when basagran was tank-mixed with other broadleaf herbicides.

Weed control in Canola, Langdon. 'Westar' canola was seeded May 21. Treatments were applied on to 2.5- to 3-inch canola, 5-leaf wheat, emerging- to 3-inch ladysthumb, 1.5 inch diameter kochia, 3.5-leaf wild buckwheat on June 26 with 75 F, 70% RH, clear sky, and 15 mph wind. Asona was applied three times for flea and blister beetles control. Treatments were applied with a hooded bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were ladysthumb and wheat at 10/m^2, green foxtail at 2/m^2, and kochia and wild buckwheat at 1/m^2 and variable. Evaluation was on July 18.

Treatment	Rate	Canola inj	Wht	Lath	Grft	Wibu	KOCZ
	oz/A			%			
DPX-A7881+Flua+Mor-act	0.25+3+0.18G	6	56	41	50	70	0
DPX-A7881+Seth+Scoil	0.25+3+.18G	5	40	71	74	0	25
DPX-A7881+Qufp+Moract	0.25+1+.18G	11	74	52	74	63	0
DPX-A7881+Clpy+Flua+Mor-act	0.25+1.5+3+.18G	4	74	68	74	0	40
Clpy+Flua+Mor-act	1.5+3+.18G	21	99	86	99	53	55
Clopyralid	1.5	8	55	75	82	35	45
Untreated	0	6	52	30	40	0	40
C.V. %		133	74	70	67	96	98
LSD 5%		NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	2	2

Summary

Clopyralid + Fluazifop tended to injure Canola, which also provided the best weed control of the various herbicide treatments.

Weed control in Canola, Fargo. 'Westar' canola was seeded May 18. Treatments were applied to 2- to 4-leaf canola, 1- to 3-inch foxtail, and 1- to 4-inch kochia on June 3 with 78 F, 71% RH, partly cloudy sky, and 5 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through an 8001 flat fan nozzle to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were kochia at 10/m^2, green and yellow foxtail at 20/m^2, and Cocklebur at 15/plot. Evaluation was on July 15.

Treatment	Rate	Canola inj	Fxtl	KOCZ	Cocb
	oz/A		%		
Pendimethalin(4E)	16	1	99	71	0
Pendimethalin-3.3(E)	16	0	99	65	0
Trifluralin(4HF)	12	0	96	76	0
Pendimethalin(4E)	32	5	99	73	9
Pendimethalin-3.3(E)	32	6	99	86	8
Trifluralin(4HF)	24	3	99	96	0
DPX-A7881+Flua+PO	0.25+3+0.18G	8	92	94	6
DPX-A7881+Seth+Scoil	0.25+3+0.18G	1	99	92	29
DPX-A7881+Clpy+Seth+Scoil	0.25+1.5+3+0.18G	80	99	66	90
Untreated	0	0	0	0	0
C.V. %		45	4	15	76
LSD 5%		7	5	16	16
# OF REPS		4	4	4	4

Summary

Canola stand was severely reduced by DPX-A7881 + clopyralid + sethoxydim. Green and yellow foxtail were controlled at 92% or more by all herbicide treatments. Clopyralid reduced kochia control with DPX-A7881 which may reflect the injury to Canola or be a direct antagonism of DPX-A7881. Common cockelbur was only controlled (90%) by the treatment with clopyralid.

Postemergent weed control in Sunflowers. 'Interstate 3001' sunflowers were seeded May 17. Treatments were applied to 6- to 8-leaf sunflowers on June 18 with 80 F, 45% RH, clear sky, 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 an 8 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 19.

Treatment	Rate	Sunflower inj	Fxtl	KOCZ	Rrpw
	oz/A		%		
Acifluorfen	0.125	0	25	0	13
Acifluorfen+X-77	0.125+0.125%	1	16	0	0
Acifluorfen+28N	0.125+0.5G	8	25	0	41
Acifluorfen+PO	0.125+0.25G	1	30	28	32
Acifluorfen+Scoil	0.125+0.25G	11	20	25	52
Acifluorfen+Poast-plus	0.125+3.2	4	99	35	16
Imazamethabenz	4	8	24	43	0
Imazamethabenz-NS+X-77	4+0.25%	3	21	38	0
Imazamethabenz-NS+SunitII	4+0.25%	6	24	36	0
Imazamethabenz-NS+Poast-plus	4+3.2	8	99	43	0
Untreated	0	0	0	0	0
C.V. %		170	62	78	106
LSD 5%		NS	31	25	21
# OF REPS		4	4	4	4

Summary

None of the treatments caused important injury to sunflower. Redroot pigweed and kochia control was inadequate, less than 55%, regardless of treatment. The inclusion of Poast Plus (sethoxydim) with acifluorfen or imazamethabenz did not increase injury to sunflower.

Adjuvants with Poast plus, Fargo. 'McCall' soybeans, 'Valley' oats, and Siberian foxtail millet were seeded in adjacent strips onMay 24. Treatments were applied to 3rd trifoliolate soybeans, 6 leaf oats, and 8- to 14-inch kochia on June 24 with 76 F, 69% RH, partly cloudy sky, 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 an 8 ft wide area the length of 10 by 30 ft plots. Evaluation was on July 23.

Treatment	Rate	KOCZ	Oats
	oz/A	----- % -----	
Poast plus	1.5	6	99
Poast plus+X-77	1.5+.25%	0	99
Poast plus+28N	1.5+4%	0	99
Poast plus+PO	1.5+0.12G	5	99
Poast plus+PO	1.5+0.25G	9	99
Poast plus+DASH	1.5+0.12G	4	99
Poast plus+DASH	1.5+0.25G	0	99
Poast plus+Scoil	1.5+0.12G	5	99
Poast plus+Scoil	1.5+0.25G	0	99
Poast plus+Bent+DASH	1.5+12+0.25G	60	99
Poast plus+Bent+Scoil	1.5+12+0.18G	66	87
Poast plus+Thif+X-77+28N	1.5+0.06+0.25%+4%	79	99
Poast plus+Imep+DASH	1.5+1+0.25%	69	99
Poast plus+Imep+Sun-itII	1.5+1+0.18%	92	99
UBI-1956+PO	1+0.25G	0	99
UBI-1956+Scoil	1+0.18G	5	99
UBI-1956+Bent+PO	1+12+0.25G	62	99
UBI-1956+Bent+Scoil	1+12+0.18G	55	98
C.V. %		48	1
LSD 5%		20	2
# OF REPS		4	4

Summary

Oats control with Poast plus was nearly complete for all treatments except when applied with bentazon + Scoil adjuvant. Siberian foxtail millet, which was also in the experiment, was completely controlled by all treatments. Kochia control by Poast plus + imazethapyr was greater where Sun-it II rather than DASH was the adjuvant.

Sethoxydim with adjuvants, Fargo. 'McCall' soybeans, 'Valley' oats, and Siberian foxtail millet were seeded in adjacent strips on May 24. Treatments were applied to 3rd trifoliolate soybeans, 6- to 7-leaf oats, and 6- to 7-leaf Siberian foxtail millet on June 24 with 76 F, 69% RH, partly cloudy sky, 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 an 8 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 24.

Treatment	Rate	Oats	Fxmi	Sobe inj
	oz/A	------	%	-------
Sethoxydim+PO(DW)	0.75+0.25G	96	99	0
Sethoxydim+NH4OH+PO(DW)	0.75+0.11G+0.25G	95	98	0
Sethoxydim+AMS+PO(DW)	0.75+23+0.25G	92	97	1
Sethoxydim+Expl0+PO(DW)	0.75+2%+0.25G	95	99	4
Sethoxydim+NH4H2PO4+PO(DW)	0.75+19+0.25G	98	99	6
Sethoxydim+(NH4)2HPO4+PO(DW)	0.75+23+0.25G	98	99	1
Sethoxydim+PO(3650 NaHCO3)	0.75+0.25G	71	83	0
Sethoxydim+NH4OH+PO(3650 NaHCO3)	0.75+0.11G+0.25G	77	90	0
Sethoxydim+AMS+PO(3650 NaHCO3)	0.75+23+0.25G	97	99	1
Sethoxydim+ExpN+PO(3650 NaHCO3)	0.75+2%+0.25G	99	99	3
Sethoxydim+NH4H2PO4+PO	0.75+19+0.25G	97	99	1
Sethoxydim+(NH4)2HPO4+PO	0.75+23+0.25G	95	99	0
C.V. %		4	3	415
LSD 5%		6	4	NS
# OF REPS		4	4	4

Summary

Oats and foxtail millet control by sethoxydim was nearly complete with all adjuvants so differences among all adjuvants could not be determined. However, sodium bicarbonate antagonized grass species control from sethoxydim when applied with only petroleum oil alone or with ammonium hydroxide adjuvants. The other nitrogen compounds overcame sodium bicarbonate antagonism of sethoxydim.

Glyphosate and adjuvants with distilled water, Fargo. 'McCall' soybeans, 'Valley' oats, and Siberian foxtail millet were seeded in adjacent strips on May 24. Treatments were applied to 3rd trifoliolate soybeans, 6- leaf oats, 8- to 14-inch kochia, and 6-leaf foxtail millet on June 24 with 76 F, 69% RH, partly cloudy sky, 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 an 8 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	7/08 Soybean inj	7/08 KOCZ	7/08 Oats	7/08 Fxmi	7/23 KOCZ
	oz/A	%	%	%	%	%
Glyphosate(DW)	1.5	64	82	99	99	70
Glyphosate+X-77(DW)	1.5+.25%	76	91	99	99	81
Glyphosate+RA600(DW)	1.5+.25%	87	92	99	99	83
Glyphosate+Emopha877(DW)	1.5+.25%	79	90	99	99	74
Glyphosate+AlphaS(DW)	1.5+.25%	73	84	99	99	80
Glyphosate+AMS(DW)	1.5+22	73	85	99	99	71
Glyphosate+Cayuse(DW)	1.5+.25G	88	97	99	99	84
Glyphosate+Sulftex(DW)	1.5+.25G	79	72	99	99	80
Glyphosate+X-77(DW)	1.5+.25%	83	95	99	99	83
Glyphosate+R-11(DW)	1.5+.25%	55	61	98	98	63
Glyphosate+Li-700(DW)	1.5+.25%	83	94	99	99	89
Glyphosate+ExpS(DW)	1.5+2%	88	96	99	99	82
Glyphosate+Exp-PM(DW)	1.5+2.6%	85	90	99	99	82
Glyphosate+DC-5309(DW)	1.5+.09G	81	87	99	99	69
Glyphosate+Exp-N(DW)	1.5+2%	83	90	98	99	76
Glyphosate+Exp-PD(DW)	1.5+2.6%	76	91	99	99	81
C.V. %		13	12	1	1	7
LSD 5%		14	15	NS	NS	8
# OF REPS		4	4	4	4	4

[a]DW=distilled water spray carrier.

Summary

The glyphosate (Roundup) rates were too high for good separation of adjuvant enhancement of grass species control, in the distilled water spray carrier. Surfactant R-11 was the least effective with glyphosate for soybean and kochia control. X-77 was generally as effective as any of the adjuvants in enhancement of glyphosate for kochia or soybean control.

Glyphosate and adjuvants with sodium bicarbonate, Fargo. 'McCall' soybeans, 'Valley' oats, and Siberian foxtail millet were in adjacent strips seeded May 24. Treatments were applied to 3rd trifoliolate soybeans, 6-leaf oats, 8- to 14-inch kochia, and 6-leaf foxtail millet on June 24 with 76 F, 69% RH, partly cloudy sky, 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 an 8 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	7/08				7/23
		Sobe inj	KOCZ	Oat	Fxmi	KOCZ
	oz/A	%				
Glyphosate(Na)	1.5	58	71	93	89	78
Glyphosate+X-77(Na)	1.5+.25%	71	85	95	89	89
Glyphosate+RA600(Na)	1.5+.25%	70	83	96	93	87
Glyphosate+Emopha877(Na)	1.5+.25%	75	90	97	94	87
Glyphosate+AlphaS(Na)	1.5+.25%	61	75	95	90	81
Glyphosate+AMS(Na)	1.5+22	85	84	98	90	82
Glyphosate+Cayuse(Na)	1.5+.25G	88	96	99	98	84
Glyphosate+Sulftex(Na)	1.5+.25G	87	95	99	94	89
Glyphosate+X-77(Na)	1.5+.25%	66	71	96	94	81
Glyphosate+R-11(Na)	1.5+.25%	51	60	97	93	75
Glyphosate+Li-700(Na)	1.5+.25%	63	71	95	93	78
Glyphosate+ExpS(Na)	1.5+2%	91	96	99	96	85
Glyphosate+Exp-PM(Na)	1.5+2.6%	87	92	99	98	87
Glyphosate+DC-5309(Na)	1.5+.09G	83	85	97	93	68
Glyphosate+Exp-N(Na)	1.5+2%	88	93	99	95	85
Glyphosate+Exp-PD(Na)	1.5+2.6%	87	89	99	99	83
C.V. %		10	9	3	4	10
LSD 5%		11	10	NS	6	11
# OF REPS		4	4	4	4	4

[a]Na=spray carrier of distilled water containing sodium bicarbonate at 3.5 g/L.

Summary

Grass species control was generally too great with the glyphosate rates for good separation of adjuvant effectiveness. Oats and foxtail millet control with glyphosate with the various adjuvants was always equal to or greater than glyphosate alone in the sodium bicarbonate spray carrier. Difference in kochia control among the various glyphosate treatments were small at the late rating. However, DC-5309 tended to be less effective than other adjuvants at the late rating.

Glyphosate and adjuvant with calcium chloride, Fargo. 'McCall' soybeans and 'Valley' oats were seeded May 24. Treatments were applied to 3rd trifoliolate soybeans, 6 leaf oats, and 8- to 14 inch kochia on June 24 with 76 F, 69% RH, partly cloudy sky, 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 an 8 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 23.

Treatment[a]	Rate	KOCZ
	oz/A	%
Glyphosate(Ca)	1.5	65
Glyphosate+X-77(Ca)	1.5+0.25%	72
Glyphosate+RA600(Ca)	1.5+0.25%	88
Glyphosate+Emopha877(Ca)	1.5+0.25%	81
Glyphosate+AlphaS(Ca)	1.5+0.25%	86
Glyphosate+AMS(Ca)	1.5+22	80
Glyphosate+Cayuse(Ca)	1.5+0.25G	89
Glyphosate+Sulftex(Ca)	1.5+0.25G	87
Glyphosate+X-77(Ca)	1.5+0.25%	80
Glyphosate+R-11(Ca)	1.5+0.25%	70
Glyphosate+Li-700(Ca)	1.5+0.25%	70
Glyphosate+ExpS(Ca)	1.5+2%	91
Glyphosate+Exp-PM(Ca)	1.5+2.6%	87
Glyphosate+DC-5309(Ca)	1.5+0.09G	64
Glyphosate+Exp-N(Ca)	1.5+2%	85
Glyphosate+Exp-PD(Ca)	1.5+2.6%	91
C.V. %		7
LSD 5%		8
# OF REPS		4

[a]Ca=spray carrier of distilled water containing calcium chloride at 2.2 g/L.

Summary

Data is presented for the late kochia control rating as the early rating data were lost to the computer. Adjuvants all enhanced kochia control from glyphosate applied in a spray carrier containing 500 ppm calcium, except for X-77, R-11, Li-700, and DC-5309.

Fall-applied trifluralin granules in no-till wheat, Carrington 1991. Experiment was established on a Heimdal-Emrick loam with pH 8.1, 3.8% organic matter, 6- to 8-inch standing wheat stubble, and 6600 lb/A surface residues. Trifluralin granules were applied either on October 22 or on November 28, 1990 using a Gandy airflow. Trifluralin emulsifiable concentrate was applied either on Oct. 22 or Nov. 30 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles. For treatments incorporated with a field cultivator, plots were first rototilled to destroy surface crop residues before herbicide application. On Oct. 22, air temperature was 50 F with sunny skies and soil was moist; on Nov. 28 skies were sunny with 24 F; on Nov. 30 skies were partly cloudy with 38 F. Herbicide granules were either left on the surface or were incorporated once on Oct. 22 with a field cultivator operated 3 inches deep, a Haybuster undercutter operated 1.5 to 2 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Field cultivated plots were worked a second time with a Melroe culti-harrow (2 to 3 inches deep) on May 9, 1991. No burndown treatment was applied. Grandin spring wheat was seeded 1.5 to 2 inches deep at 90 lb/A on May 10 using a Tye no-till drill. Wheat plants per m of row was determined May 22. Bromoxynil + MCPA at 0.75 + 0.19 lb/A was applied June 7 over the entire experiment for broadleaf weed control. Diclofop + Sun-It at 1.25 lb/A + 1 qt/A was applied to handweeded check plots on June 6. Visual estimates of percentage green foxtail control were taken on June 6 and August 21. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined on June 8. Plots were combine-harvested on Aug. 14 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

Herbicide application			Herbicide incorporation method	Wheat stand	Foxtail control		Foxtail density	Grain yield
Herbicide[a]	Rate (lb/A)	Date		(plts/m)[b]	6/6 (%)	8/21 (%)	6/8 (plt/area)[b]	(Bu/A)
Trif-10G	0.5	10/22	Field cultivator	31	89	90	22	21.6
Trif-4EC	0.5	10/22	Field cultivator	23	70	75	32	24.4
Trif-4EC	0.5	11/30	None	23	10	46	55	21.6
Trif-10G	0.5	11/28	None	25	44	39	43	20.2
Trif-10G	0.75	11/28	None	26	83	75	20	20.3
Trif-10G	1	11/28	None	21	93	86	11	22.4
Trif-10G	0.5	10/22	None	24	88	72	24	23.5
Trif-10G	0.5	10/22	Rotary hoe	22	92	84	4	23.4
Trif-10G	0.75	10/22	Rotary hoe	18	97	86	5	21.4
Trif-10G	1	10/22	Rotary hoe	18	99	93	5	21.0
Trif-10G	0.5	10/22	Undercutter	27	85	67	9	23.5
Trif-10G	0.75	10/22	Undercutter	22	95	84	13	19.9
Trif-10G	1	10/22	Undercutter	19	96	87	10	17.3
Trif-10G	0.5	10/22	Undercut/Rotary hoe	25	87	80	29	22.8
Trif-10G	0.75	10/22	Undercut/Rotary hoe	23	93	83	9	20.6
Trif-10G	1	10/22	Undercut/Rotary hoe	20	96	89	6	17.5
Weedy check	0	10/22	Field cultivator	25	6	65	31	22.8
Weedy check	0	10/22	Undercutter	27	13	40	27	22.9
Handweeded	0	10/22	Field cultivator	23	100	100	0	25.4
Handweeded	0	10/22	Undercutter	26	100	100	0	23.0
C.V. %				25	13	23	107	12.0
LSD 5%				NS	15	25	16	3.8

[a]Trif-10G = Treflan 10G granules; Trif-4EC = Treflan emulsifiable concentrate.
[b]Plts/m = wheat plants per meter of row; Plt/area = foxtail plants per 0.25 m^2 area, three subsamples per plot.

-- See next page for additional data and summary --

-- See previous page for data and experiment description --

Crop residues present on the soil surface initially and after planting. Trifluralin granules were incorporated in the fall with four different tillage practices or were left unincorporated.

Residue sampling time[a]	Tillage implement	Residue sampling method[b]: Aboveground dry matter (kg/ha)	Residue sampling method[b]: Line transect (%)
Fall	None	7420	93
Spring	None	5090	66
Spring	Field cultivator	520	11
Spring	Rotary hoe	2650	56
Spring	Undercutter	1480	50
Spring	Undercutter/Rotary hoe	3610	42
C.V.		42	15
LSD 5%		2020	11

[a] Fall sampling done in October before any tillage or other disturbance; spring sampling done in May after planting with a no-till drill.

[b] Surface crop residues measured by 1) collecting all aboveground dry matter in 0.25 m^2 areas, 2) placing a 25-ft line diagonally across a plot and determining whether residue was present under each marker spaced at 1-ft intervals along the line.

Summary. Wheat stands were not reduced by any of the treatments. Trifluralin granules at 0.5 lb ai/A applied in late October in standing stubble and left unincorporated controlled foxtail about 88%, while the same treatment applied in late November performed poorly. Late November unincorporated applications were effective, however, at 0.75 and 1 lb/A of trifluralin granules. When trifluralin granules at 0.5 lb/A were applied in late October in standing stubble and incorporated with a rotary hoe or undercutter, foxtail control was 85 to 90%. Higher trifluralin rates provided greater control.

Fall-applied trifluralin granules in no-till wheat, Minot 1991. Experiment was established on a Max-Williams loam with pH 5.6, 3.4% organic matter, 6 to 8-inch standing wheat stubble, and 5600 lb/A surface residues. Trifluralin granules were applied either on October 16 or 19, or on November 20, 1990 using a Gandy airflow. Trifluralin emulsifiable concentrate was applied either on Oct. 16 or Nov. 20 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles. For herbicide treatments incorporated with a field cultivator, the plots were first rototilled to destroy surface crop residues before herbicide application. On Oct. 16, air temperature was 43 F with cloudy skies and soil was dry; on Oct. 19 skies were sunny with 43 F; on Nov. 20 skies were sunny with 42 F. Herbicide granules were either left on the surface or were incorporated once on Oct. 19 with a field cultivator operated 3 inches deep, a Haybuster undercutter operated 1.5 to 2 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Field cultivated plots were worked a second time with a field cultivator (2 to 3 inches deep) on May 13, 1991. Lloyd durum was seeded 1.5 to 2 inches deep at 82 lb/A on May 13 using a John Deere single-disc no-till drill. A preemergence burndown treatment of glyphosate + 2,4-D (0.38 + 0.25 lb ae/A) was applied May 22 to control emerged weeds over the entire experimental area. Wheat plants per m of row was determined June 1. Bromoxynil&MCPA at 0.25 + 0.25 lb/A was applied June 14 over the entire experiment for broadleaf weed control. Diclofop at 1.13 lb/A was applied to handweeded check plots on June 12. Visual estimates of percentage green foxtail control were taken on June 12 and Aug. 23. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined on June 12. Plots were combine-harvested Aug. 23 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft. The experiment was a randomized complete block with four replications.

Herbicide application			Herbicide incorporation method	Wheat stand	Foxtail control		Foxtail density	Grain Yield
Herbicide[a]	Rate (lb/A)	Date		(plts/m)[b]	6/12 (%)	8/23 (%)	6/12 (plt/area)[c]	(Bu/A)
Trif-G	0.5	10/19	Field cultivator	37	87	65	58	34.6
Trif-4EC	0.5	10/16	Field cultivator	35	10	2	189	31.8
Trif-4EC	0.5	11/20	None	48	0	8	127	37.2
Trif-G	0.5	11/20	None	41	74	46	106	41.9
Trif-G	0.75	11/20	None	45	94	77	47	49.3
Trif-G	1	11/20	None	38	97	90	32	43.9
Trif-G	0.5	10/19	None	33	62	42	103	43.6
Trif-G	0.5	10/19	Rotary hoe	42	88	70	85	43.5
Trif-G	0.75	10/19	Rotary hoe	42	95	93	28	45.6
Trif-G	1	10/16	Rotary hoe	38	98	96	30	45.2
Trif-G	0.5	10/19	Undercutter	45	90	87	42	45.1
Trif-G	0.75	10/19	Undercutter	45	97	93	14	42.4
Trif-G	1	10/16	Undercutter	37	98	96	8	39.5
Trif-G	0.5	10/19	Undercut/Rotary hoe	45	92	82	48	42.3
Trif-G	0.75	10/19	Undercut/Rotary hoe	39	97	95	14	41.1
Trif-G	1	10/16	Undercut/Rotary hoe	48	98	96	11	43.4
Weedy check	0	10/19	Field cultivator	38	0	0	185	31.7
Weedy check	0	10/19	Undercutter	44	0	0	107	37.0
Handweeded	0	10/19	Field cultivator	41	100	100	0	37.2
Handweeded	0	10/19	Undercutter	49	100	100	0	41.3
C.V. %				26	10	21	81	10.1
LSD 5%				NS	11	20	40	6.0

[a]Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate.
[b]Wheat stand measured as plants per meter of row.
[c]Foxtail density measured as plants per 0.25 m^2.

-- See previous page for experimental details and data --

Crop residues present on the soil surface initially and after planting. Trifluralin granules were incorporated in the fall with four different tillage practices or were left unincorporated.

Residue sampling time[a]	Tillage implement	Residue sampling method[b]: Aboveground dry matter (kg/ha)	Residue sampling method[b]: Line transect (%)
Fall	None	6250	91
Spring	None	4290	84
Spring	Field cultivator	1640	29
Spring	Rotary hoe	3830	75
Spring	Undercutter	4090	62
Spring	Undercutter/Rotary hoe	3080	64
C.V.		40	16
LSD 5%		1880	15

[a] Fall sampling done in October before any tillage or other disturbance; spring sampling done in May after planting with a no-till drill.

[b] Surface crop residues measured by 1) collecting all aboveground dry matter in 0.25 m^2 areas, 2) placing a 25-ft line diagonally across a plot and determining whether residue was present under each marker spaced at 1-ft intervals along the line.

Summary. None of the treatments reduced wheat stands. Trifluralin emulsifiable concentrate performed poorly, even when incorporated. Trifluralin granules at 0.5 lb ai/A controlled foxtail 62 and 74% on June 12 when applied the previous Oct. 22 and Nov. 28, respectively, and left unincorporated in standing stubble. Application of 0.5 lb ai/A trifluralin granules in standing stubble with a rotary hoe, undercutter, or undercutter plus rotary hoe controlled foxtail 88 to 92% which was comparable to a standard field cultivator-incorporated treatment with minimal surface crop residues.

Fall-applied trifluralin granules in no-till wheat, Harwood 1991. The experiment was established in standing wheat stubble on a silty clay loam with pH 7.9 and 5.8% organic matter. Trifluralin granules were applied either October 25 or November 18, 1990 using a Gandy airflow applicator. Trifluralin emulsifiable concentrate was applied either on Oct. 25 or Nov. 18 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles. For treatments incorporated with a field cultivator, plots were first rototilled to destroy surface crop residues before herbicide application. On Oct. 25, air temperature was 50 to 55 F with sunny skies and soil was moist; on Nov. 19 air temperature was 45 F. Herbicide granules were either left on the surface or were incorporated once on Oct. 25 with a field cultivator operated 3 inches deep, a Haybuster undercutter operated 1.5 to 2 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Field cultivated plots were tilled a second time with a field cultivator/harrow (2 to 3 inches deep) on May 14, 1991. Butte 86 spring wheat was seeded 1.5 to 2 inches deep at 95 lb/A on May 15 using a Haybuster no-till drill and no seedbed preparation tillage. Glyphosate at 1 lb ae/A was applied over the entire experimental area on May 16 to control emerged weeds. Wheat plants per m of row (two samples per plot) was determined June 10. Foxtail population was extremely sparse and inadequate to evaluate control. Hessian fly infestation was moderate to severe and precluded meaningful grain yield determination. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

Herbicide application			Herbicide incorporation method	Wheat stand
Herbicide[a]	Rate (lb/A)	Date		(Plant/m)
Trifluralin-G	0.5	10/25	Field cultivator	20.4
Trifluralin-4E	0.5	10/25	Field cultivator	22.6
Trifluralin-4E	0.5	11/18	None	23.4
Trifluralin-G	0.5	11/18	None	22.9
Trifluralin-G	0.75	11/18	None	16.0
Trifluralin-G	1	11/18	None	17.9
Trifluralin-G	0.5	10/25	None	20.9
Trifluralin-G	0.5	10/25	Rotary hoe	17.0
Trifluralin-G	0.75	10/25	Rotary hoe	20.8
Trifluralin-G	1	10/25	Rotary hoe	19.4
Trifluralin-G	0.5	10/25	Undercutter	18.3
Trifluralin-G	0.75	10/25	Undercutter	18.9
Trifluralin-G	1	10/25	Undercutter	19.6
Trifluralin-G	0.5	10/25	Undercutter/Rotary hoe	23.1
Trifluralin-G	0.75	10/25	Undercutter/Rotary hoe	21.3
Trifluralin-G	1	10/25	Undercutter/Rotary hoe	18.1
Untreated	0		Field cultivator	24.8
Untreated	0		None	25.8
Handweeded	0		Field cultivator	26.0
Handweeded	0		None	26.3
C.V. %				20.7
LSD 5%				4.3

[a]Trifluralin-G = Treflan 10G granules; Trifluralin-4E = Treflan emulsifiable concentrate.

Summary. Wheat stands appeared to be reduced by trifluralin, especially at 0.75 and 1 lb ai/A.

Fall-applied quinclorac for field bindweed control, Minot 1991. Experiment was established on a loam soil in standing wheat stubble (about 1000 lb/A) with 1 to 5 field bindweed plants per sq m. Plot size was 15 by 25 ft with a 10- by 25-ft area treated. Treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles on September 20, 1990 when air temperature was 62 F, relative humidity was 72%, soil was very dry (misting rain had occurred earlier the same day), and field bindweed vines were 4 to 10 inches long and very green (no frost had occurred). Wind was 4 to 8 mph. Visual estimates of percentage weed control were taken October 19, 1990.The experiment was seeded with "Amidon" spring wheat (1.5 to 2 inches deep) on May 6, 1991 with no seedbed preparation tillage and a John Deere no-till drill. Forty-five lb/A of 11-55-0 was applied with the seed at planting. Weed control and crop injury were evaluated May 30, 1991 when wheat was 5 to 6-leaf and tillered, and field bindweed was 3 to 10 inches long. Wheat was bulk-harvested using a production-sized combine and field bindweed control was estimated again on September 3, 1991. The experiment was a randomized complete block with four replications.

Treatment[a]	Rate (lb/A)	Wheat injury	Field bindweed control 10/19/90	5/30/91	9/3/91
			(%)		
Untreated	0	0	60	0	0
Quinclorac+Sun-it	0.25+0.25G	2	52	87	13
Quinclorac+Sun-it	0.375+0.25G	8	74	99	42
Quinclorac+Sun-it	0.5+0.25G	20	88	99	20
Quinclorac+2,4-D+Sun-it	0.25+0.5+0.25G	3	86	100	45
Quinclorac+2,4-D+Sun-it	0.375+0.5+0.25G	15	98	100	56
Quinclorac+2,4-D+Sun-it	0.5+0.5+0.25G	13	100	100	76
Quinclorac+Dicamba+Sun-it	0.25+0.25+0.25G	5	94	99	25
Quinclorac+Dicamba+Sun-it	0.375+0.25+0.25G	13	84	100	30
Quinclorac+Dicamba+Sun-it	0.5+0.25+0.25G	22	94	100	63
Quinclorac+Glyt&2,4-D+Sun-it	0.25+1.05+0.25G	2	96	99	46
Quinclorac+Glyt&2,4-D+Sun-it	0.375+1.05+0.25G	8	99	100	65
Quinclorac+Glyt&2,4-D+Sun-it	0.5+1.05+0.25G	13	99	100	86
2,4-D+X-77	1+0.5%	0	98	92	34
Dicamba+X-77	0.25+0.5%	0	79	66	14
Dicamba+X-77	0.5+0.5%	0	84	91	15
Glyphosate+X-77	0.75+0.25%	0	85	49	67
Glyphosate	1.5	0	98	44	58
Dicamba+2,4-D+X-77	0.25+1+0.5%	0	96	95	57
Dicamba+2,4-D+X-77	0.5+1+0.5%	0	97	95	51
Glyphosate+2,4-D+X-77	0.375+1+0.5%	0	99	85	73
Glyphosate+2,4-D+X-77	0.75+1+0.25%	0	100	93	69
Glyphosate+Dicamba+X-77	0.375+0.5+0.5%	1	99	98	56
C.V. %		66	11	17	52
LSD 5%		5	14	20	34

[a]Butoxyethyl ester of 2,4-D was used; dry flowable formulation of quinclorac was used; Glyt&2,4-D = Landmaster BW herbicide containing 0.9 lb/gal glyphosate plus 1.6 lb/gal 2,4-D amine; Sun-it = methylated seed oil adjuvant containing emulsifier.

Summary. Spring wheat was injured about 10 to 20% by quinclorac at 0.375 to 0.5 lb/A applied the previous fall. Injury was expressed as stunting and a dull green color. Several treatments provided greater than 85% bindweed control when evaluated May 30, almost 8 months after treatment. Best treatments 11 months after application were those involving quinclorac at 0.5 lb/A.

Fall-applied quinclorac for field bindweed control, Halliday 1991. Experiment was established on a loam soil with little surface crop residues and a dense stand (5 to 15 plants per sq m) of field bindweed. Plot size was 15 by 25 ft with a 10- by 25-ft area treated. Treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles on September 19, 1990 when air temperature was 70 F, relative humidity was 25%, skies were cloudy, soil was very dry, field bindweed vines were 6 to 10 inches long (75 to 100 leaves) and very green (no frost had occurred). Wind was 8 to 10 mph for the initial treatments listed below but had dropped to 3 to 5 mph for the last 6 treatments. The experiment was partially seeded with Butte 86 spring wheat (1.5 to 2 inches deep) on May 15, 1991 with no seedbed preparation tillage and a Tye drill. The drill (80 inch effective width) was centered over the untreated strips between plots and no wheat was seeded in the treated portion of the plots. Visual estimates of percentage field bindweed control were taken May 30, 1991. The experiment was a randomized complete block with four replications.

Treatment[a]	Rate (lb/A)	Field bindweed control (%)
Untreated	0	0
Quinclorac+Sun-it	0.25+0.25G	87
Quinclorac+Sun-it	0.375+0.25G	93
Quinclorac+Sun-it	0.5+0.25G	94
Quinclorac+2,4-D+Sun-it	0.25+0.5+0.25G	100
Quinclorac+2,4-D+Sun-it	0.375+0.5+0.25G	97
Quinclorac+2,4-D+Sun-it	0.5+0.5+0.25G	100
Quinclorac+Dicamba+Sun-it	0.25+0.25+0.25G	92
Quinclorac+Dicamba+Sun-it	0.375+0.25+0.25G	99
Quinclorac+Dicamba+Sun-it	0.5+0.25+0.25G	100
Quinclorac+Glyt&2,4-D+Sun-it	0.25+1.05+0.25G	100
Quinclorac+Glyt&2,4-D+Sun-it	0.375+1.05+0.25G	99
Quinclorac+Glyt&2,4-D+Sun-it	0.5+1.05+0.25G	99
2,4-D+X-77	1+0.5%	96
Dicamba+X-77	0.25+0.5%	15
Dicamba+X-77	0.5+0.5%	59
Glyphosate+X-77	0.75+0.25%	70
Glyphosate	1.5	90
Dicamba+2,4-D+X-77	0.25+1+0.5%	97
Dicamba+2,4-D+X-77	0.5+1+0.5%	98
Glyphosate+2,4-D+X-77	0.375+1+0.5%	85
Glyphosate+2,4-D+X-77	0.75+1+0.25%	97
Glyphosate+Dicamba+X-77	0.375+0.5+0.5%	84
C.V. %		9
LSD 5%		11

[a]Butoxyethyl ester of 2,4-D was used; dry flowable formulation of quinclorac was used; Glyt&2,4-D = Landmaster BW herbicide containing 0.9 lb/gal glyphosate plus 1.6 lb/gal 2,4-D amine; Sun-it = methylated seed oil adjuvant containing emulsifier.

Summary. 2,4-D applied alone at 1 lb/A in the fall controlled field bindweed 96% the following spring. Similarly, most treatments containing 1 lb/A 2,4-D provided excellent control. Dicamba at 0.5 lb/A was much less effective and glyphosate at 1.5 lb ae/A provided 90% control. Quinclorac at 0.5 lb/A controlled field bindweed 94% quinclorac at 0.25 lb/A mixed with either 2,4-D or glyphosate&2,4-D (Landmaster BW) provided essentially complete control. Quinclorac plus dicamba was slightly less effective.

Summer-applied quinclorac for field bindweed control, Minot 1991. Plot size was 15 by 25 ft and the experiment was a randomized complete block design with three replications. Treatments were arranged in a split plot with treatment timing (early, mid, and late summer) serving as main plots. Soil type was a loam with pH 6.9 and 3.1% organic matter (0 to 2 inches). All treatments were applied with a 6-nozzle (20-inch spacing) bicycle wheel sprayer treating a 10-ft-wide area and delivering 8.5 gal/A with 8001 tips and 40 psi.

Early-summer treatments

Early-summer treatments were applied May 30, 1991 when field bindweed was 5 to 10 inches tall, green foxtail was 3- to 4-leaf (0.5 to 2.5 inches tall), common lambsquarters was 1 to 3 inches tall, air temperature was 70 F, relative humidity was 49%, wind was 0 to 4 mph, skies were sunny, and soil was dry. Visual estimates of percentage weed control were made on June 12 and July 9. Early-summer main plots were worked 2 to 3 inches deep on July 10, August 15, and Sept. 24 with a field cultivator/harrow.

Treatment	Rate (lb/A)	Evaluated 6/12 Fibw	Grft	Colq	Evaluated 7/9 Fibw	Grft	Colq
		(% control)					
Untreated	0	0	0	0	0	0	0
Quinclorac+Picloram+SunitII	0.25+0.05+0.25G	42	69	79	99	27	100
Quinclorac+2,4-D-bee+SunitII	0.25+0.5+0.25G	70	64	77	98	37	100
Quinclorac+Dicamba+SunitII	0.25+0.5+0.25G	74	43	79	98	15	100
Quinclorac+Glyt&2,4-D+SunitII	0.25+0.38&0.67+0.25G	89	97	94	94	57	100
Glyphosate&2,4-D	0.38&0.67	74	92	89	96	40	100
C.V. %		8	15	17	3	49	0
LSD 5%		8	17	21	4	26	NS

Mid-summer treatments

On May 30, mid-summer main plots were worked 4 to 5 inches deep with a field cultivator/harrow to control emerged vegetation. Treatments were applied July 9 when field bindweed was 12 to 18 inches long, green foxtail was 5 to 8 inches tall and well-tillered (some headed), redroot pigweed was 1 to 4 inches tall, air temperature was 87 F, relative humidity was 30%, wind was calm, skies were sunny, and soil in the rooting zone was moist. Visual estimates of percentage weed control were made August 7. Mid-summer main plots were worked 2 to 3 inches deep Aug. 15 and Sept. 24 with a field cultivator/harrow.

Treatment	Rate (lb/A)	Evaluated 8/7 Fibw	Grft	Rrpw
		(% control)		
Untreated	0	0	0	0
Quinclorac+Picloram+SunitII	0.25+0.05+0.25G	95	32	85
Quinclorac+2,4-D-bee+SunitII	0.25+0.5+0.25G	99	16	98
Quinclorac+Dicamba+SunitII	0.25+0.5+0.25G	98	13	92
Quinclorac+Glyt&2,4-D+SunitII	0.25+0.38&0.67+0.25G	98	99	97
Glyphosate&2,4-D	0.38&0.67	98	99	99
C.V. %		2	28	5
LSD 5%		3	22	7

-- see next two pages for additional data and summary --

-- see previous page --

Late-summer treatments

Late-summer main plots were worked with a field cultivator/harrow 4 to 5 inches deep on May 30 and 2 to 3 inches deep on July 10 to control emerged vegetation. Treatments were applied August 15 when field bindweed was 6 to 12 inches long, air temperature was 72 F, relative humidity was 63%, wind was 2 to 5 mph, skies were sunny, and soil was dry. Visual estimates of percentage field bindweed control were made Sept. 4. Plots were worked 2 to 3 inches deep with a field cultivator/harrow on Sept. 24.

Treatment[a]	Rate (lb/A)	Evaluated 9/4 Field bindweed control (%)
Untreated	0	0
Quinclorac+Picloram+SunitII	0.25+0.05+0.25G	83
Quinclorac+2,4-D-bee+SunitII	0.25+0.5+0.25G	99
Quinclorac+2,4-D-bee+SunitII	0.25+1+0.25G	98
Quinclorac+Dicamba+SunitII	0.25+0.5+0.25G	98
Quinclorac+Glyt&2,4-D+SunitII	0.25+0.38&0.67+0.25G	96
Glyphosate&2,4-D	0.38&0.67	97
Picloram+2,4-D-dma	0.25+0.5	93
Dicamba+2,4-D-dma	0.25+1	98
C.V. %		7
LSD 5%		10

[a]SunitII = methylated seed oil adjuvant; 2,4-D-bee = butoxyethyl ester of 2,4-D; Glyt&2,4-D = Landmaster-BW herbicide containing 0.9 lb ae/gal glyphosate plus 1.6 lb ae/gal 2,4-D amine; 2,4-D-dma = dimethylamine formulation of 2,4-D.

Summary. All treatments provided excellent control of bindweed when evaluated within a few weeks after application. When evaluated on September 24 late-summer treatments showed the highest field bindweed control while early-summer treatments had been allowed more time to recover from treatment effects and showed the lowest control. On September 24, the least effective of the early- and mid-summer treatments appeared to be quinclorac + 2,4-D and quinclorac + glyt&2,4-D.

-- see next page for additional data --

-- see previous two pages for additional data and summary--

Late evaluation of all treatments

Plots treated early summer (E), mid summer (M), and late summer (L) were evaluated together on September 24. All plots were tilled 2 to 3 inches deep with a field cultivator/harrow later that same day.

Treatment[a]	Rate (lb/A)	Field bindweed control (%)
Untreated(E)	0	0
Quinclorac+Picloram+SunitII(E)	0.25+0.05+0.25G	45
Quinclorac+2,4-D-bee+SunitII(E)	0.25+0.5+0.25G	29
Quinclorac+Dicamba+SunitII(E)	0.25+0.5+0.25G	54
Quinclorac+Glyt&2,4-D+SunitII(E)	0.25+1.05+0.25G	45
Glyphosate&2,4-D(E)	0.38&0.67	50
Untreated(M)	0	0
Quinclorac+Picloram+SunitII(M)	0.25+0.05+0.25G	88
Quinclorac+2,4-D-bee+SunitII(M)	0.25+0.5+0.25G	73
Quinclorac+Dicamba+SunitII(M)	0.25+0.5+0.25G	86
Quinclorac+Glyt&2,4-D+SunitII(M)	0.25+1.05+0.25G	73
Glyphosate&2,4-D(M)	0.38&0.67	83
Untreated(L)	0	0
Quinclorac+Picloram+SunitII(L)	0.25+0.05+0.25G	93
Quinclorac+2,4-D-bee+SunitII(L)	0.25+0.5+0.25G	97
Quinclorac+2,4-D-bee+SunitII(L)	0.25+1+0.25G	95
Quinclorac+Dicamba+SunitII(L)	0.25+0.5+0.25G	97
Quinclorac+Glyt&2,4-D+SunitII(L)	0.25+1.05+0.25G	93
Glyphosate&2,4-D(L)	0.38&0.67	96
Picloram+2,4-D-dma(L)	0.25+0.5	97
Dicamba+2,4-D-dma(L)	0.25+1	97
C.V. %		15
Timing effect		**
Treatments within a timing		**
LSD 5%		17

[a]SunitII = methylated seed oil adjuvant; 2,4-D-bee = butoxyethyl ester of 2,4-D; Glyt&2,4-D = Landmaster-BW herbicide containing 0.9 lb ae/gal glyphosate plus 1.6 lb ae/gal 2,4-D amine; 2,4-D-dma = dimethylamine formulation of 2,4-D.

Preemergence and postemergence treatments in spring wheat, Minot 1991. Amidon spring wheat was seeded 1 to 1.5 inches deep on April 17 in a conventionally tilled loam soil with pH 6.6 and 3.4% organic matter. Preemergence (Pre) treatments were applied April 23 when the soil surface was dry, wheat coleoptiles were 0.25 to 0.5 inch below the soil surface, and wind was 0 to 4 mph. Postemergence (Po) treatments were applied May 23 when wheat was 3- to 6-leaf, tillered, and 5 to 7 inches tall, green foxtail was 2- to 3-leaf and 0.5 to 1.5 inch tall, Russian thistle was 1 to 1.5 inch tall, kochia was 0.5 to 1 inch tall, wind was 4 to 8 mph, air temperature was 84 F, relative humidity was 48%, and skies were sunny. All treatments were applied with a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Visual estimates of percentage wheat injury and weed control were taken June 12. Plot size was 10 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Wheat injury	Weed control		
			Grft	Ruth	KOCZ
	(oz/A)	(%)			
Fenx-P&MCPA(Po)	0.5&6	5	99	12	58
Fenx-P&MCPA+Tribenuron(Po)	0.5&6+0.125	1	98	97	100
Fenx-P&MCPA+Thif&Trib(Po)	0.5&6+0.225	0	96	97	100
Fenx-P&MCPA+Metsulfuron(Po)	0.5&6+0.06	3	99	97	73
Fenx-P&MCPA+Dicamba(Po)	0.5&6+1	2	99	86	100
Fenx-P&MCPA+Bromoxynil(Po)	0.5&6+4	2	97	95	99
Fenx&2,4-D&MCPA(Po)	1.5&1.2&3.5	1	100	74	52
Propanil-DF+MCPA-bee(Po)	16+4	3	88	42	72
Propanil&MCPA(Po)	16&4	3	88	64	75
C4243(Pre)/2,4-D-dma+X-77(Po)	1.44/8+0.5%	3	88	92	98
C4243(Pre)	1.92	1	96	97	100
Diclofop+Brox+MCPA-bee(Po)	1+0.375+0.05	0	99	93	100
Control	0	0	10	3	0
C.V. %		163	15	27	26
LSD 5%		NS	17	24	26

[a]Fenx-P&MCPA = Dakota herbicide containing 0.23 lb/gal fenoxaprop-P plus 2.81 lb/gal MCPA ester; Thif&Trib = Harmony Extra herbicide containing 50% thifensulfuron plus 25% tribenuron; Fenx&2,4-D&MCPA = Tiller herbicide containing 0.75 lb/gal fenoxaprop plus 0.58 lb/gal 2,4-D ester plus 1.75 lb/gal MCPA ester; Propanil-DF is a dry flowable formulation of propanil; Propanil&MCPA = Stampede CM containing 3 lb/gal propanil plus 0.8 lb/gal MCPA; 2,4-D-dma = dimethylamine of 2,4-D; MCPA-bee = butoxyethyl ester of MCPA.

Summary. No treatments injured wheat appreciably. Mixtures containing fenoxaprop or diclofop controlled green foxtail close to 100% while propanil provided 88% control. Fenoxaprop&MCPA (Dakota) was weak on Russian thistle and kochia, but mixing with tribenuron, thifensulfuron&tribenuron (Harmony Extra), or bromoxynil controlled these broadleaf species. C4243 at 1.92 oz/A controlled foxtail, kochia, and Russian thistle. C4243 preemergence at 1.44 oz/A had left some broadleaf weeds uncontrolled and thus the follow-up postemergence treatment of 2,4-D was applied.

Spring treatments for chemical fallow, Minot 1991. Experiment was established on a loam soil with standing wheat stubble 6 to 8 inches tall, pH 6.2, and 2.8% organic matter. Preemergence (Pre) treatments were applied April 23 with no weeds emerged except a few small kochia. On April 24, the entire area was treated with glyphosate at 0.375 lb ae/A plus 2,4-D at 0.25 lb ae/A to control any emerged weeds. Postemergence (Po) treatments were applied May 30 when air temperature was 70 F, relative humidity was 40%, kochia was 0.5 to 3 inches tall, Russian thistle was 1 to 3 inches tall, wild oats were 5 to 7 inches tall, 3 to 5-leaf, and tillering, foxtail (60% yellow, 40% green foxtail) was 1 to 3 inches tall and 3 to 4-leaf. All treatments were applied with a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi, treating the center 7 ft of each plot. Visual estimates of percentage weed control were taken July 9. Plot size was 10 by 25 ft and the experiment was a randomized complete block with four replications.

Treatment	Rate[a] (lb/A)	Weed control			
		Wioa	Fxtl	KOCZ	Ruth
		(% control)			
Clomazone+Atrazine-DF(Pre)	0.5+0.5	96	52	100	98
C4243+POC(Po)	0.09+0.25G	18	55	99	100
C4243+Quizalofop-P+POC(Po)	0.09+0.06+0.25G	100	92	97	100
C4243+Glyphosate+X77(Po)	0.09+0.375+0.25%	95	78	97	100
Imazethapyr+X77(Po)	0.031+0.25%	25	75	91	94
Imazethapyr+X77(Po)	0.047+0.25%	33	76	95	99
Imazethapyr+X77(Po)	0.0625+0.25%	69	93	98	98
Imazethapyr+X77+28%UAN(Po)	0.047+0.25%+0.25G	62	84	88	95
Imazethapyr+X77+28%UAN(Po)	0.0625+0.25%+0.25G	87	91	97	98
Imazethapyr+Glyt+X77(Po)	0.047+0.5+0.25%	37	84	98	100
Imazethapyr+Glyt+X77(Po)	0.0625+0.5+0.25%	100	93	100	100
Imazethapyr+Imazapyr+X77(Po)	0.031+0.008+0.25%	94	81	82	100
Imazethapyr+Imazapyr+X77(Po)	0.031+0.016+0.25%	92	78	97	100
Imep+Impr+Glyt+X77(Po)	0.031+0.016+0.5+0.25%	98	89	99	100
Imazethapyr+Imazapyr+X77(Po)	0.031+0.032+0.25%	100	93	96	100
Imep+Paraquat+X77(Po)	0.047+0.25+0.25%	93	88	100	100
Imep+Paraquat+X77(Po)	0.0625+0.25+0.25%	99	93	100	100
Untreated	0	0	0	0	0
C.V. %		26	17	12	2
LSD 5%		24	17	13	3

[a]0.25G = 0.25 gal/A.

Summary. Complete postemergence control of wild oats was provided by quizalofop-P or by imazethapyr plus either glyphosate at 0.375 lb/A or imazapyr at 0.016 lb/A. Several treatments controlled kochia essentially completely, including soil-applied clomazone + atrazine, postemergence C4243 at 0.09 lb/A, and treatments involving postemergence imazethapyr at 0.0625 lb/A. All treatments controlled Russian thistle 94% or greater.

Postharvest treatments with paraquat and glyphosate, Fargo 1991. Experiment was established 4 days after spring wheat harvest (approximately 50 bu/A yield) on a silty clay loam in 6-inch standing stubble. Treatments were applied July 31 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzle tips and 40 psi, and when air temperature was 77 F, relative humidity was 40%, skies were clear, wind was 8 to 12 mph, soil was moist in the rooting zone, green foxtail was 6 to 10 inches tall and mostly headed, and wild buckwheat was 12 to 24 inches long. Visual estimates of percentage weed control were taken August 15. Plot size was 15 by 25 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate[a] (lb/A)	Yellow foxtail (% control)	Wild buckwheat (% control)
Paraquat+X77	0.375+0.5%	85	1
Paraquat+X77	0.5+0.5%	90	5
Paraquat+X77	0.75+0.5%	97	10
Paraquat+X77	1+0.5%	98	49
Paraquat+2,4-D+X77	0.375+0.25+0.5%	79	41
Paraquat+2,4-D+X77	0.5+0.25+0.5%	97	41
Paraquat+2,4-D+X77	0.75+0.25+0.5%	92	71
Paraquat+2,4-D+X77	0.375+0.5+0.5%	80	40
Paraquat+2,4-D+X77	0.5+0.5+0.5%	85	75
Paraquat+Dicamba+X77	0.375+0.125+0.5%	77	58
Paraquat+Dicamba+X77	0.5+0.125+0.5%	95	71
Paraquat+Dicamba+X77	0.75+0.125+0.5%	99	75
Paraquat+Dicamba+X77	0.375+0.25+0.5%	96	73
Paraquat+Dicamba+X77	0.5+0.25+0.5%	92	88
Paraquat+Atrazine+X77	0.5+0.25+0.5%	98	35
Glyphosate+X77+AS	0.14+0.5%+1.5	99	11
Glyphosate+X77+AS	0.1875+0.5%+1.5	99	20
Glyphosate+X77+AS	0.28+0.5%+1.5	100	33
Glyphosate+X77+AS	0.375+0.5%+1.5	100	38
Glyphosate+X77+AS	0.5+0.5%+1.5	100	50
Glyphosate&2,4-DII+AS	0.188&0.166+1.5	100	20
Glyphosate&2,4-DII+AS	0.28&0.25+1.5	100	45
Glyphosate&2,4-DII+AS	0.375&0.33+1.5	100	64
Glyphosate+Dicamba+AS	0.1875+0.085+1.5	88	28
Glyphosate+Dicamba+AS	0.28+0.127+1.5	96	31
Glyphosate+Dicamba+AS	0.375+0.17+1.5	97	36
C.V. %		12	48
LSD 5%		16	27

[a]Paraquat formulation was Cyclone 2 lb/gal; AS = ammonium sulfate; Glyphosate&2,4-DII = Landmaster II herbicide containing 0.9 lb/gal glyphosate plus 0.8 lb/gal 2,4-D isopropylamine salt; Atrazine formulation was 90DF; 2,4-D = butoxyethyl ester of 2,4-D; lqt = 1 quart per acre; Dicamba = Banvel herbicide, dimethylamine salt of dicamba.

Summary. Glyphosate applied alone (Roundup) or mixed with 2,4-D (Landmaster II) completely controlled foxtail, even at 0.14 lb ae/A. Mixing dicamba with glyphosate reduced foxtail control compared to glyphosate alone. Paraquat controlled foxtail 90% or more when applied at rates of 0.5 to 1 lb/A. Best foxtail control with paraquat at 0.5 lb/A was achieved when atrazine was added at 0.25 lb/A. None of the treatments adequately controlled wild buckwheat, although paraquat plus dicamba at 0.5 + 0.25 lb/A provided 88% control.

Postharvest treatments with paraquat and glyphosate, Minot 1991. Experiment was established in barley stubble on a loam soil (pH about 6.3 and organic matter about 2.8%). Treatments were applied Aug. 15 with 6- to 12-inch-tall kochia using a bicycle wheel plot sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. At time of application, wind was 0 to 5 mph, air temperature was 73 F, relative humidity was 53%, skies were sunny, and soil was dry. Visual estimates of percentage kochia control were made Sept. 4. Plot size was 10 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate (lb/A)	Kochia control (%)
Paraquat+X77	0.375+0.5%	91
Paraquat+X77	0.5+0.5%	96
Paraquat+X77	0.75+0.5%	98
Paraquat+X77	1+0.5%	98
Paraquat+2,4-D+X77	0.375+0.25+0.5%	92
Paraquat+2,4-D+X77	0.5+0.25+0.5%	95
Paraquat+2,4-D+X77	0.75+0.25+0.5%	98
Paraquat+2,4-D+X77	0.375+0.5+0.5%	92
Paraquat+2,4-D+X77	0.5+0.5+0.5%	94
Paraquat+Dicamba+X77	0.375+0.125+0.5%	96
Paraquat+Dicamba+X77	0.5+0.125+0.5%	98
Paraquat+Dicamba+X77	0.75+0.125+0.5%	99
Paraquat+Dicamba+X77	0.375+0.25+0.5%	96
Paraquat+Dicamba+X77	0.5+0.25+0.5%	98
Paraquat+Atrazine-DF+X77	0.5+0.25+0.5%	96
Glyphosate+X77+AS	0.14+0.5%+1.5	6
Glyphosate+X77+AS	0.1875+0.5%+1.5	10
Glyphosate+X77+AS	0.28+0.5%+1.5	61
Glyphosate+X77+AS	0.375+0.5%+1.5	81
Glyphosate+X77+AS	0.5+0.5%+1.5	89
Glyphosate&2,4-D+AS	0.188&0.17+1.5	68
Glyphosate&2,4-D+AS	0.28&0.25+1.5	90
Glyphosate&2,4-D+AS	0.375&0.33+1.5	94
Glyphosate&Dicamba+AS	0.188&0.086+1.5	60
Glyphosate&Dicamba+AS	0.28&0.13+1.5	81
Glyphosate&Dicamba+AS	0.375&0.17+1.5	92
C.V. %		12
LSD 5%		14

[a]Butoxyethyl ester of 2,4-D was used; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb ae/gal glyphosate plus 0.8 lb ae/gal 2,4-D amine; glyphosate&dicamba = Fallowmaster herbicide containing 1.1 lb/gal glyphosate plus 0.5 lb ae/gal dicamba; AS = ammonium sulfate.

Summary. Glyphosate alone (applied with X-77 surfactant and ammonium sulfate) was weak on kochia, requiring 0.5 lb/A to achieve 90% control. Glyphosate&2,4-D (Landmaster II) appeared to be slightly more effective in controlling kochia than glyphosate&dicamba (Fallowmaster). Paraquat plus 0.25 lb/A 2,4-D was no more effective on kochia than paraquat alone, and an additional 0.25 lb/A of 2,4-D did not improve control.

Postharvest treatments with paraquat and glyphosate, Leonard 1991. Experiment was established 8 days after spring wheat harvest (approximately 25 bu/A yield) on a sandy loam in 5-inch standing stubble. Treatments were applied August 13 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzle tips and 40 psi, and when air temperature was 87 F, relative humidity was 58%, skies were clear, wind was 3 to 5 mph, soil was somewhat dry in the rooting zone, foxtail (70% green and 30% yellow foxtail) was 6 to 10 inches tall and mostly headed, and Russian thistle was 4 to 8 inches tall. Visual estimates of percentage weed control were taken August 27. Plot size was 15 by 25 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate (lb/A)	Weed control Grft (%)	Weed control Ruth (%)
Paraquat+X-77	0.375+0.5%	87	100
Paraquat+X-77	0.5+0.5%	97	100
Paraquat+X-77	0.75+0.5%	97	100
Paraquat+X-77	1+0.5%	97	100
Paraquat+2,4-D+X-77	0.375+0.25+0.5%	94	100
Paraquat+2,4-D+X-77	0.5+0.25+0.5%	96	100
Paraquat+2,4-D+X-77	0.75+0.25+0.5%	99	100
Paraquat+2,4-D+X-77	0.375+0.5+0.5%	96	100
Paraquat+2,4-D+X-77	0.5+0.5+0.5%	99	100
Paraquat+Dicamba+X-77	0.375+0.125+0.5%	94	100
Paraquat+Dicamba+X-77	0.5+0.125+0.5%	95	99
Paraquat+Dicamba+X-77	0.75+0.125+0.5%	99	100
Paraquat+Dicamba+X-77	0.375+0.25+0.5%	95	100
Paraquat+Dicamba+X-77	0.5+0.25+0.5%	95	100
Paraquat+Atrazine+X-77	0.5+0.25+0.5%	97	100
Glyphosate+X-77+AS	0.14+0.5%+1.5	78	59
Glyphosate+X-77+AS	0.1875+0.5%+1.5	82	65
Glyphosate+X-77+AS	0.28+0.5%+1.5	88	63
Glyphosate+X-77+AS	0.375+0.5%+1.5	96	98
Glyphosate+X-77+AS	0.5+0.5%+1.5	100	100
Glyphosate&2,4-DII+AS	0.188&0.166+1.5	94	95
Glyphosate&2,4-DII+AS	0.28&0.25+1.5	93	97
Glyphosate&2,4-DII+AS	0.375&0.33+1.5	97	99
Glyphosate&Dicamba+AS	0.1875+0.085+1.5	94	93
Glyphosate&Dicamba+AS	0.28+0.127+1.5	97	97
Glyphosate&Dicamba+AS	0.375+0.17+1.5	98	98
C.V. %		6	7
LSD 5%		7	9

[a]Butoxyethyl ester formulation of 2,4-D was used; AS = ammonium sulfate; X-77 = nonionic surfactant by Valent Co.; Glyphosate&2,4-DII = Landmaster II herbicide; Glyphosate&dicamba = Fallowmaster herbicide; dry flowable formulation of atrazine was used.

Summary. Paraquat controlled Russian thistle completely at all rates applied. Glyphosate applied alone required 0.375 lb ae/A for complete Russian thistle control but glyphosate plus 2,4-D (Landmaster II) or glyphosate plus dicamba (Fallow Master) were much more effective. Foxtail control was good to excellent with all treatments except the lowest rates (0.14 and 0.188 lb ae/A) of glyphosate.

Wheat plantback after quinclorac treatments in fallow, Minot 1991. The experiment was established in 5 to 12-inch tall durum stubble (3800 lb/A residue) on a loam soil with pH 6.7 and 2.4% organic matter. Fall (F) treatments were applied Oct. 17, 1989 when air temperature was 36 F and soil surface was dry. Spring (S) treatments were applied Apr. 25, 1990 and application was followed immediately by rain. Almost no annual weeds were emerged on Apr. 25. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 5 when green foxtail was 2-leaf and densely populated, kochia was 0.5- to 2-inch tall with 5 to 200 per sq yd, and Russian thistle was 0.5- to 3-inch tall with 3 to 75 per sq yd. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 5 to control emerged vegetation. Green foxtail control (dense population) was estimated again on July 11, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 11. "Amidon" spring wheat was seeded 1.5 inches deep on Apr. 9, 1991 with a John Deere single-disc no-till drill and with no preplant tillage. Urea at 50 lb N/A was surface-applied on Apr. 8 to supplement 90 lb N/A detected by soil test. Forty-five lb/A of 11-55-0 was applied with the seed at planting. Wheat was harvested with a plot combine on Aug. 12, 1991 and yields were corrected to 12% moisture. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

1990 treatment[a]	Rate	Plant height	Wheat grain yield	
	(lb/A)	(cm)	(kg/ha)	(Bu/A)
Quinclorac(F)	0.75	103	3770	55
Quinclorac(F)	1	106	4018	58
Quinclorac(F)	1.5	103	4031	58
Quinclorac(F)	2	103	3871	56
Quinclorac(S)	0.5	105	4011	58
Quinclorac(S)	0.75	103	3800	55
Quinclorac(S)	1	106	3976	57
Quinclorac(S)	1.25	104	3933	57
Quinclorac(S)	1.5	103	3784	55
Quinclorac+Atrazine(S)	0.5+0.5	102	3717	54
Quinclorac+Atrazine(S)	0.75+0.5	101	3470	51
Quinclorac+Atrazine(S)	1+0.5	102	3821	55
Quinclorac+Atrazine(S)	1.25+0.5	103	4196	60
Quinclorac+Atrazine+Clomazone(S)	0.5+0.5+0.5	106	4156	60
Quinclorac+Atrazine+Clomazone(S)	0.75+0.5+0.5	104	4132	60
Quinclorac+Atrazine+Clomazone(S)	1+0.5+0.5	100	3536	52
Quinclorac+Atrazine+Clomazone(S)	1.25+0.5+0.5	103	3744	54
Clomazone+Atrazine(S)	0.5+0.5	104	4128	60
C.V. %		2	9	9
LSD 5%		NS	NS	NS

[a]Dry flowable formulation of atrazine was used.

Summary. There was no evidence of plant height or grain yield reductions by any of the treatments, although an untreated check was not included in the experiment. No appreciable wheat injury was observed early in the season.

Wheat plantback after quinclorac treatments in fallow, Carrington 1991. The experiment was established in barley stubble (2280 lb/A residue) on a loam soil with pH 6.9 and 2.4% organic matter. Fall (F) treatments were applied October 16, 1989 when air temperature was 57 F and soil surface was dry. Spring (S) treatments were applied April 26, 1990 when air temperature was 47 F with drizzling rain. Almost no annual weeds were emerged on April 26. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 6 when foxtail (60% green and 40% yellow foxtail) was 2- to 4-leaf and 10 to 150 per sq yd, kochia was 2 to 4 inches tall with 0.5 to 50 per sq yd, Russian thistle was 2 to 4 inches tall with 0.5 to 25 per sq yd, wild buckwheat was 4 inches tall with 2 to 30 per sq yd, and common lambsquarters was 2 to 4 inches tall with 0.5 to 10 per sq yd. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 6 to control emerged vegetation. Foxtail, redroot pigweed, and kochia control was estimated again on July 12, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 12.

Urea was applied in early May 1991 at 60 lb N/A to supplement 44 lb N/A measured by soil test. Stoa hard red spring wheat was seeded 1.5 inch deep on May 20 at 90 lb/A using a Tye no-till drill and no seedbed preparation tillage. Glyphosate at 1 lb ae/A was applied May 24 over the entire experimental area to control emerged weeds. The entire area was sprayed postemergence with diclofop + bromoxynil + MCPA at 1.25 + 0.38 + 0.047 lb/A for control of foxtail and broadleaf weeds. Plots were machine-harvested at maturity and yields adjusted to 12% moisture. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

1990 treatment[a]	Rate (lb/A)	Wheat grain yield (bu/A)	(kg/ha)
Quinclorac(F)	0.75	26	1562
Quinclorac(F)	1	24	1424
Quinclorac(F)	1.5	25	1480
Quinclorac(F)	2	28	1661
Quinclorac(S)	0.5	27	1583
Quinclorac(S)	0.75	30	1774
Quinclorac(S)	1	30	1774
Quinclorac(S)	1.25	34	1997
Quinclorac(S)	1.5	28	1654
Quinclorac+Atrazine(S)	0.5+0.5	33	1948
Quinclorac+Atrazine(S)	0.75+0.5	32	1900
Quinclorac+Atrazine(S)	1+0.5	28	1692
Quinclorac+Atrazine(S)	1.25+0.5	30	1784
Quinclorac+Atrazine+Clomazone(S)	0.5+0.5+0.5	26	1559
Quinclorac+Atrazine+Clomazone(S)	0.75+0.5+0.5	29	1733
Quinclorac+Atrazine+Clomazone(S)	1+0.5+0.5	33	1936
Quinclorac+Atrazine+Clomazone(S)	1.25+0.5+0.5	31	1861
Clomazone+Atrazine(S)	0.5+0.5	27	1610
C.V. %		17	17
LSD 5%		NS	NS

[a]Dry flowable formulation of atrazine was used.

Summary. None of the treatments appeared to reduce grain yield. No herbicide injury symptoms were observed.

Wheat plantback after quinclorac treatments in fallow, Fargo 1991. The experiment was established in wheat stubble (3190 lb/A residue) on a silty clay soil with pH 7.8 and 3.9% organic matter. Fall (F) treatments were applied October 20, 1989 when air temperature was 31 F and soil surface was dry. Spring (S) treatments were applied April 19, 1990 when air temp was 70 F with a dry soil surface. No weeds were emerged on April 19. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 12, 1990. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 12 to control emerged vegetation. Weed control was estimated again on July 14, 1990 followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 14.

Butte 86 hard red spring wheat was seeded April 26, 1991 at 90 lbs/A with a Haybuster no-till drill with double-disc openers and a seeding depth of 1.5 inches. The entire experimental area was treated with thifensulfuron&tribenuron (Harmony Extra) at 0.375 oz/A on May 28 for broadleaf weed control. Grain was machine harvested at maturity (Aug. 7, 1991) and yields were adjusted to 12% moisture. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

1990 treatment[a]	Rate (lb/A)	Wheat grain yield (bu/A)	(kg/ha)
Quinclorac(F)	1	41	2816
Quinclorac(F)	1.5	46	3172
Quinclorac(F)	2	44	3018
Quinclorac(S)	0.75	39	2641
Quinclorac(S)	1	40	2745
Quinclorac(S)	1.25	45	3051
Quinclorac(S)	1.5	41	2814
Quinclorac(S)	2	45	3065
Quinclorac+Atrazine(S)	0.75+0.5	43	2934
Quinclorac+Atrazine(S)	1+0.5	43	2944
Quinclorac+Atrazine(S)	1.25+0.5	46	3147
Quinclorac+Atrazine(S)	2+0.5	43	2934
Quinclorac+Atrazine+Clomazone(S)	0.75+0.5+0.5	44	3017
Quinclorac+Atrazine+Clomazone(S)	1+0.5+0.5	41	2793
Quinclorac+Atrazine+Clomazone(S)	1.25+0.5+0.5	46	3178
Quinclorac+Atrazine+Clomazone(S)	1.5+0.5+0.5	39	2679
Clomazone+Atrazine(S)	0.5+0.5	46	3138
Untreated	0	36	2427
C.V. %		13	13
LSD 5%		NS	NS

[a]Atrazine dry flowable was used.

Summary. None of the treatments reduced yield of wheat planted 12 or 17 months after application. No early-season wheat injury was observed (data not shown).

Synergists for foxtail control with thifensulfuron and tribenuron, Fargo 1991. Treatments were applied July 11 with a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Yellow foxtail had 6 to 9 leaves and was 12 to 14 inches tall with 2 tillers at time of treatment. Foxtail had been mowed once, several weeks before treatment. Environmental conditions at treatment were: air temperature 71 F, relative humidity 60%, cloudy skies, wind 2 to 5 mph, and moist soil. About 0.5 inch of rain fell 3 hours after treatment. Visual estimates of percentage control were made July 25. Plot size was 10 by 25 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate (oz/A)	Yellow foxtail control (%)
Thifensulfuron	0.5	27
Thifensulfuron+Mefluidide	0.5+2	48
Thif+Chlorpyrifos	0.5+8	26
Thif+Disulfoton	0.5+8	27
Thif+Piperonyl butoxide	0.5+8	24
Thif+Paclobutrazol	0.5+8	43
Thifensulfuron&Tribenuron	0.5	46
Thif&Trib+Mefluidide	0.5+2	64
Thif&Trib+Chlorpyrifos	0.5+8	48
Thif&Trib+Disulfoton	0.5+8	46
Thif&Trib+Piperonyl butoxide	0.5+8	51
Thif&Trib+Paclobutrazol	0.5+8	51
C.V. %		15
LSD 5%		9

[a]All treatments were applied with methylated seed oil adjuvant (Sun-It) at 1 qt/A; Chlorpyrifos = Lorsban 4E insecticide; Mefluidide = Embark 2E; Disulfoton = Di-Syston 6E insecticide.

Summary. Mefluidide enhanced control of yellow foxtail by thifensulfuron and thifensulfuron&tribenuron (Harmony Extra). Similarly, paclobutrazol increased control by thifensulfuron. Treatments were applied to large, relatively mature plants. If these synergists are working through inhibition of cytochrome P450 monooxygenases, they probably would enhance control to a greater degree in younger plants.

Insecticide synergism of nicosulfuron in corn, Fargo 1991. The experiment was established on a conventionally tilled silty clay with pH 7.8 and 4.3% organic matter. Pioneer 3963 corn was planted May 16 at 23,000 seeds/A and 1.5 inches deep using a 4-row Hiniker with double disc openers and dual angled press wheels. Insecticide granules were applied to the two center rows of each 4-row plot. Granules were applied with the planter in three ways: 1) "Furrow" placed granules in contact with the seed by positioning the tube immediately behind the leading edge of the double disc openers; 2) "T-band" also has been referred to a modified in furrow application and placed granules at various levels above the seed (very little on the ground surface) by positioning the tube end behind the double disc openers, in front of the press wheels, and about 4 inches above the soil surface; 3) "Band" placed granules in a 7-inch band behind the openers and before the press wheels. The entire area was treated May 17 with cyanazine + atrazine + alachlor at 2 + 0.38 + 3 lb/A for general weed control. Plots were essentially weed-free all season. The entire area (except for untreated check plots) was sprayed June 8 with nicosulfuron + petroleum oil adjuvant + urea ammonium nitrate at 0.5 oz ai/A + 1% + 4% v/v using an ATV-mounted sprayer delivering 10 gal/A with 8002 nozzles (extended range tips) and 28 psi. Conditions during nicosulfuron treatment were: 63 F, sunny, corn 4- to 7-leaf and 7 to 10 inches tall. Visual estimates of corn injury on the center two rows of each plot were taken June 19. Plot size was 10 by 25 ft and the experiment was randomized complete block design with four replications.

Treatment[a]	Rate[b] (oz ai/A)	Corn injury (%)
Untreated	0	0
Nicosulfuron	0.5	1
Counter-15G band / Nicosulfuron	1.2 / 0.5	0
Counter-15G T-band / Nicosulfuron	1.2 / 0.5	3
Counter-15G furrow / Nicosulfuron	1.2 / 0.5	9
Counter-20CR band / Nicosulfuron	1.2 / 0.5	0
Counter-20CR T-band / Nicosulfuron	1.2 / 0.5	1
Counter-20CR furrow / Nicosulfuron	1.2 / 0.5	0
Force-1.5G band / Nicosulfuron	0.12 / 0.5	0
Force-1.5G T-band / Nicosulfuron	0.12 / 0.5	0
Force-1.5G furrow / Nicosulfuron	0.12 / 0.5	0
Lorsban-15G band / Nicosulfuron	1.2 / 0.5	0
Lorsban-15G T-band / Nicosulfuron	1.2 / 0.5	0
Lorsban-15G furrow / Nicosulfuron	1.2 / 0.5	0
C.V. %		245
LSD 5%		3

[a]Nicosulfuron applied with petroleum oil adjuvant at 1% v/v plus 28% urea ammonium nitrate at 4% v/v.

[b]Insecticide rates given in oz ai per 1000 ft of row. Counter-15G, Lorsban, and Force applied at 8 oz product per 1000 ft of row, while Counter-20CR was applied at 6 oz product per 1000 ft of row.

Summary. Counter-15G applied in furrow followed by postemergence nicosulfuron caused 9% injury to corn. Other treatments injured corn negligibly or not at all.

Insecticide synergism of nicosulfuron in corn, Leonard 1991. The experiment was established on a conventionally tilled sandy loam with pH 8.1 and 2.4% organic matter. Pioneer 3963 corn was planted May 11 at 21,000 seeds/A and 1.5 inches deep using a 4-row Hiniker with double disc openers and dual angled press wheels. Insecticide granules were applied to the two center rows of each 4-row plot. Granules were applied with the planter in three ways: 1) "Furrow" placed granules in contact with the seed by positioning the tube immediately behind the leading edge of the double disc openers; 2) "T-band" also has been referred to a modified in furrow application and placed granules at various levels above the seed (very little on the ground surface) by positioning the tube end behind the double disc openers, in front of the press wheels, and about 4 inches about the soil surface; 3) "Band" placed granules in a 7-inch band behind the openers and before the press wheels. The entire area was treated May 11 with cyanazine + alachlor at 1.5 + 1.5 lb/A for general weed control. The entire area (except for untreated check plots) was sprayed June 5 with nicosulfuron + petroleum oil adjuvant + urea ammonium nitrate at 0.5 oz ai/A + 1% + 4% v/v using an ATV-mounted sprayer delivering 10 gal/A with 8002 nozzles (extended range tips) and 28 psi. Conditions during nicosulfuron treatment were: 70 F, cloudy, soil moist, corn 5- to 7-leaf and 8 to 15 inches tall. Visual estimates of corn injury on the center two rows of each plot were taken June 17. Plot size was 10 by 25 ft and the experiment was randomized complete block design with four replications.

Treatment[a]	Rate[b] (oz ai/A)	Corn injury (%)
Untreated	0	0
Nicosulfuron	0.5	2
Counter-15G band / Nicosulfuron	1.2 / 0.5	3
Counter-15G T-band / Nicosulfuron	1.2 / 0.5	8
Counter-15G furrow / Nicosulfuron	1.2 / 0.5	13
Counter-20CR band / Nicosulfuron	1.2 / 0.5	0
Counter-20CR T-band / Nicosulfuron	1.2 / 0.5	1
Counter-20CR furrow / Nicosulfuron	1.2 / 0.5	3
Force-1.5G band / Nicosulfuron	0.12 / 0.5	0
Force-1.5G T-band / Nicosulfuron	0.12 / 0.5	0
Force-1.5G furrow / Nicosulfuron	0.12 / 0.5	0
Lorsban-15G band / Nicosulfuron	1.2 / 0.5	0
Lorsban-15G T-band / Nicosulfuron	1.2 / 0.5	0
Lorsban-15G furrow / Nicosulfuron	1.2 / 0.5	0
C.V. %		218
LSD 5%		7

[a] Nicosulfuron applied with petroleum oil adjuvant at 1% v/v plus 28% urea ammonium nitrate at 4% v/v.

[b] Insecticide rates given in oz ai per 1000 ft of row. Counter-15G, Lorsban, and Force applied at 8 oz product per 1000 ft of row, while Counter-20CR was applied at 6 oz product per 1000 ft of row.

Summary. Counter-15G applied in furrow or in a T-band followed by postemergence nicosulfuron caused 13% and 8% injury, respectively, to corn. Other treatments injured corn negligibly or not at all.

Nicosulfuron injury in corn by postemergence insecticides, Fargo 1991. The experiment was established on a conventionally-tilled silty clay with pH 7.8 and 4.4% organic matter. Interstate 343A corn was planted 1.5 inches deep on May 20 at 23,000 seeds/A in good soil moisture. All nicosulfuron was applied June 17 with 82 F air temperature, 48% relative humidity, sunny skies, good growing conditions, and corn 7.5-leaf and 14 inches tall. Nicosulfuron was mixed with 1% v/v petroleum oil adjuvant plus 4% v/v 28% urea ammonium nitrate. Chlorpyrifos and malathion were applied 7 days before (7DE), 4 days before (4DE), 1 day before (1DE), 1 day after (1DL), 4 days after (4DL), or 7 days after (7DL) nicosulfuron. Additional treatments included chlorpyrifos or malathion applied as a tank mix with nicosulfuron. All treatments were applied to the two center rows of each plot with a bicycle wheel plot sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. The entire area was treated June 27 with clopyralid + dicamba at 0.094 + 0.25 lb ae/A for control of Canada thistle, kochia, and other broadleaf weeds. Visual estimates of percentage corn injury were made June 29 and July 30 by comparing the two inner treated rows with the two outer untreated rows of each four-row plot. Plot size was 10 by 25 ft and the experiment was a completely randomized design with four replications.

Treatment	Rate (oz/A)	Corn injury evaluated 6/29 (%)	7/30 (%)
Chlorpyrifos(7DE)/Nicosulfuron	8/0.5	2	0
Chlorpyrifos(4DE)/Nicosulfuron	8/0.5	2	0
Chlorpyrifos(1DE)/Nicosulfuron	8/0.5	5	1
Nicosulfuron+Chlorpyrifos	0.5+8	36	11
Nicosulfuron/Chlorpyrifos(1DL)	0.5/8	2	1
Nicosulfuron/Chlorpyrifos(4DL)	0.5/8	1	0
Nicosulfuron/Chlorpyrifos(7DL)	0.5/8	2	0
Malathion(7DE)/Nicosulfuron	8/0.5	1	0
Malathion(4DE)/Nicosulfuron	8/0.5	0	0
Malathion(1DE)/Nicosulfuron	8/0.5	7	0
Nicosulfuron+Malathion	0.5+8	21	4
Nicosulfuron/Malathion(1DL)	0.5/8	3	0
Nicosulfuron/Malathion(4DL)	0.5/8	4	0
Nicosulfuron/Malathion(7DL)	0.5/8	1	0
Nicosulfuron	0.5	0	0
Untreated	0	0	0
C.V. %		97	303
LSD 5%		7	5

[a]Nicosulfuron treatments were mixed with petroleum oil adjuvant at 1% plus 28% urea ammonium nitrate at 4% v/v.

Summary. Tank mixing nicosulfuron with chlorpyrifos (LORSBAN 4EC) or malathion (CYTHION 5EC) insecticides resulted in 36 and 21% corn injury, respectively. Nicosulfuron alone did not injure corn. Injury was detectable but considerably less when nicosulfuron and insecticide applications were separated by 1, 4, or 7 days.

Postemergence bentazon and acifluorfen in drybeans, Prosper 1991. Nodak pintos were seeded in 30-inch rows at 70,000 plants per acre on June 7 in a conventionally tilled silt loam. Initial postemergence treatments (P1) were applied using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles on June 27 when air temperature was 74 F, relative humidity was 40%, skies were sunny, growing conditions good, drybeans were 1.5 trifoliolate, wild mustard was 2 to 4-leaf and 1 to 2 inches tall, and common lambsquarters was 4 to 9-leaf and 1 to 5 inches tall. Two treatments received a second postemergence application (P2) on July 8 when air temperature was 74 F, relative humidity was 40%, skies were partly cloudy, drybeans were 4 trifoliolate and 8 inches tall, wild mustard was 4 to 6-leaf, and common lambsquarters was 3 to 7 inches tall. Visual estimates of crop injury and weed control were taken on July 23. Plot size was 10 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate (lb/A)	Drybean injury	Weed control Wimu	Colq
			(%)	
Bentazon+POC(P1)	0.75+1pt	2	99	98
Bentazon+Sunit(P1)	0.75+1pt	3	99	88
Bentazon+28%UAN(P1)	0.75+2qt	2	100	48
Acifluorfen(P1)	0.125	2	97	26
Acifluorfen+X77(P1)	0.125+0.25%	2	100	35
Acifluorfen+Sunit(P1)	0.125+1pt	4	100	88
Bentazon&Acifluorfen(P1)	0.563&0.125	2	100	42
Bentazon&Acif+X77(P1)	0.563&0.125+0.25%	2	100	62
Bent+POC(P1)/Bent+POC(P2)	0.5+1pt/0.5+1pt	2	100	98
Bent&Acif+X77(P1)/Bent+POC(P2)	0.563&0.125+0.25%/0.5+1pt	2	100	86
C.V. %		47	1	26
LSD 5%		NS	1	25

[a]POC = petroleum oil adjuvant containing 17% emulsifier; Sunit = methylated vegetable oil containing 15% emulsifier; Bent&Acif = Galaxy herbicide by BASF containing 3 lb/gal bentazon plus 0.667 lb/gal acifluorfen.

Summary. Little drybean injury was observed. All treatments controlled wild mustard. Bentazon with petroleum oil adjuvant or Sunit controlled common lambsquarters, as did acifluorfen with Sunit. Split applications involving bentazon plus petroleum oil adjuvant also controlled lambsquarters.

Drybean cultivar response to clomazone, Carrington 1991. The experiment was established May 31 on a conventionally tilled loam soil with pH 6.6 and 3.8% organic matter. Treatments were applied with a bicycle wheel sprayer delivering 17 gpa with 8002 nozzle tips and 40 psi. Herbicides were double-pass incorporated within 1 hr after application with a field cultivator/harrow cutting 3 inches deep. Drybeans were seeded 1.5 inches deep on June 7 at 90,000 seeds/A for Upland, Mayflower, and Schooner, and 70,000 seeds/A for Nodak and Topaz. Visual estimates of percentage crop injury were made June 25 when drybeans were in the first trifoliolate stage. Plot size was 11 by 25 ft and the experiment was a split plot with four replications and cultivars serving as main plots.

Treatment	Rate (lb/A)	Drybean cultivar[a]				
		Mayflower	Nodak	Schooner	Topaz	Upland
		(% injury)				
Clomazone	0.5	4	1	1	2	3
Clomazone+Ethalfluralin	0.5+0.75	3	1	1	2	2
Clomazone+Trifluralin	0.5+0.75	3	1	1	2	3

C.V. %	73
Cultivar	**
Treatment	NS
Treatment x cultivar	NS

[a]Upland, Mayflower, and Schooner are navy beans and Nodak and Topaz are pintos.

Summary. None of the cultivars were injured greatly by clomazone. Injury was expressed as foliar bleaching.

Herbicides and cultivation for drybeans, Carrington 1991. The experiment was established May 31 on a conventionally tilled silt loam with pH 6.6 and 3.8% organic matter. Preplant incorporated (PPI) herbicides were applied onto a dry soil surface with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Air temperature was 82 F. The entire experimental area was double pass incorporated with a field cultivator/harrow operated 3 inches deep and within 1.5 hours of EPTC treatments. Nodak pintos were seeded 1.5 inches deep at 70,000 seeds per acre in 30-inch rows on May 31. High cultivation plots were rotary hoed June 7 when drybeans were in the cracking to crook stage and again on June 14 when in the unifoliolate stage. Visual estimates of percentage weed control and crop injury were taken June 24. Postemergence (PO) treatments were applied June 24 with the sprayer used above but with 8.5 gal/A and 8001 nozzles. Conditions during spraying were: 88 F air temp, overcast skies, 65% relative humidity, foxtail (50% yellow and 50% green foxtail) was 3- to 5-leaf, 2 to 6 inches tall, and tillered, redroot pigweed was 4- to 7-leaf and 1 to 3 inches tall, wild mustard was 3- to 7-leaf and 0.5 to 4 inches tall, wild buckwheat was 3- to 8-leaf and 1.5 to 4 inches tall, and drybeans were 2-trifoliolate and 5 to 7 inches tall. All plots were cultivated June 25 and high cultivation plots were cultivated again July 16. Visual estimates of weed control and crop injury were taken July 16 after cultivation. Seed yields were taken August 28 and 29 from the center two rows of each plot by hand pulling plants and passing through a plot combine. The experiment was a split plot with four replications; main plots were cultivation level (high and low). Plot size was 10 by 27 ft and treatments (herbicides, rotary hoeing, and cultivation) were applied to the center 7 ft leaving untreated areas along the plot edges used for weed control evaluation.

Summary. Drybean stands were reduced slightly by two rotary hoeings, but herbicide injury symptoms were not affected (Table 1). On June 24, weed control averaged across all herbicide treatments was greater in the high (two rotary hoeings) than in the low (no rotary hoeings) cultivation plots for all weed species. By July 16, however, after low culivation plots had been cultivated once and high cultivation plots had received two cultivations and two rotary hoeings, weed control was high in all plots. Nevertheless, wild mustard and wild buckwheat control were slightly higher on July 16 in the high cultivation plots.

Clomazone injured drybeans early but plants recovered by mid July (Table 2). All treatments had similar grain yield. The June 24 weed control evaluation (taken before cultivation and before postemergence herbicide treatment) shows that two rotary hoeings in the high cultivation plots increased weed control compared to the low cultivation plots (Table 3). Weed control was excellent for all plots by mid July after all mechanical control measures had been completed (the untreated low-cultivation plots had been cultivated once and showed 50 to 70% control).

Table 1. Effect of level of cultivation on drybean injury and weed control (averaged across all treatments).

Cultivation level	Stand red.	Injury 6/24	Injury 7/16	Weed control Evaluated June 24 Fxtl	Wimu	Wibw	Rrpw	Weed control Evaluated July 16 Fxtl	Wimu	Wibw	Rrpw	Seed yield
	(%)											(kg/ha)
High	4	2	2	92	93	91	94	99	100	100	100	2080
Low	1	0	1	80	66	78	81	97	96	96	98	2360
F-test	**	NS	NS	**	**	*	*	NS	*	*	NS	NS
P value	.009	.274	.185	.005	.004	.030	.012	.070	.031	.012	.185	.083

-- See next two pages for additional data --

-- See previous page for experiment description and summary --

Table 2. Effect of herbicides and level of cultivation on drybean injury and yield.

Herbicide[a]	Rate[a] (lb/A)	Cultivation level	Stand red.	Injury 6/24 (%)	Injury 7/16 (%)	Seed yield (kg/ha)	Seed yield (lb/A)
Untreated	0	High	1	1	0	2350	2090
		Low	0	0	0	2250	2010
Etha+Imep(PPI)	0.5+0.031	High	6	1	0	2470	2210
		Low	0	0	0	2320	2070
Clom+Etha(PPI)	0.5+0.75	High	8	17	2	2100	1870
		Low	4	2	0	2440	2180
Clom+Etha(PPI)/ Bent&Acif+X77(PO)	0.5+0.75/ 0.57&0.13+0.25%	High	4	7	2	2100	1880
		Low	1	2	1	2310	2060
EPTC+Etha(PPI)	2.2+0.75	High	5	1	1	2080	1850
		Low	1	0	0	2580	2300
EPTC+Etha(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	4	2	2	2060	1840
		Low	1	1	0	2360	2110
EPTC+Trifluralin(PPI)	2.2+.75	High	7	1	2	2230	1980
		Low	1	0	0	2410	2150
EPTC+Trif(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	3	0	0	1990	1780
		Low	3	0	2	2330	2080
Alachlor+Etha(PPI)	2+0.75	High	3	1	0	2050	1830
		Low	3	0	0	2360	2100
Alac+Etha(PPI)/ Bent&Acif+X77(PO)	2+0.75/ 0.57&0.13+0.25%	High	8	3	5	1930	1720
		Low	2	0	2	2570	2290
Imazethapyr+Etha(PPI)	0.031+0.75	High	1	4	0	2340	2090
		Low	4	2	2	2520	2250
Imep+Etha(PPI)/ Bent&Acif+X77(PO)	0.031+0.75/ 0.57&0.13+0.25%	High	5	2	4	2020	1800
		Low	1	1	0	2300	2050
Etha(PPI)/ Bent&Acif+X77(PO)	0.75/ 0.57&0.13+0.25%	High	6	0	3	1800	1610
		Low	1	0	0	2360	2100
EPTC(PPI)/ Bent&Acif+X77(PO)	3/ 0.57&0.13+0.25%	High	1	1	1	2030	1810
		Low	1	0	0	2490	2220
Bent&Acif+Seth+Sun(PO)	0.57&0.13+0.2+1Q	High	3	0	7	1810	1620
		Low	0	0	3	2200	1970
Imep+Seth+Sunit(PO)	0.031+0.2+1Q	High	7	0	2	1950	1740
		Low	0	1	0	1920	1710
C.V. %			91	265	218	12	12
LSD 5%			4	6	NS	NS	NS

[a]Bent&Acif = Galaxy herbicide containing 3 lb/gal bentazon plus 0.67 lb/gal acifluorfen; Sun or Sunit = Sun-it II methylated seed oil adjuvant containing emulsifier; 1Q = 1 quart per acre.

-- See previous two pages --

Table 3. Effect of herbicides and level of cultivation on weed control.

Herbicide[a]	Rate[a] (lb/A)	Cultivation level	Weed control, Evaluated June 24 Fxtl (%)	Wimu (%)	Wibw (%)	Rrpw (%)	Evaluated July 16 Fxtl (%)	Wimu (%)	Wibw (%)	Rrpw (%)
Untreated	0	High	72	71	34	73	94	97	96	98
		Low	0	0	0	0	58	71	60	71
Etha+Imep(PPI)	0.5+0.031	High	100	100	100	100	100	100	100	100
		Low	100	100	100	100	100	100	100	100
Clom+Etha(PPI)	0.5+0.75	High	100	94	100	100	100	100	100	100
		Low	98	79	97	100	99	92	98	100
Clom+Etha(PPI)/ Bent&Acif+X77(PO)	0.5+0.75/ 0.57&0.13+0.25%	High	100	93	100	100	100	100	100	100
		Low	96	60	98	100	99	100	100	100
EPTC+Etha(PPI)	2.2+0.75	High	100	100	100	100	100	100	100	100
		Low	99	75	99	100	99	98	100	100
EPTC+Etha(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	99	98	100	100	100	100	100	100
		Low	100	94	97	100	100	99	100	100
EPTC+Trif(PPI)	2.2+0.75	High	99	93	100	100	100	100	100	100
		Low	100	79	97	100	100	95	99	100
EPTC+Trif(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	100	99	100	100	100	100	100	100
		Low	100	81	92	100	100	96	100	100
Alachlor+Etha(PPI)	2+0.75	High	99	84	100	100	98	96	99	99
		Low	99	74	99	100	100	98	99	100
Alac+Etha(PPI)/ Bent&Acif+X77(PO)	2+0.75/ 0.57&0.13+0.25%	High	100	98	100	100	100	100	100	100
		Low	99	69	75	100	100	96	99	100
Imep+Etha(PPI)	0.031+0.75	High	100	100	100	100	100	100	100	100
		Low	99	100	100	100	100	100	100	100
Imep+Etha(PPI)/ Bent&Acif+X77(PO)	0.031+0.75/ 0.57&0.13+0.25%	High	100	100	100	100	100	100	100	100
		Low	99	100	100	100	100	100	100	100
Etha(PPI)/ Bent&Acif+X77(PO)	0.75/ 0.57&0.13+0.25%	High	97	100	100	100	99	100	100	100
		Low	98	60	96	100	100	97	99	99
EPTC(PPI)/ Bent&Acif+X77(PO)	3/ 0.57&0.13+0.25%	High	74	100	100	100	100	100	100	100
		Low	99	94	92	99	99	99	98	99
Be&Ac+Seth+Sun(PO)	0.57&0.13+0.2+1Q	High	66	71	58	75	99	100	100	100
		Low	0	0	0	0	99	97	95	98
Imep+Seth+Sunit(PO)	0.031+0.2+1Q	High	72	81	67	58	100	100	99	99
		Low	0	0	0	0	99	100	95	100
C.V. %			18	25	16	17	4	5	3	4
LSD 5%			22	29	20	21	6	7	4	5

[a]Bent&Acif = Galaxy herbicide containing 3 lb/gal bentazon plus 0.67 lb/gal acifluorfen; Sun or Sunit = Sun-it II methylated seed oil adjuvant containing emulsifier; 1Q = 1 quart per acre.

Trifluralin and ethalfluralin granules for no-till sunflowers, Pillsbury 1991. Experiment was established in standing wheat stubble (50 bushel/A yield in 1990) on a loam soil with pH 7.3 and 4.3% organic matter (0 to 2 inch). Trifluralin (Treflan 10G) and ethalfluralin (Sonalan 10G) granules were applied either on Oct. 30 or on Nov. 19, 1990 using a Gandy airflow. For treatments incorporated with a field cultivator, the plots were first rototilled to destroy surface crop residues before herbicide application. On Oct. 30, air temp was 65 F with sunny skies and soil was moist; on Nov. 19 skies were sunny with 50 F. Herbicide granules were either left on the surface or were incorporated once with a field cultivator/harrow operated 3 inches deep, a Haybuster undercutter operated 1.5 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Incorporation by field cultivator was done Oct. 30 while other incorporation operations were done Oct. 31 with highs in the mid 50s F with sunny skies. Visual estimates of percentage green foxtail control were taken June 3 before seeding sunflowers. No-residue, field cultivator-incorporated treatments received a second incorporation with a field cultivator June 6. Northrup King sunflowers were seeded June 8 using a John Deere MaxEmerge no-till planter. Foxtail control was evaluated again July 8. Plot size was 25 by 33 ft. The experiment was a randomized complete block with four replications.

Herbicide application			Herbicide incorporation method	Green foxtail control	
Herbicide	Rate (lb ai/A)	Date		6/3	7/8
				(%)	
Trifluralin	1	Oct. 30	Field cultivator[a]	68	90
Trifluralin	1	Oct. 30	None	89	88
Trifluralin	1	Nov. 19	None	80	73
Trifluralin	1.5	Nov. 19	None	97	96
Trifluralin	1	Oct. 30	Rotary hoe	91	95
Trifluralin	1.5	Oct. 30	Rotary hoe	98	97
Trifluralin	1	Oct. 30	Undercutter	89	91
Trifluralin	1.5	Oct. 30	Undercutter	89	94
Trifluralin	1	Oct. 30	Undercutter/Rotary hoe	83	83
Trifluralin	1.5	Oct. 30	Undercutter/Rotary hoe	99	98
Ethalfluralin	1	Oct. 30	Field cultivator[a]	79	90
Ethalfluralin	1	Oct. 30	None	80	37
Ethalfluralin	1	Nov. 19	None	92	60
Ethalfluralin	1.5	Nov. 19	None	98	92
Ethalfluralin	1	Oct. 30	Rotary hoe	93	84
Ethalfluralin	1.5	Oct. 30	Rotary hoe	91	94
Ethalfluralin	1	Oct. 30	Undercutter	76	62
Ethalfluralin	1.5	Oct. 30	Undercutter	88	83
Ethalfluralin	1	Oct. 30	Undercutter/Rotary hoe	79	65
Ethalfluralin	1.5	Oct. 30	Undercutter/Rotary hoe	90	88
C.V. %				9	21
LSD 5%				11	25

[a]Little to no surface crop residues in these plots.

-- See next page for summary --

-- See previous page for data and experiment description --

Summary. When granules were left on the surface without incorporation, trifluralin controlled foxtail better when applied in late October compared to Nov. 19; opposite results were obtained with ethalfluralin. For trifluralin, preplant foxtail control with no incorporation was better than the single-pass field incorporation, but incorporation with the undercutter or rotary hoe did not further improve control. Mid-season foxtail control with trifluralin was about 90% for both field cultivator incorporation and no incorporation and may have been improved slightly by rotary hoe incorporation. For ethalfluralin, preplant foxtail control was greater than 90% only when incorporated by rotary hoe or when applied Nov. 19 and left unincorporated. Mid-season foxtail control with ethalfluralin was 90% when field cultivator incorporated, slightly less when rotary hoe incorporated, and 60 to 65% when incorporated with the undercutter. None of the treatments injured sunflowers.

Burndown treatments in no-till soybeans, Carrington 1991. Experiment was established on a loam soil with pH 6.0 and 3.5% organic matter. Treatments were applied May 31 in standing barley stubble with a bicycle wheel plot sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Conditons at time of treatment were: 78 F air temperature, 35% relative humidity, sunny skies, dry soil surface, foxtail (60% green and 40% yellow foxtail) 2- to 4-leaf and 1 to 3 inches tall, horseweed 4 to 8 inches tall, and kochia 2 to 6 inches tall. Maple Ridge soybeans were seeded 1.5 inches deep on June 11 with a John Deere MaxEmerge planter set on 30-inch rows. Visual estimates of percentage weed control were taken June 25. Plot size was 10 by 25 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate[a]	Foxtail	Horseweed	KOCZ
	(lb/A)	(% control)		
Glyphosate+X77	0.28+0.5%	95	94	74
Glyphosate+X77	0.375+0.5%	97	93	93
Glyphosate+2,4-D-dma+X77	0.28+0.5+0.5%	95	96	84
Paraquat+X77	0.5+0.5%	97	100	100
Glyphosate+Acif+Dash	0.188+0.125+0.25G	61	68	70
Acifluorfen+2,4-D-bee+Dash	0.125+0.5+0.25G	14	87	50
Acifluorfen+BCH77000S	0.125+0.25%	18	0	14
Acifluorfen+BCH234S	0.125+0.25G	37	16	18
Sethoxydim+2,4-D-bee+Dash	0.1+0.5+0.25G	60	87	15
Thif+Mefluidide+X77	0.0234+0.25+0.5%	14	66	59
Thif+Mefluidide+X77	0.0117+0.25+0.5%	6	64	59
Control (Metr+Pend+X77)	0 (0.188+1.5+0.5%)	18	11	16
C.V. %		34	12	29
LSD 5%		25	11	23

[a]Metribuzin (dry flowable formulation) plus pendimethalin at 0.19 + 1.5 lb/A was applied as a tank mix with all treatments; 2,4-D-dma = dimethylamine salt of 2,4-D; 2,4-D-bee = butoxyethyl ester of 2,4-D; Thif = thifensulfuron; Dash, BCH77000S, and BCH234S are BASF adjuvants of proprietary composition; 0.25G = 0.25 gal/A.

Summary. Essentially complete control of all species was achieved with paraquat at 0.5 lb/A. Glyphosate at 0.375 lb/A controlled all species 93% or greater. Glyphosate at 0.28 lb/A or lower controlled kochia unsatisfactorily. All other treatments provided fair to poor burndown of most species present.

Total postemergence weed control in soybeans, Carrington 1991. Maple Ridge soybeans were seeded June 13 in a conventionally tilled loam with pH 5.7 and 3.5% organic matter. Split herbicide applications were applied to the first five treatments shown below. The first application (P1) was made June 24 to unifoliolate soybeans, 4- to 8-inch-tall kochia, 1 to 5 inch wild buckwheat, 2- to 5-leaf and 5- to 6-inch-tall foxtail (60% green and 40% yellow foxtail), 2- to 5-inch-tall redroot pigweed, and 3- to 6-inch-tall common lambsquarters. On June 24, air temperature was 78 F, relative humidity was 55%, skies were overcast, and soil moisture was good. The second application of the split (P2) was made July 3 when soybeans were unifoliolate to first trifoliolate and foxtail was 4- to 6-leaf and 4 to 7 inches tall. Environmental conditions on July 3 included 65 F, 55% relative humidity, cloudy skies, and wet soil. Treatments 6 to 10 received only one herbicide application and were treated June 24 (P1). All herbicides were applied with a bicycle wheel plot sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Visual estimates of percentage weed control and soybean injury were made July 16. Plot size was 10 by 25 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate[a] (oz/A)	Sobe inj	Weed control Fxtl	Wibw	Rrpw	KOCZ	Colq
			(%)				
Bent&Acif+28%(P1)/ Bent+Seth+Dash+28%(P2)	11+1G/ 8+3.2+1Q+1G	0	95	97	100	91	99
Bent&Acif+POC(P1)/ Bent+Seth+Dash+28%(P2)	11+1Q/ 8+3.2+1Q+1G	0	96	76	100	97	77
Bent&Acif+28%(P1)/ Bent+Seth+Dash+28%(P2)	14.7+1G/ 8+3.2+1Q+1G	0	94	92	100	100	-
Bent&Acif+POC(P1)/ Bent+Seth+Dash+28%(P2)	14.7+1Q/ 8+3.2+1Q+1G	0	94	91	99	97	-
Bent&Acif+Thif+X77+28%(P1) Bent+Seth+Dash+28%(P2)	11+0.032+0.13%+1G/ 8+3.2+1Q+1G	0	95	98	100	96	100
Bentazon+Sethoxydim+X77+28%(P1)	8+3.2+1Q+1G	0	96	36	39	-	-
Bent&Acif+Seth+X77+28%(P1)	11+3.2+0.25%+1G	0	74	84	97	-	-
Bent&Acif+Thif+Seth+X77+28%(P1)	11+0.032+3.2+0.25%+1G	0	63	81	100	98	100
Imazethapyr+SunitII(P1)	0.5+0.19G	0	72	79	98	91	75
Thifensulfuron+Sethoxydim(P1)	0.062+3.2	0	74	63	100	52	100
C.V. %		0	8	17	5	12	19
LSD 5%		NS	9	20	7	16	22

[a]Sethoxydim and Seth = Poast Plus herbicide containing sethoxydim plus proprietary adjuvant; 28% = 28% urea ammonium nitrate solution; Bent&Acif = Galaxy herbicide containing; G = gal/A and Q = quarts/A; POC = petroleum oil adjuvant containing 17% emulsifier; Dash = BASF adjuvant of proprietary composition; SunitII = methylated seed oil adjuvant containing emulsifier.

Summary. Rain within days after the first application stimulated another flush of foxtail and to a lesser extent wild buckwheat, thereby lowering apparent control with plots treated only on June 24 (P1). Redroot pigweed was readily controlled by all treatments except where bentazon was the only broadleaf herbicide applied. 28% UAN appeared to be a more effective than petroleum oil adjuvant for control of wild buckwheat and common lambsquarters with bentazon&acifluorfen. Imazethapyr at 0.5 oz/A plus Sun-It II controlled foxtail as well as sethoxydim (Poast plus) tank mixed with bentazon&acifluorfen plus adjuvants. All treatments except thifensulfuron controlled kochia.

Fall-applied trifluralin and ethalfluralin granules in no-till soybeans, Carrington 1991. Experiment was established on a Heimdal-Emrick loam with pH 8.1, 3.8% organic matter, 6 to 8-inch standing wheat stubble, and 6600 lb/A surface residues. Trifluralin and ethalfluralin granules were applied either on Oct. 22 or on Nov. 28, 1990 using a Gandy airflow. Trifluralin emulsifiable concentrate was applied either Oct. 22 or Nov. 30 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles. In the two treatments incorporated with a field cultivator, the plots were first rototilled to destroy all surface crop residues before herbicide application. On Oct. 22, air temperature was 50 F with sunny skies and soil was moist; on Nov. 28, skies were sunny with 24 F; on Nov. 30, skies were partly cloudy with 38 F. Herbicide granules were either left on the surface or were incorporated once on Oct. 22 with a field cultivator operated 3 inches deep, a Haybuster undercutter operated 1.5 to 2 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Field cultivated plots were worked a second time with a Melroe culti-harrow (2 to 3 inches deep) on May 22, 1991. McCall soybeans were seeded 1.5 to 2 inches deep at 146,000 seeds/A on May 31 using a John Deere MaxEmerge no-till planter with 30-inch row spacing. Glyphosate + 2,4-D at 0.19 + 0.25 lb ae/A was applied June 1 to the entire experimental area to control emerged weeds. Soybean plants per m of row was determined June 15. Bentazon + acifluorfen at 0.75 + 0.063 lb/A was applied July 4 over the entire experiment for broadleaf weed control. Sethoxydim + Sun-it at 0.3 lb/A + 1 qt/A was applied to handweeded check plots on June 20. Visual estimates of percentage green foxtail control were taken on July 3 and Sept. 5. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined on July 4. Plots were combine-harvested on Sept. 27 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

Crop residues present on the soil surface initially and after planting. Trifluralin granules were incorporated in the fall with four different tillage practices or were left unincorporated.

Residue sampling time[a]	Tillage implement	Residue sampling method[b]: Aboveground dry matter (kg/ha)	Residue sampling method[b]: Line transect (%)
Fall	None	7420	93
Spring	None	6770	84
Spring	Field cultivator	2450	29
Spring	Rotary hoe	8090	83
Spring	Undercutter	6970	64
Spring	Undercutter/Rotary hoe	4330	60
C.V.		38	4
LSD 5%		3050	3

[a]Fall sampling done in October before any tillage or other disturbance; spring sampling done in May after planting with a no-till drill.

[b]Surface crop residues measured by 1) collecting all above-ground dry matter in 0.25 m^2 areas, 2) placing a 25-ft line diagonally across a plot and determining whether residue was present under each marker spaced at 1-ft intervals along the line.

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Herbicide application[a] Chemical	Rate (lb/A)	Date	Herbicide incorporation method	Soybean stand (plt/m)	Foxtail control 7/3 (%)	Foxtail control 9/5 (%)	Foxtail density (plt/m²)	Grain yield[b] (B/A)	Grain yield[b] (K/H)
Trif-10G	1	Oct. 22	Field cultivator	36.5	89	92	5.7	45	2760
Trif-4EC	1	Oct. 22	Field cultivator	38.3	88	90	14.7	36	2250
Trif-4EC	1	Nov. 30	None	32.8	0	0	51.3	34	2110
Trif-10G	1	Nov. 28	None	34.5	93	91	20.7	35	2120
Trif-10G	1.5	Nov. 28	None	33.3	95	91	14.3	36	2240
Trif-10G	1	Oct. 22	None	33.3	95	91	16.7	39	2440
Trif-10G	1	Oct. 22	Rotary hoe	33.0	92	95	10.0	35	2170
Trif-10G	1.5	Oct. 22	Rotary hoe	34.0	98	98	5.3	34	2130
Trif-10G	1	Oct. 22	Undercutter	36.5	95	96	9.3	39	2430
Trif-10G	1.5	Oct. 22	Undercutter	33.8	96	97	8.7	34	2100
Trif-10G	1	Oct. 22	Undercut/Rotary hoe	36.8	95	95	6.0	33	2080
Trif-10G	1.5	Oct. 22	Undercut/Rotary hoe	37.3	97	96	7.0	36	2210
Etha-10G	1	Oct. 22	Field cultivator	37.8	90	92	9.0	39	2430
Etha-3EC	1	Oct. 22	Field cultivator	36.8	63	86	19.0	38	2390
Etha-3EC	1	Nov. 30	None	33.0	5	15	38.7	30	1840
Etha-10G	1	Nov. 28	None	31.0	89	89	16.3	34	2110
Etha-10G	1.5	Nov. 28	None	32.0	95	92	8.3	33	2070
Etha-10G	1	Oct. 22	None	34.5	93	86	15.3	35	2200
Etha-10G	1	Oct. 22	Rotary hoe	37.5	91	86	21.7	35	2190
Etha-10G	1.5	Oct. 22	Rotary hoe	35.0	97	96	6.7	36	2210
Etha-10G	1	Oct. 22	Undercutter	37.8	88	91	14.0	39	2440
Etha-10G	1.5	Oct. 22	Undercutter	34.0	96	97	7.3	39	2400
Etha-10G	1	Oct. 22	Undercut/Rotary hoe	35.3	92	93	8.0	41	2570
Etha-10G	1.5	Oct. 22	Undercut/Rotary hoe	33.5	97	97	5.3	41	2520
Untreated	0	-	Field cultivator	36.3	0	0	32.3	37	2290
Untreated	0	-	Undercutter	31.0	0	0	44.7	34	2090
Handweeded	0	-	Field cultivator	36.8	100	100	0	38	2380
Handweeded	0	-	Undercutter	31.8	100	100	0	42	2620
C.V. %				11.6	7	8	90.0	13	13
LSD 5%				NS	8	10	11.4	7	420

[a] Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate; Etha-10G = Sonalan 10G granules; Etha-3EC = Sonalan 3E emulsifiable concentrate.
[b] B/A = bushels per acre; K/A = kilograms per hectare.

Summary. Liquid formulations of trifluralin or ethalfluralin applied in the fall in standing stubble and left unincorporated were ineffective in controlling foxtail. Trifluralin 10G and 4E applied to tilled plots with little crop residue and incorporated with a field cultivator controlled foxtail about 90% the following spring. Similar control was achieved with ethalfluralin 10G under these "standard" tilled conditions, but control was lower with ethalfluralin 3E. Trifluralin or ethalfluralin granules applied in late October at 1 lb ai/A in standing stubble and left unincorporated or incorporated with an undercutter or rotary hoe controlled foxtail about 90%. Control seemed to increase slightly with a higher application rate of 1.5 lb/A.

Fall-applied trifluralin and ethalfluralin granules in no-till soybeans, Minot 1991. Experiment was established on a Max-Williams loam with pH 5.6, 3.2% organic matter (0 to 2 inches), 6 to 8-inch standing wheat stubble, and 5600 lb/A surface residues. Trifluralin and ethalfluralin granules were applied Oct. 16 or Nov. 20, 1990 using a Gandy airflow applicator. Trifluralin and ethalfluralin emulsifiable concentrates were applied either Oct. 16 or Nov. 20 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles. For herbicide treatments incorporated with a field cultivator, the plots were first worked twice with a field cultivator (Oct. 15) to destroy most surface crop residues before herbicide application. On Oct. 16, air temperature was 43 F with cloudy skies and soil was dry; on Oct. 19, skies were sunny with 43 F; on Nov. 20, skies were sunny with 42 F. Herbicide granules were either left on the surface or incorporated once Oct. 19 with a field cultivator operated 3 inches deep, a Haybuster undercutter operated 1.5 to 2 inches deep, a rotary hoe, or the undercutter followed by rotary hoe. Field cultivated plots were worked a second time with a field cultivator (2 to 3 inches deep) on May 23, 1991. McCall soybeans were seeded 1.5 to 2 inches deep at 191,000 seeds/A on May 23 using a John Deere single-disc no-till drill. Glyphosate + 2,4-D (0.38 + 0.25 lb ae/A) was applied May 22 to control emerged weeds over the entire experimental area. Soybean plants per m of row was determined June 12. Bentazon at 1 lb/A was applied June 14 over the entire experiment for broadleaf weed control. Visual estimates of percentage green foxtail control were taken June 12 and Aug. 24. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined June 13. Plots were combine-harvested Aug. 26 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

Crop residues present on the soil surface initially and after planting. Trifluralin granules were incorporated in the fall with four different tillage practices or were left unincorporated.

Residue sampling time[a]	Tillage implement	Residue sampling method[b]: Aboveground dry matter (kg/ha)	Residue sampling method[b]: Line transect (%)
Fall	None	6250	91
Spring	None	4290	84
Spring	Field cultivator	1640	29
Spring	Rotary hoe	3830	75
Spring	Undercutter	4090	62
Spring	Undercutter/Rotary hoe	3080	64
C.V.		40	16
LSD 5%		1880	15

[a] Fall sampling done in October before any tillage or other disturbance; spring sampling done in May after planting with a no-till drill.

[b] Surface crop residues measured by 1) collecting all above-ground dry matter in 0.25 m^2 areas, 2) placing a 25-ft line diagonally across a plot and determining whether residue was present under each marker spaced at 1-ft intervals along the line.

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Herbicide application[a]			Herbicide incorporation method	Soybean stand	Foxtail control		Foxtail density	Grain yield[b]	
Chemical	Rate (lb/A)	Date		(plt/m)	6/12 —(%)—	8/24	(plt/m^2)	(B/A)	(K/H)
Trif-10G	1	Oct. 16	Field cultivator	16.8	93	95	69.0	24	1440
Trif-4EC	1	Oct. 16	Field cultivator	15.5	20	36	370.7	10	640
Trif-4EC	1	Nov. 20	None	15.8	5	3	614.0	6	355
Trif-10G	1	Nov. 20	None	17.5	93	83	76.7	15	945
Trif-10G	1.5	Nov. 20	None	20.3	97	92	38.3	18	1100
Trif-10G	1	Oct. 16	None	12.3	92	85	131.3	15	920
Trif-10G	1	Oct. 16	Rotary hoe	16.5	97	92	75.7	18	1110
Trif-10G	1.5	Oct. 16	Rotary hoe	19.8	99	95	45.7	20	1225
Trif-10G	1	Oct. 16	Undercutter	18.3	96	94	50.7	20	1215
Trif-10G	1.5	Oct. 16	Undercutter	21.0	98	96	25.0	22	1315
Trif-10G	1	Oct. 16	Undercut/Rotary hoe	17.0	96	95	36.0	21	1305
Trif-10G	1.5	Oct. 16	Undercut/Rotary hoe	15.8	98	98	19.7	24	1450
Etha-10G	1	Oct. 16	Field cultivator	14.3	93	96	63.7	24	1450
Etha-3EC	1	Oct. 16	Field cultivator	16.8	48	73	360.3	11	685
Etha-3EC	1	Nov. 20	None	14.3	0	3	781.7	3	205
Etha-10G	1	Nov. 20	None	15.8	53	35	226.3	12	725
Etha-10G	1.5	Nov. 20	None	15.3	77	54	162.3	10	630
Etha-10G	1	Oct. 16	None	18.3	84	52	205.3	10	595
Etha-10G	1	Oct. 16	Rotary hoe	18.5	93	85	75.7	16	980
Etha-10G	1.5	Oct. 16	Rotary hoe	15.5	98	93	27.7	20	1215
Etha-10G	1	Oct. 16	Undercutter	17.3	97	94	45.7	18	1115
Etha-10G	1.5	Oct. 16	Undercutter	17.3	99	97	16.0	22	1335
Etha-10G	1	Oct. 16	Undercut/Rotary hoe	22.5	96	95	30.3	26	1570
Etha-10G	1.5	Oct. 16	Undercut/Rotary hoe	17.0	98	98	11.7	23	1430
Untreated	0	-	Field cultivator	17.8	0	0	725.7	5	285
Untreated	0	-	Undercutter	17.8	0	0	818.7	4	245
Handweeded	0	-	Field cultivator	18.8	0	0	0	-	-
Handweeded	0	-	Undercutter	21.3	0	0	0	-	-
C.V. %				24.0	17	17	96.5	24	24
LSD 5%				NS	19	18	140.7	5	335

[a] Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate; Etha-10G = Sonalan 10G granules; Etha-3EC = Sonalan 3E emulsifiable concentrate.
[b] B/A = bushels per acre; K/A = kilograms per hectare.

Summary. Liquid formulations of trifluralin or ethalfluralin applied in the fall in standing stubble and left unincorporated were ineffective in controlling foxtail. Control with trifluralin and ethalfluralin granules was about 95% when applied to plots with little crop residue and incorporated with a field cultivator. In contrast, foxtail control by trifluralin and ethalfluralin liquid formulations applied in these "standard" tilled conditions was much lower. Trifluralin or granules applied in late October at 1 lb ai/A in standing stubble and left unincorporated or incorporated with an undercutter or rotary hoe controlled foxtail about 95%. Similar results were obtained with ethalfluralin except that control was somewhat lower without incorporation.

Burndown treatments for winter rye, Fargo. Rye was seeded September 6, 1989 in a Fargo silty clay with little surface crop residues. Treatments were applied May 11, 1990 when rye was 4 to 8 inches tall and tillered, air temperature was 68 F, and soil moisture was good. Treatments were applied with a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Visual estimates of percentage rye control were taken on May 28. Plot size was 10 by 30 ft and the experiment was a randomized complete block design with three replications.

Treatment	Rate (lb/A)	Rye control
Glyphosate	0.25	98
Glyphosate+R-11	0.25+0.5%	98
Glyphosate+R-11+Cayuse	0.25+0.5%+0.5%	97
Glyphosate+R-900	0.25+0.5%	88
Glyphosate+AS+X77	0.25+1.5+0.5%	100
Glyphosate	0.375	100
Glyphosate+R-11	0.375+0.5%	100
Glyphosate+R-11+Cayuse	0.375+0.5%+0.5%	100
Glyphosate+R-900	0.375+0.5%	66
Glyphosate+AS+X77	0.5+1.5+0.5%	100
Cyanazine-DF+POC	2+0.25G	7
Cyanazine-DF+POC	2.5+0.25G	10
Cyanazine-L+POC	2+0.25G	12
Cyanazine-DF+Sunit	2+0.25G	7
C.V. %		27
LSD 5%		32

Summary. Glyphosate at 0.25 lb/A plus ammonium sulfate and X77 controlled rye 100%. R-900 was antagonistic to glyphosate activity.

Weed control economics in a minimum till and no-till soybean-wheat rotation, Fargo 1990. 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.

SOYBEANS, 1990

Methods

Minimum till plots were chisel plowed in late October 1989. McCall soybeans were seeded 1.5 inches deep at 150,000 seeds per acre on May 23 using a Hiniker no-till planter for 30-inch rows and a Tye drill for 10-inch rows. Herbicides 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. 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 Table 1. Cultivation of 30-inch row plots also was done on an as-needed basis, and took place on July 2. Broadleaf weeds taller than 6 inches and foxtail plants of any size found within a plot were counted just prior to harvest. Grain yields were machine harvested on September 17 and values adjusted to 12% moisture. Plots requiring post-harvest Canada thistle control were treated on September 27.

Summary

Preplant incorporated herbicides in tilled plots performed well and required no follow-up postemergence treatments (Table 1). All no-till plots, however, required postemergence treatment for broadleaf and grass control except where imazethapyr had been applied. In imazethapyr plots, only foxtail needed controlling with postemergence sethoxydim. Burndown herbicides were not needed in no-till plots receiving early preplant cyanazine or imazethapyr. All 30-inch row soybeans, tilled and no-till, were cultivated for weed control (Table 5).

Weed populations at time of postemergence herbicide application were higher in no-till than under minimum till (Table 2). Imazethapyr applied PPI in minimum till completely controlled yellow foxtail, kochia, redroot pigweed, and common lambsquarters. Early preplant imazethapyr in no-till was less effective than in minimum till but generally was more effective than other herbicide treatments in no-till. High populations of yellow foxtail where imazethapyr was used in no-till are somewhat misleading because these plants were greatly stunted in growth compared to foxtail in plots receiving no prior treatment. Early preplant cyanazine in no-till completely controlled kochia and common lambsquarters.

Weeds present at soybean harvest and soybean grain yields are shown in Table 3. Weed control was generally good with all treatments. Weeds were most difficult to control in no-till 10-inch rows and especially where a total postemergence herbicide program was used. Soybean yields were highest in no-till 10-inch rows, despite the higher numbers of uncontrolled weeds in this production system. Grain yields in tilled and no-till 30-inch rows were similar.

Herbicide and adjuvant costs are given in Table 4, and Table 5 shows the comparative economic analysis for all soybean treatments. No-till 10-inch rows generally provided the highest relative net returns. This production system generally required $10 to $15 more in herbicide than the other two systems, but this additional cost was more than compensated for by higher yields. Treatments involving imazethapyr produced among the highest net returns in all three tillage systems, especially in no-till 10-inch rows.

Table 1. Rates and dates of herbicide applications in soybeans in 1990[a].

Planned herbicide treatment			As-needed burndown treatment			As-needed post-emergence treatment[b]		
Herbicide	Rate (lb/A)	Date	Hrbicde	Rate (lb/A)	Date	Herbicide	Rate (lb/A)	Date
TILLED, 30-INCH ROWS								
Trif+Metr(PPI)	1+0.2	5/22	None	-	-	None	-	-
Trif+Imep(PPI)	1+0.063	5/22	None	-	-	None	-	-
Trif+Clom(PPI)	1+0.75	5/22	None	-	-	None	-	-
Trif+Clam(PPI)	1+2.5	5/22	None	-	-	None	-	-
Total post(PO)	-	-	None	-	-	Seth+Bent +Acif	0.2+0.75 +0.125	6/25
HWC - Trif+ Imep+Clom(PPI)	0.75+ 0.04+0.4	5/22	None	-	-	None	-	-
NO-TILL, 30-INCH ROWS								
Imazethapyr(EPP)	0.063	4/20	None	-	-	Seth	0.15	6/25
Cyanazine(EPP)	3	4/20	None	-	-	Seth+Bent +Acif	0.2+0.75 +0.125	6/25
Metribuzin(EPP)	0.25	4/20	Glyt+AS +surf.	0.3+1.5 +0.4%	5/22	Seth+Bent +Acif	0.2+0.75 +0.125	6/25
Metribuzin(PRE)	0.2	5/29	Glyt +surf.	0.3 +0.4%	5/29	Seth+Bent +Acif	0.2+0.75 +0.125	6/25
Total post(PO)	-	-	Glyt+AS +surf.	0.38+1.5 +0.4%	5/22	Seth+Bent +Acif	0.2+0.75 +0.125	6/25
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	4/20	Glyt	0.75	5/22	Seth/ Bent+Dash	0.25/ 1+1 qt	6/26 6/30
NO-TILL, 10-INCH ROWS								
Imazethapyr(EPP)	0.063	4/20	None	-	-	Seth	0.15	6/26
Cyanazine(EPP)	3	4/20	None	-	-	Seth+Bent +Acif	0.18+0.75 +0.125	6/26
Metribuzin(EPP)	0.25	4/20	Glyt+AS +surf.	0.3+1.5 +0.4%	5/22	Seth+Bent +Acif	0.18+0.75 +0.125	6/26
Metribuzin(PRE)	0.2	5/29	Glyt +surf.	0.3 +0.4%	5/29	Seth+Bent +Acif	0.18+0.75 +0.125	6/26
Total post(PO)	-	-	Glyt+AS +surf.	0.38+1.5 +0.4%	5/22	Seth+Bent +Acif	0.2+0.75 +0.125	6/26
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	4/20	Glyt	0.75	5/22	Seth/ Bent+Dash	0.25/ 1+1 qt	6/26 6/30

[a]See Table 4 for information on spray adjuvants used; EPP = early preplant; PPI = preplant incorporated; PRE = preemergence; PO = postemergence; HWC = hand weeded.
[b]Sethoxydim treatments always were applied with 1 quart/A Dash adjuvant.

Table 2. Weeds present in 1990 soybeans before postemergence herbicide treatment (if any).

Planned herbicide treatment	Weeds present at postemergence spraying on June 25/26[a]			
	Yeft	KOCZ	Rrpw	Colq
	-----(Plants per 100 m^2)-----			
TILLED, 30-INCH ROWS				
Trifluralin+Metribuzin(PPI)	1,800	50	150	0
Trifluralin+Imazethapyr(PPI)	0	0	0	0
Trifluralin+Clomazone(PPI)	400	0	0	0
Trifluralin+Chloramben(PPI)	400	100	50	150
Total postemergence	7,600	450	4,650	2,350
Hand-weeded check[b]	0	0	0	0
NO-TILL, 30-INCH ROWS				
Imazethapyr(EPP)	16,300	1,150	50	0
Cyanazine(EPP)	8,250	0	350	0
Metribuzin(EPP)	9,300	300	500	100
Metribuzin(PRE)	10,150	250	600	0
Total postemergence	12,600	2,800	2,050	550
Hand-weeded check[c]	0	0	0	0
NO-TILL, 10-INCH ROWS				
Imazethapyr(EPP)	14,200	100	150	0
Cyanazine(EPP)	4,350	0	450	0
Metribuzin(EPP)	10,650	950	1,150	150
Metribuzin(PRE)	7,400	550	600	50
Total postemergence	14,050	1,550	3,200	450
Handweeded check[c]	0	0	0	0
LSD 5% (Treatment within a tillage)	5,830	1,610	1,680	610
Tillage effect	**	NS	NS	NS

[a] Yeft = yellow foxtail; KOCZ = kochia; Rrpw = redroot pigweed; Colq = common lambsquarters.

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

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

Table 3. Weed control and grain yield of 1990 soybeans grown in rotation with wheat.

Planned herbicide treatment	Weeds present at harvest[a]					Soybean grain yield
	Yeft	KOCZ	Rrpw	Colq	Cath	
	----(Plants per 100 m^2)-----					(Bu/A)
TILLED, 30-INCH ROWS						
Trifluralin+Metribuzin(PPI)	25	1	0	2	88	22.9
Trifluralin+Imazethapyr(PPI)	5	0	0	0	24	27.4
Trifluralin+Clomazone(PPI)	34	0	0	2	0	23.7
Trifluralin+Chloramben(PPI)	25	1	1	1	84	24.2
Total postemergence	10	8	1	42	0	24.2
Hand-weeded check[b]	0	0	0	0	0	25.4
NO-TILL, 30-INCH ROWS						
Imazethapyr(EPP)	10	1	0	0	0	24.8
Cyanazine(EPP)	5	1	1	0	15	23.9
Metribuzin(EPP)	4	2	1	0	0	23.7
Metribuzin(PRE)	10	2	0	2	0	24.4
Total postemergence	3	13	0	0	0	23.7
Hand-weeded check[c]	0	0	0	0	0	25.0
NO-TILL, 10-INCH ROWS						
Imazethapyr(EPP)	3	20	2	5	14	31.8
Cyanazine(EPP)	41	0	11	0	0	27.3
Metribuzin(EPP)	45	63	11	7	34	32.4
Metribuzin(PRE)	14	35	10	0	0	31.7
Total postemergence	70	224	13	86	6	28.7
Handweeded check[c]	0	0	0	0	0	28.9
LSD 5% (Treatment within a tillage)	NS	42	NS	30	NS	NS
Tillage effect	NS	*	*	NS	NS	**

[a]Yeft = yellow foxtail; KOCZ = kochia; Rrpw = redroot pigweed; Colq = common lambsquarters; Cath = Canada thistle.

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

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

Table 4. Herbicide and adjuvant costs for minimum till and no-till soybeans[a].

Planned treatment			Burndown treatment			Postemergence treatment			Post harvest[b]
Herbicide	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	($/A)
TILLED, 30-INCH ROWS									
Trifluralin	1	6.50	None	-	0	None	-	0	1.86
Metribuzin	0.2	5.60							
Trifluralin	1	6.50	None	-	0	None	-	0	1.86
Imazethapyr	0.063	16.44							
Trifluralin	1	6.50	None	-	0	None	-	0	0
Clomazone	0.75	12.00							
Trifluralin	1	6.50	None	-	0	None	-	0	1.86
Chloramben	2.5	27.23							
Total post	-	0	None	-	0	Sethoxydim	0.2	4.49	0
						+Bentazon	+0.75	3.63	
						+Acifluor	+0.13	1.21	
						+Dash	+1 qt	.63	
NO-TILL, 30-INCH ROWS									
Imazethapyr (EPP)	0.063	16.44	None	-	0	Sethoxydim	0.15	3.37	0
						+Dash	+1 qt	.63	
Cyanazine (EPP)	3	14.49	None	-	0	Sethoxydim	0.2	4.49	1.86
						+Bentazon	+0.75	3.63	
						+Acifluor	+0.13	1.21	
						+Dash	+1 qt	.63	
Metribuzin (EPP)	0.25	7.00	Glyt	0.3	3.60	Sethoxydim	0.2	4.49	0
			+AS	+1.5	.38	+Bentazon	+0.75	3.63	
			+surf.	+0.4%	.54	+Acifluor	+0.13	1.21	
						+Dash	+1 qt	.63	
Metribuzin (PRE)	0.2	5.60	Glyt	0.3	3.60	Sethoxydim	0.2	4.49	0
			+AS	+1.5	.38	+Bentazon	+0.75	3.63	
			+surf.	+0.4%	.54	+Acifluor	+0.13	1.21	
						+Dash	+1 qt	.63	
Total post	-	0	Glyt	0.375	4.50	Sethoxydim	0.2	4.49	0
			+AS	+1.5	.38	+Bentazon	+0.75	3.63	
			+surf.	+0.4%	.54	+Acifluor	+0.13	1.21	
						+Dash	+1 qt	.63	
NO-TILL, 10-INCH ROWS									
Imazethapyr (EPP)	0.063	16.44	None	-	0	Sethoxydim	0.15	10.10	2.85
						+Dash	+1 qt	1.90	
Cyanazine (EPP)	3	14.49	None	-	0	Sethoxydim	0.18	12.11	0
						+Bentazon	+0.75	10.88	
						+Acifluor	+0.13	3.63	
						+Dash	+1 qt	1.90	
Metribuzin (EPP)	0.25	7.00	Glyt	0.3	3.60	Sethoxydim	0.18	12.11	2.85
			+AS	+1.5	.38	+Bentazon	+0.75	10.88	
			+surf.	+0.4%	.54	+Acifluor	+0.13	3.63	
						+Dash	+1 qt	1.90	
Metribuzin (PRE)	0.2	5.60	Glyt	0.3	3.60	Sethoxydim	0.18	12.11	0
			+AS	+1.5	.38	+Bentazon	+0.75	10.88	
			+surf.	+0.4%	.54	+Acifluor	+0.13	3.63	
						+Dash	+1 qt	1.90	

-- See next page for additional data and summary --

-- See previous page for data and experiment description --

Table 4. Herbicide and adjuvant costs for minimum till and no-till soybeans .

Planned treatment			Burndown treatment			Postemergence treatment			Post harvest[b]
Herbicide	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	($/A)
NO-TILL, 10-INCH ROWS (continued)									
Total post	-	0	Glyt	0.375	4.50	Sethoxydim	0.2	13.46	1.01
			+AS	+1.5	.38	+Bentazon	+0.75	10.88	
			+surf.	+0.4%	.54	+Acifluor	+0.13	3.63	
						+Dash	+1 qt	1.90	

[a]AS = ammonium sulfate; surf. = X-77 surfactant; Glyt = glyphosate; Acifluor = acifluorfen.

[b]Selected treatments received a 'spot spraying' for Canada thistle with Curtail herbicide at 4 pts/A (clopyralid at 0.18 lb ae/A plus 2,4-D at 1 lb ae/A) costing $12.25 per treated acre. Other treatments received a 'spot spraying' of 0.75 pts/A of Banvel (dicamba at 0.188 lb ae/A) costing $5.44 per treated acre. When only one plot required spraying, cost was figured as 1/8 of total per acre cost. Application cost of $0.33/A was included in post-harvest cost figures.

Table 5. Economic analysis for minimum till and no-till soybeans grown under various weed control systems in 1990.

Planned herbicide treatment	Variable production costs[a]				Crop value[b]	Net return
	Herbicide plus adjuvant	Herbicide appl. and incorp.	Culti-vation	Chisel plowing		
	($/A)					
TILLED, 30-INCH ROWS						
Trif+Metribuzin(PPI)	13.96	5.85	2.29	4.26	127.10	100.74
Trif+Imazethapyr(PPI)	24.80	5.85	2.29	4.26	152.07	114.87
Trif+Clomazone(PPI)	18.50	5.85	2.29	4.26	131.54	100.64
Trif+Chloramben(PPI)	35.59	5.85	2.29	4.26	134.31	86.32
Total postemergence	9.96	.67	2.29	4.26	134.31	117.13
NO-TILL, 30-INCH ROWS						
Imazethapyr(EPP)	20.44	1.34	2.29	0	137.64	113.57
Cyanazine(EPP)	26.31	1.34	2.29	0	132.65	102.71
Metribuzin(EPP)	21.48	2.01	2.29	0	131.54	105.76
Metribuzin(PRE)	20.08	1.34	2.29	0	135.42	111.71
Total postemergence	15.38	1.34	2.29	0	131.54	112.53
NO-TILL, 10-INCH ROWS						
Imazethapyr(EPP)	28.44	1.34	0	0	176.49	146.71
Cyanazine(EPP)	43.01	1.34	0	0	151.52	107.17
Metribuzin(EPP)	42.89	2.01	0	0	179.82	134.92
Metribuzin(PRE)	38.64	1.34	0	0	175.94	135.96
Total postemergence	36.30	1.34	0	0	159.29	121.65

[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. Spraying cost = $.67/A, herbicide incorporation cost = $2.59/A, cultivation cost = $2.29/A.

[b]1990 soybeans were valued at $5.55 per bushel.

WHEAT, 1990

Methods

Tilled plots were chisel plowed in late October 1988. Wheaton hard red spring wheat was seeded 1.5-inch deep on April 19, 1990 using a Haybuster drill. Tilled plots were worked once with a field cultivator/harrow (2.5 to 3-inches deep) immediately prior to seeding. No nitrogen fertilizer was applied as soil tests taken in early May 1990 indicated that about 50 lb/A of N was present. On May 28, all plots were sprayed with thifensulfuron&tribenuron (Harmony Extra) at 0.33 oz ai/A (0.5 oz product/A) plus X-77 surfactant at 0.25%. Weed counts were taken on May 30 (three 0.25-m^2 quadrats per plot). Plots were machine-harvested August 8. Post-harvest tillage or herbicide treatment was done on September 5. All tilled plots received one pass with a field cultivator/harrow (2-inch depth). Selected no-till plots were treated with 0.75 lb ae/A glyphosate plus 0.25 lb ae/A dicamba for Canada thistle or perennial smartweed (see Table 7 for details).

Summary. Wheat grain yields for 1990 were similar between tillage systems and between treatments within a tillage system (Table 6). Bleaching injury from carryover residues of clomazone was about 20% on 2 to 3-leaf wheat in the plots receiving trifluralin + clomazone in 1989 (data not shown). This injury would probably be unacceptable for most growers, although yields were not affected. Weeds present in the wheat during time of postemergence spraying indicate the degree of success of the previous year's treatments in soybeans. Kochia populations in wheat seemed higher under no-till although differences between tillage system were not significant. Kochia populations following total postemergence weed control in soybeans generally were higher than with other soybean herbicide systems. Common lambsquarter populations were higher following tilled soybeans.

Net return in dollars per acre for 1990 wheat grown under tilled or no-till conditions and in rotation with various herbicide treatments applied in soybeans is shown in Table 7. All plots had similar broadleaf weed infestations and required treatment with thifensulfuron&tribenuron (Harmony Extra). Chisel plowing and seedbed preparation added almost $9.50 to the cost of raising wheat under minimum tillage compared to no-till.

Table 6. Weeds present at time of postemergence herbicide application and grain yield of wheat grown in rotation with soybeans.

1989 soybean herbicide treatments	Weeds present at postemergence herbicide application						1990 wheat grain yield	
	Yeft	Wibw	Wimu	KOCZ	Colq	Cath		
	(no. per m^2)						(Bu/A)	(kg/ha)
TILLED, 30-INCH ROWS								
Trifluralin+Metribuzin(PPI)	39	12	1	158	55	0.3	72.9	5071
Trifluralin+Imazethapyr(PPI)	56	4	1	70	18	0.3	74.7	5194
Trifluralin+Clomazone(PPI)	20	10	1	304	58	0	76.9	5349
Trifluralin+Chloramben(PPI)	113	7	0	45	5	0	67.3	4682
Total postemergence	106	34	0	730	306	1.3	64.1	4458
Hand-weeded check	-	-	-	-	-	-	69.3	4816
NO-TILL, 30-INCH ROWS								
Imazethapyr(EPP)	36	11	0	220	2	0	66.5	4621
Cyanazine(EPP)	197	26	1	202	39	0	62.9	4371
Metribuzin(EPP)	27	39	0	192	3	0	73.6	5119
Metribuzin(PRE)	98	16	1	854	5	0	64.7	4496
Total postemergence	40	47	0	791	5	0	67.5	4691
Hand-weeded check	-	-	-	-	-	-	70.8	4919
NO-TILL, 10-INCH ROWS								
Imazethapyr(EPP)	138	75	0	118	5	2.7	62.2	4328
Cyanazine(EPP)	91	90	1	277	12	1.3	63.2	4392
Metribuzin(EPP)	61	33	1	403	61	0.7	61.8	4299
Metribuzin(PRE)	62	18	0	951	9	0.3	68.3	4751
Total postemergence	37	18	2	1912	13	0	59.1	4109
Hand-weeded check	-	-	-	-	-	-	66.3	4608
Treatment within a tillage	NS	NS	NS	152	78	NS	NS	NS
Tillage effect	NS	NS	NS	NS	**	*	NS	NS

Table 7. Economic analysis for minimum till and no-till spring wheat grown in rotation with soybeans under various herbicide programs.

1989 planned herbicide treatment in soybeans	1990 Variable production costs[a]					1990 HRSW value[d]	Net return
	Herbicide plus adjuvant[b]	Herbicide application	Chisel plowing	Seedbed preparation	Post-harvest[c]		
	($/A)						
TILLED, 30-INCH ROWS							
Trif+Metr(PPI)	6.02	.67	4.26	5.18	0	178.61	162.48
Trif+Imep(PPI)	6.02	.67	4.26	5.18	0	183.02	166.89
Trif+Clom(PPI)	6.02	.67	4.26	5.18	0	188.41	172.28
Trif+Clam(PPI)	6.02	.67	4.26	5.18	0	164.89	148.76
Total post	6.02	.67	4.26	5.18	0	157.05	140.92
NO-TILL, 30-INCH ROWS							
Imazethapyr(EPP)	6.02	.67	0	0	0	162.93	156.24
Cyanazine(EPP)	6.02	.67	0	0	1.93	154.11	145.50
Metribuzin(EPP)	6.02	.67	0	0	0	180.32	173.63
Metribuzin(PRE)	6.02	.67	0	0	1.93	158.52	149.90
Total post	6.02	.67	0	0	0	165.38	158.69
NO-TILL, 10-INCH ROWS							
Imazethapyr(EPP)	6.02	.67	0	0	3.53	152.39	142.17
Cyanazine(EPP)	6.02	.67	0	0	3.53	154.84	144.61
Metribuzin(EPP)	6.02	.67	0	0	1.93	151.41	142.79
Metribuzin(PRE)	6.02	.67	0	0	1.93	167.34	158.72
Total post	6.02	.67	0	0	1.93	144.80	136.18

[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. Spraying cost = $0.67/A.

[b] All plots were sprayed with thifensulfuron&tribenuron at 0.375 oz ai/A ($5.68/A) plus X-77 surfactant at 0.25% ($.34/A).

[c] Tilled plots received one field cultivator pass following harvest. Selected no-til treatments received a 'spot-spraying' for Canada thistle with 0.75 lb ae/A glyphosate ($9.00/treated acre) plus 0.25 lb ae/A dicamba ($3.78/treated acre). When one plot required spraying, cost was figured as 1/8 of total per acre cost; when two plots required spraying, cost was 1/4 of the total. Application cost of $0.33/A was included in post-harvest cost figures.

[d] 1990 hard red spring wheat was valued at $2.45 per bushel.

Weed control economics in a minimum till and no-till soybean-wheat rotation, Fargo 1991. 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.

SOYBEANS, 1991

Methods

Minimum till plots were chisel plowed in late October 1990. McCall soybeans were seeded 1.5 inches deep at 185,000 seeds/A on May 26 using a Hiniker no-till planter for 30-inch rows and 215,000 seeds/A 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. 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 24 and again on July 19. 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 September 20 and values adjusted to 12% moisture. Plots requiring post-harvest Canada thistle control were treated on October 1.

Table 1. Rates and dates of early preplant, preplant incorporated, preemergence and no-till burndown herbicide applications in 1991 soybeans.

Planned herbicide treatment[a]			As-needed burndown treatment[b]			
Herbicide	Rate (lb/A)	Date	Herbicide	Rate (lb/A)	Date	Target weed species
TILLED, 30-INCH ROWS						
Trif+Metr(PPI)	1+0.2	5/25	None	-	-	None
Trif+Imep(PPI)	1+0.063	5/25	None	-	-	None
Trif+Clom(PPI)	1+0.75	5/25	None	-	-	None
Trif+Clam(PPI)	1+2.5	5/25	None	-	-	None
Total post(PO)	-	-	None	-	-	None
HWC - Trif+ Imep+Clom(PPI)	0.75+ 0.04+0.4	5/25	None	-	-	None
NO-TILL, 30-INCH ROWS						
Cyanazine(EPP)	3	4/29	Glyt+S	0.5+0.13%	5/22	Foxtail barley
Metribuzin(EPP)	0.25	4/29	Glyt+S[d]	0.5+0.13%	5/22	Ftba (spot spray)
Imazethapyr(EPP)	0.063	4/29	Glyt+S	0.5+0.13%	5/22	Ftba, Canada thistle
Metribuzin(PRE)	0.2	5/28	Gl+2,4D +S	0.28+0.19 0.25%	5/22	KOCZ, Colq, Wimu, Wibw
Total post(PO)	-	-	Gl+2,4D +S	0.28+0.19 0.25%	5/22	KOCZ, Colq, Wimu, Wibw
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	4/29	Glyt	1.5	5/22	-
NO-TILL, 7-INCH ROWS						
Cyanazine(EPP)	3	4/29	Glyt+S	0.14+ 0.13%	5/22	1-leaf yellow foxtail
			Glyt+S[c]	0.5+0.13%	5/22	Cath (spot spray)
Metribuzin(EPP)	0.25	4/29	Glyt+S[d]	0.5+0.13%	5/22	Cath (spot spray)
Imazethapyr(EPP)	0.063	4/29	Gl+2,4D +S	0.28+0.19 0.25%	5/22	KOCZ, Colq, Wibw
			Glyt+S[c]	0.5+0.13%	5/22	Cath (spot spray)
Metribuzin(PRE)	0.2	5/28	Glyt+S	0.5+0.13%	5/22	Yeft, KOCZ, Wibw, Cath
Total post(PO)	-	-	Gl+2,4D +S	0.28+0.19 +0.25%	5/22	Yeft, KOCZ, Colq, Wimu, Wibw
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	4/29	Glyt	1.5	5/22	-

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

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

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

[d] Only 2 of 4 plots required treatment. Thus, this treatment was considered to be spot sprayed over 1/4 of the field.

Table 2. Rates and dates of postemergence herbicide applications in 1991 soybeans.

Planned herbicide[a] treatment	Rate (lb/A)	As-needed postemergence treatment[b] Herbicide	Rate (lb/A)	Date	Target weed species
TILLED, 30-INCH ROWS					
Trif+Metr(PPI)	1+0.2	None	-	-	None
Trif+Imep(PPI)	1+0.063	Bentazon	1[c]	6/18	Canada thistle (spot spray)
Trif+Clom(PPI)	1+0.75	Bent+Acif	0.75+0.13	6/18	KOCZ, Rrpw, Wimu
Trif+Clam(PPI)	1+2.5	Bent+Acif	0.75+0.13	6/18	KOCZ, Wimu, Colq
Total post(PO)	-	Bent+Acif	0.75+0.13	6/18	KOCZ, Rrpw, Wimu, Colq
		Sethoxy	0.15	6/19	Yellow foxtail
HWC - Trif+ Imep+Clom(PPI)	0.75+ 0.04+0.4	None	-	-	-
NO-TILL, 30-INCH ROWS					
Cyanazine(EPP)	3	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Colq, Wibw
Metribuzin(EPP)	0.25	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Wimu, Wibw
		Sethoxy	0.15	6/19	Yellow foxtail
Imazethapyr(EPP)	0.063	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Colq, Wimu, Wibw
		Sethoxy	0.15	6/19	Yellow foxtail
Metribuzin(PRE)	0.2	Bent+Acif	0.75+0.19	6/18	Kochia, wild buckwheat
		Sethoxy	0.15	6/19	Yellow foxtail
Total post(PO)	-	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Wimu, Wibw
		Sethoxy	0.15	6/19	Yellow foxtail
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	None	-	-	-
NO-TILL, 7-INCH ROWS					
Cyanazine(EPP)	3	Acifluor	0.13	6/18	Redroot pigweed
		Bentazon[c]	1	6/18	Canada thistle (spot spray)
		Sethoxy	0.15	6/19	Yellow foxtail
Metribuzin(EPP)	0.25	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Colq, Wibw
		Sethoxy	0.15	6/19	Yellow foxtail
Imazethapyr(EPP)	0.063	Bentazon[c]	1	6/18	Canada thistle (spot spray)
		Bent+Acif	0.75+0.13	6/18	Kochia, redroot pigweed
Metribuzin(PRE)	0.2	Bentazon	1	6/18	Canada thistle, kochia
Total post(PO)	-	Bent+Acif	0.75+0.19	6/18	KOCZ, Rrpw, Colq, Wimu, Wibw
		Sethoxy	0.15	6/19	Yellow foxtail
HWC - Pend+ Imep+Clom(EPP)	2+ 0.04+0.4	None	-	-	-

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

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

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

Table 3. Weeds present in 1991 soybeans at time of postemergence herbicide treatments.

Planned herbicide treatment	Weeds present at postemergence spraying on June 19[a]							
	Yeft	KOCZ	Rrpw	Colq	Wibw	Wimu	Prsp	Cath
	(Plants per 100 m^2)							
TILLED, 30-INCH ROWS								
Trifluralin+Metribuzin(PPI)	67	100	67	33	0	0	0	33
Trifluralin+Imazethapyr(PPI)	33	0	0	0	0	0	0	0
Trifluralin+Clomazone(PPI)	0	67	133	0	0	0	0	33
Trifluralin+Chloramben(PPI)	67	33	33	0	0	0	0	0
Total postemergence	3133	233	1967	1400	0	0	0	0
Hand-weeded check[b]	167	0	33	0	0	0	0	0
Tillage average:	578	72	372	239	0	0	0	11
NO-TILL, 30-INCH ROWS								
Imazethapyr(EPP)	633	567	0	33	33	33	433	33
Cyanazine(EPP)	1633	33	300	0	67	0	0	0
Metribuzin(EPP)	700	167	33	0	0	0	33	0
Metribuzin(PRE)	1367	100	0	0	0	33	0	0
Total postemergence	800	567	233	100	67	233	333	0
Hand-weeded check[c]	33	33	0	0	0	0	0	0
Tillage average:	861	244	94	22	28	50	133	6
NO-TILL, 7-INCH ROWS								
Imazethapyr(EPP)	433	0	33	0	0	33	0	167
Cyanazine(EPP)	1467	0	67	0	167	0	0	167
Metribuzin(EPP)	767	0	133	67	0	0	267	33
Metribuzin(PRE)	267	0	0	0	33	0	0	0
Total postemergence	1633	567	267	133	0	67	500	33
Hand-weeded check[c]	33	0	0	0	33	0	0	267
Tillage average:	767	94	83	33	39	17	128	111
LSD 5% (Treatments within a tillage)	732	319	326	385	NS	NS	NS	NS
Tillage effect	NS	NS	NS	*	NS	NS	NS	NS

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

[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 4. Weed control and grain yield of 1991 soybeans grown in rotation with wheat.

Planned herbicide treatment	Weeds present at harvest[a] (Plants per 100 m^2)								Soybean grain yield
	Yeft	KOCZ	Rrpw	Colq	Wibw	Ftba	Dand	Cath	
TILLED, 30-INCH ROWS									
Trifluralin+Metribuzin(PPI)	6	7	1	3	0	0	0	50	33.6
Trifluralin+Imazethapyr(PPI)	1	0	0	0	0	0	0	33	36.5
Trifluralin+Clomazone(PPI)	7	0	0	3	0	0	0	0	34.4
Trifluralin+Chloramben(PPI)	24	0	0	1	0	0	0	51	29.2
Total postemergence	41	23	0	180	0	0	0	64	32.0
Hand-weeded check[b]	8	5	0	18	0	0	0	28	34.2
NO-TILL, 30-INCH ROWS									
Cyanazine(EPP)	132	2	1	8	8	1	0	21	34.4
Metribuzin(EPP)	5	4	0	1	3	0	0	0	35.8
Imazethapyr(EPP)	2	11	0	1	0	0	4	2	34.2
Metribuzin(PRE)	13	13	1	9	2	1	0	59	34.3
Total postemergence	5	48	0	3	8	0	13	6	35.5
Hand-weeded check[c]	7	3	0	2	2	0	0	3	37.5
NO-TILL, 7-INCH ROWS									
Cyanazine(EPP)	21	2	1	13	16	0	1	73	37.4
Metribuzin(EPP)	8	12	1	35	4	0	1	6	37.4
Imazethapyr(EPP)	97	7	0	11	3	0	1	164	30.3
Metribuzin(PRE)	120	2	0	8	8	1	1	69	37.8
Total postemergence	10	26	0	12	29	0	5	3	33.3
Hand-weeded check[c]	21	5	0	8	4	0	1	36	41.7
LSD 5% (Treatments within a tillage)	51	18	NS	84	12	NS	NS	NS	2.9
Tillage effect	NS	NS	NS	NS	NS	NS	NS	NS	NS

[a]Yeft = yellow foxtail; KOCZ = kochia; Rrpw = redroot pigweed; Colq = common lambsquarters; Wibw = wild buckwheat; Ftba = foxtail barley; Dand = dandelion; Cath = Canada thistle.

[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 minimum till and no-till soybeans[a].

Planned treatment			Burndown treatment			Postemergence treatment			Post harvest[b]
Herbicide	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	($/A)
TILLED, 30-INCH ROWS									
Trifluralin+ Metribuzin	1 0.2	6.60 6.14	None	-	0	None	-	0	1.48
Trifluralin+ Imazethapyr	1 0.063	6.60 16.44	None	-	0	Bentazon+ Scoil	1[c] 1.5 pt	1.87 .33	1.48
Trifluralin+ Clomazone	1 0.75	6.60 13.58	None	-	0	Bentazon+ Acifluor Scoil	0.75 0.13 1 pt	3.75 1.15 .58	0
Trifluralin+ Chloramben	1 2.5	6.60 28.00	None	-	0	Bentazon+ Acifluor Scoil	0.75 0.13 1 pt	3.75 1.15 .58	1.48
Total post	-		None	-	0	Bentazon+ Acifluor Scoil Sethoxydim+ Scoil	0.75 0.13 1 pt 0.15 0.5 pt	3.75 1.15 .58 3.52 .29	1.48
NO-TILL, 30-INCH ROWS									
Imazethapyr (EPP)	0.063	16.44	Glyphosate+ X-77 AS	0.5 0.13% 1.5	6.00 .18 .38	Bentazon+ Acifluor Scoil Sethoxydim+ Scoil	0.75 0.188 1 pt 0.15 0.5 pt	3.75 1.73 .58 3.52 .29	1.45
Cyanazine (EPP)	3	15.99	Glyphosate+ X-77 AS	0.5 0.13% 1.5	6.00 .18 .38	Bentazon+ Acifluor Scoil	0.75 0.188 1 pt	3.75 1.73 .58	1.48
Metribuzin (EPP)	0.25	7.67	Glyphosate+[d] X-77 AS	0.5 0.13% 1.5	1.50 .04 .10	Bentazon+ Acifluor Scoil Sethoxydim+ Scoil	0.75 0.188 1 pt 0.15 0.5 pt	3.75 1.73 .58 3.52 .29	0
Metribuzin (PRE)	0.2	6.14	Glyphosate+ 2,4-D X-77 AS	0.28 0.188 0.25% 1.5	3.36 .47 .35 .38	Bentazon+ Acifluor Scoil Sethoxydim+ Scoil	0.75 0.188 1 pt 0.15 0.5 pt	3.75 1.73 .58 3.52 .29	2.75
Total post	-	-	Glyphosate+ 2,4-D X-77 AS	0.28 0.188 0.25% 1.5	3.36 .47 .35 .38	Bentazon+ Acifluor Scoil Sethoxydim+ Scoil	0.75 0.188 1 pt 0.15 0.5 pt	3.75 1.73 .58 3.52 .29	1.48

Table 5, continued. Herbicide and adjuvant costs for minimum till and no-till soybeans.

Planned treatment			Burndown treatment			Postemergence treatment			Post harvest[b]
Herbicide	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	Herbicide or adjuvant	Rate (lb/A)	Cost ($/A)	($/A)
NO-TILL, 7-INCH ROWS									
Imazethapyr (EPP)	0.063	16.44	Glyphosate+	0.28	3.36	Bentazon+	1[c]	1.87	2.75
			2,4-D	0.188	.47	Scoil	1.5 pt	.33	
			X-77	0.25%	.35	Bentazon+	0.75	11.23	
			AS	1.5	.38	Acifluor	0.125	3.46	
			Glyphosate+[c]	0.5	.75	Scoil	1 pt	1.75	
			X-77	0.13%	.02				
			AS	1.5	.05				
Cyanazine (EPP)	3	15.99	Glyphosate+	0.14	1.68	Bentazon+	1[c]	1.87	1.48
			X-77	0.38%	.53	Scoil	1.5 pt	.33	
			AS	1.5	.38	Acifluor+	0.125	3.46	
			Glyphosate+[c]	0.5	.75	Scoil	1 pt	1.75	
			X-77	0.13%	.02	Sethoxydim+	0.15	10.56	
			AS	1.5	.05	Scoil	0.5 pt	.88	
Metribuzin (EPP)	0.25	7.67	Glyphosate+[d]	0.5	1.50	Bentazon+	0.75	11.23	1.48
			X-77	0.13%	.04	Acifluor	0.188	3.46	
			AS	1.5	.10	Scoil	1 pt	1.75	
						Sethoxydim+	0.15	10.56	
						Scoil	0.5 pt	.88	
Metribuzin (PRE)	0.2	6.14	Glyphosate+	0.5	6.00	Bentazon	1	14.97	9.81
			X-77	0.13%	.18	Scoil	1.5 pt	2.63	
			AS	1.5	.38				
Total post	-	-	Glyphosate+	0.28	3.36	Bentazon+	0.75	11.23	1.48
			2,4-D	0.188	.47	Acifluor	0.188	3.46	
			X-77	0.25%	.35	Scoil	1 pt	1.75	
			AS	1.5	.38	Sethoxydim+	0.15	10.56	
						Scoil	0.5 pt	.88	

[a] AS = ammonium sulfate; Acifluor = acifluorfen.

[b] Selected treatments were 'spot sprayed' for Canada thistle with Curtail herbicide at 3 pts/A (clopyralid at 0.14 lb ae/A plus 2,4-D at 0.75 lb ae/A) costing $9.19 per treated acre. When only one plot of the four required spraying, cost was figured as 1/8 of total per-acre cost, and an application cost of $0.33/A was included in post-harvest cost figures. When two plots required spraying, cost was 1/4 of total per-acre cost plus $0.45/A for application. If three or four plots required spraying, the full per-acre cost of $9.19/A was assessed along with $0.62 for application.

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

[d] Only 2 of 4 plots required treatment. Thus, this treatment was considered to be spot sprayed over 1/4 of the field, and cost was reduced by 1/4.

Table 6. Economic analysis for minimum till and no-till soybeans grown under various weed control systems in 1991.

Planned herbicide treatment	Variable production costs[a]					Crop value[b]	Net return
	Seed	Herbicide plus adjuvant	Herbicide appl. and incorp.	Culti-vation	Chisel plowing		
	($/A)						
TILLED, 30-INCH ROWS							
Trif+Metribuzin(PPI)	12.22	14.22	5.85	4.58	4.26	180.43	139.30
Trif+Imazethapyr(PPI)	12.22	26.72	6.18	2.29	4.26	196.01	144.34
Trif+Clomazone(PPI)	12.22	25.66	6.52	2.29	4.26	184.73	133.78
Trif+Chloramben(PPI)	12.22	41.56	6.52	4.58	4.26	156.80	87.66
Total postemergence	12.22	10.77	1.34	4.58	4.26	171.84	138.66
NO-TILL, 30-INCH ROWS							
Imazethapyr(EPP)	12.22	34.32	2.68	4.58	0	183.65	129.85
Cyanazine(EPP)	12.22	30.09	2.01	4.58	0	184.73	135.83
Metribuzin(EPP)	12.22	19.18	2.46	4.58	0	192.25	153.81
Metribuzin(PRE)	12.22	23.32	2.68	4.58	0	184.19	141.39
Total postemergence	12.22	15.91	2.01	4.58	0	190.64	155.92
NO-TILL, 7-INCH ROWS							
Imazethapyr(EPP)	14.20	43.21	2.67	0	0	162.71	102.63
Cyanazine(EPP)	14.20	39.73	3.34	0	0	200.84	143.57
Metribuzin(EPP)	14.20	38.67	2.46	0	0	200.84	145.51
Metribuzin(PRE)	14.20	40.11	2.01	0	0	202.99	146.67
Total postemergence	14.20	33.92	2.01	0	0	178.82	128.69

[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. Spraying cost = $.67/A, herbicide incorporation cost = $2.59/A for a single pass, cultivation cost = $2.29/A.

[b]1991 soybeans were valued at $5.37 per bushel (Ave. price for Sept.-Nov. 1991, ND Agricultural Statistics).

WHEAT, 1991

Methods

Tilled plots were chisel plowed October 31, 1990. Ammonium nitrate was applied Nov. 2, 1990 at 340 lb/A (115 lb N/A) according to soil test recommendations. Butte 86 hard red spring wheat was seeded 1.5-inch deep at 90 lb/A on April 25, 1991 with a Haybuster drill. Tilled plots were worked once with a field cultivator/harrow (2.5 to 3-inches deep) on April 24. Selected treatments were sprayed with glyphosate plus 2,4-D + X-77 at 0.28 + 0.188 lb ae/A + 0.13% for control of 0.5-inch kochia. On May 25, all plots were sprayed with thifensulfuron&tribenuron (Harmony Extra) at 0.375 oz ai/A (0.5 oz product/A) plus X-77 surfactant at 0.25% for control of kochia, and redroot pigweed. Weed counts were taken on May 22 (three 0.25-m^2 quadrats per plot). Plots were machine-harvested August 8. Post-harvest tillage or herbicide treatment was done on Aug. 23. All tilled plots received one pass with a field cultivator/harrow (3-inch depth). All no-till plots were treated with glyphosate plus dicamba plus X-77 at 0.375 + 0.25 lb ae/A + 0.13% for control of yellow foxtail, kochia, wild buckwheat, Canada thistle, and perennial smartweed (Table 8). All tilled treatments were "spot-sprayed" Sept. 12 with glyphosate at 0.56 lb/A + dicamba at 0.375 lb/A + X-77 at 0.25% (one or two plots out of four treated) for Canada thistle and some perennial smartweed.

Table 7. Weeds present at time of postemergence herbicide application and grain yield of 1991 wheat grown in rotation with soybeans.

1990 soybean herbicide treatments	Weeds present at postemergence herbicide application								1991 wheat grain yield	
	Yeft	Wioa	Wimu	KOCZ	Colq	Rrpw	Cath	Dand	(bu/A)	(kg/ha)
	(no. per m^2)									
TILLED, 30-INCH ROWS										
Trifluralin+Metribuzin(PPI)	1	3	0	19	3	1	0	0	36.3	2372
Trifluralin+Imazethapyr(PPI)	1	1	0	24	2	4	0	0	35.7	2335
Trifluralin+Clomazone(PPI)	0	0	0	8	3	5	0	0	33.8	2212
Trifluralin+Chloramben(PPI)	0	2	1	15	3	2	0	0	36.9	2415
Total postemergence	0	2	0	33	12	3	0	0	35.3	2307
Hand-weeded check	0	2	0	11	3	0	0	0	37.0	2417
Tillage average:	0	2	0	18	4	2	0	0	35.8	2343
NO-TILL, 30-INCH ROWS										
Cyanazine(EPP)	3	0	0	54	4	0	0	1	36.1	2359
Metribuzin(EPP)	1	1	0	30	5	3	0	0	36.3	2373
Imazethapyr(EPP)	1	1	0	52	3	5	0	1	37.3	2436
Metribuzin(PRE)	0	1	0	38	4	4	0	0	36.7	2402
Total postemergence	0	1	0	63	4	2	0	0	38.7	2533
Hand-weeded check	1	0	0	38	3	10	0	1	38.9	2544
Tillage average:	1	1	0	46	3	4	0	0	37.3	2441
NO-TILL, 7-INCH ROWS										
Cyanazine(EPP)	0	1	0	45	7	5	0	0	41.4	2709
Metribuzin(EPP)	0	1	0	45	14	6	0	0	38.9	2546
Imazethapyr(EPP)	0	1	0	45	5	7	0	6	35.8	2340
Metribuzin(PRE)	3	2	1	65	2	11	1	0	40.1	2622
Total postemergence	0	1	0	79	2	18	0	0	38.1	2492
Hand-weeded check	0	1	0	43	4	12	0	0	39.6	2590
Tillage average:	0	1	0	53	5	9	0	1	39.0	2550
LSD5% Trts within a tillage	NS	NS	1	NS	NS	NS	NS	1	NS	NS
Tillage effect	NS	NS	NS	**	NS	NS	NS	NS	*	*

Table 8. Economic analysis for minimum till and no-till spring wheat grown in rotation with soybeans under various herbicide programs.

1990 planned herbicide treatment in soybeans	1991 Variable production costs[a]					1991 HRSW value[d]	Net return
	Herbicide plus adjuvant[b]	Herbicide application	Fall chisel plowing	Seedbed preparation	Post-harvest[c]		
	($/A)						
TILLED, 30-INCH ROWS							
Trif+Metr(PPI)	6.10	.67	4.26	2.59	4.49	106.00	87.89
Trif+Imep(PPI)	6.10	.67	4.26	2.59	6.18	104.24	84.44
Trif+Clom(PPI)	6.10	.67	4.26	2.59	4.49	98.70	80.59
Trif+Clam(PPI)	6.10	.67	4.26	2.59	4.49	107.75	89.64
Total post	6.10	.67	4.26	2.59	4.49	103.08	84.97
NO-TILL, 30-INCH ROWS							
Imazethapyr(EPP)	6.10	.67	0	0	8.97	105.41	89.67
Cyanazine(EPP)	6.10	.67	0	0	8.97	106.00	90.26
Metribuzin(EPP)	6.10	.67	0	0	8.97	108.92	93.18
Metribuzin(PRE)	6.10	.67	0	0	8.97	107.16	91.42
Total post	6.10	.67	0	0	8.97	113.00	97.26
NO-TILL, 7-INCH ROWS							
Imazethapyr(EPP)	6.10	.67	0	0	8.97	120.89	105.15
Cyanazine(EPP)	10.10	1.34	0	0	8.97	113.59	93.18
Metribuzin(EPP)	10.10	1.34	0	0	8.97	104.54	84.13
Metribuzin(PRE)	10.10	1.34	0	0	8.97	117.09	96.68
Total post	10.10	1.34	0	0	8.97	111.25	90.84

[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. Spraying cost = $0.67/A.

[b] All plots were sprayed with thifensulfuron&tribenuron at 0.375 oz ai/A ($5.75/A) plus X-77 surfactant at 0.25% ($.35/A). Selected plots also treated with glyphosate at 0.28 lb/A ($3.36/A) + 2,4-D at 0.19 lb/A ($.47/A) + X-77 at 0.13% ($.17/A).

[c] Tilled plots received one field cultivator pass ($2.59/A) following harvest and "spot-spray" treatment of glyphosate at 0.56 lb/A ($6.75/A) + dicamba at 0.375 lb/A ($5.44/A) + X-77 at 0.25% ($.35/A). When one plot of four required spraying, cost was figured as 1/8 of total per acre cost; when two plots required spraying, cost was 1/4 of the total; when three or four plots required spraying, cost was 100% of the total. Application costs of $0.33, $.45/A, and $0.67/A, respectively, were included in post-harvest cost figures. All no-till treatments received a broadcast treatment of glyphosate at 0.375 lb/A ($4.50/A) + dicamba at 0.25 lb/A ($3.63/A) + X-77 at 0.13% ($.17/A).

[d] 1991 hard red spring wheat was valued at $2.92 per bushel (ave. for Sept.-Nov. 1991, ND Agricultural Statistics).

Picloram plus 2,4-D applied annually for 9 years to control leafy spurge. Lym, Rodney G., and Calvin G. Messersmith. Picloram is an effective herbicide for leafy spurge control, especially when applied at rates from 1 to 2 lb/A. However, the high cost of picloram at 1 to 2 lb/A makes it uneconomical to treat large acreages in pasture and rangeland weed control programs. Research by North Dakota State University has suggested that picloram at 0.25 to 0.5 lb/A applied annually will give satisfactory leafy spurge control after 3 to 5 yr. The purposes of this experiment were to establish the number of annual applications of picloram needed to provide 90 to 100% control of leafy spurge and to investigate possible synergism between picloram and 2,4-D.

The experiment was established at three locations in North Dakota and began on 25 August 1981 at Dickinson, 1 September 1982 at Sheldon, and on 11 June 1982 at Valley City. Dickinson had a loamy fine sand soil with pH 6.6 and 3.6% organic matter, Sheldon had a fine sandy loam with pH 7.7 and 2.1% organic matter, and Valley City had a loam with pH 6.7 and 9.4% organic matter. Dickinson, located in western North Dakota, generally receives much less precipitation than the other two sites located in eastern North Dakota. All treatments were applied annually except 2,4-D alone which was applied biannually (both spring and fall). Picloram and picloram plus 2,4-D were applied in late August 1981 and in June of 1982 through 1986. The Sheldon and Dickinson locations were discontinued following the fall evaluations in 1985 and spring evaluations in 1989, respectively. The Valley City site has received nine picloram and picloram plus 2,4-D treatments and 18 2,4-D treatments prior to the evaluation in June 1991. The plots were 10 by 30 ft and each treatment was replicated four times in a randomized complete block design. Evaluations were a visual estimate of percent stand reduction as compared to the control.

Leafy spurge control averaged 79% across all treatments 48 months after first treatment (MAFT) and declined slightly to 71% following the 1988 drought (60 and 72 months MAFT) before increasing to 87% in 1990 (84 MAFT) (Table). Leafy spurge control 96 MAFT (June 1991) increased by an average of 24, 12, and 9% when 2,4-D at 1 to 2 lb/A was applied with picloram at 0.25, 0.38 or 0.5 lb/A, respectively, as compared to picloram alone. The greatest enhancement of leafy spurge control with 2,4-D plus picloram was with 2,4-D at 2 lb/A and picloram at 0.25 lb/A in 1991, but in general the 2,4-D rate did not influence control.

Picloram at 0.5 lb/A alone and all picloram at 0.38 or 0.5 lb/A plus 2,4-D treatments provided or nearly provided the target of 90% leafy spurge control following four annual applications (Table). Control did not increase or increased only slightly with subsequent retreatments in these small plot experiments which have a constant pressure for reinfestation from plants in the plot borders. In a field situation the remaining areas of infestation could be treated with high rates of picloram to prevent reinfestation. Probably some type of chemical treatment will need to be continued to maintain control, but perhaps more economical treatments will sustain the target control level. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table. Leafy spurge control from nine annual picloram or picloram plus 2,4-D treatments and biannual 2,4-D treatments in North Dakota (Lym and Messersmith).

Herbicide	Rate	1991 Valley City		Months after first treatment						
		June	Aug	12[a]	24	36	48	60	72	84
	lb/A	% control								
Picloram	0.25	56	82	39	48	48	58	49	38	64
Picloram	0.38	72	87	65	62	52	77	69	67	96
Picloram	0.5	81	93	65	71	81	86	77	71	92
2,4-D bian	1	69	59	22	30	38	50	39	55	77
2,4-D bian	1.5	57	53	22	24	26	45	49	49	62
2,4-D bian	2	67	60	19	30	26	54	54	62	75
Picloram + 2,4-D	0.25 + 1	80	89	52	66	63	85	73	76	92
Picloram + 2,4-D	0.25 + 1.5	73	85	58	66	70	85	77	62	88
Picloram + 2,4-D	0.25 + 2	88	95	57	62	66	83	76	77	91
Picloram + 2,4-D	0.38 + 1	82	92	69	72	70	90	84	76	96
Picloram + 2,4-D	0.38 + 1.5	83	92	68	74	76	93	84	79	88
Picloram + 2,4-D	0.38 + 2	86	96	68	59	76	91	86	82	96
Picloram + 2,4-D	0.5 + 1	84	97	71	75	84	94	87	82	96
Picloram + 2,4-D	0.5 + 1.5	95	97	64	73	80	97	91	88	99
Picloram + 2,4-D	0.5 + 2	90	97	76	75	81	95	91	88	99
LSD (0.05)		17	12	18	14	19	14	14	15	19
Treatment mean		78	85	52	55	63	79	72	70	87

[a]Mean values through 48 and 72 months after first treatment include data from the Sheldon and Dickinson locations which were discontinued after 1985 and 1989, respectively.

Comparison of 2,4-D formulations applied with dicamba, glyphosate, metsulfuron, or picloram for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Picloram plus 2-4,D is the most cost-effective treatment for leafy spurge control. Previous research at North Dakota State University has shown that leafy spruge 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. Control has been similar regardless of the 2,4-D formulation applied with picloram. However, subtle differences between treatments may not be revealed when treatments are applied only once. Recently glyphosate plus 2,4-D has been labeled for leafy spurge control in pasture and rangeland. The purpose of these experiments was to evaluate various 2,4-D formulations plus dicamba, glyphosate, metsulfuron, or picloram applied annually for leafy spurge control.

The first experiments were established in 1986 on June 11 or Sept. 15 near Dickinson, on June 18 or Sept. 3 near Valley City, and on August 28 on the Sheyenne National Grasslands. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. Retreatments were applied annually in the spring or fall through 1988. 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 with 2,4-D plus picloram plus dicamba spring-applied was similar regardless of the 2,4-D formulation (Table 1). Control averaged across all treatments and both locations was 70% in the fall of 1988 (data not shown) but declined to 53% 1 yr after the third application [36 months after the first treatment (MAFT)]. This is similar control to the commonly used treatment of picloram plus 2,4-D at 0.25 plus 1 lb/A which averaged 60% or more based on long-term observations, 12 months after the last retreatment was applied in a 3 yr annual retreatment program.

Picloram plus dicamba plus 2,4-D fall-applied provided much better control at 12 and 24 MAFT than the same treatments spring-applied (Table 1). Control averaged across all fall-applied treatments and locations was 66 and 43% [12 and 24 months after the third (last) treatment]. Leafy spurge control with picloram at 0.5 lb/A averaged 59% 36 MAFT but improved to 81% when dicamba at 2 lb/A was added. Based on previous research at North Dakota State University, the 80% or better leafy spurge control is similar to that obtained with annual applications of dicamba at 2 lb/A or picloram plus 2,4-D at 0.5 plus 1 lb/A. Leafy spurge control with picloram plus dicamba was not improved by adding 2,4-D regardless of the 2,4-D formulation.

The second experiments were established in June 7, 1990 near Valley City using the same methods as previously described. Leafy spurge was in the true-flower growth stage and growing vigorously. The treatments were reapplied in June 1991.

As in the previous three-annual-treatment experiment, leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 2). Control was generally lower 15 MAFT (following the retreatment) than 3 MAFT. Above average precipitation was received during the second year (1991) and leafy spurge regrowth was vigorous. Picloram at 0.25 lb/A provided better leafy spurge control than either 2,4-D formulation alone even when applied at 4 lb/A. Leafy spurge control with 2,4-D plus glyphosate at 1.3 plus 0.76 lb/A averaged 49% after two applications (15 MAFT) and was similar regardless of 2,4-D formulation (Table 3). Metsulfuron did not control leafy spurge whether applied alone or with 2,4-D regardless of formulation.

In general, leafy spurge control was similar with all 2,4-D formulations in combination with picloram and dicamba or glyphosate. Picloram plus dicamba provided better leafy spurge control than picloram alone as a fall-applied treatment but is more expensive than the commonly used treatment of picloram plus 2,4-D. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105)

Table 1. Leafy spurge control with picloram plus dicamba and various formulations of 2,4-D applied annually from 1986 to 1988 averaged over three locations (Lym and Messersmith).

Application date and treatment	Rate	Months after first treatment[a] 12	24	36	45	48
	— lb/A —	% control				
Spring						
2,4-D mixed amine[b] + dicamba + picloram	2 + 1 + 0.25	5	17	53	..	..
2,4-D mixed amine[b] + dicamba + picloram	2 + 0.5 + 0.25	18	22	56	..	..
2,4-D mixed amine[b] + dicamba + picloram	1 + 0.12 + 0.5	6	13	46	..	..
2,4-D alkanolamine+ dicamba + picloram	2 + 1 + 0.25	7	22	62	..	..
Dicamba + picloram	1 + 0.25	8	26	49	..	..
LSD (0.05)		NS	NS	NS		
Fall						
2,4-D mixed amine[b] + dicamba + picloram	2 + 1 + 0.25	24	26	45	43	29
2,4-D alkanolamine+ dicamba + picloram	2 + 1 + 0.25	37	42	53	54	31
2,4-D mixed amine[b] + dicamba + picloram	4 + 2 + 0.5	51	56	86	79	57
2,4-D ester[c] + 2,4-DP + dicamba + picloram	2 + 2 + 0.5 + 0.25	18	22	46	43	35
2,4-D ester[c] + 2,4-DP + dicamba + picloram	2 + 2 + 0.5 + 0.5	44	50	79	75	60
2,4-D alkanolamine + dicamba + picloram	4 + 2 + 0.5	33	50	79	72	54
Dicamba + picloram	2 + 0.5	40	49	81	77	52
Picloram	0.5	27	32	59	53	29
LSD (0.05)		NS	11	14	15	17

[a]Final treatment applied 24 months after the first treatment (3 treatments total).
[b]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-EH 736.
[c]2,4-D isooctyl ester:2,4-DP butoxyethanol ester:dicamba (4:4:1 v/v/v)-EH 680.

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

Treatment	Rate	Months after first treatment		
		3	12	15
	- lb/A -	% control		
2,4-D mixed amine[a]	1	27	0	0
2,4-D mixed amine[a]	2	33	0	0
2,4-D mixed amine[a]	4	29	0	1
2,4-D alkanolamine	4	43	0	4
2,4-D mixed amine[a] + picloram	2 + 0.25	59	18	26
2,4-D alkanolamine + picloram	2 + 0.25	58	13	46
2,4-D mixed amine[a] + picloram	2 + 0.5	83	50	54
2,4-D alkanolamine + picloram	2 + 0.5	78	47	64
Picloram	0.25	62	4	23
Picloram	0.5	79	35	60
Picloram	1	96	89	93
2,4-D alkanolamine + picloram	1 + 0.5	77	29	64
LSD (0.05)		18	22	25

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-EH 736.

Table 3. Comparison of 2,4-D amine and mixed amine formulations applied with glyphosate and metsulfuron in June 1990 and 1991 for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Months after first treatment		
		3	12	15
	- lb/A -	% control		
2,4-D mixed amine[a]	0.95	15	0	5
2,4-D mixed amine[a]	1.9	22	0	6
Metsulfuron	0.016	0	0	0
Glyphosate	0.125	0	0	0
2,4-D mixed amine[a] + metsulfuron	0.95 + 0.016	8	0	0
2,4-D mixed amine[a] + metsulfuron	1.9 + 0.016	10	0	0
2.4-D mixed amine[a] + glyphosate	0.95 + 0.125	13	0	0
2,4-D mixed amine[a] + glyphosate	1.9 + 0.125	12	0	2
2,4-D alkanolamine + glyphosate	1.9 + 0.125	15	0	0
2,4-D mixed amine[a] + glyphosate	1.3 + 0.76	19	0	44
2,4-D alkanolamine + glyphosate	1.3 + 0.76	22	0	53
LSD (0.10)		13	NS	16

[a]Mixed amine salts of 2,4-D (2:1 v/v dimethylamine:diethanolamine)-EH 736.

Leafy spurge control with sulfometuron and/or picloram plus 2,4-D in a 3 yr rotation. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that sulfometuron applied with picloram or 2,4-D provides good leafy spurge control, especially when fall applied. However, sulfometuron fall-applied can cause severe grass injury. Picloram plus 2,4-D at 0.25 plus 1 lb/A will provide approximately 90% leafy spurge control when applied annually for 3 to 5 yr. The purpose of this research was to evaluate leafy spurge control and grass injury with sulfometuron plus picloram or 2,4-D applied annually for 3 yr or rotated with picloram plus 2,4-D as spring- or fall-applied treatments in pastures.

The experiment was established at three locations in North Dakota: Chaffee and Valley City in the east and Dickinson in the west. The soil at Dickinson was a loamy fine sand with pH 6.5 and 6% organic matter, at Valley City a loam with pH 7.1 and 9.2% organic matter, and at Chaffee a sandy loam with pH 7.4 and 6.7% organic matter. Spring treatments were applied the first week of June and fall treatments the first or second week of September in 1988 and the retreatments were applied at a similar time in 1989 and 1990. Leafy spurge received the same treatments in 1990 as in 1988 to complete the 3 yr treatment program. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 9 by 30 ft at Chaffee and Dickinson and 10 by 30 ft at Valley City. Each treatment was replicated four times in a randomized complete block design at all sites. Evaluations taken visually were based on percent stand reduction as compared to the control. The initial grass stand at Dickinson was too sparse to allow reliable evaluation of grass injury and was abandoned following the June 1990 evaluation.

Leafy spurge control, averaged across all spring-applied treatments in the Table increased from 18 to 49 to 78% 12, 24, and 36 months after the first treatment (MAT), respectively. Sulfometuron spring-applied with picloram or 2,4-D annually for 3 yr provided an average of 79% leafy spurge control which was similar to picloram plus 2,4-D at 80%. However, grass injury from sulfometuron spring-applied for 3 yr averaged 34%. Applying sulfometuron following picloram plus 2,4-D or vice versa gave leafy spurge control similar to picloram plus 2,4-D with no sulfometuron.

Leafy spurge control with sulfometuron plus picloram at 1.25 plus 4 oz/A fall applied for 3 consecutive yr averaged 96%, but grass injury averaged 94% (Table). Sulfometuron plus 2,4-D at 1.25 plus 16 oz/A averaged 62% leafy spurge control and 95% grass injury following three consecutive fall-applied treatments. Picloram plus 2,4-D fall applied for 3 consecutive yr averaged only 27% leafy spurge control, but control increased to 34 and 44% when sulfometuron plus 2,4-D or sulfometuron plus picloram, respectively, were applied the second yr rather than picloram plus 2,4-D. However, grass injury also increased to an average of 30%.

In general, leafy spurge control with sulfometuron plus 2,4-D or picloram was similar to picloram plus 2,4-D when applied in the spring. Sulfometuron combinations gave the best leafy spurge control when fall applied but grass injury was severe when sulfometuron was applied in the fall. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table. Long-term leafy spurge control and grass injury from sulfometuron, picloram, and 2,4-D in pastures (Lym and Messersmith).

1988 and 1990 Date applied and treatment	Rate	1989 Treatment	Rate	Location and evaluation date: Chaffee June 91 Control	Chaffee June 91 Grass injury	Chaffee Aug 91 Control	Chaffee Aug 91 Grass injury	Valley City June 91 Control	Valley City June 91 Grass injury	Valley City Aug 91 Control	Valley City Aug 91 Grass injury	Mean[a] 12 MAT Control	Mean[a] 12 MAT Grass injury	Mean[a] 24 MAT Control	Mean[a] 24 MAT Grass injury	Mean[a] 36 MAT Control	Mean[a] 36 MAT Grass injury
	- oz/A -		- oz/A -	%													
Spring																	
Sume+picl	1.25+4	Sume+picl	1.25+4	69	21	42	4	88	60	50	15	18	12	37	23	79	41
Sume+picl	1.25+4	Picl+2,4-D	4+16	81	13	56	4	91	35	53	20	18	11	46	10	86	24
Sume+2,4-D	1.25+16	Sume+2,4-D	1.25+16	80	14	73	6	76	39	23	7	21	16	28	14	78	26
Sume+2,4-D	1.25+16	Picl+2,4-D	4+16	73	4	60	6	84	18	66	0	28	9	57	7	79	11
Picl+2,4-D	4+16	Picl+2,4-D	4+16	88	0	68	0	71	3	62	0	13	0	56	2	80	1
Picl+2,4-D	4+16	Sume+picl	1.25+4	77	0	68	0	64	3	59	0	17	0	67	55	71	2
Picl+2,4-D	4+16	Sume+2,4-D	1.25+16	82	0	67	0	71	15	56	8	11	0	49	21	76	8
LSD (0.05)												NS	7	12	16	11	19
Fall																	
Sume+picl	1.25+4	Sume+picl	1.25+4	98	98	100	100	99	90	91	88	46	70	80	86	96	94
Sume+picl	1.25+4	Picl+2,4-D	4+16	99	95	88	75	99	87	89	46	52	76	42	56	89	61
Sume+2,4-D	1.25+16	Sume+2,4-D	1.25+16	97	99	75	99	96	95	50	90	31	80	49	89	62	95
Sume+2,4-D	1.25+16	Picl+2,4-D	4+16	96	97	39	64	92	94	33	76	25	89	10	51	35	70
Picl+2,4-D	4+16	Picl+2,4-D	4+16	80	3	34	0	74	8	19	0	10	3	7	3	27	0
Picl+2,4-D	4+16	Sume+picl	1.25+4	79	51	58	0	92	66	30	53	6	0	62	48	44	26
Picl+2,4-D	4+16	Sume+2,4-D	1.25+16	81	23	51	9	78	68	17	65	2	0	38	64	34	33
LSD (0.05)				18	16	31	16	13	31	24	32	12	7	16	19	20	18

[a] Mean 12, 24, or 36 months after the first treatment.

Leafy spurge control and forage production with various fall-applied herbicide treatments. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that glyphosate plus 2,4-D at 0.4 plus 0.6 lb/A applied in September will provide 60 to 70% leafy spurge control the following spring. Grass injury can be 30 to 50%, but grass generally recovers to produce similar forage to the weed-free control. Picloram plus 2,4-D at 0.5 plus 1 lb/A will provide 80 to 90% leafy spurge control the following growing season with no grass injury. However, the picloram plus 2,4-D treatment costs approximately $22/A compared to $8/A for the glyphosate plus 2,4-D treatment. The purpose of this research was to evaluate leafy spurge control and grass injury with glyphosate plus 2,4-D fall-applied annually for 3 yr or rotated with picloram plus 2,4-D or dicamba as fall-applied treatments.

The experiment was established at Chaffee and Valley City, on September 19, 1990, when leafy spurge was in the fall regrowth stage. The plants were mowed to a 4 to 6 inch height on October 16 at both locations to facilitate herbage production evaluations the next summer. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 ft and each treatment was replicated four times in a randomized complete block design. The main grasses were several bluegrass spp. and occasional crested wheatgrass and smooth brome at both locations.

Grass stand reduction and leafy spurge control were estimated visually as compared with the untreated control in May 1991. Herbage production was determined in July 1991 by clipping three 0.25-m^2 quadrats per plot and separating into leafy spurge and forage components. The samples were oven dried at 140 F for 24 hr. The entire plot area was mowed following harvest. Herbicide retreatments were applied on September 20 or 24, 1991 at Chaffee and Valley City, respectively, to begin the second-year treatment program.

Control was similar with glyphosate plus 2,4-D at both locations and averaged 68% 9 months after first treatment (MAFT) (Table 1). Grass injury from glyphosate plus 2,4-D averaged 53% over both locations but was especially high at Valley City. No other treatment resulted in grass injury. Picloram at 0.5 lb/A applied alone or with 2,4-D provided the best leafy spurge control and averaged 92 and 65% at Valley City and Chaffee, respectively. The reason for the increased control with picloram at Valley City compared to Chaffee is not known. Dicamba at 2 lb/A and picloram plus 2,4-D at 0.25 plus 1 lb/A provided an average of 73 and 63% control, respectively.

Herbage production was higher at Chaffee than Valley City, probably due in part to much above average precipitation at Chaffee including a 4-inch rainfall in May 1991 (Table 2). Forage production with glyphosate plus 2,4-D averaged 438 lb/A which is a 64% reduction compared to the control. Herbage production was similar to the control with the picloram, picloram plus 2,4-D, and dicamba treatments. Picloram at 0.5 lb/A applied alone or with 2,4-D reduced leafy spurge production to an average of 698 lb/A over both locations, a 50% reduction compared to the control. Dicamba at 2 lb/A and picloram plus 2,4-D at 0.25 plus 1 lb/A reduced leafy spurge production by approximately 30% compared to the control.

Leafy spurge control with each herbicide combination was similar to results from previous research. However, grass injury and the resulting decrease in forage production following application of glyphosate plus 2,4-D was higher than expected. Severe long-term grass injury will likely result if glyphosate is applied 2 yr in a row. Retreatment with picloram plus 2,4-D or dicamba rather than glyphosate may allow the grass to recover and provide good leafy spurge control resulting in a less costly management program than using only picloram plus 2,4-D or dicamba applied annually.

Table 1. Leafy spurge control with various fall-applied herbicide treatments at Valley City and Chaffee, ND.

1990 and 1992 Treatment		1991 Treatment		Control 1991/9 MAFT[a]			Grass injury/9 MAFT[a]		
Herbicide	Rate	Herbicide	Rate	Valley City	Chaffee	Mean	Valley City	Chaffee	Mean
	- lb/A -		- lb/A -			%			
Glyphosate+2,4-D	0.4+0.6	Glyphosate+2,4-D	0.4+0.6	57	76	70	62	34	45
Glyphosate+2,4-D	0.4+0.6	Picloram+2,4-D	0.5+1	67	65	65	77	33	55
Glyphosate+2,4-D	0.4+0.6	Dicamba	2	72	68	70	85	32	60
Picloram+2,4-D	0.5+1	Glyphosate+2,4-D	0.4+0.6	89	70	80	3	0	0
Picloram+2,4-D	0.5+1	Picloram+2,4-D	0.5+1	95	75	85	0	0	0
Picloram	0.5	Glyphosate+2,4-D	0.4+0.6	93	57	75	0	7	5
Picloram	0.5	Picloram	0.5	91	58	75	0	0	0
Dicamba	2	Glyphosate+2,4-D	0.4+0.6	75	67	70	0	0	0
Dicamba	2	Dicamba	2	82	65	75	0	0	0
Picloram+2,4-D	0.25+1	Glyphosate+2,4-D	0.4+0.6	80	47	65	0	0	0
Picloram+2,4-D	0.25+1	Picloram+2,4-D	0.25+1	76	40	60	0	2	0
Control				0	0	0	0	0	0
LSD (0.05)				13	24	14	21	11	12

[a] Months after first treatment.

Table 2. Forage and leafy spurge production following various fall-applied herbicide treatments.

1990 and 1992 Treatment		1991 Treatment		Yield 1991/10 MAFT[a]					
				Forage			Leafy spurge		
Herbicide	Rate	Herbicide	Rate	Valley City	Chaffee	Mean	Valley City	Chaffee	Mean
	- lb/A -		- lb/A -			lb/A			
Glyphosate+2,4-D	0.4+0.6	Glyphosate+2,4-D	0.4+0.6	90	895	490	1640	795	1220
Glyphosate+2,4-D	0.4+0.6	Picloram+2,4-D	0.5+1	25	595	310	1390	1650	1520
Glyphosate+2,4-D	0.4+0.6	Dicamba	2	20	1010	515	1155	520	840
Picloram+2,4-D	0.5+1	Glyphosate+2,4-D	0.4+0.6	680	1535	1110	910	580	745
Picloram+2,4-D	0.5+1	Picloram+2,4-D	0.5+1	1125	1715	1420	530	235	385
Picloram	0.5	Glyphosate+2,4-D	0.4+0.6	665	1905	1285	745	955	850
Picloram	0.5	Picloram	0.5	1175	1630	1400	720	895	810
Dicamba	2	Glyphosate+2,4-D	0.4+0.6	525	1330	930	1205	1145	1175
Dicamba	2	Dicamba	2	685	1610	1150	905	700	800
Picloram+2,4-D	0.25+1	Glyphosate+2,4-D	0.4+0.6	720	2010	1365	1045	725	885
Picloram+2,4-D	0.25+1	Picloram+2,4-D	0.25+1	605	1525	1065	1050	1000	1025
Control				650	1750	1200	1580	1190	1385
LSD (0.05)				550	690	475	650	NS	540

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

The first experiment was established in June and July 1989 near Hunter, ND, when leafy spurge was in the true flower and late seed-set growth stages, respectively. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 25 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. Quinclorac was applied with soybean oil plus Atplus 300F emulsifier rather than the recommended oil additive BAS-090 because that additive caused rapid injury to leafy spurge leaves in greenhouse trials. However, in subsequent field research, BAS-090 alone did not injure leafy spurge severely and was included in the second experiment. The second 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 new fall growth. The experimental design was as previously described except the plots were 10 by 30 ft.

Quinclorac provided an average of 50% and 35% leafy spurge control in August when applied in June and July, respectively (Table 1). Adding soybean oil plus Atplus 300F or Silwett L-77 generally did not improve control compared to quinclorac applied alone. Picloram plus 2,4-D and picloram plus quinclorac when applied in June or July provided similar leafy spurge control.

Quinclorac provided much better leafy spurge control when applied in September compared to June or July (Tables 1 and 2). Quinclorac at 1 lb/A plus BAS-090 provided better leafy spurge control than quinclorac applied alone or with the seed-oil-based additive Scoil (Table 2). Control with quinclorac plus BAS-090 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. Scoil applied with picloram did not improve leafy spurge control compared to picloram alone and reduced control when applied with picloram plus 2,4-D. Leafy spurge control declined rapidly after the July 1991 evaluation and all treatments were reapplied in September 1991.

Quinclorac plus BAS-090 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).

Table 1. Quinclorac alone, with various additives, or with picloram for leafy spurge control (Lym).

Application date and treatment	Rate	Evaluation date		
		Aug 89	June 90	Aug 90
	lb/A	% control		
June 1989				
Quinclorac + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	60	4	0
Quinclorac + soybean oil + Atplus 300F	1 + 1 qt + 1%	26	1	1
Quinclorac + Silwett L-77	1 + 0.25%	55	38	16
Quinclorac	1	55	41	31
Picloram + quinclorac	0.25 + 0.5	72	26	10
Picloram + 2,4-D	0.25 + 0.5	80	14	4
July 1989				
Quinclorac + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	34	3	0
Quinclorac + soybean oil + Atplus 300F	1 + 1 qt + 1%	53	6	1
Quinclorac + Silwett L-77	1 + 0.25%	28	22	2
Quinclorac	1	28	17	3
Picloram + quinclorac	0.25 + 0.5	66	9	0
Picloram + 2,4-D	0.25 + 0.5	80	0	0
LSD (0.05)		24	NS	17

Table 2. Quinclorac and picloram with various additives applied in September 1990 for leafy spurge control (Lym).

Treatment	Rate	Evaluation date	
		June 91	July 91
	lb/A	% control	
Quinclorac + BAS-090	1 + 1 qt	90	63
Quinclorac + Scoil	1 + 1 qt	74	56
Quinclorac	1	49	26
Quinclorac + picloram	1 + 0.5	85	64
Quinclorac + picloram + BAS-090	1 + 0.5 + 1 qt	91	77
Picloram + 2,4-D	0.5 + 1	81	67
Picloram + 2,4-D + Scoil	0.5 + 1 + 1 qt	43	22
Picloram + 2,4-D + BAS-090	0.5 + 1 + 1 qt	57	19
Picloram + Scoil	0.5 + 1 qt	71	34
Picloram	0.5	60	12
LSD (0.05)		28	36

Various spray additives applied with picloram and 2,4-D for leafy spurge control. Lym, Rodney G., and Frank A. Manthey. Picloram is the most effective herbicide for leafy spurge control and when applied with 2,4-D provides better control than picloram applied alone. Previous research at North Dakota State University has shown that less than 40% of the picloram applied to leafy spurge is absorbed and approximately 5% reaches the roots. The increased control from the addition of 2,4-D is due to decreased picloram metabolism, not increased absorption or translocation. A likely approach for increased picloram efficiency for leafy spurge control is to increase absorption and thereby increase the amount of picloram translocated to the roots. The purpose of these experiments was to evaluate various additives applied with picloram and picloram plus 2,4-D for increased leafy spurge control compared to the herbicides applied alone. Many spray additives were screened for potential to increase leafy spurge control with picloram and 2,4-D in greenhouse studies. Compounds with the most potential were evaluated in a series of field trials.

The first experiment evaluated picloram alone or applied with various spray additives as spring or fall applied treatments. The experiment was established on June 7 and September 19, 1990 near Valley City, ND, and June 24 and September 12, 1990 on the Sheyenne National Grasslands. A second experiment evaluated picloram plus 2,4-D applied alone or with various spray additives and was established at the same locations and dates as the picloram experiment. The 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. Leafy spurge control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

The additives evaluated included the commercial surfactants, X-77, LI-700, Silwett L-77, Triton CS-7, Triton X-100, Triton N-57 and Surftac. Industrial surfactants evaluated were Gafac RA-600 (free acids of a complex organic phosphate ester), Emulphor ON-877 (polyoxyethylated fatty alcohol), Mapeg 400 MO (PEG 400 Monooleate), Pluronic L63 (block copolymers of propylene oxide and ethylene oxide), and Tetronic 1504 (block copolymers of ethylene oxide and propylene oxide).

Leafy spurge control for the June-applied treatments averaged over both locations 15 months after the first treatment (MAFT) increased or tended to increase when picloram at 0.25 lb/A was applied with all additives evaluated except Surftac compared to picloram alone (Table 1). Leafy spurge control with picloram at 0.25 lb/A alone was 54% averaged over both locations compared to 77% when applied with the spray additives (except Surftac). Control for the September-applied treatments was similar regardless whether picloram at 0.5 lb/A was applied alone or with a spray additive.

In the second experiment leafy spurge control averaged over both locations 15 MAFT for the June-applied treatments tended to increase when picloram plus 2,4-D at 0.25 plus 1 lb/A was applied with Pluronic L63 (Table 2). Control was similar with all other additives applied with picloram plus 2,4-D compared to the herbicide alone in June except Triton X-100 which tended to decrease control. As with picloram alone, control for picloram plus 2,4-D applied in September was similar regardless of the additive.

In general, leafy spurge control was increased slightly when a spray additive was added to picloram or picloram plus 2,4-D applied in June but not in September. The additives that did increase short-term control with picloram or picloram plus 2,4-D represent several groups of chemicals. Thus, it is not yet possible to narrow the focus for the "ideal" spray additive with these herbicides for leafy spurge control. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table 1. Evaluation of picloram plus various additives applied in spring or fall for leafy spurge control (Lym and Manthey).

Application time and additive	Rate[a]	Location/evaluation date (MAFT)[b] Valley City 3/9	12	15	Sheyenne 3/9	12	15	Mean[c] 15/12
	- % -	%						
June								
None	..	36	5	28	64	11	80	54
Pluronic L63	0.5	47	3	76	74	26	87	81
Tetronic 1504	0.5	57	7	66	77	22	79	72
Triton X-100	0.5	50	4	58	78	15	91	75
Triton CS-7	0.5	66	9	54	69	16	90	75
Surftac	0.5	50	11	33	56	16	85	59
X-77 + L-77	0.25 + 0.25	62	10	60	74	44	95	77
Mapeg 400 MO	0.5	63	12	66	78	27	96	81
LI-700	0.5	56	3	43	80	31	93	72
X-77	0.5	54	6	56	80	21	96	76
Gafac RA-600	0.5	57	6	65	86	40	96	81
Emulphor ON-877	0.5	60	7	70	78	16	96	83
LSD (0.05)		21	NS	18	20	NS	14	11
September								
None	..	74	9	..	93	45	..	27
Pluronic L63	0.5	79	12	..	97	45	..	28
Tetronic 1504	0.5	84	14	..	95	35	..	24
Triton X-100	0.5	81	13	..	97	39	..	26
Triton CS-7	0.5	83	10	..	97	62	..	36
Surftac	0.5	86	12	..	96	26	..	19
X-77 + L-77	0.25 + 0.25	83	11	..	93	23	..	17
Mapeg 400 MO	0.5	83	9	..	90	43	..	26
LI-700	0.5	83	6	..	97	35	..	21
X-77	0.5	90	13	..	92	39	..	26
Gafac RA-600	0.5	78	5	..	93	58	..	31
Emulphor ON-877	0.5	82	21	..	95	63	..	42
LSD (0.10)		9	NS		NS	NS		NS

[a]Picloram was applied at 0.25 lb/A in June or 0.5 lb/A in September.

[b]Months after first treatment.

[c]Mean 15 or 12 MAFT for spring or fall applied treatments, respectively, (LSD = 0.15).

Table 2. Evaluation of picloram plus 2,4-D applied in the spring or fall with various additives for leafy spurge control (Lym and Manthey).

Application time/ additive	Rate[a]	Location/evaluation date (MAFT)[b] Valley City 3/9	Valley City 12	Valley City 15	Sheyenne 3/9	Sheyenne 12	Sheyenne 15	Mean 15/12
	- % -	%						
June								
None	..	47	18	28	84	51	43	61
Pluronic L63	0.5	56	13	62	90	39	94	78
Tetronic 1504	0.5	36	12	31	88	48	94	62
Triton X-100	0.5	31	13	18	91	44	94	45
Triton CS7	0.5	39	7	44	80	19	92	68
Surftac	0.5	38	9	31	87	31	93	62
X-77 + L-77	0.25 + 0.25	31	9	17	83	46	93	55
Mapeg 400 MO	0.5	38	13	30	84	43	92	61
LI-700	0.5	34	9	25	77	24	92	58
X-77	0.5	36	8	39	81	25	92	66
Gafac RA-600	0.5	38	3	25	85	40	92	58
Triton N57	0.5	35	12	28	79	36	94	50
LSD (0.05)		NS	NS	25	NS	NS	NS	17
September								
None	..	79	10	..	92	20	..	15
Pluronic L63	0.5	91	18	..	94	27	..	22
Tetronic 1504	0.5	87	8	..	95	10	..	9
Triton X-100	0.5	84	13	..	94	3	..	8
Triton CS7	0.5	82	11		96	23		17
Surftac	0.5	79	3	..	95	46	..	25
X-77 + L-77	0.25 + 0.25	85	24	..	96	23	..	24
Mapeg 400 MO	0.5	82	15	..	97	26	..	21
LI-700	0.5	89	18	..	96	27	..	23
X-77	0.5	88	12	..	93	25	..	19
Gafac RA-600	0.5	82	6	..	93	13	..	10
Triton N57	0.5	86	13	..	97	21	..	17
LSD (0.05)		NS	NS		NS	NS		NS

[a]Picloram was applied at 0.25 or 0.5 lb/A plus 2,4-D at 1 lb/A in June and September, respectively.

[b]Months after original treatment

[c]Mean 15 or 12 MAFT for spring or fall applied treatments, respectively, (LSD = 0.15).

Evaluation of various herbicides and herbicide-insecticide combinations for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Over 100 herbicides were screened for activity on leafy spurge in a series of greenhouse experiments conducted at North Dakota State University. The herbicides that showed potential for leafy spurge control were evaluated in field trials and compared to picloram, 2,4-D, and glyphosate applied alone or in various combinations. Certain herbicide-insecticide combinations, especially with ALS-inhibiting herbicides cause excessive broadleaf crop injury. It was hypothesized that adding an insecticide to an ALS-inhibiting herbicide that is phytotoxic to leafy spurge would increase control. The purpose of these experiments was to evaluate various herbicides applied alone and combined with other herbicides or insecticides for leafy spurge control.

The first screening experiment was established at West Fargo, ND, on June 14, 1990, in a dense stand of leafy spurge in the flower to early seed-set growth stage. The weather was partly cloudy with 65 F and 70% relative humidity. The soil was a loamy-clay with 7.5 pH. The second screening trial was established on September 24, 1990 near Amenia, ND. The leafy spurge was a dense stand in the fall regrowth stage, and vigorous. The weather was clear, 87 F, with 34% relative humidity, and the soil was similar to the West Fargo site. The herbicide-insecticide experiment was established on June 13, 1990 near Chaffee, ND, on a sandy soil with 7.8 pH. The weather was clear, 84 F, and 44% relative humidity, and the leafy spurge was in the flower to seed-set growth stage and vigorous.

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. Leafy spurge control evaluations were based on a visual estimate of percent stand reduction as compared to the untreated check.

No herbicide treatment in the June applied screening experiment provided satisfactory leafy spurge control 3 or 12 months after treatment (MAT) (Table 1). However, several compounds provided good to excellent control when fall applied. Imazaquin at 4 oz/A provided 99 and 88% control 9 and 10 MAT with no grass injury. Nicosulfuron at 1 to 2 oz/A and quinclorac at 16 oz/A averaged 85% control 9 MAT but nicosulfuron injured grass severely, especially at the 2 oz/A rate. Glyphosate plus 2,4-D plus picloram provided 98% control 9 MAT but also caused 94% grass injury. Imazaquin at 4 oz/A, nicosulfuron at 1 and 2 oz/A, quinclorac at 16 oz/A, and the glyphosate plus 2,4-D plus picloram treatments fall-applied all provided better leafy spurge control 11 MAT than the standard treatment of picloram plus 2,4-D at 8 plus 16 oz/A, respectively. The addition of 2,4-D to most herbicides decreased control compared to the herbicides alone except when applied with glyphosate or picloram.

Imazamethabenz, AC-310488, EPTC, thifensulfuron plus tribenuron and primisulfuron did not provide satisfactory leafy spurge control either spring or fall applied (Table 1). The insecticides malathion and disulfoton applied with various herbicides in June did not increase leafy spurge control 3 or 12 MAT compared to the herbicides applied alone (Table 2).

Imazethapyr, imazaquin, nicosulfuron and quinclorac provided good to excellent leafy spurge control when fall applied and maintained control longer than picloram plus 2,4-D. Of these, only glyphosate plus 2,4-D and nicosulfuron injured grass which would limit their use in a leafy spurge control program. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo).

Table 1. Evaluation of various herbicide treatments spring or fall applied for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Application date/evaluation (MAT)							
		14 June 90		24 Sept 90			24 Sept 1990		
		3	12	9	10	11	9	10	11
	oz/A	% control					% grass inj		
Imazamethabenz + X-77	1 + 0.5%	10	0	6	..	..	0	..	..
Imazamethabenz + X-77	2 + 0.5%	0	0	13	..	..	0	..	..
Imazamethabenz + 2,4-D + X-77	2 + 16 + 0.5%	30	5	28	..	..	0	..	..
AC-310488 + X-77	1 + 0.5%	9	5	5	..	..	0	..	..
AC-310488 + X-77	2 + 0.5%	3	0	0	..	..	0	..	..
AC-310488 + 2,4-D + X-77	1 + 16 + 0.5%	19	9	20	..	..	0	..	..
Imazethapyr + X-77	1 + 0.5%	10	0	67	39	27	0	0	0
Imazethapyr + X-77	2 + 0.5%	1	0	79	56	11	0	0	0
Imazethapyr + 2,4-D + X-77	1 + 16 + 0.5%	10	6	59	23	8	0	0	0
Imazaquin + X-77	2 + 0.5%	0	0	92	62	33	5	0	4
Imazaquin + X-77	4 + 0.5%	0	0	99	88	54	0	0	1
Imazaquin + 2,4-D + X-77	2 + 16 + 0.5%	20	8	69	33	28	0	0	0
EPTC + X-77	96 + 0.5%	0	0	9	..	28	0	..	..
EPTC + picloram	96 + 8 + 0.5%	49	35	81	..	..	0	..	..
Nicosulfuron + X-77	1 + 0.5%	5	0	85	68	53	38	11	10
Nicosulfuron + X-77	2 + 0.5%	0	0	85	79	67	76	26	28
Nicosulfuron + 2,4-D + X-77	1 + 16 + 0.5%	72	28	80	59	24	48	10	21
Quizalofop + X-77	1 + 0.5%	0	0	21	..	..	19	..	..
Quizalofop + X-77	2 + 0.5%	0	0	8	..	..	46	..	..
Quizalofop + 2,4-D + X-77	1 + 16 + 0.5%	23	23	15	..	..	0	..	..
Thifensulfuron + tribenuron	0.65 + 0.35 + 0.5%	14	0	0	..	..	0	..	..
Thifensulfuron + tribenuron	1.5 + 0.5 + 0.5%	5	0	5	..	..	0	..	..
Thifensulfuron + 2,4-D + X-77	0.65 + 0.35 + 16 + 0.5%	17	9	6	..	..	0	..	..
Primisulfuron + Agridex	0.29 + 1 qt	0	5	0	..	..	0	..	..
Primisulfuron + Agridex	0.6 + 1 qt	0	0	4	..	..	0	..	..
Primisulfuron + 2,4-D + Agridex	0.6 + 1 + 1 qt	11	5	23	..	..	0	..	..
Quinclorac	16	27	21	100	86	68	0	0	0
Quinclorac + Surftac (BAS-090)[a]	16 + 0.5%	3	4	85	80	67	3	0	0
Glyphosate + 2,4-D + X-77	0.4 + 0.7 + 0.5%	37	50	69	40	31	91	40	58
Glyphosate + 2,4-D + picloram + X-77	0.2 + 0.3 + 6 + 0.5%	57	75	..	..	..	11	..	..
Glyphosate + 2,4-D + picloram + X-77	0.4 + 0.7 + 8 + 0.5%	..	..	98	81	54	94	54	52
Picloram + 2,4-D	4 + 16	24	10	76	27	19	0	0	0
Picloram + 2,4-D	8 + 16	41	34	94	52	25	4	1	0
LSD (0.05)		18	18	21	24	28	15	17	14

[a]The additive BAS-090 at 1 qt/A was applied in place of Surftac with quinclorac applied in September.

Table 2. Evaluation of herbicide plus insecticide mixtures for leafy spurge control (Lym and Messersmith).

Treatment	Rate	Control/MAT 3	12
	— oz/A —	— % —	
Picloram + X-77	4 + 0.5%	49	21
Dicamba + X-77	32 + 0.5%	36	10
Imazethapyr + X-77	1 + 0.5%	4	0
Imazaquin + X-77	2 + 0.5%	0	3
Sulfometuron + X-77	1 + 0.5%	2	0
Picloram + malathion + X-77	4 + 8 + 0.5%	21	6
Dicamba + malathion + X-77	32 + 8 + 0.5%	28	0
Imazethapyr + malathion + X-77	1 + 8 + 0.5%	5	0
Imazaquin + malathion + X-77	2 + 8 + 0.5%	0	0
Sulfometuron + malathion + X-77	1 + 8 + 0.5%	0	0
Picloram + disulfoton + X-77	4 + 8 + 0.5%	51	9
Dicamba + disulfoton + X-77	32 + 8 + 0.5%	57	13
Imazethapyr + disulfoton + X-77	1 + 8 + 0.5%	6	3
Imazaquin + disulfoton + X-77	2 + 8 + 0.5%	5	0
Sulfometuron + disulfoton + X-77	1 + 8 + 0.5%	2	0
Malathion + X-77	8 + 0.5%	0	0
Disulfoton + X-77	8 + 0.5%	0	0
LSD (0.05)		17	8

Long-term leafy spurge control with herbicides followed by insect biocontrol agents. Lym, Rodney G., and Calvin G. Messersmith. An experiment to evaluate long-term leafy spurge control and forage production was established near Valley City, North Dakota in 1983. Herbicide treatments were applied until 1988 when the forage production part of the experiment was completed. The introduction and establishment of leafy spurge biocontrol agents in North Dakota holds promise for economical management of this weed. However, the effect of long-term herbicide application prior to insect introduction on the biocontrol agents establishment is not known. Prior herbicide treatment of a leafy spurge infestation may be detrimental to insect establishment due to less dense stands and to the insect life cycle because of chemical residue. Since much of the leafy spurge acreage has been treated with herbicides it is important to determine if biological control agents will establish and reproduce on previously treated leafy spurge. Thus, herbicide treatments were continued in 1991 on the forage production plots to establish a research area until insects are available to conduct the establishment and life-cycle experiment.

The treatments were selected based on previous research conducted at North Dakota State University and included 2,4-D at 2 lb/A, picloram plus 2,4-D at 0.25 plus 1 lb/A, picloram at 2 lb/A, and dicamba at 8 lb/A, and were applied in August 1983 or June 1984 as fall or spring treatments. The 2,4-D at 2 lb/A and picloram plus 2,4-D treatments were applied annually, while the picloram alone and dicamba treatments were reapplied when leafy spurge control declined to 70% or less. Sulfometuron plus picloram at 0.08 plus 0.5 lb/A were applied in June or August, 1988 to plots that previously were only mowed. No treatments were applied in 1989. When the experiment was reestablished in 1990, the herbicide treatments were the same except the sulfometuron plus picloram treatment was replaced by glyphosate plus 2,4-D at 0.4 plus 0.6 lb/A. Also, the picloram plus 2,4-D rate fall-applied was increased from 0.25 plus 1 lb/A to 0.5 plus 1 lb/A.

The herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 15 by 50 ft in a randomized complete block design with four replications. Evaluations taken visually were based on percent stand reduction as compared to the control.

All treatments were reapplied in 1990, 72 or 84 months after the original spring or fall application, respectively. Control was similar to the 60 month after treatment evaluation even though no retreatments were applied in 1989. All treatments except picloram at 2 lb/A were reapplied in 1991. The experimental site will be maintained until a sufficient number of biocontrol agents are available to continue the experiment.

Table. Long-term leafy spurge control with herbicides prior to introduction of insect biocontrol agents (Lym and Messersmith).

Original treatment date and herbicide	Rate	Retreatment date and herbicide	Rate	Year applied	Control/MAT[a] 12	24	36	48	60	72	84	96
	- lb/A -		- lb/A -		%							
Spring 1984		Spring										
2,4-D	2	2,4-D	2	85-88 90-91	0	0	10	16	30	28	4	..
Picloram + 2,4-D	0.25+1	Picloram + 2,4-D	0.25+1	85-88 90-91	24	31	59	58	60	60	43	..
Picloram	2	Picloram	2[b]	88 90-91	99	94	84	68	99	94	98	..
Dicamba	8	Dicamba	8[b]	85-87 90-91	53	30	86	58	45	65	79	..
Mowed only	...	Sulfometuron + picloram	0.08+0.25	88								
		Glyphosate + 2,4-D	0.4+0.6	90-91		0	0	0	0	16	0	10
LSD (0.05)						20	17	15	20	15	14	16
Fall 1983		Fall										
2,4-D	2	2,4-D	2	84-88 90-91	0	0	0	0	4	4	0	0
Picloram + 2,4-D	0.25+1	Picloram + 2,4-D	0.25+1	84-88								
			0.5+1	90-91	40	4	8	16	22	15	11	0
Picloram	2	Picloram	2[b]	85 90	99	36	94	99	84	80	70	80
Dicamba	8	Dicamba	8[b]	86 88 90-91	91	87	58	88	69	91	81	48
Mowed only	...	Sulfometuron + picloram	0.08+0.25	88								
		Glyphosate + 2,4-D	0.38+0.62	90-91	0	0	0	0	0	67	0	3
LSD (0.05)					17	18	18	10	13	15	14	18

[a] Months after original treatment.
[b] Applied when control declines to less than 70%.

Effect of herbicide application on leafy spurge biocontrol insect establishment. Lym, Rodney G., and Robert B. Carlson. The most cost-effective long-term leafy spurge management program probably will require the integration of biological agents with herbicides. The herbicide rates and dates of application will have to be beneficial to the various insects. Improperly timed herbicide applications such as annual treatments for topgrowth control could disrupt an insect's feeding and/or reproductive cycle causing the population to rapidly decline. The purpose of this research is to determine the best timing of herbicide application to enhance establishment of a biocontrol agent and the effect of both biocontrol agents and herbicides on plant species composition and production.

An experiment to determine the effect of herbicide application timing on Aphthona spp. was established on previously untreated leafy spurge infestations. Each area was approximately a third of an acre and was divided into quarters prior to the insect release. One-half (Quadrants 1 and 2) were treated with picloram plus 2,4-D at 0.5 plus 1 lb/A just prior to insect release. Quadrants 3 and 4 remained untreated to allow the insect to establish. The following year Quadrants 2 and 3 were treated. Thus, in Year 2, the insect was presented with an area treated 12 months earlier but containing leafy spurge reqrowth (Quadrant 1), an area treated 2 years in a row (Quadrant 2), a newly treated area (Quadrant 3), and an untreated area (Quadrant 4).

The following year (Year 3), Quadrants 3 and 4 will be treated. This will present the insect with leafy spurge treated 24 months earlier (Quadrant 1), 2 years in a row but not in the last 12 months (Quadrant 2), 2 years in a row including the current year (Quadrant 3), and a newly treated area (Quadrant 4).

Forage species composition and production will be monitored prior to establishment of the insects, during the study, and 12 to 24 months after the last herbicide treatment.

The experiment was established at Valley City in 1989 and at Buffalo, Hunter, the Sheyenne National Grasslands, and at a second location near Valley City in 1991. Approximately 600 A. nigriscutus were released on two plots in 1989 at the Valley City 1989 site. Quadrants 3 and 4 were treated in 1991 and a small population of A. nigriscutus was found. Approximately 300 A. nigriscutus were released in 1991 at the second Valley City and the Hunter sites. Approximately 500 A. cyparissiae were released at the Sheyenne National Grassland and Buffalo sites in 1991. More insects were found in the treated compared to the non-treated quadrants in both 1989 and 1990 at the 1989 Valley City site, but the population had not increased enough to cause a visible change in leafy spurge density.

Evaluation of various grass species to control leafy spurge. Lym, Rodney G., 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 which may be competitive with leafy spurge.

The experiment was established in a dense stand of leafy spurge (42 stems/ft^2) on the NDSU experiment station at Fargo. 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 0.7 lb/A were applied to all plots when leafy spurge was in the flowering growth stage and again on July 27, 1990, to regrowth that was flowering again. Glyphosate plus 2,4-D alone without grass seeding was applied in September 1990 and 1991.

The soilbed was prepared for seeding on August 6 and 28, 1990, and the grass was planted on August 29. Grass species seeded and seeding rate are shown in Table 1. 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.

Bromoxynil plus 2,4-D at 0.75 plus 0.75 lb/A were applied on May 24, 1991, to control annual weeds. Leafy spurge and grass species density were recounted on May 14, 1991. The plots were harvested on July 23 to 24, 1991 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 24 hours at 140 F. Herbage data are reported on a dry weight basis.

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.

'Arthur' Dahurian wildrye, 'Bozoisky' Russian wildrye, 'Hycrest' crested wheatgrass and 'MDN-1813' intermediate wheatgrass established rapidly despite the dry conditions in Fall 1990 (Table 1). 'Killdeer' sideoats grama was the only species that failed to have at least a 10% stand prior to winter.

'Hycrest' crested wheatgrass had the best stand density counts in May 1991 and was the only species to reduce the leafy spurge stand equal to the herbicide treatment (Table 2). Killdeer sideoats grama failed to establish. All established grass species tended to reduce leafy spurge production compared to the control. MDN-1813 intermediate wheatgrass had the highest forage production at 2290 lb/A. However, Rodan western wheatgrass, Arthur Dahurain wildrye, and Bozoisky Russian wildrye provided the best leafy spurge control when visually evaluated in September 1991 which averaged 32% compared to the control.

The initial leafy spurge control from the various grass species was less than observed in Wyoming from the same or similar species. However, initial stand establishment and growth was reduced by dry soil conditions and several of the grass species may become more competitive following the average seasonal precipitation received in 1991.

Table 1. Initial grass stand counts and establishment with several grass species at Fargo, ND (Lym and Tober).

Grass species/cultivar	Plant stand	Count[a]	Plants seeded[b]	Establishment
	No./m in row	-ft^2-	No./ft^2	%
'Rebound' smooth bromegrass	8	3.7	19	20
'Rodan' western wheatgrass	14.8	6.7	25	27
'Bozoisky' Russian wildrye	21.3	9.8	26	38
'Arthur' Dahurian wildrye	23.7	10.8	17	64
'MDN-1813' intermediate wheatgrass	14	6.4	17	38
'T-17596' mountain rye	4.7	2.1	17	13
'Hycrest' crested wheatgrass	10	4.6	24	19
'Killdeer' sideoats grama	1.4	0.7	30	2
LSD (0.05)	8			15

[a]Three 20-cm by 1-m quadrats per plot were counted on October 30, 1990.
[b]Grass was planted August 29, 1991.

Table 2. Grass stand establishment, yield and resulting leafy spurge control with several grass species seeded August 29, 1990 and evaluated in 1991 at Fargo, ND (Lym and Tober).

Grass species and herbicide[a]	Stand count[b]		Yield[c]					Control[d]
	Grass species	Leafy spurge	Grass species	Leafy spurge	Weedy grasses	Forbs	Total	
	ft^2		lb/A					%
'Rebound' smooth brome	2	21	510	290	1185	45	2035	23
'Rodan' western wheatgrass	6	27	945	270	650	120	1990	39
'Bozoisky' Russian wildrye	10	23	640	230	930	115	1915	25
'Arthur' Dahurian wildrye	16	25	1180	220	595	55	2045	31
'MDN-1813' intermediate wheatgrass	14	20	2290	215	125	70	2700	16
'T-17596' mountain rye	6	20	355	145	1855	85	1810	8
'Hycrest' crested wheatgrass	18	17	1100	210	760	5	2075	3
'Killdeer' sideoats gramma	0	27	1	320	1390	295	2005	0
Glyphosate + 2,4-D	0	17	0	505	1815	65	2380	1
Control	0	36	0	505	795	35	1330	0
LSD (0.05)	5	10	770	NS	NS	NS	NS	14

[a]2,4-D + bromoxynil at 0.75 + 0.75 lb/A applied to all plots 24 May 91.
[b]Three 0.25 quadrats per plot were counted 14 May 91.
[c]Four 0.25 quadrats per plot were harvested 23-24 July 91.
[d]Visual evaluation of leafy spurge control 23 Sept. 91.

Cattail control with imazapyr, 1990 to 1991. Thorsness, Kevin B., Calvin G. Messersmith, and Rodney G. Lym. Cattails are robust perennial hydrophytes commonly associated with marshes, lake edges, drainage ditches, and other wetlands in North Dakota. Cattails provide excellent habitat for blackbird nesting and roosting. Blackbirds prefer to feed on sunflower achenes and can cause yield losses over 70% in some fields. The purpose of this research was to evaluate imazapyr and glyphosate for cattail control. Perhaps reduced sunflower density will decrease the number of blackbirds roosting in marshes and thus reduce sunflower yield loss in nearby fields. Reduced cattail density should reduce sunflower losses due to blackbird predation.

The experiment was established on August 17, 1990, near Fargo, ND. Treatments included imazapyr and glyphosate, tradename Rodeo, as a treated check and were applied with an all-terrain-vehicle-mounted sprayer delivering 80 L/ha at 280 kPa. The cattails were in the catkin development growth stage. The experimental units were 3.0 by 9.1 m, in a randomized complete block with four replications. Cattail control was determined by visual evaluations compared to an untreated control on June 17 and September 4, 1991.

Herbicide	Rate	1991 evaluations	
		June 17	Sept 4
	kg/ha	- % control -	
Imazapyr	0.85	99	95
Imazapyr	1.70	99	96
Glyphosate + X-77	2.5 + 0.25%	96	88
Untreated control	-	0	0
LSD (0.05)		3	5

Imazapyr at 0.85 and 1.7 kg/ha and glyphosate at 2.5 kg/ha provided 96 to 99% control of cattails 10 mo after treatment (Table). Cattail control 13 mo after treatment continued to be very good with imazapyr at 0.85 and 1.70 kg/ha, but control declined to 88% with glyphosate. Cattail control for 3 to 4 yr after application is desired because annual applications would be expensive. Imazapyr applied at rates less than the 0.85 kg/ha as in this experiment may provide cattail control for 3 to 4 yr and would further reduce costs. Also, imazapyr efficacy may increase by adding an adjuvant thus requiring less chemical to control cattails. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Canada thistle control with primisulfuron applied at four growth stages. Lym, Rodney G., C.G. Messersmith, and K.M. Christianson. Canada thistle is a perennial weed that regrows from crown and root segments each year and continues to be a problem in cultivated crops. An experiment to evaluate two rates of primisulfuron applied with various additives at two Canada thistle growth stages and spring or fall applied was established near Fargo, ND. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi when the Canada thistle plants were at the 4 to 6 leaf or 10 to 12 leaf growth stage in May and June or in mid-August and mid-September when the plants were in a similar growth stage following harvest. The experiment was established in a randomized complete block design with four replications and plots were 10 by 30 ft. The treatments were evaluated visually for percent Canada thistle suppression as compared to the control. The Canada thistle was mowed on July 26, 1990 after the spring-applied treatments were evaluated; regrowth was evaluated in late August for the spring-applied treatments and was treated at the appropriate stages for the fall-applied treatments.

			Treatment date/evaluations			
			Spring 1990			Fall 1990
Treatment	Growth stage	Rate	July	Aug	June 91	June 90
	- leaf -	gm/ha	% suppression			
Primisulfuron+X-77	4	20+0.25%	19	12	13	7
Primisulfuron+Agridex	4	20+0.25%	33	17	1	0
Primisulfuron+X-77	4	40+0.25%	29	23	6	5
Primisulfuron+Agridex	4	40+0.25%	42	10	7	12
Dicamba+2,4-D+X-77	4	0.0673+0.28+0.25%	18	14	5	6
Clopyralid+2,4-D	4	0.100+0.56	46	20	8	2
Primisulfuron+Sunit	4	20+0.25%	31	20	1	10
Primisulfuron+Sunit	4	40+0.25%	55	20	0	0
Primisulfuron+X-77	10	20+0.25%	39	13	1	3
Primisulfuron+Agridex	10	20+0.25%	50	6	0	20
Primisulfuron+X-77	10	40+0.25%	38	6	0	14
Primisulfuron+Agridex	10	40+0.25%	52	3	0	9
Dicamba+2,4-D+X-77	10	0.0673+0.28+0.25%	51	10	4	13
Clopyralid+2,4-D	10	0.100+0.56	59	26	14	22
Primisulfuron+Sunit	10	20+0.25%	55	10	4	25
Primisulfuron+Sunit	10	40+0.25%	54	5	3	11
LSD (0.05)			19	NS	NS	12

Primisulfuron spring applied provided 50% Canada thistle suppression in July when applied at the 10 leaf stage compared to 34% when applied at the 4 leaf stage plants (Table). Canada thistle suppression generally was similar from primisulfuron at 20 and 40 g/ha. Generally primisulfuron provided better suppression when applied with Sunit or Agridex (46%) than X-77 (31%). The clopyralid plus 2,4-D treatments gave 53% Canada thistle suppression, similar to primisulfuron applied with Sunit or Agridex. Dicamba plus 2,4-D provided an average of 35% suppression.

Suppression of Canada thistle by all treatments declined substantially by August 1990. Suppression from primisulfuron was similar regardless of leaf stage at application, rate, or additive. Suppression with clopyralid plus 2,4-D and dicamba plus 2,4-D declined to an average of 18%. No treatment fall-applied provided satisfactory Canada thistle control the following growing season. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).