1992 NORTH DAKOTA WEED CONTROL RESEARCH

WEED SCIENCE

BIOLOGICAL CULTURAL CHEMICAL

NDSU

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

NOT FOR PUBLICATION

SUMMARY OF 1992
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

K. M. Christianson
M. G. Ciernia
J. A. Kapaun
J. L. Luecke
R. F. Roach
J. D. Stromberg

Graduate Research Assistants

D. E. Bruns
M. El-Antri
G. J. Endres
J. D. Hurbour
P. J. Isakson
B. D. Kuehl
A. Obeidat
T. W. Roebke
L. J. Verwest

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 Res/Ext Center at Minot
Anthony Thilmony, North Central Res/Ext Center at Minot
Eric Eriksmoen, Hettinger Research Center
Mark Bredehoeft, Southern Minnesota Beet Sugar Cooperative
Patrick Carr, Dickinson Research Center
Glenn Martin, Dickinson Research Center

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CLIMATIC DATA - CARRINGTON, 1992

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.62		.87	39	15	81	49	84	46	64	46	83	54	65	48
2							52	20	68	26	80	51	69	48	76	46	71	49
3		T	.06	.02		T	54	20	73	29	79	59	63	45	72	43	69	46
4			.01		.22		60	26	70	31	84	42	69	40	72	43	74	46
5							69	31	73	35	76	40	72	45	76	40	71	55
6				.20		.57	58	32	89	49	70	39	74	50	76	41	55	44
7	.05			.02		.01	58	29	89	53	65	33	70	50	85	59	55	40
8					.22		54	29	86	48	65	42	83	55	89	61	63	38
9				.11			52	22	91	48	73	42	83	55	90	64	61	43
10	.30	.17		.04		.01	41	23	86	45	79	45	83	53	85	49	65	46
11							33	18	71	43	85	57	82	41	80	50	82	45
12				.02			33	8	68	42	89	53	82	46	79	44	76	47
13					.11	.12	45	24	61	37	89	54	78	52	80	54	71	51
14			.03				57	31	76	44	89	56	79	53	83	56	66	38
15			.23	.05		.01	57	34	77	39	80	51	89	52	86	54	77	42
16		.11	.33	.11		.30	54	38	76	51	70	53	77	54	92	56	77	43
17			.18	.15	T		-	33	65	43	78	59	79	53	91	60	66	41
18	.13		.01	.03			-	-	82	38	76	57	72	45	85	45	64	34
19			.06	.02			-	32	88	52	73	46	81	45	88	55	77	40
20							32	21	90	56	64	38	68	43	86	62	84	45
21							30	22	90	53	77	41	75	41	77	46	75	50
22	.04	.42	.06				34	22	83	47	72	45	75	45	77	62	59	28
23	.02						36	28	53	30	89	48	78	49	84	52	79	37
24		.30	.10		1.46		40	31	51	37	84	56	78	58	55	47	88	45
25		.18	.02	.09	.11	.06	48	25	55	33	83	46	77	58	63	41	82	54
26		.02			.06		55	23	64	33	83	44	78	51	69	37	--	--
27							66	31	70	35	82	51	84	52	75	46	57	31
28			.07	.03			80	47	74	44	88	57	86	48	81	51	60	21
29	T		.01	.15			78	45	80	51	83	43	75	49	79	50	79	33
30			.20	.01	.44		93	48	80	46	68	47	75	48	61	--	84	39
31									80	45			80	47	66	38		

CLIMATIC DATA - CASSELTON, 1992

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation August	Precipitation September	April Max	April Min	May Max	May Min	June Max	June Min	July Max	July Min	August Max	August Min	September Max	September Min
1				2.60			39	17	95	55	79	45	54	49	86	54	68	47
2					T	.48	42	15	78	41	79	46	65	53	86	48	62	56
3				.01			54	24	69	27	81	54	58	48	75	46	76	42
4			.45			T	58	19	68	35	81	48	64	45	73	47	72	53
5						.16	58	19	67	30	70	48	68	47	73	44	79	55
6	T		.02				75	38	68	32	68	42	74	50	79	45	75	47
7				T	1.50	.99	57	28	89	49	62	36	74	50	78	64	63	48
8							48	22	92	49	62	41	84	57	83	60	53	35
9							61	25	85	55	75	48	80	54	91	60	62	51
10				.12			44	27	90	60	80	52	80	51	90	54	64	48
11		.25					34	25	75	42	85	53	70	53	82	53	67	41
12		.10		.33	.20		34	11	80	47	87	55	70	53	73	48	79	42
13		.03	.01			T	37	26	64	35	89	56	77	60	71	47	73	53
14		.02					52	26	58	37	88	59	73	53	75	48	74	41
15			.15	1.03		T	48	37	77	37	86	56	70	60	78	48	70	41
16		.49	2.29	.06		.03	58	40	83	57	61	56	73	54	79	51	76	52
17		.16	1.78	.01		.89	60	30	67	42	78	60	73	54	82	60	57	36
18	.22		1.54			.02	58	38	70	42	66	59	73	53	80	50	59	41
19	.10		.09				59	46	78	56	79	49	78	58	80	48	59	37
20			T	T			59	30	94	45	59	39	71	46	83	48	71	42
21	T			.03	T		33	24	89	59	66	46	72	47	89	56	78	57
22	T	.88	.09	T			30	24	89	39	67	50	75	55	76	56	67	28
23		.18	.59				36	26	47	24	77	50	74	48	89	60	57	31
24			.02		2.27		39	30	50	33	77	56	75	55	65	50	78	44
25			.18		.17		40	32	52	33	73	52	73	61	56	50	82	53
26							44	28	57	38	68	42	75	53	68	40	74	42
27							58	26	65	37	70	48	83	54	68	42	63	31
28							65	33	70	40	75	55	89	55	72	54	67	22
29			.01	T	.33		84	41	71	46	81	42	75	50	82	53	57	30
30	T		T		.12		82	41	81	45	69	44	74	52	66	50	75	38
31				.05					83	50			76	52	66	47		

CLIMATIC DATA - CROOKSTON, 1992

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		T		.02		.93	36	19	80	44	82	54	58	52	78	47	61	54
2				.26			47	28	59	28	75	58	68	56	72	45	74	44
3			.26	T			50	25	60	30	82	50	62	46	69	44	71	47
4		.01	.06				51	32	60	28	67	47	67	44	75	43	78	56
5							68	34	66	40	64	43	73	49	78	55	68	38
6	T			T	.24	.55	60	30	83	51	56	45	68	55	77	61	55	44
7					.26	.48	41	28	90	52	65	42	84	57	80	70	50	33
8				.08		.77	53	24	84	57	72	44	76	52	91	74	60	38
9				.08		.02	36	24	89	64	73	56	76	51	86	55	62	45
10	.13	.50				.12	37	23	75	50	84	61	71	50	79	44	65	44
11					.04		26	11	77	51	88	55	72	53	73	45	74	48
12		.04					36	13	56	33	87	58	79	58	70	47	74	53
13		T				.12	49	30	60	39	84	57	74	54	76	50	71	46
14			.11				45	33	73	42	80	52	77	58	79	53	68	41
15			1.13	.17		.01	55	36	75	53	61	51	76	54	77	56	73	41
16		.66	1.59	.06		.45	56	31	69	44	73	58	72	52	82	60	53	34
17			1.05		.80	.06	55	38	65	46	63	59	69	48	75	48	58	40
18	.02		T	.13			49	44	77	54	67	49	75	59	78	52	56	35
19	.35			.03			50	31	87	64	60	39	66	43	81	58	68	44
20	.13			.05			32	22	87	69	70	43	68	46	88	51	79	50
21	.18		.07		.04		29	23	84	38	66	52	74	46	77	58	60	29
22	T	.25	.03	.01	.42		31	26	44	33	66	49	77	50	85	59	53	31
23		.15	T		1.17		36	28	52	31	73	50	76	54	61	48	71	41
24					.02		35	30	50	40	70	52	66	58	57	49	81	57
25	.02	.36		.13			40	31	59	41	66	37	81	49	66	37	73	48
26							53	28	64	37	70	51	71	48	68	41	60	34
27				T			62	36	70	45	80	59	85	52	71	46	61	26
28					.21		74	39	70	49	72	38	69	39	78	57	55	29
29	T				.34		73	47	78	54	68	42	73	44	63	50	68	36
30			.84				87	56	81	58	62	49	76	51	65	49	79	38
31				.04					83	60			85	50	65	43		

CLIMATIC DATA - DICKINSON, 1992

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation August	Precipitation September	April Max	April Min	May Max	May Min	June Max	June Min	July Max	July Min	August Max	August Min	September Max	September Min
1			.15	.55		T	39	10	83	42	66	50	51	42	87	42	72	39
2				T		.17	45	15	64	34	72	47	61	44	88	48	78	50
3					T		66	25	67	30	82	50	64	40	69	43	73	39
4					.03		71	37	73	34	72	41	70	41	73	47	82	43
5	T				.24	.11	74	36	75	36	68	38	72	52	66	51	68	43
6				.97	T		56	27	79	49	63	29	77	52	72	52	73	47
7				T	.28	.16	54	25	89	40	64	38	80	51	70	52	51	36
8			.46	.05		.05	47	22	92	41	72	44	80	49	90	55	53	37
9				.35	T	T	54	21	81	45	76	47	78	47	100	57	73	38
10	.18	.58		1.16			36	21	72	40	81	54	75	47	85	44	57	32
11	T	T		T	T		36	15	68	42	87	57	63	48	81	49	72	34
12	T	T		.17		T	31	14	64	34	90	57	63	50	76	40	82	39
13	T			.03		.06	27	18	54	35	90	57	70	52	77	46	76	43
14		.02	1.62			T	62	23	60	38	84	51	77	55	83	50	65	30
15			.37				69	29	72	36	67	48	86	48	88	53	68	32
16		.35	.38			T	56	24	75	44	60	50	69	48	97	58	83	44
17		.15	T	.15			59	34	55	32	75	52	66	49	92	58	67	43
18	.21		.02				69	41	73	43	75	52	75	52	82	47	66	29
19	.12		T				51	36	88	53	78	48	81	54	87	52	59	32
20	.21						41	19	90	58	65	44	68	42	95	60	67	46
21	T						29	20	93	51	65	47	73	48	75	47	78	34
22		T					44	20	59	37	77	47	69	48	78	50	62	37
23							43	24	57	30	83	48	70	49	75	43	75	38
24	.13	T					48	30	58	33	81	48	69	53	50	42	95	38
25	T	T				.54	48	31	66	31	79	40	87	50	55	32	92	47
26		T				T	57	22	53	24	75	46	80	47	61	35	65	50
27							62	37	62	30	81	52	85	58	72	39	54	43
28				.06			75	40	68	37	90	57	87	48	82	50	65	22
29				.03			77	43	77	38	75	48	77	49	82	43	67	23
30			.28	.07			80	40	78	43	62	45	66	45	63	36	85	32
31		T							80	46			76	44	65	35		

CLIMATIC DATA - FARGO - NW 22 - 1992

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1						.30	40	18	78	54	84	58	62	53	82	53	62	52
2				.01			51	14	66	34	78	54	58	54	72	50	75	50
3			.24				56	27	66	26	84	58	64	50	70	45	72	42
4			.70				54	20	62	34	68	52	68	47	72	53	79	59
5						.05	74	43	69	30	68	44	71	47	79	50	74	50
6			.02		.55	.45	63	36	84	47	57	44	73	54	78	63	64	45
7					.01	.26	45	30	92	55	63	39	84	60	83	64	52	40
8	.26					.04	59	27	89	54	74	42	78	60	91	65	62	37
9				.08			43	29	91	62	81	54	80	57	90	66	63	50
10	.10	.17				.05	35	29	76	50	86	58	68	54	80	54	67	49
11		.02		.03			33	16	80	48	88	62	70	56	72	52	80	46
12		.05		.07			37	11	61	37	89	60	76	58	70	59	74	56
13		.16		.03			51	30	58	36	85	59	74	62	77	50	74	50
14				.08			47	34	75	43	84	58	78	56	78	50	71	53
15			2.07	.09			59	41	81	43	66	56	78	58	77	51	78	53
16		.34	.25	.05		.58	59	35	69	48	74	57	72	57	82	55	67	41
17		T	1.61			.11	56	36	65	43	66	60	70	52	77	51	61	39
18	.30						51	46	79	48	74	52	78	52	80	46	57	39
19			.01				57	32	95	60	56	45	70	50	82	55	71	40
20	.02	.06	.02	.02			35	28	90	64	67	40	72	45	88	61	82	48
21		.57	.02	T	.46		30	23	87	54	66	47	76	51	74	57	65	38
22			.09		.12		34	27	54	40	72	53	75	58	88	67	57	29
23			.01		1.49		39	30	52	34	75	56	76	50	72	53	79	45
24		.35	.30				37	29	53	34	73	55	69	56	56	51	83	58
25		.10					40	33	29	38	66	47	82	58	66	44	76	56
26		.12					56	29	65	37	71	56	77	54	70	40	62	39
27							64	29	70	39	80	53	87	58	71	44	66	36
28			.04				81	45	73	46	76	50	71	56	80	58	56	26
29					.39		80	42	79	48	67	43	74	47	65	55	73	37
30			1.81				94	54	82	52	55	48	74	57	64	51	80	42
31									81	58			85	55	67	52		

CLIMATIC DATA - HETTINGER 1992

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.11	.37	.02	38	8	87	45	63	42	51	44	80	52	73	48
2							45	15	65	35	69	42	56	48	86	48	74	48
3							65	32	69	35	72	41	62	40	76	50	73	40
4							73	35	73	35	77	40	68	49	71	52	85	45
5						.03	72	38	74	38	73	38	77	53	65	53	85	46
6					.40		61	31	78	50	65	28	75	57	67	55	67	41
7					.18	.21	56	23	78	49	66	43	79	59	72	53	51	39
8					.30		51	27	93	53	70	45	77	51	85	53	54	38
9					.03	T	55	25	83	56	73	45	76	48	95	60	73	42
10	.13	1.30			.09		42	27	77	44	79	54	72	50	84	49	60	32
11	.04						43	18	69	45	86	55	60	48	77	46	72	39
12	T				.49		27	18	68	36	88	58	65	53	74	42	84	42
13	T	.03			.06		25	18	58	40	87	57	66	56	74	43	88	45
14				2.13			59	24	57	40	79	53	74	56	78	51	67	31
15				.15			66	32	73	39	67	53	81	54	80	49	70	38
16		.17		.88	T		64	35	74	39	58	50	72	51	87	60	85	47
17		.17					52	39	52	30	76	54	66	48	82	52	68	46
18	.14						69	41	70	43	73	54	72	49	79	49	71	30
19	.14						46	36	85	56	78	47	83	55	82	54	61	35
20	.06						40	21	87	60	68	48	70	41	88	56	78	43
21							28	23	90	58	65	49	71	56	79	52	81	53
22		.31					45	25	66	40	76	48	59	49	70	58	68	42
23				.06	.37		50	30	57	32	81	59	62	51	82	45	77	37
24		.03			.11		43	34	56	39	81	52	64	53	50	43	94	43
25						.13	49	28	66	34	75	42	82	56	52	32	91	49
26							57	20	48	24	73	48	74	51	60	37	66	39
27					.27		59	33	58	33	78	49	80	55	66	44	58	40
28				.04			73	46	65	35	84	62	85	50	85	44	56	20
29				.14			78	41	76	42	78	52	78	54	83	37	68	33
30				.83			82	44	77	36	57	47	63	53	59	36	85	35
31		.12							78	51			74	48	66	40		

CLIMATIC DATA - LANGDON 1992

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.77			28	16	84	49	76	54	56	47	81	53	63	41
2		T		.19			35	20	69	40	79	51	53	49	71	46	65	51
3				.13			45	26	60	27	75	57	53	47	68	42	63	38
4			.23	.12			42	26	64	29	79	48	56	41	64	45	71	43
5			.30			.34	48	30	53	35	53	43	63	43	73	43	72	43
6							56	30	70	42	57	39	73	49	74	52	59	37
7	.01			.03		.34	54	27	84	51	49	41	61	55	75	59	52	38
8	.04						36	23	81	42	60	41	74	55	77	59	54	31
9				.03		.13	48	16	65	45	71	47	71	50	95	63	62	38
10	.04	T		.19	.10	.21	27	17	86	45	76	53	68	45	82	49	55	43
11	.09	.45					29	14	55	42	83	58	63	41	74	44	61	43
12					.02		22	7	67	40	86	54	67	41	66	39	70	47
13		.02				.14	31	10	47	25	81	55	72	52	67	45	73	45
14				.34		.01	43	27	57	34	74	48	71	55	75	47	65	37
15				.24			41	32	67	37	70	50	76	52	80	51	60	41
16	.01	.15	.11	.17			44	36	65	43	66	52	67	50	81	57	73	43
17		.65			.21	.01	46	35	52	34	69	51	71	53	86	52	53	32
18						.09	55	38	60	43	62	55	70	48	73	45	53	34
19	.10			.10			48	39	79	53	59	43	71	49	78	50	52	35
20	.11			.01			39	20	90	62	63	38	63	46	83	58	71	42
21	.02			.07	.01		24	19	87	63	65	45	65	43	77	42	76	43
22	.14	1.3	.36				28	19	82	32	60	49	70	45	74	54	54	23
23		.02	.27		.40		29	21	41	31	73	52	74	48	76	50	55	26
24					.16		40	27	48	31	71	47	73	54	52	45	73	41
25	T	.25	.23	.40	.16		35	27	42	30	67	47	71	57	52	41	79	54
26		.03		.O6		.03	40	26	57	37	61	38	72	48	60	36	68	36
27				.01			50	30	64	39	68	49	70	53	68	42	52	30
28					.02	.04	59	35	68	42	85	54	75	46	65	47	52	19
29							72	45	71	51	65	36	64	42	75	48	54	21
30					.10		65	44	75	50	66	43	71	44	56	46	73	37
31				.02					74	51			74	48	58	45		

CLIMATIC DATA - MINOT, 1992																		
	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1		T	.14	.64	T		35	11	85	49	78	49	52	44	87	58	69	36
2				.16	.06	T	42	16	66	41	78	52	57	48	74	47	74	47
3				.02	.03		60	31	64	41	80	56	60	43	74	44	66	43
4							57	27	71	39	71	46	64	43	75	45	74	44
5			T			.01	63	31	72	42	63	42	74	50	76	48	73	44
6	T		.02	.12		T	59	30	80	49	52	41	74	55	76	50	65	44
7	.01			.02	.02		55	29	91	53	58	36	76	55	72	53	49	35
8				.23			42	26	89	42	73	49	80	55	88	59	55	37
9		.01		.04	.08	.02	56	19	72	45	79	51	76	53	99	59	67	43
10	.22	.66		.35			36	19	83	41	83	55	76	51	86	48	57	43
11	.01	.03					32	16	65	40	87	62	66	46	79	52	66	42
12					T		29	8	64	40	91	60	69	46	79	40	78	43
13		.03		.04			35	16	51	32	89	55	74	57	75	42	75	48
14			.04			T	51	27	60	37	84	53	79	58	81	55	64	37
15			.04	.07			67	33	73	43	71	52	87	52	87	59	62	38
16		.03	.42	.08			46	36	68	46	73	52	69	52	94	57	67	42
17		T	T	.08			49	31	54	43	75	55	68	53	91	57	56	39
18	.31		.02	.12			65	31	71	45	69	54	72	51	78	50	65	34
19	.21		.16	.06			52	39	87	56	72	44	78	53	87	51	54	34
20	.37		T	.02	.12		39	19	95	59	59	42	68	44	92	62	77	47
21					.01		24	19	95	54	68	41	72	43	71	45	78	45
22		T	T		.04		37	21	59	37	78	48	76	49	78	48	56	30
23					.44		33	26	54	28	83	57	78	49	78	47	65	39
24	.01	T	.02		.48		36	29	58	36	81	50	78	53	49	44	85	39
25		.19		.01		T	44	31	41	31	79	43	86	55	51	42	88	56
26						.13	52	26	59	34	72	43	86	55	51	43	65	36
27						.23	59	30	68	39	81	54	87	56	71	47	58	37
28			.21				67	38	71	44	88	55	87	48	82	52	50	24
29		T	.01		.15		79	47	79	48	67	43	76	50	82	46	62	27
30			.11		.01		80	47	82	48	67	45	70	52	57	45	80	43
31				.09					82	50			77	52	59	36		

CLIMATIC DATA - OLIVIA, 1992

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	August	September	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1				.22		1.08	35	22	90	54	82	52	69	53	77	51	70	43
2				1.67	.58	.05	39	19	88	48	75	52	78	56	86	54	65	56
3					.01		45	22	69	36	77	56	64	51	74	53	77	48
4						.14	59	25	72	42	86	56	70	47	72	49	77	48
5						.23	53	25	67	40	74	51	71	49	69	51	78	58
6			.22			.10	68	42	64	36	80	50	74	50	74	55	74	46
7					1.39		57	34	76	47	66	40	75	50	75	61	72	47
8			.31				53	29	84	48	66	51	81	60	80	60	70	42
9	.02					.03	53	29	86	55	62	53	80	57	86	63	64	36
10	.02			.03	.20		47	32	87	57	76	57	77	59	90	62	65	39
11	.03	.47					39	33	84	61	82	58	73	53	75	52	63	42
12				.46	.10		42	17	73	54	87	61	71	62	76	48	74	44
13							36	20	69	37	90	51	75	56	70	49	72	55
14			.03				41	30	59	48	90	65	66	51	69	44	77	53
15	.18			.06			52	30	75	52	89	62	76	57	71	44	76	50
16	.02	.14	.95	.38		.55	42	37	77	58	84	61	73	54	71	48	78	61
17		.05	1.29				51	33	79	48	79	62	75	55	74	49	85	51
18			.06		.50		48	37	69	46	70	60	76	54	75	52	64	45
19	1.30		.03				54	45	76	52	78	60	76	59	77	49	64	39
20	.13						60	33	88	60	62	39	73	51	75	55	67	42
21	.83						48	32	90	56	66	42	73	48	80	58	78	47
22	.22	.01	.18	.45			42	30	82	67	66	49	70	51	76	61	76	33
23				.26			39	30	76	42	65	51	70	51	81	62	60	33
24							40	33	65	39	77	57	66	54	83	57	75	52
25		.60			1.12		48	32	59	41	75	55	68	54	61	56	73	48
26		.54			.42		45	32	47	36	69	45	78	56	62	47	75	52
27							47	31	65	40	70	48	79	54	65	47	64	34
28							58	33	70	41	77	53	83	54	70	47	70	30
29					.02		78	45	70	41	84	56	76	55	74	52	54	30
30							81	49	75	50	71	57	71	56	74	50	70	35
31									78	52			72	47	68	42		

CLIMATIC DATA - WILLISTON 1992

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation August	Precipitation September	April Max	April Min	May Max	May Min	June Max	June Min	July Max	July Min	August Max	August Min	September Max	September Min
1		T	.04	.37	.05		46	19	77	47	70	51	58	43	88	57	80	50
2				.03	.39		73	23	68	37	81	50	61	50	75	56	81	53
3			T			.08	72	34	71	39	81	51	67	43	74	49	76	46
4						.13	70	35	76	40	64	47	75	48	75	54	76	46
5	.50		.03	.09			65	34	82	46	61	37	76	51	79	48	69	49
6	T			.03			51	38	88	50	60	39	81	57	79	54	67	39
7	T				T	T	51	28	90	51	75	39	81	53	90	53	55	36
8						.02	55	27	91	43	83	48	78	55	98	59	70	38
9	T	.49			.09	.09	55	17	75	48	86	52	78	50	90	61	66	40
10	.23	.15		.02			36	23	66	39	90	55	69	49	82	50	71	36
11				.04			33	16	65	48	94	63	66	52	82	54	79	48
12		.03		.60			32	17	65	38	93	62	74	50	76	44	78	51
13						.50	61	23	60	33	90	61	79	52	85	48	78	46
14		.01	.43	.04			71	35	72	40	88	50	82	58	90	49	63	35
15			.39	.06			70	31	73	40	69	48	81	52	95	51	68	44
16			.37	.04		.02	55	33	65	45	72	55	69	55	95	60	65	42
17	.01				.12		69	40	78	33	77	55	78	50	90	57	63	46
18	1.19		.09				62	40	88	47	78	57	80	53	90	50	57	31
19	.36	T					40	29	91	52	68	49	79	52	97	62	77	39
20	.05				.10		32	22	92	61	71	44	73	45	96	59	77	46
21		.29					48	24	85	43	80	55	77	47	76	49	72	42
22		T			.53		48	23	64	37	80	56	75	46	71	55	74	39
23	.01				.72		48	28	57	36	81	51	78	51	58	43	92	43
24	.10	.05	.02		.12	T	54	32	58	43	81	50	87	57	50	43	93	65
25						.08	59	32	58	27	76	46	82	54	60	38	88	51
26							63	30	65	33	83	47	88	54	75	39	60	37
27						.04	80	39	72	37	93	55	88	59	81	58	60	40
28			.15	T			80	49	76	44	92	57	80	50	81	54	67	27
29		.05		.23	.14		78	48	80	45	69	44	75	51	77	46	83	41
30		.12	1.03	.03			82	55	79	55	68	48	78	53	64	39	87	43
31		.42							70	49			88	52	71	38		

SOIL TEST RESULTS AT VARIOUS WEED EXPERIMENT LOCATIONS

	Soil Texture	Organic matter	pH	N (lb/A)	P (lb/A)	K (lb/A)
Camp Grafton (Goat)	Sandy loam	4.7	7.2	3	3	180
Camp Grafton (Insect)	Loamy sand	2.8	7.0	3	3	98
Carrington, ND	Loam	3.6	7.2	Fertilized by test		
Casselton, ND (Dalrymple)	Silty clay	5.0	7.9	Applied 80 lb N		
Cavalier, ND	Silty clay	5.7	7.0	166	26	710
Chaffee, ND	Fine sandy loam	6.7	7.4	20	36	950
Crookston, MN	Loam	4.1	8.1	77	20	390
Cuba, ND		7.0	8.2	3	4	100
Danube, MN	Silt loam	4.5	7.5	105	95	425
Fargo, ND (Sec. 22)	Silty clay	6.0	7.5	190	26	1095
Fargo (date of thinning, hand weeded sugarbeet, herbicide drift, grass control experiment)	Clay	5.4	7.4	355	63	660
Fargo (desmedipham plus insecticides, time of cultivation)	Silty clay	5.8	7.2	127	40	668
Fargo (Sec. 22) Multispecies screening	Clay	4.5	7.8	118	41	1060
Fargo (Sec. 22) Residue experiments	Clay	4.0	7.7	117	30	950
Hallock, MN	Clay loam	4.6	7.8	107	28	700
Hendrum, MN	Silty clay loam	5.2	7.9	226	23	480
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	Clay loam	5.7	7.1	183	50	900
Sheyenne ND, Grasslands (Goat)	Sandy loam	6.2	7.5	8	4	85
Sheyenne ND, Grasslands (Insect)	Loamy sand	2.5	6.9	3	7	125
St. Thomas, ND	Loam	4.6	7.9	87	46	990
Valley City, ND	Stony loam	9.4	6.7	5	5	1415
West Fargo, ND	Silty clay	3.6	7.2	8	42	1460
Williston, ND	Loam	2.3	6.8	Fertilized by test		

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

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

LC = Liquid concentrate

WP = Wettable powder

G = Granules or gallon/A

SG = Soluble granules

Inc = I = Incorporation

%ir = inju = Percent injury rating

%sr = %std, strd = Percent stand reduction

HT = Plant height

SPK = Spike stage

Tswt = TW = Test weight

Yld = Yield

alk = alkanolamine

bee = Butoxyethyl ester

dea = diethanolamine

dma = Dimethylamine

ioe = isooctyl ester

EE = ethylated seed oil

MS, MSO, ME = methylated seed oil

PO, OC = Petroleum oil concentrate (17% emulsifier)

SURF = S = Surfactant

NIS = nonionic surfactant

28N = 28% liquid nitrogen fertilizer

AMS = ammonium sulfate

AMN = ammonium nitrate

X-77 = Surfactant by Valent

LIST OF HERBICIDES TESTED IN 1992

Common Name or Code Name	Abbre-viation	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
Atrazine	Atra	Various	80% WP, 90% DF, 4 lb/gal F	Numerous
BAS-527-16	BAS527	BASF	----------	None
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+
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	Dow Elanco	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
DE-498	DE498	DowElanco	Applied in combination	Broadstrike
Desmedipham	Desm	Nor-Am	1.3 lb/gal E	Betanex
Desmedipham + Phenmedipham	Des&Phen	Nor-Am	0.65+0.65 lb/gal E	Betamix
Dicamba	Dica	Sandoz	4 lb/gal S	Banvel
Dichlorprop	Dich	Rhone-Poulenc	4 lb/gal EC	2,4-DP

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
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	Upbeet
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
F6285		FMC	4 lb/gal F	None
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	1.6:7.6:0.187:0.092	Cheyenne
Fluazifop-P	Flfp-P	ICI	1 lb/gal E	Fusilade 2000
Flumetsulam + Metolachlor	Flum & Meto NAF2	DowElanco	7.66 lb/gal	Broadstrike/Dual
Flumetsulam + Trifluralin	Flum & Trif XRM-5313	DowElanco	3.65 lb/gal	Broadstrike/Treflan
Fluroxypyr	Flox	Dow Elanco	1.7 lb/gal	Starane
Glyphosate	Glyt	Monsanto	3 lb/gal S	Roundup, Honcho
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
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

Common Name or Code Name	Abbreviation	Company	Formulation	Trade Name
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
Mon-12000	MON12037 MON12041	Monsanto	75% DF 15% DF	Permit Battalion
Mon-13200	MON13200	Monsanto	2 lb/gal	None
Mon-8421	MON8421	Monsanto	4 lb/gal F	None
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
Quinclorac	Qucr BAS-514-34	BASF	75% WP 50% DF	Facet Impact
Quizalofop-P	Qufp	DuPont	0.75 lb/gal EC	Assure
Quizalofop-UB	Qufp-UB	Uniroyal	1 lb/gal	Pantera
Rimsulfuron	Rims	DuPont	25% DF	None
SAN-582	SAN582	Sandoz	7.5 lb/gal	Frontier
Sethoxydim	Seth, Sth	BASF	1.5 lb/gal E 1.0 lb/gal E	Poast Poast-plus

Common Name or Code Name	Abbre-viation	Company	Formulation	Trade Name
Sulfometuron	Sume	DuPont	75% DF	Oust
Thifensulfuron	Thif	DuPont	25% DF	Pinnacle
Thifensulfuron & Tribenuron	Thif & Trib	DuPont	75% DF (2:1)	Harmony Extra
Tribenuron	Trib	DuPont	75% DF	Express
Triallate	Tria	Monsanto	4 lb/gal E, 10% G	Far-go
Triasulfuron	Tria	Ciba-Geigy	75% DF	Amber
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
VCC-4243	VCC4243	Uniroyal	0.83 lb/gal E	None
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.

Soil applied herbicides, Danube, 1992. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi to the center four rows of six row plots 1:30 pm May 7 when the air temperature was 82F, soil temperature at six inches was 55F, relative humidity was 34%, wind velocity was 22 mph, and soil moisture was fair. Incorporation was with a rototiller set four inches deep for treatments containing EPTC and cycloate and two inches deep for all other PPI treatments. 'ACH-194' sugarbeet was seeded in 22 inch rows May 8. Yellow foxtail, redroot pigweed, common lambsquarters, and sunflower control and sugarbeet injury were evaluated June 27.

Treatment	Rate	Sgbt inj	Yeft cntl	Rrpw cntl	Colq cntl	Sufl cntl
	(lb/A)	(%)				
EPTC	2	8	100	50	38	0
Cycloate	4	0	100	70	76	0
EPTC+Cycloate	2+2	10	100	76	78	0
EPTC+Cycloate	0.88+2.5	9	99	64	74	0
EPTC+Cycloate	0.88+3	7	99	75	82	0
EPTC+Cycloate	0.88+4	11	99	83	81	0
EPTC+Cycloate	1.5+2.5	11	100	75	76	0
EPTC+Cycloate	2+2.5	20	100	75	79	0
Diethatyl	4	3	85	86	15	0
Ethofumesate	3	9	73	93	76	0
EPTC+Cycl+Diet	0.88+2.5+3	24	100	96	90	0
Cycl+Ethofumesate	3+3	40	100	98	90	0
HIGH MEAN		40	100	98	90	0
LOW MEAN		0	73	50	15	0
EXP MEAN		13	96	78	71	0
C.V. %		74	5	11	11	0
LSD 5%		13	8	12	11	NS
LSD 1%		18	10	17	15	NS
# OF REPS		4	4	4	4	4

Summary

EPTC+cycloate at 2+2.5 lb/A, EPTC+cycloate+diethatyl at 0.88+2.5+3 lb/A, and cycloate+ethofumesate at 3+3 lb/A caused significant sugarbeet injury. Diethatyl at 4 lb/A and ethofumesate at 3 lb/A gave less control of yellow foxtail than the other treatments. Only EPTC+cycloate+diethatyl at 0.88+2.5+3 lb/A and cycloate+ethofumesate at 3+3 lb/A gave 90% or greater control of both redroot pigweed and common lambsquarters. None of the treatments affected common sunflower.

Postemergence herbicides for broadleaf weeds, Clara City, 1992. 'KW 2398' sugarbeet was seeded in 22 inch rows May 3. The first half of split treatments was applied 2:00 pm May 21 when the air temperature was 75F, relative humidity was 65%, wind velocity was 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, and wild buckwheat was 1 to 2 inches tall. The second half of split treatments was applied 4:00 pm May 25 when the air temperature was 70F, relative humidity was 70%, wind velocity was 5 to 10 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, and wild buckwheat was 1 to 3.5 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Wild buckwheat was evaluated June 10.

Treatment*	Rate (lb/A)	Wild Buckwheat control -- (%) --
Desmedipham/Desmedipham	0.25/0.33	64
Desmed+Clopyralid/Desmed+Clopyralid	0.25+0.09/0.33+0.09	74
Des&Phen+Clopyralid/Des&Phen+Clopyralid	0.25+0.09/0.33+0.09	90
Desmedipham+Endothall/Desmedipham+Endothall	0.25+0.25/0.33+0.33	88
Desmed+DPX-66037/Desmed+DPX-66037	0.25+0.0156/0.33+0.0156	66
DPX-66037+X-77/DPX-66037+X-77	0.0156+.25%/0.0156+.25%	63
Des+Clpy+DPX-66/Des+Clpy+DPX-66	0.25+0.09+0.0156/0.33+0.09+0.0156	70
Desmed+DPX-66037/Desmed+Clopyralid	0.25+0.031/0.33+0.19	72
NA307/NA307	0.45/0.45	85
NA307+Clopyralid/NA307+Clopyralid	0.45+0.09/0.45+0.09	95
NA307+DPX-66037/NA307+DPX-66037	0.45+0.0156/0.45+0.0156	89
DPX-66+Clopyralid/DPX-66+Clopyralid	0.0156+0.09/0.0156+0.09	66
HIGH MEAN		95
LOW MEAN		63
EXP MEAN		77
C.V. %		16
LSD 5%		17
LSD 1%		23
# OF REPS		4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

Summary

NA307 + clopyralid gave 95% control of wild buckwheat which was similar to control from desmedipham&phenmedipham + clopyralid, desmedipham + endothall, NA307, and NA307 + DPX-66037.

Postemergence herbicides for broadleaf weeds, Danube, 1992. 'ACH 194' sugarbeet was seeded in 22 inch rows May 8. The first half of split treatments was applied 2:30 pm May 22 when the air temperature was 65F, relative humidity was 57%, wind velocity was 15 to 20 mph, sugarbeet was in the cotyledon to 2 leaf stage, common sunflower, redroot pigweed, and common lambsquarters were in the cotyledon stage. The second half of split treatments was applied 5:00 pm May 27 when the air temperature was 77F, relative humidity was 72%, wind velocity was 10 mph, sugarbeet was in the 2 to 4 leaf stage, common sunflower was 2 to 3 inches tall, redroot pigweed was in the cotyledon stage to 2 inches tall, and common lambsquarters was 1 to 2 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common sunflower and redroot pigweed control were evaluated June 17 and June 27. Common lambsquarters control was evaluated June 17. Yellow foxtail control was evaluated June 27.

Treatment*	Rate	June 17				June 27			
		Sgbt inj	Cosf cntl	Rrpw cntl	Colq cntl	Sgbt inj	Cosf cntl	Yeft cntl	Rrpw cntl
	(lb/A)	(%)							
Desmedipham/Desmedipham	0.25/0.33	25	25	76	59	14	22	66	69
Desm+Clopyralid/Desm+Clopyralid	0.25+0.09/0.33+0.09	25	91	84	69	11	100	70	78
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	25	91	80	79	13	100	74	68
Desm+Endothall/Desm+Endothall	0.25+0.25/0.33+0.33	30	10	71	51	25	30	64	66
Desm+DPX-66037/Desm+DPX-66037	0.25+0.0156/0.33+0.0156	26	91	82	61	10	40	81	86
DPX-66037+X-77/DPX-66037+X-77	0.0156+.25%/0.0156+.25%	0	86	35	25	0	46	31	21
Des+Clpy+DPX-66/Des+Clpy+DPX-66	0.25+0.09+0.0156/0.33+0.09+0.0156	38	98	88	71	21	100	70	81
Desm+DPX-66037/Desm+Clopyralid	0.25+0.031/0.33+0.19	38	96	79	69	15	100	86	95
NA307/NA307	0.45/0.45	51	81	97	97	28	27	86	83
NA307+Clopyralid/NA307+Clpy	0.45+0.09/0.45+0.09	51	97	98	98	24	100	68	79
NA307+DPX-66037/NA307+DPX-66037	0.45+0.0156/0.45+0.0156	50	98	98	98	31	55	80	90
DPX-66037+Clopyralid/DPX-66+Clpy	0.0156+0.09/0.0156+0.09	0	98	45	23	0	100	24	18
C.V. %		11	6	7	8	56	12	11	15
LSD 5%		5	7	7	8	13	12	10	15
LSD 1%		7	10	10	11	17	17	14	20
# OF REPS		4	4	4	4	4	4	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

SUMMARY: Sugarbeet injury was less on June 27 than on June 17 reflecting sugarbeet recovery from the injury. On June 17, treatments that included NA307 gave greater sugarbeet injury than other treatments. Treatments that included clopyralid gave complete control of common sunflower on June 27. Treatments with DPX-66037 gave 86 to 98% control of sunflower on June 17 but the plants had recovered significantly by June 27. DPX-66037 and DPX-66037+clopyralid gave the least control of yellow foxtail, redroot pigweed and common lambsquarters.

Postemergence herbicides for broadleaf weeds, DeGraff, 1992. 'ACH 198' sugarbeet was seeded in 22 inch rows May 5. The first half of split treatments was applied 3:00 pm May 14 when the air temperature was 70F, relative humidity was 65%, wind velocity was 5 to 10 mph, soil moisture was good, and sugarbeet, eastern black nightshade, common lambsquarters, and redroot pigweed were in the cotyledon stage. The second half of split treatments was applied 5:00 pm May 20 when the air temperature was 75F, relative humidity was 75%, wind velocity was 15 mph, soil moisture was good, sugarbeet was in the cotyledon stage, eastern black nightshade was 1 to 2 inches tall, and common lambsquarters and redroot pigweed were in the cotyledon stage to 1 inch tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Common lambsquarters, redroot pigweed, and eastern black nightshade control were evaluated June 12.

Treatment*	Rate (lb/A)	Colq cntl	Rrpw cntl	Ebns cntl
		---------	(%)	-------
Desmedipham/Desmedipham	0.25/0.33	64	73	58
Desm+Clopyralid/Desm+Clopyralid	0.25+0.09/0.33+0.09	72	76	79
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	65	70	68
Desm+Endothall/Desm+Endothall	0.25+0.25/0.33+0.33	67	60	39
Desm+DPX-66037/Desm+DPX-66037	0.25+0.0156/0.33+0.0156	73	78	91
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	38	55	84
De+Clp+DPX66/De+Clp+DPX66	.25+.09+.0156/.33+.09+.0156	81	84	95
Desm+DPX-66037/Desm+Clopyralid	0.25+0.031/0.33+0.19	84	86	96
NA307/NA307	0.45/0.45	91	91	96
NA307+Clopyralid/NA307+Clpy	0.45+0.09/0.45+0.09	95	95	95
NA307+DPX-66/NA307+DPX-66	0.45+0.0156/0.45+0.0156	95	97	100
DPX-66+Clopyralid/DPX-66+Clpy	0.0156+0.09/0.0156+0.09	59	61	84
HIGH MEAN		95	97	100
LOW MEAN		38	55	39
EXP MEAN		73	77	82
C.V. %		6	6	5
LSD 5%		6	7	6
LSD 1%		8	9	9
# OF REPS		4	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

Summary

Treatments including NA307 gave or tended to give greater control of common lambsquarters and redroot pigweed than the other treatments. Treatments that included NA307 or desmedipham+DPX-66037 gave greater control of eastern black nightshade than other treatments.

Postemergence herbicides for broadleaf weeds, Fairfax, 1992. 'KW 2398' sugarbeet was seeded in 22 inch rows May 2. The first half of split treatments was applied 3:00 pm May 15 when the air temperature was 75F, relative humidity was 65%, wind velocity was 10 mph, sugarbeet was in cotyledon to 2 leaf stage, and velvetleaf was in the cotyledon stage. The second half of split treatments was applied 3:00 pm May 20 when the air temperature was 73F, relative humidity was 67%, wind velocity was 10 to 15 mph, sugarbeet was in the 2 to 4 leaf stage, and velvetleaf was in the cotyledon stage to 1.5 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Velvetleaf control was evaluated June 10.

Treatment*	Rate	Velvetleaf control
	(lb/A)	-- (%) --
Desmedipham/Desmedipham	0.25/0.33	6
Desmed+Clopyralid/Desmed+Clopyralid	0.25+0.09/0.33+0.09	13
Des&Phen+Clopyralid/Des&Phen+Clopyralid	0.25+0.09/0.33+0.09	5
Desmedipham+Endothall/Desmedipham+Endothall	0.25+0.25/0.33+0.33	0
Desmed+DPX-66037/Desmed+DPX-66037	0.25+0.0156/0.33+0.0156	73
DPX-66037+X-77/DPX-66037+X-77	0.0156+.25%/0.0156+.25%	81
Des+Clpy+DPX-66/Des+Clpy+DPX-66	0.25+0.09+0.0156/0.33+0.09+0.0156	95
Desmed+DPX-66037/Desmed+Clopyralid	0.25+0.031/0.33+0.19	96
NA307/NA307	0.45/0.45	74
NA307+Clopyralid/NA307+Clopyralid	0.45+0.09/0.45+0.09	81
NA307+DPX-66037/NA307+DPX-66037	0.45+0.0156/0.45+0.0156	100
DPX-66+Clopyralid/DPX-66+Clopyralid	0.0156+0.09/0.0156+0.09	74
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		58
C.V. %		10
LSD 5%		9
LSD 1%		12
# OF REPS		4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

Summary

Desmedipham+DPX-66037 followed by desmedipham+clopyralid; desmedipham + clopyralid+DPX-66037; and NA307+DPX-66037 gave greater control of velvetleaf than the other treatments.

Postemergence herbicides for broadleaf weeds, Hallock, 1992. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 13. Lorsban 15G at 13 pounds product per acre was applied modified in-furrow at planting. The first half of split treatments was applied 2:00 pm June 2 when the air temperature was 80F, soil temperature at six inches was 59F, relative humidity was 41%, wind velocity was 17 mph, soil moisture was good and sugarbeet was in the 2 leaf stage. The second half of split treatments was applied 11:45 am June 8 when the air temperature was 70F, soil temperature at six inches was 56F, relative humidity was 52%, wind velocity was 11 mph, soil moisture was good and sugarbeet was in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + oil June 2. Sugarbeet injury was evaluated June 25.

Treatment*	Rate (lb/A)	Sugarbeet injury (%)
Desmedipham/Desmedipham	0.25/0.33	30
Desm+Clopyralid/Desm+Clopyralid	0.25+0.09/0.33+0.09	33
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	33
Desm+Endothall/Desm+Endothall	0.25+0.25/0.33+0.33	19
Desm+DPX-66037/Desm+DPX-66037	0.25+0.0156/0.33+0.0156	28
DPX-66037+X-77/DPX-66037+X-77	0.0156+0.25%/0.0156+0.25%	4
Des+Clpy+DPX66/Des+Clpy+DPX66	0.25+0.09+0.0156/0.33+0.09+0.0156	38
Desm+DPX-66037/Desm+Clopyralid	0.25+0.031/0.33+0.19	46
NA307/NA307	0.45/0.45	49
NA307+Clopyralid/NA307+Clopyralid	0.45+0.09/0.45+0.09	78
NA307+DPX-66037/NA307+DPX-66037	0.45+0.0156/0.45+0.0156	48
DPX-66037+Clpy/DPX-66037+Clpy	0.0156+0.09/0.0156+0.09	3
HIGH MEAN		78
LOW MEAN		3
EXP MEAN		34
C.V. %		11
LSD 5%		5
LSD 1%		7
# OF REPS		4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio.
X-77 = non-ionic surfactant from Valent

Summary

Desmedipham, desmedipham+clopyralid and desmedipham&phenmedipham + clopyralid gave similar sugarbeet injury. Desmedipham+endothall gave less sugarbeet injury than other treatments that included desmedipham. Desmedipham +clopyralid+DPX-66037 gave more sugarbeet injury than desmedipham + clopyralid or desmedipham+DPX-66037. NA307+clopyralid gave more injury than any other treatment.

Postemergence herbicides for broadleaf weeds, Cavalier, 1992. 'Bush Johnson BJ 1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12. Lorsban 15G at 13 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 3:15 pm June 2 when the air temperature was 81F, soil temperature at six inches was 61F, relative humidity was 45%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, wild buckwheat was in the cotyledon to 2 leaf stage, redroot pigweed was in the cotyledon to 2 leaf stage, and nightflowering catchfly was in the 2 leaf stage. The second half of split treatments was applied 1:30 pm June 8 when the air temperature was 72F, soil temperature at six inches was 57F, relative humidity was 53%, wind velocity was 21 mph, soil moisture was good, and sugarbeet, wild buckwheat, redroot pigweed, and nightflowering catchfly were in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.3 lb ai/A + 1 quart/A June 9. Sugarbeet injury and wild buckwheat, redroot pigweed, and nightflowering catchfly control were evaluated June 24. Sugarbeet injury and nightflowering catchfly control were evaluated July 1.

Treatment*	Rate	June 24 Sgbt inj	June 24 Wibw cntl	June 24 Rrpw cntl	June 24 Nfcf cntl	July 1 Sgbt inj	July 1 Nfcf cntl
	(lb/A)	(%)					
Desmedipham/Desmedipham	0.25/0.33	20	56	94	27	9	11
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	24	99	99	36	15	19
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	25	100	95	20	14	20
Desm+Endothall/Desm+Endo	0.25+0.25/0.33+0.33	10	93	93	26	1	13
Desm+DPX-66/Desm+DPX-66	0.25+0.0156/0.33+0.0156	25	76	99	84	13	48
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	6	45	68	88	5	85
De+Cl+DPX/De+Cl+DPX	.25+.09+.0156/.33+.09+.0156	30	98	100	90	15	68
Desm+DPX-66037/Desm+Clpy	0.25+0.031/0.33+0.19	26	98	100	92	13	33
NA307/NA307	0.45/0.45	41	97	97	65	28	63
NA307+Clpy/NA307+Clpy	0.45+0.09/0.45+0.09	41	100	99	62	31	55
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	39	99	100	97	26	83
DPX-66+Clpy/DPX-66+Clpy	0.0156+0.09/0.0156+0.09	14	97	82	88	1	78
C.V. %		26	6	6	17	45	35
LSD 5%		9	7	8	16	9	24
LSD 1%		12	10	11	21	12	33
# OF REPS		4	4	4	4	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio.
X-77 = non-ionic surfactant from Valent

Summary

Sugarbeet injury and nightflowering catchfly control generally was less on July 1 than June 24 reflecting plant recovery from herbicide injury. Based on the June 24 evaluation: desmedipham+clopyralid+DPX-66037 gave more sugarbeet injury than desmedipham; DPX-66037+X-77, desmedipham and desmedipham + DPX-66037 gave less wild buckwheat control than other treatments; DPX-66037 and DPX-66037+clopyralid gave less redroot pigweed control than other treatments; and treatments that included DPX-66037 gave better control of nightflowering catchfly than other treatments. Treatments including NA307 gave greater sugarbeet injury than other treatments at both evaluation dates.

Postemergence herbicides for broadleaf weeds, Halstad, 1992. 'Bush Johnson BJ 1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 8. Lorsban 15G at 13 pounds product per acre was applied in a 2-inch band and drag chain incorporated at planting. The first half of split treatments was applied 3:15 pm May 26 when the air temperature was 65F, soil temperature at six inches was 52F, relative humidity was 36%, wind velocity was 12 mph, soil moisture was good, sugarbeet was in cotyledon to early 2 leaf stage and redroot pigweed was in the cotyledon to 2 leaf stage. The second half of split treatments was applied 3:45 pm June 1 when the air temperature was 85F, soil temperature at six inches was 65F, relative humidity was 31%, wind velocity was 4 mph, soil moisture was good and sugarbeet and redroot pigweed were in the 2 to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and redroot pigweed control were evaluated June 8 and July 3.

Treatment*	Rate (lb/A)	June 8 Sgbt inj	June 8 Rrpw cntl	July 3 Sgbt cntl	July 3 Rrpw cntl
		-----------	(%)	----------	
Desmedipham/Desmedipham	0.25/0.33	21	100	6	93
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	28	100	10	97
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	30	95	15	90
Desm+Endothall/Desm+Endo	0.25+0.25/0.33+0.33	28	94	8	76
Desm+DPX-66/Desm+DPX-66	0.25+0.0156/0.33+0.0156	21	100	11	98
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	9	78	0	73
De+Cl+DPX/De+Cl+DPX	.25+.09+.0156/.33+.09+.0156	35	100	13	99
Desm+DPX-66037/Desm+Clpy	0.25+0.031/0.33+0.19	31	100	10	99
NA307/NA307	0.45/0.45	35	100	16	96
NA307+Clpy/NA307+Clpy	0.45+0.09/0.45+0.09	41	100	19	97
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	33	100	13	98
DPX-66+Clpy/DPX-66+Clpy	0.0156+0.09/0.0156+0.09	9	60	0	54
HIGH MEAN		41	100	19	99
LOW MEAN		9	60	0	54
EXP MEAN		27	94	10	89
C.V. %		15	5	52	4
LSD 5%		6	7	7	5
LSD 1%		8	9	10	7
# OF REPS		4	4	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio.
X-77 = non-ionic surfactant from Valent

Summary

Sugarbeet injury and redroot pigweed control generally were less on July 3 than on June 8 reflecting plant recovery from herbicide injury. All treatments except desmedipham + endothall, DPX-66037 + X-77 and DPX-66037 + clopyralid gave over 90% redroot pigweed control on July 3. DPX-66037+X-77 and DPX-66037+clopyralid gave less sugarbeet injury than other treatments.

Postemergence herbicides for broadleaf weeds, Mooreton, 1992. 'Bush Johnson BJ 1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 6. Lorsban 15G at 13 pounds product per acre was applied modified in-furrow at planting. The first half of split treatments was applied 4:45 pm May 25 when the air temperature was 53F, soil temperature at six inches was 50F, relative humidity was 58%, wind velocity was 9 mph, soil moisture was good, sugarbeet was in the cotyledon to 2 leaf stage, common lambsquarters was in the 2 to 4 leaf stage, and redroot pigweed was in the cotyledon to 4 leaf stage. The second half of split treatments was applied 6:00 pm May 31 when the air temperature was 80F, soil temperature at six inches was 64F, relative humidity was 32%, wind velocity was 9 mph, soil moisture was good, sugarbeet was in the cotyledon to 4 leaf stage, common lambsquarters was in the 2 to 8 leaf stage, and redroot pigweed was in the cotyledon to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.25 lb ai/A + 1 quart/A May 29. Sugarbeet injury was evaluated June 10, June 20, and July 4. Redroot pigweed and common lambsquarters control were evaluated June 20 and July 4.

Treatment*	Rate	June10 Sgbt inj	June 20 Sgbt inj	June 20 Colq cntl	June 20 Rrpw cntl	July 4 Sgbt inj	July 4 Colq cntl	July 4 Rrpw cntl
	(lb/A)	(%)						
Desmedipham/Desmedipham	0.25/0.33	24	24	100	98	8	95	92
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	24	26	100	99	10	100	97
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	28	31	100	97	15	100	92
Desm+Endothall/Desm+Endo	0.25+0.25/0.33+0.33	38	44	100	95	21	89	89
Desm+DPX-66/Desm+DPX-66	0.25+0.0156/0.33+0.0156	20	21	99	98	14	96	97
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	9	12	50	82	5	49	81
De+Cl+DPX/De+Cl+DPX	.25+.09+.0156/.33+.09+.0156	29	30	100	100	13	100	100
Desm+DPX-66037/Desm+Clpy	0.25+0.031/0.33+0.19	26	33	100	99	16	100	98
NA307/NA307	0.45/0.45	44	46	100	98	33	99	94
NA307+Clpy/NA307+Clpy	0.45+0.09/0.45+0.09	44	40	100	99	28	100	99
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	43	44	100	100	31	100	99
DPX-66+Clpy/DPX-66+Clpy	0.0156+0.09/0.0156+0.09	10	9	68	84	4	51	84
HIGH MEAN		44	46	100	100	33	100	100
LOW MEAN		9	9	50	82	4	49	81
EXP MEAN		28	30	93	96	16	90	93
C.V. %		15	17	6	3	39	10	3
LSD 5%		6	7	8	5	9	13	5
LSD 1%		8	10	11	6	12	17	6
# OF REPS		4	4	4	4	4	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1 ratio.
X-77 = non-ionic surfactant from Valent

Summary

Evaluations of sugarbeet injury and weed control tended to be lower on July 4 than on June 20 reflecting plant recovery from herbicide injury. Treatments that included NA307 or endothall gave or tended to give more sugarbeet injury than the other treatments. All treatments gave over 90% control of common lambsquarters and redroot pigweed except desmedipham + endothall, DPX-66037+X-77, and DPX-66037+clopyralid.

Postemergence herbicides split applied, Crookston, 1992. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Lorsban 15G at 13 pounds product per acre was applied modified in-furrow at planting. The first half of split application treatments was applied 12:30 pm May 26 when the air temperature was 65F, soil temperature at six inches was 48F, relative humidity was 36%, wind velocity was 8 mph, soil moisture was good, sugarbeet was in the cotyledon stage, prostrate pigweed was in the cotyledon to 4 leaf stage, wild buckwheat was in the cotyledon to 2 leaf stage, and kochia was in the cotyledon stage to 0.25 inch rosette diameter. The second half of split applications and single application treatments were applied 12:45 pm June 1 when the air temperature was 85F, soil temperature at six inches was 65F, relative humidity was 31%, wind velocity was 5 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, prostrate pigweed was in the 2 to 6 leaf stage, wild buckwheat was in the 2 to 5 leaf stage, and kochia had a 0.25 to 0.75 inch rosette diameter. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. The entire plot area was treated with sethoxydim + Dash at 0.2 lb ai/A + 1 quart/A May 21. Sugarbeet injury and prostrate pigweed and wild buckwheat control were evaluated June 11 and July 3. Kochia control was evaluated July 3.

		June 11			July 3			
Treatment*	Rate	Sgbt inj	Prpw cntl	Wibw cntl	Kocz cntl	Sgbt inj	Wibw cntl	Prpw cntl
	(lb/A)	------------			(%)			-----------
DPX66+X-77/DPX66+X-77	0.0156+0.25%/0.0156+0.25%	0	61	25	100	0	28	51
DPX66+De&Ph/DPX66+De&Ph	0.0156+0.33/0.0156+0.33	24	98	84	100	16	88	96
DPX66+Desm/DPX66+Desm	0.0156+0.33/0.0156+0.33	19	100	80	100	13	71	97
DPX66+Clpy/DPX66+Clpy	0.0156+0.09/0.0156+0.09	1	45	86	82	0	89	50
DPX+DP+Clp/DPX+DP+Clp	.0156+.33+.09/.0156+.33+.09	36	100	98	99	19	94	97
--/DPX-66037+Endothall	--/0.0156+0.75	6	50	46	0	0	66	48
--/DPX-66037+Sethoxy+Scoil	--/0.0156+0.2+0.19G	1	61	44	100	0	43	53
--/DPX66+Quizalofop+Scoil	--/0.0156+0.09+0.19G	0	58	43	100	0	40	43
Des&Phen/Des&Phen	0.19/0.19	9	87	55	62	3	63	91
Des&Phen/Des&Phen	0.3/0.3	24	97	76	53	9	73	93
Des&Phen/Des&Phen	0.37/0.37	29	96	90	37	19	75	95
NA307/NA307	0.28/0.28	20	97	89	37	14	86	94
NA307/NA307	0.45/0.45	35	99	95	81	18	91	96
NA307/NA307	0.56/0.56	41	100	100	77	25	95	96
NA308/NA308	0.28/0.28	26	96	89	68	10	78	91
NA308/NA308	0.45/0.45	41	99	99	82	25	92	95
NA308/NA308	0.56/0.56	56	100	100	73	34	96	97
De&Ph+Etho-SC/De&Ph+Etho-SC	0.19+0.09/0.19+0.09	29	94	89	63	20	80	93
De&Ph+Etho-SC/De&Ph+Etho-SC	0.30+0.15/0.30+0.15	36	98	96	82	25	90	96
De&Ph+Etho-SC/De&Ph+Etho-SC	0.37+0.19/0.37+0.19	38	99	98	85	28	95	97
--/Desmedipham&Phenmedipham	--/0.74	31	93	85	23	23	76	89
--/NA307	--/1.13	45	99	100	80	40	96	97
--/NA308	--/1.13	59	100	100	92	41	96	97
--/Desmed&Phenmed+Ethofumesate-SC	--/0.75+0.38	68	100	100	77	50	95	97
Clopyralid/Clopyralid	0.09/0.09	0	14	89	0	0	89	35
Des&Phen+Clpy/Des&Phen+Clpy	0.33+0.09/0.33+0.09	25	98	97	43	10	94	96
C.V. %		23	5	7	22	50	8	7
LSD 5%		9	7	8	24	12	9	8
LSD 1%		11	9	11	33	16	12	10
# OF REPS		4	4	4	3	4	4	4

* X-77 = non-ionic surfactant from Valent; NA307 and NA308 = desmed+phenmed + ethofumesate, 1:1:1 ratio; Scoil = methylated seed oil from Agsco.

(experiment continued on next page)

Summary

All treatments including DPX-66037 gave nearly total kochia control except DPX-66037+clopyralid which suggests that clopyralid antagonized kochia control from DPX-66037. However, DPX-66037 + clopyralid + desmedipham & phenmedipham gave 99% kochia control so the addition of the desmedipham & phenmedipham overcame most of the antagonism. NA307, NA308, and desmedipham & phenmedipham+ethofumesate-SC gave or tended to give more sugarbeet injury than desmedipham&phenmedipham without ethofumesate. Averaged over rates and evaluation times, desmedipham&phenmedipham gave 18% sugarbeet injury while treatments including ethofumesate gave 34% injury. Averaged over rates, wild buckwheat, prostrate pigweed, and evaluation times; desmedipham&phenmedipham gave 83% weed control while treatments including ethofumesate gave 95% weed control. NA308 gave greater sugarbeet injury and similar weed control to NA307. The best overall control of wild buckwheat, prostrate pigweed, and kochia was from DPX-66037+desmedipham&phenmedipham+clopyralid.

Lanceleaf sage control with postemergence herbicides, Wendell, 1992. Experimental test plots 30 feet long and 11 feet wide were established in a commercial wheat field with a moderate population of lanceleaf sage. The first half of split applications was applied 11:30 am May 28 when the air temperature was 67F, soil temperature at six inches was 55F, relative humidity was 46%, wind velocity was 11 mph, and lanceleaf sage was in the cotyledon to 4 leaf stage. The second half of split applications was applied 1:30 pm June 4 when the air temperature was 65F, soil temperature at six inches was 66F, relative humidity was 66%, wind velocity was 18 mph, soil moisture was good, and lanceleaf sage was in the cotyledon to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. Lanceleaf sage was evaluated June 26.

Treatment*	Rate (lb/A)	Lanceleaf sage control ----- (%) ----
Desmedipham/Desmedipham	0.25/0.33	23
Desmed+Clopyralid/Desmed+Clopyralid	0.25+0.09/0.33+0.09	85
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	85
Desmed+Endothall/Desmed+Endothall	0.25+0.25/0.33+0.33	35
Desmed+DPX-66037/Desmed+DPX-66037	0.25+0.0156/0.33+0.0156	33
DPX-66037+X-77/DPX-66037+X-77	0.0156+0.25%/0.0156+0.25%	38
Des+Clpy+DPX/Des+Clpy+DPX66	0.25+0.09+0.0156/0.33+0.09+0.0156	79
Desmedipham+DPX-66037/Desmedipham+Clpy	0.25+0.031/0.33+0.19	86
NA307/NA307	0.45/0.45	71
NA307+Clopyralid/NA307+Clopyralid	0.45+0.09/0.45+0.09	83
NA307+DPX-66037/NA307+DPX-66037	0.45+0.0156/0.45+0.0156	84
DPX-66037+Clpy/DPX-66037+Clpy	0.156+0.09/0.0156+0.09	49
HIGH MEAN		86
LOW MEAN		23
EXP MEAN		62
C.V. %		32
LSD 5%		29
LSD 1%		39
# OF REPS		4

* X-77 = non-ionic surfactant from Valent
NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1

Summary

Treatments that included clopyralid or NA307 gave over 70% control of lanceleaf sage except DPX-66037+clopyralid, suggesting an antagonism between the two herbicides. Desmedipham+clopyralid gave control similar to desmedipham&phenmedipham+clopyralid. NA307+clopyralid tended to give better control than NA307 alone. Desmedipham+clopyralid gave much better control than desmedipham alone.

Common mallow and venice mallow control with postemergence herbicides, Fargo, 1992. Experimental test plots eleven feet wide and thirty feet long were established in a field with natural stands of common mallow and venice mallow. The first half of treatments was applied 5:30 pm August 17 when the air temperature was 79F, soil temperature at six inches was 68F, relative humidity was 41%, wind velocity was 15 mph, soil moisture was fair, and common mallow and venice mallow were just emerging to the cotyledon stage. The second half of treatments was applied 3:00 pm August 21 when the air temperature was 73F, soil temperature at six inches was 67F, relative humidity was 48%, wind velocity was 10 mph, soil moisture was fair, common mallow was in the cotyledon to 1 leaf stage, and venice mallow was in the 1 leaf stage. The same experiment excluding three treatments was established in a new location in the same field August 31. The first half of treatments was applied 4:30 pm August 31 when the air temperature was 67F, soil temperature at six inches was 64F, relative humidity was 50%, wind velocity was 0 to 5 mph, soil moisture was good, and common mallow and venice mallow were in the cotyledon stage. The second half of treatments was applied 4:30 pm September 10 when the air temperature was 66F, soil temperature at six inches was 58F, relative humidity was 45%, wind velocity was 3 mph, soil moisture was good, and common mallow and venice mallow were in the cotyledon to 1 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. Common mallow and venice mallow control were evaluated August 31 in the first experiment and September 26 in the second experiment.

Treatment*	Rate	August 31		September 26	
		Vema cntl	Coma cntl	Coma cntl	Vema cntl
	(lb/A)	----------	---------- (%)	----------	----------
BAS119-45H+DashHC/BAS45+DashHC	1+0.125G/1+0.125G	35	22	0	68
BAS119-45H+Sylgard/BAS45+Sylgard	1+0.25%/1+0.25%	8	3	--	--
BAS119-45H+OC/BAS45+OC	1+0.25G/1+0.25G	3	0	--	--
BAS119-45H+Dash/BAS45+Dash	1+0.25G/1+0.25G	25	15	0	0
BAS119-45H+BCH74902S/BAS45+BCH	1+0.5G/1+0.5G	15	8	--	--
BAS119-16+Dash/BAS16+Dash	1+0.25G/1+0.25G	31	26	0	63
Desmedipham/Desmedipham	0.25/0.33	6	3	0	0
Desm+Clpy/Desm+Clpy	0.25+0.09/0.33+0.09	1	1	13	51
Desm/Desm+Clpy	0.25/0.33+0.09	8	2	15	28
DPX-66+X-77/DPX66+X-77	0.0156+0.25%/0.0156+0.25%	25	12	23	15
Des+DPX-66037/Des+DPX66	0.25+0.0156/0.33+0.0156	15	17	8	0
De&Ph+DPX66/De&Ph+DPX66	0.25+0.0156/0.33+0.0156	23	13	35	33
Desmed/Desmed	0.25/0.33	1	10	0	0
De+DPX+Clp/De+DPX+Clp	.25+.0156+.09/.33+.0156+.09	11	15	18	5
Des+DPX66/Des+Clpy	0.25+0.031/0.33+0.19	23	15	23	50
NA307/NA307	0.45/0.45	16	0	2	21
Desm+Etho-SC/Desm+Etho-SC	0.25+0.15/0.33+0.15	4	10	0	15
Desm+Etho-SC/Desm+Etho-SC	0.25+0.25/0.33+0.33	13	13	37	45
Desm+Etho/Desm+Etho	0.25+0.25/0.33+0.33	9	17	0	8
Desm+Etho-SC/Desm+Etho-SC	0.25+0.5/0.33+0.5	18	13	5	30
DPX66+Clpy/DPX66+Clpy	0.0156+0.09/0.0156+0.09	10	20	0	0
De+Et-SC+Clp/De+Et-SC+Clp	.25+.25+.09/.33+.33+.09	18	14	3	10
D+EtSC+DPX/D+EtSC+DPX	.25+.25+.0156/.33+.33+.0156	15	24	21	28
C.V. %		65	58	156	90
LSD 5%		13	11	22	30
LSD 1%		17	15	29	40
# OF REPS		4	3	4	4

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1

SUMMARY: The late summer application on weed regrowth after tillage was not efficacious.

Multiple application of postemergence herbicides, Glyndon, 1992. Experimental test plots six rows wide by 30 feet long were established in a commercial sugarbeet field. Herbicide applications were made May 19, May 23, May 28, and June 3. Application information is listed below.

	Date of Application			
	May 19	May 23	May 28	June 3
Time of Day	8:00 pm	3:45 pm	3:00 pm	9:30 pm
Air Temp.	85 F	54 F	74 F	72 F
Soil Temp.	67 F	50 F	62 F	64 F
Rel. Humidity	39%	65%	34%	57%
Wind Velocity	10-15 mph	17 mph	20 mph	19 mph
Soil Moisture	good	good	good	good
Sugarbeet	emerg-cotyl	cotyl-2 leaf	2 leaf	2-4 leaf
Redroot Pigweed	emerg-cotyl	cotyl-2 leaf	cotyl-4 leaf	cotyl-1.5" tall
Common Lambsquarters	emerg-2 leaf	cotyl-4 leaf	cotyl-6 leaf	cotyl-10 leaf

All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Dash at 0.3 lb ai/A + 1 qt/A was broadcast over entire plot area May 30. Sugarbeet injury and redroot pigweed and common lambsquarters control were evaluated June 19.

Treatment*	Rate (lb/A)	Sgbt inj	Rrpw cntl (%)	Colq cntl
Des&Phen/Des&Phen/Des&Phen/Des&Phen	0.25/0.25/0.25/0.25	26	80	100
Des&Phen/Des&Phen/Des&Phen/Des&Phen	0.16/0.25/0.33/0.5	43	83	100
--/--/Desmed&Phenmed/Desmed&Phenmed	--/--/0.5/0.5	40	81	100
--/--/Desmed&Phenmed/Desmed&Phenmed	--/--/0.33/0.67	40	83	100
Des&Phen/Des&Phen/--/--	0.25/0.33/--/--	15	48	79
NA307/NA307/NA307/NA307	0.39/0.39/0.39/0.39	35	88	100
NA307/NA307/NA307/NA307	0.22/0.33/0.45/0.57	40	92	100
--/--/NA307/NA307	--/--/0.78/0.78	54	93	100
--/--/NA307/NA307	--/--/0.57/1.02	69	94	100
NA308/NA308/NA308/NA308	0.39/0.39/0.39/0.39	40	91	100
NA308/NA308/NA308/NA308	0.22/0.33/0.45/0.57	46	89	100
--/--/NA308/NA308	--/--/0.78/0.78	43	93	100
--/--/NA308/NA308	--/--/0.57/1.02	50	90	100
De&Ph+Etho-SC(4X)	0.26+0.13/0.26+0.13/0.26+0.13/0.26+0.13	35	88	100
De&Ph+Etho-SC(4X)	0.15+0.07/0.22+0.11/0.3+0.15/0.38+0.19	33	92	100
--/--/D&P+Etho-SC/D&P+Etho-SC	--/--/0.52+0.26/0.52+0.26	44	92	100
--/--/D&P+Etho-SC/D&P+Etho-SC	--/--/0.38+0.19/0.68+0.34	34	91	100
DPX66+X-77/DPX66+X-77/--/--	0.0156+0.25%/0.0156+0.25%/--/--	4	24	21
DPX66+De&Ph/DPX66+De&Ph/--/--	0.0156+0.25/0.0156+0.33/--/--	19	64	73
DPX66+Des/DPX66+Des/--/--	0.0156+0.25/0.0156+0.33/--/--	18	76	86
DPX-66037+Des(4X)	0.0156+.16/.0156+.25/.0156+.33/.0156+.5	33	99	100
DPX66+Clpy/DPX66+Clpy/--/--	0.0156+0.09/0.0156+0.09/--/--	20	54	96
DPX+DP+Clp(2X)/--/--	0.0156+0.25+0.09/.0156+.33+.09/--/--	21	85	100
Clopyralid/Clopyralid/--/--	0.09/0.09/--/--	5	38	89
Des&Ph+Clpy/Des&Ph+Clpy/--/--	0.25+0.09/0.33+0.09/--/--	19	71	100
--/DPX-66037+Endothall/--/--	--/0.0156+0.75/--/--	14	25	14
--/DPX-66037+Seth+Scoil/--/--	--/0.0156+0.2+0.19G/--/--	3	21	13
--/DPX-66037+Quiz+Scoil/--/--	--/0.0156+0.09+0.19G/--/--	5	33	24
C.V. %		31	13	9
LSD 5%		13	13	10
LSD 1%		18	18	14
# OF REPS		4	4	4

* NA307 and NA308 = desmedipham + phenmedipham + ethofumesate, 1:1:1 ratio; Scoil = methylated seed oil from Agsco

(experiment continued on next page)

Summary

The results of this experiment are difficult to interpret because multiple flushes of redroot pigweed emerged from planting until after the last postemergence application. Observation of the plots suggested than DPX-66037 had soil residual which inhibited emergence of redroot pigweed. This was most evident in the plots where desmedipham+DPX-66037 was applied four times. NA307, NA308, and desmedipham&phenmedipham+ethofumesate-SC gave similar control of redroot pigweed and common lambsquarters but NA307 and NA308 tended to cause more sugarbeet injury than desmedipham&phenmedipham+ethofumesate-SC. On average, treatments that included ethofumesate (NA307, NA308, and des&phen + etho) gave 44% sugarbeet injury and 91% redroot pigweed control while desmedipham&phenmedipham without the ethofumesate at the same rates and timings gave 37% sugarbeet injury and 82% redroot pigweed control. The addition of DPX-66037 to desmedipham&phenmedipham improved control of redroot pigweed but not common lambsquarters. The addition of clopyralid to desmedipham&phenmedipham improved control of both redroot pigweed and common lambsquarters. DPX-66037+desmedipham&phenmedipham+clopyralid gave total control of common lambsquarters and better control of redroot pigweed than the two way tank mixes with desmedipham&phenmedipham.

Multispecies screening of postemergence sugarbeet herbicides, Fargo (NW Section 22), 1992. Canola, crambe, buckwheat, 'BJ 1320' sugarbeet, safflower, 'Neche' flax, 'Morex' barley, 'Valley' oats, 'Gus' wheat, 'Vic' durum, 'IS-343A' corn, 'McCall' soybean, 'Othello' pinto bean, and 'IS-3311' sunflower were seeded in strips across herbicide plots May 19. Kochia and wild mustard populations were natural. The first half of split applications was applied 9:15 am June 12 when the air temperature was 78F, soil temperature at six inches was 66F, relative humidity was 57%, wind velocity was 0 mph, soil moisture was good, wild mustard was in the 2 to 4 leaf stage, kochia was 0.25 inch rosette diameter to 2 inches tall, canola was in the 3 leaf stage (3 inches tall), crambe was in the 2 leaf stage (3 inches tall), tame buckwheat was 3 to 6 inches tall, sugarbeet was in the 2 leaf stage, safflower was 2 to 5 inches tall, flax was 3 inches tall, barley was 7 inches tall, oats, hard red spring wheat, and durum wheat was 6 inches tall, soybean and pinto bean was in the 2 leaf stage, corn was in the 3 leaf stage (3 inches tall) to 5 inches tall, and sunflower was in the 2 leaf stage (3 inches tall). The second half of split applications was applied 4:00 pm June 22 when the air temperature was 70F, soil temperature at six inches was 64F, relative humidity was 72%, wind velocity was 0 to 5 mph, soil moisture was good, wild mustard was 5 to 10 inches tall, kochia was 0.5 inch rosette diameter to 5 inches tall, canola was in the 5 leaf stage (5 inches tall), crambe was in the 4 leaf stage (5 inches tall), tame buckwheat was 7 to 9 inches tall, sugarbeet was in the 4 to 6 leaf stage, safflower was 4 to 7 inches tall, flax was 7 inches tall, barley was 14 inches tall, oats was 12 inches tall, hard red spring wheat and durum wheat were 11 inches tall, soybean was in the first trifolialate stage, pinto bean was in the second trifolialate stage, corn was in the 5 leaf stage (6 inches tall) to 10 inches tall, and sunflower was in the 6 leaf stage(6 inches tall). All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. A visual estimate of percent fresh weight reduction compared to the untreated check adjacent to each plot was taken July 8.

Treatment*	Rate	Wimu	Kocz	Cano	Cram	Tabw	Sgbt
	(lb/A)	------	percent	control	------		
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	89	42	30	30	0	0
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	89	33	20	13	3	0
D&P+DPX-66/D&P+DPX-66	0.25+0.0156/0.33+0.0156	99	97	67	73	87	0
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	99	98	48	53	88	0
DP+Cl+DPX/DP+Cl+DPX	.25+.09+.0156/.33+.09+.0156	99	95	47	63	77	0
D&P+DPX-66037/D&P+Clpy	0.25+0.031/0.33+0.19	98	97	38	47	65	0
NA307/NA307	0.45/0.45	99	55	38	70	18	0
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	99	93	55	68	82	0
DPX-66+Clpy/DPX-66+Clpy	0.156+0.09/0.0156+0.09	96	63	8	7	83	0
C.V. %		7	14	32	34	12	0
LSD 5%		NS	18	22	28	12	NS
LSD 1%		NS	25	30	38	16	NS
# OF REPS		3	3	3	3	3	3

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

(experiment continued on next page)

Multispecies screening of postemergence sugarbeet herbicides, Fargo (NW Section 22), 1992. (continued)

Treatment*	Rate (lb/A)	Flax	Saff	Barl	Oats	Hrsw
		------ percent control -----				
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	27	7	10	8	7
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	30	99	7	7	7
D&P+DPX-66/D&P+DPX-66	0.25+0.0156/0.33+0.0156	72	20	63	10	17
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	43	20	75	23	27
DP+Cl+DPX/DP+Cl+DPX	.25+.09+.0156/.33+.09+.0156	63	99	58	8	13
D&P+DPX-66037/D&P+Clpy	0.25+0.031/0.33+0.19	70	98	47	12	13
NA307/NA307	0.45/0.45	68	20	12	20	30
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	75	20	48	18	32
DPX-66+Clpy/DPX-66+Clpy	0.156+0.09/0.0156+0.09	15	99	5	2	0
C.V. %		32	18	21	45	42
LSD 5%		29	17	13	9	12
LSD 1%		40	24	18	13	16
# OF REPS		3	3	3	3	3

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent

Multispecies screening of postemergence sugarbeet herbicides, Fargo (NW Section 22), 1992. (continued)

Treatment*	Rate (lb/A)	Duru	Sufl	Soyb	Pnto	Corn
		------ percent control -----				
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	7	8	8	8	3
Des&Phen+Clpy/Des&Phen+Clpy	0.25+0.09/0.33+0.09	7	99	99	99	5
D&P+DPX-66/D&P+DPX-66	0.25+0.0156/0.33+0.0156	42	97	72	62	18
DPX-66+X-77/DPX-66+X-77	0.0156+.25%/0.0156+.25%	50	95	77	72	60
DP+Cl+DPX/DP+Cl+DPX	.25+.09+.0156/.33+.09+.0156	28	99	99	99	13
D&P+DPX-66037/D&P+Clpy	0.25+0.031/0.33+0.19	47	99	99	99	20
NA307/NA307	0.45/0.45	17	27	65	33	7
NA307+DPX66/NA307+DPX66	0.45+0.0156/0.45+0.0156	33	88	73	70	22
DPX-66+Clpy/DPX-66+Clpy	0.156+0.09/0.0156+0.09	3	99	99	99	15
C.V. %		23	8	11	12	52
LSD 5%		10	11	14	14	16
LSD 1%		14	15	20	20	23
# OF REPS		3	3	3	3	3

* NA307 = desmedipham+phenmedipham+ethofumesate, 1:1:1
X-77 = non-ionic surfactant from Valent
Cano=canola, Cram=crambe, Tabw=tame buckwheat, Sgbt=sugarbeet, Saff=safflower, Barl=barley, Hrsw=hard red spring wheat, Duru=durum wheat, Sufl=sunflower, Soyb=soybean, Pnto=pinto bean.

Summary

DPX-66037+clopyralid gave less kochia control than DPX-66037+X-77 or desmedipham&phenmedipham+DPX-66037. However, kochia control from DPX-66037 + clopyralid + desmedipham&phenmedipham was similar to the best treatments in the experiment. DPX-66037 injured all species in the experiment except sugarbeet.

Sethoxydim plus Bivert and time of application, Fargo, 1992. 'NewDak' oats at 17 lb/A and 'Siberian' foxtail millet at 7.5 lb/A were seeded in 9 foot strips across herbicide plots April 29. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in six 22 inch rows across herbicide plots April 29. Counter 15G was applied at 12 pounds product per acre 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 15 minutes before adding the next group of chemicals. Herbicide treatments were applied May 29, June 5, June 12, and June 24.

	Date of Application			
	May 29	June 5	June 12	June 24
Time of Day	12:30 pm	2:00 pm	8:00 am	9:00 am
Air Temp.	77 F	61 F	71 F	60 F
Soil Temp.	56 F	68 F	65 F	64 F
Rel. Humidity	36%	69%	60%	89%
Wind Velocity	20 mph	8 mph	2 mph	7 mph
Soil Moisture	good	good	good	good
Sugarbeet	cotyl-2 leaf	4-6 leaf	6-8 leaf	8-12 leaf
Oats	5-6 inches	6-9 inches	10-12 inches	16-20 inches
Foxtail Millet	2-4 inches	3-6 inches	5-9 inches	12-15 inches

All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. Sugarbeet injury was evaluated June 23. Oats and foxtail millet control were evalutated June 23 and July 4.

		June 23			July 4	
Treatment (rate)*		Oats cntl	Ftmi cntl	Sgbt inj	Oats cntl	Ftmi cntl
		(%)				
Sethoxydim+Scoil(0.1+0.19G)	(May 29)	98	100	0	98	99
Desmed+Sethoxydim+Scoil(0.5+0.1+0.19G)	(May 29)	80	89	14	74	84
Bentazon+Seth+Scoil(1+0.1+0.19G)	(May 29)	18	85	100	13	86
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Des(0.5)	(May 29)	76	91	8	73	80
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Bent(1)	(May 29)	24	76	100	14	71
Sethoxydim+Scoil(0.1+0.19G)	(June 5)	98	99	0	98	100
Desmed+Sethoxydim+Scoil(0.5+0.1+0.19G)	(June 5)	61	97	0	58	97
Bentazon+Seth+Scoil(1+0.1+0.19G)	(June 5)	98	100	0	98	100
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Des(0.5)	(June 5)	60	95	3	53	91
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Bent(1)	(June 5)	29	96	100	10	93
Sethoxydim+Scoil(0.1+0.19G)	(June 12)	51	98	0	84	100
Desmed+Sethoxydim+Scoil(0.5+0.1+0.19G)	(June 12)	50	96	8	48	97
Bentazon+Seth+Scoil(1+0.1+0.19G)	(June 12)	21	93	89	15	98
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Des(0.5)	(June 12)	50	93	8	50	96
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Bent(1)	(June 12)	15	93	90	15	95
Sethoxydim+Scoil(0.1+0.19G)	(June 24)	--	--	--	26	19
Desmed+Sethoxydim+Scoil(0.5+0.1+0.19G)	(June 24)	--	--	--	38	30
Bentazon+Seth+Scoil(1+0.1+0.19G)	(June 24)	--	--	--	25	25
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Des(0.5)	(June 24)	--	--	--	20	13
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Bent(1)	(June 24)	--	--	--	26	15
C.V. %		11	5	14	16	12
LSD 5%		8	7	7	11	12
LSD 1%		11	9	9	14	17
# OF REPS		4	4	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 Wilbur-Ellis; Scoil=methylated seed oil from Agsco

SUMMARY: Bivert did not reduce the antagonism between sethoxydim and desmedipham or bentazon.

Bivert and herbicide antagonism, Fargo, 1992. 'NewDak' oats at 17 lb/A and 'Siberian' foxtail millet at 7.5 lb/A were seeded in 9 foot strips across herbicide plots April 29. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in six 22 inch rows across herbicide plots April 29. Counter 15G was applied at 12 pounds product per acre 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 one hour before adding the next group of chemicals. Herbicides were applied 2:00 pm June 5 when the air temperature was 61F, soil temperature at six inches was 68F, relative humidity was 69%, wind velocity was 8 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, oats was 6 to 9 inches tall, and foxtail millet was 3 to 6 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. Oats and foxtail millet control and sugarbeet injury were evaluated June 23.

Treatment (rate) *	Oats control	Foxtail Millet control	Sugarbeet injury
	------------	(%)	------------
Clethodim-94+Scoil (0.066+0.19G)	100	100	0
Clethodim-94+Scoil (0.094+0.19G)	100	100	0
Desm+Clethodim-94 (0.5+0.094)	98	100	0
Desm+Clethodim-94 (0.5+0.125)	99	100	0
Desm+Clet-94+Scoil (0.5+0.066+0.19G)	98	100	0
Clet94+Bivert(.066+.03G)+Scoil(.19G)+Des(.5)	98	100	0
Sethoxydim+Scoil (0.1+0.19G)	98	100	0
Sethoxydim+Scoil (0.2+0.19G)	100	100	0
Desmedipham+Sethoxydim (0.5+0.2)	76	93	0
Desmedipham+Sethoxydim (0.5+0.3)	94	98	0
Desmedipham+Seth+Scoil (0.5+0.1+0.19G)	68	95	0
Seth+Bivert(0.1+0.03G)+Scoil(0.19G)+Des(0.5)	68	97	0
Seth+Bivert (0.2+0.03G)+Desm (0.5)	71	90	0
Quizalofop+Scoil (0.034+0.19G)	100	100	0
Quizalofop+Scoil (0.055+0.19G)	100	100	0
Desm+Quizalofop (0.5+0.055)	80	90	0
Desm+Quizalofop (0.5+0.069)	96	97	0
Desm+Qufp+Scoil (0.5+0.034+0.19G)	84	98	0
Qufp+Bivert(.034+.03G)+Scoil(.19G)+Des(.5)	74	99	3
Qufp+Bentazon+Scoil (0.034+1+0.19G)	99	96	96
Qufp+Bivert(.034+.03G)+Scoil(.19G)+Bent(1)	97	100	93
C.V. %	6	4	17
LSD 5%	7	5	2
LSD 1%	10	7	3
# 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 Wilbur-Ellis; Scoil=methylated seed oil from Agsco

SUMMARY: Clethodim, sethoxydim and quizalofop used with Scoil and no broadleaf herbicide gave nearly complete control of oats and foxtail millet. Clethodim in combination with desmedipham gave nearly total grass control even without an oil additive. Desmedipham antagonized oats control from sethoxydim and Bivert did not overcome the antagonism. Desmedipham antagonized oats control from quizalofop and Bivert did not overcome the antagonism. Bentazon did not antagonize quizalofop. Increasing the rates of sethoxydim or quizalofop reduced but did not eliminate antagonism from desmedipham.

Sethoxydim plus additives, Fargo, 1992. 'NewDak' oats at 17 lb/A and 'Siberian' foxtail millet at 7.5 lb/A were seeded in 9 foot strips across herbicide plots April 29. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in six 22 inch rows across herbicide plots April 29. Counter 15G was applied at 12 pounds product per acre using a modified in-furrow system at planting. Herbicides were applied 12:30 pm June 6 when the air temperature was 55F, soil temperature at six inches was 61F, relative humidity was 71%, wind velocity was 10 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, oats was 6 to 9 inches tall, foxtail millet was 3 to 6 inches tall, and yellow foxtail was 1 to 3 inches tall. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots. Oats, foxtail millet, and yellow foxtail control and sugarbeet injury were evaluated June 26.

Treatment*	Rate	Oats control	Foxtail Millet control	Yellow Foxtail control	Sugarbeet injury
	(lb/A)	----------	---------- (%)	----------	----------
Sethoxydim	0.1	10	58	53	0
Sethoxydim+X-77	0.1+0.125G	29	86	60	0
Sethoxydim+Dash	0.1+0.25G	95	100	99	0
Sethoxydim+Scoil	0.1+0.19G	95	100	99	0
Sethoxydim+Raider	0.1+0.125G	16	39	40	0
Sethoxydim+Herbimax	0.1+0.25G	66	94	96	0
Sethoxydim+Bivert	0.1+0.03G	18	64	53	0
Sethoxydim+LI700	0.1+0.125G	21	85	67	0
HIGH MEAN		95	100	99	0
LOW MEAN		10	39	40	0
EXP MEAN		44	78	71	0
C.V. %		14	11	14	0
LSD 5%		9	13	18	NS
LSD 1%		12	17	25	NS
# OF REPS		4	4	3	4

* X-77=non-ionic surfactant from Valent; Dash=adjuvant from BASF; Scoil=methylated seed oil from Agsco; Herbimax=petroleum oil from Loveland; Bivert=adjuvant from Wilbur-Ellis; LI700=non-ionic surfactant from Loveland; Raider=surfactant from Nature's Choice.

Summary

None of the treatments caused sugarbeet injury. Sethoxydim plus Dash or Scoil gave better oats control than other treatments. Sethoxydim plus Herbimax gave control of foxtail millet and yellow foxtail similar to Dash and Scoil but all other treatments gave less control.

Additives with desmedipham, Glyndon, 1992. Experimental test plots six rows wide by 30 feet long were established in a commercial sugarbeet field. The first half of split treatments was applied 3:45 pm May 23 when the air temperature was 54F, soil temperature at six inches was 50F, relative humidity was 65%, wind velocity was 17 mph, soil moisture was good, sugarbeet and redroot pigweed were in the cotyledon to 2 leaf stage, and common lambsquarters was in the cotyledon to 4 leaf stage. The second half of split treatments was applied 3:00 pm May 28 when the air temperature was 74F, soil temperature at six inches was 62F, relative humidity was 34%, wind velocity was 20 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, redroot pigweed was in the cotyledon to 4 leaf stage, and common lambsquarters was in the cotyledon to 6 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim+Dash at 0.3 lb ai/A + 1 qt/A was broadcast over entire plot area May 30. Sugarbeet injury and redroot pigweed and common lambsquarters control were evaluated June 9 and June 19.

		June 9			June 19		
Treatment*	Rate	Sgbt inj	Rrpw cntl	Colq cntl	Sgbt inj	Rrpw cntl	Colq cntl
	(lb/A)	(%)					
Desmedipham/Desmedipham	0.25/0.33	23	82	87	18	58	82
Desmedipham/Desmedipham	0.33/0.5	45	83	90	30	65	82
Des+Raider/Des+Raider	0.25+0.125G/0.33+0.125G	23	80	82	20	67	78
Des+Raider/Des+Raider	0.33+0.125G/0.5+0.125G	40	83	88	29	63	78
Raider/Raider	0.125G/0.125G	0	0	0	0	0	0
Raider/Raider	0.25G/0.25G	0	0	0	0	0	0
Des+Cycloate/Des+Cycloate	0.25+0.75/0.33+0.75	30	82	87	29	68	83
Des+Cycloate/Des+Cycloate	0.33+0.75/0.5+0.75	36	87	92	25	77	87
Des+FoamBuster/Des+FB	0.25+0.0625G/0.33+0.0625G	21	80	83	24	63	78
Des+FoamBuster/Des+FB	0.33+0.0625G/0.5+0.0625G	31	87	91	23	67	85
Desmed+Scoil/Des+Scoil	0.25+0.19G/0.33+0.19G	40	83	85	23	72	80
Desmed+Scoil/Des+Scoil	0.33+0.19G/0.5+0.19G	61	88	88	44	70	77
Diethatyl/--	6/--	9	40	0	3	55	17
Desmedipham+Diethatyl/Desmedipham	0.33+6/0.5	41	100	94	33	99	85
C.V. %		24	6	6	30	14	14
LSD 5%		10	7	7	9	14	15
LSD 1%		13	10	9	12	19	21
# OF REPS		4	3	3	4	3	3

* Scoil=methylated seed oil from Agsco; Foambuster=anti-foaming agent from Ostlund; Raider=surfactant from Nature's Choice.

Summary

Raider had no effect on sugarbeet injury or weed control when applied alone or in combination with desmedipham. Cycloate increased sugarbeet injury from desmedipham at 0.25/0.33 lb/A on the June 19 evaluation. Foambuster reduced sugarbeet injury from desmedipham at 0.33/0.5 lb/A on the June 9 evaluation. Scoil increased or tended to increase sugarbeet injury at both rates of desmedipham and both evaluation dates. None of the additives had a significant effect on weed control. Diethatyl was added to desmedipham as a lay-by treatment to provide weed control through soil residual. Diethatyl had no effect on sugarbeet injury but redroot pigweed control was improved compared to desmedipham alone. The improvement in redroot pigweed control was due to a reduction in establishment of late germinating redroot pigweed.

<u>Desmedipham plus insecticides, St. Thomas, 1992.</u> 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 13. 'Lorsban 15G' insecticide at 13 lb/A was applied in a two inch band and drag chain incorporated at planting. The first half of each treatment was applied 7:00 pm June 2 when the air temperature was 80F, soil temperature at six inches was 64F, relative humidity was 41%, wind velocity was 10 mph, soil moisture was good, and sugarbeet was in the 2 leaf stage. The second half of treatments were applied 5:00 pm June 8 when the air temperature was 74, soil temperature at six inches was 65F, relative humidity was 47%, wind velocity was 5 to 10 mph, soil moisture was good, and sugarbeet was in the 2 to 4 leaf stage. Desmedipham and desmedipham plus insecticides were applied in 8.5 or 17 gpa water at 40 psi through 8001 or 8002 nozzles respectively to the center four rows of six row plots. Sethoxydim + Dash at 0.3 lb ai/A+1 qt/A was applied to the entire experiment June 9. Sugarbeet injury was evaluated July 3.

Treatment	Application Volume	Rate	Sugarbeet injury
	(gpa)	(lb/A)	(%)
Desmed/Desmedipham	(8.5)	0.25/0.33	8
Desmed/Desmedipham	(8.5)	0.33/0.5	15
Desmed/Desm+Lorsban	(8.5)	0.25/0.33+1.5	15
Desmed/Desm+Lorsban	(8.5)	0.25/0.33+3	11
Desmed/Desm+Lorsban	(8.5)	0.25/0.33+6	13
Desmed/Desm+Lorsban	(8.5)	0.33/0.5+0.38	19
Desmed/Desm+Lorsban	(8.5)	0.33/0.5+0.75	20
Desmed/Desm+Lorsban	(8.5)	0.33/0.5+1.5	19
Desmed/Desm+Lorsban	(8.5)	0.33/0.5+3	29
Desmed/Desm+Lorsban	(8.5)	0.33/0.5+6	25
Des+Clpy/Des+Clpy+Lors	(8.5)	0.33+0.09/0.5+0.09+3	30
Des+Clpy/Des+Clpy+Lors	(8.5)	0.33+0.09/0.5+0.09+6	29
Desmed/Desm+Lorsban	(17)	0.33/0.5+1.5	15
Desmed/Desm+Lorsban	(17)	0.33/0.5+3	28
Desmed/Desm+Lorsban	(17)	0.33/0.5+6	26
Desmed/Desm+Diazinon	(8.5)	0.33/0.5+1.5	24
Desmed/Desm+Furadan	(8.5)	0.33/0.5+1.5	23
Desmed/Desm+Dyfonate	(8.5)	0.33/0.5+3.0	18
Untreated Check	0	0	0
HIGH MEAN			30
LOW MEAN			0
EXP MEAN			19
C.V. %			33
LSD 5%			9
LSD 1%			12
# OF REPS			4

Summary

Lorsban at 3 or 6 lb/A and diazinon at 1.5 lb/A plus the higher rate of desmedipham gave greater sugarbeet injury than desmedipham alone.

Desmedipham plus insecticides, Fargo, 1992. Diethatyl+cycloate at 3+3 lb ai/A was applied to plot area and incorporated twice with a 'Kongskilde Triple K' field cultivator operated 3 inches deep April 30. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. The first half of each treatment was applied 12:30 pm May 29 when the air temperature was 77F, soil temperature at six inches was 56F, relative humidity was 36%, wind velocity was 20 mph, soil moisture was good, and sugarbeet was in the cotyledon to 2 leaf stage. The second half of treatments were applied 8:00 pm June 4 when the air temperature was 67, soil temperature at six inches was 69F, relative humidity was 46%, wind velocity was 11 mph, soil moisture was good, and sugarbeet was in the 2 to 4 leaf stage. Herbicides were applied in 8.5 or 17 gpa water at 40 psi through 8001 or 8002 nozzles respectively to the center four rows of six row plots. Sethoxydim+Dash at 0.2 lb ai/A+1 qt/A was applied to the entire experiment May 27. All plots were cultivated July 20. Sethoxydim+Scoil at 0.3 lb ai/A+1 qt/A was applied to the entire experiment July 20. Sugarbeet was hand thinned to an 8 inch spacing July 9. Sugarbeet was maintained weed free by hand weeding throughout the growing season. Sugarbeet injury was evaluated June 13 and July 4. The center two rows of 30 foot long plots were harvested and counted September 28.

Treatment	Application volume (gpa)	Rate (lb/A)	6-13 Sgbt inj (%)	7-4 Sgbt inj (%)	Sgbt popl (60')	Sucr (%)	Loss to Mol (%)	Root Yield (ton/A)	Impur Index	Extr Sucr (lb/A)
Desmed/Desmed	(8.5)	0.25/0.33	19	11	75	16.3	1.6	19.5	727	5644
Desmed/Desmed	(8.5)	0.33/0.5	26	14	82	16.6	1.6	22.0	693	6542
Des/Des+Lorsban	(8.5)	0.25/0.33+1.5	32	15	81	16.4	1.6	22.8	723	6662
Des/Des+Lorsban	(8.5)	0.25/0.33+3	33	18	82	16.8	1.6	20.8	689	6273
Des/Des+Lorsban	(8.5)	0.25/0.33+6	44	28	79	16.5	1.6	22.5	727	6648
Des/Des+Lorsban	(8.5)	0.33/0.5+0.38	31	19	81	17.4	1.5	22.9	631	7190
Des/Des+Lorsban	(8.5)	0.33/0.5+0.75	36	24	76	16.7	1.6	20.8	700	6208
Des/Des+Lorsban	(8.5)	0.33/0.5+1.5	43	25	78	17.0	1.5	23.2	665	7100
Des/Des+Lorsban	(8.5)	0.33/0.5+3	49	28	84	16.6	1.7	22.7	741	6707
Des/Des+Lorsban	(8.5)	0.33/0.5+6	59	38	80	17.2	1.6	23.4	670	7243
De+Clp/De+Clp+Lor	(8.5)	.33+.09/.5+.09+3	55	35	85	16.9	1.6	22.5	686	6860
De+Clp/De+Clp+Lor	(8.5)	.33+.09/.5+.09+6	55	36	79	16.9	1.6	23.3	684	7073
Desmed/Desm+Lors	(17)	0.33/0.5+1.5	41	24	83	16.6	1.6	20.9	720	6173
Desmed/Desm+Lors	(17)	0.33/0.5+3	43	25	82	16.9	1.6	22.2	709	6734
Desmed/Desm+Lors	(17)	0.33/0.5+6	48	29	84	16.2	1.6	23.7	732	6829
Des/Des+Diazinon	(8.5)	0.33/0.5+1.5	40	21	80	16.7	1.6	23.5	702	7046
Des/Des+Furadan	(8.5)	0.33/0.5+1.5	29	19	81	16.8	1.5	24.1	645	7327
Des/Des+Dyfonate	(8.5)	0.33/0.5+3.0	45	29	80	16.5	1.6	22.5	722	6654
Untreated Check	(0)	0	0	0	86	17.4	1.6	25.3	657	7917
C.V. %			15	29	9	2.8	8.3	10.5	10	12
LSD 5%			8	10	NS	0.7	NS	NS	NS	NS
LSD 1%			11	13	NS	NS	NS	NS	NS	NS
# OF REPS			4	4	4	4	4	4	4	4

Summary

Sugarbeet injury was less on July 4 than on June 13 reflecting sugarbeet recovery from herbicide injury. The yields were not sufficiently uniform across the experiment for significance among treatments. Based on the June 13 evaluation, all insecticide combinations with desmedipham gave greater sugarbeet injury than desmedipham alone except for Lorsban at 0.38 lb/A and Furadan at 1.5 lb/A. Sugarbeet injury tended to be less with spray volume of 17 gpa rather than 8.5 gpa. Higher rates of Lorsban in combination with desmedipham tended to cause more sugarbeet injury than lower rates.

Herbicides on hand weeded sugarbeet, Fargo, 1992. Diethatyl+cycloate at 3+3 lb ai/A was applied to the entire plot area April 29 and incorporated with a 'Kongskilde Triple K' field cultivator and a second time with an 'Alloway Seedbetter' field cultivator. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 29. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. The first half of herbicide treatments was applied 2:00 pm May 27 when the air temperature was 72F, soil temperature at six inches was 53F, relative humidity was 35%, wind velocity was 5 mph, soil moisture was good, and sugarbeet was in the 2 to 4 leaf stage. The second half of treatments was applied 1:00 pm June 3 when the air temperature was 86F, soil temperature at six inches was 64F, relative humidity was 31%, wind velocity was 30 mph, soil moisture was good, and sugarbeet was in the 4 to 6 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet was cultivated May 21 and June 15. Sugarbeet was hand weeded May 30 and maintained weed free by hand labor throughout the growing season. Sugarbeet was hand thinned to an 8 inch spacing June 2. Sugarbeet injury was evaluated June 13. Sugarbeet was harvested and counted from the center two rows of 35 foot long plots September 15.

Treatment*	Rate	Sgbt inj	Sgbt popl	Sucr	Loss to Mol	Root Yield	Impur Index	Extr Sucr
	(lb/A)	(%)	(/70')	(%)	(%)	(ton/A)		(lb/A)
Untreated Check	0	0	83	12.1	2.5	24.7	1487	4637
Desmedipham/Desmedipham	0.33/0.5	8	82	11.9	2.5	23.1	1564	4210
Des+Clpy/Des+Clpy	0.33+0.09/0.5+0.09	13	88	12.2	2.5	24.8	1480	4752
Des+Clpy/Des+Clpy	0.33+0.19/0.5+0.19	24	85	12.0	2.4	22.3	1499	4152
Des+Scoil/Des+Scoil	0.33+0.19G/0.5+0.19G	29	81	11.7	2.5	21.1	1575	3772
Des+Clpy+Scoil/Des+Clpy+Scoil	0.33+0.19+0.19G/0.5+0.19+0.19G	43	84	11.6	2.6	21.3	1625	3751
Clopyralid/Clopyralid	0.19/0.19	4	84	12.2	2.5	24.1	1494	4568
Clpy+Scoil/Clpy+Scoil	0.19+0.19G/0.19+0.19G	14	83	12.3	2.5	22.9	1505	4351
Clpy+Scoil/Clpy+Scoil	0.25+0.19G/0.25+0.19G	20	83	11.8	2.5	23.8	1573	4307
DPX-66037/DPX-66037	0.0156/0.0156	1	86	11.8	2.5	23.1	1576	4149
DPX-66037/DPX-66037	0.031/0.031	4	84	12.0	2.5	23.2	1508	4311
DPX-66037/DPX-66037	0.06/0.06	1	87	12.0	2.5	23.5	1506	4375
Des+DPX-66/Des+DPX-66	0.33+0.0156/0.5+0.0156	14	84	11.4	2.5	22.2	1599	3839
Des+DPX-66/Des+DPX-66	0.33+0.031/0.33+0.031	14	88	11.7	2.4	22.9	1524	4113
Des+DPX-66/Des+DPX-66	0.33+0.06/0.5+0.06	13	82	12.3	2.4	23.4	1429	4560
Des+DPX-66/Des+Clpy	0.33+0.031/0.5+0.19	19	80	12.1	2.4	20.6	1454	3881
Untreated Check	0	0	86	11.5	2.5	25.4	1604	4431
C.V. %		25	5	4.6	4.1	7.5	8	12
LSD 5%		5	NS	NS	NS	2.5	NS	NS
LSD 1%		6	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4

* Scoil = methylated seed oil from Agsco

SUMMARY: Five treatments caused a significant reduction in root yield compared to the average root yield of the two untreated checks (25.0 T/A): desmedipham+clopyralid at 0.19 lb/A, desmedipham+Scoil, desmedipham+clopyralid + Scoil, desmedipham+DPX-66037, and desmedipham+DPX-66037 followed by desmedipham+clopyralid. The addition of Scoil to desmedipham, clopyralid or desmedipham+clopyralid caused increased sugarbeet injury.

Date of thinning and sugarbeet yield, Fargo, 1992. Diethatyl+cycloate at 3+3 lb ai/A was applied to the entire plot area April 29 and incorporated with a 'Kongskilde Triple K' field cultivator and a second time with an 'Alloway Seedbetter' field cultivator. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 29. Counter 15G insecticide at 12 pounds product per acre was applied modified in-furrow at planting. Sugarbeet was hand thinned to an eight inch spacing May 21, May 29, June 5, June 12, June 24, and July 1. Sugarbeet was cultivated May 21 and June 15. Sugarbeet was hand weeded May 26 and maintained weed free by hand labor throughout the growing season. Sugarbeet was harvested and counted from the center two rows of 35 foot long plots September 15.

Date of Thinning	Sugarbeet (leaf stage)	Sgbt popl (#/70ft)	Sucrose (%)	Loss to Mol (%)	Root Yield (ton/A)	Impurity Index	Extract Sucrose (lb/A)
May 21	(cotyledon)	83	11.9	2.4	25.5	1478	4708
May 29	(2 to 4 leaf)	85	12.8	2.3	27.0	1301	5560
June 5	(4 to 6 leaf)	88	13.0	2.3	27.0	1279	5648
June 12	(6 to 8 leaf)	81	12.6	2.3	25.0	1309	5078
June 24	(8 to 12 leaf)	81	13.1	2.2	25.8	1237	5491
July 1	(10 to 14 leaf)	79	12.3	2.3	23.9	1383	4703
HIGH MEAN		88	13.1	2.4	27.0	1478	5648
LOW MEAN		79	11.9	2.2	23.9	1237	4703
EXP MEAN		83	12.6	2.3	25.7	1331	5198
C.V. %		6	3.6	5.2	5.4	8	8
LSD 5%		6	0.5	NS	1.7	132	511
LSD 1%		NS	0.7	NS	2.2	NS	691
# OF REPS		6	6	6	6	6	6

Summary

Sugarbeet thinned on May 29, June 5, or June 24 yielded more extractable sucrose than sugarbeet thinned on May 21 or July 1.

Interaction of desmedipham with Lorsban insecticide, Crookston, 1992. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Lorsban 15G at 6.5 or 13 pounds product per acre was applied modified in-furrow at planting. Sethoxydim + Dash at 0.2 lb ai/A+1 qt/A was applied to the entire plot area May 21 and July 22. The first half of split treatments beginning in the cotyledon stage were applied 12:30 pm May 26 when the air temperature was 65F, soil temperature at six inches was 48F, relative humidity was 36%, wind velocity was 8 mph, soil moisture was good, and sugarbeet was in the cotyledon stage. The second half of these treatments was applied 12:45 pm June 1 when the air temperature was 85F, soil temperature at six inches was 56F, relative humidity was 31%, wind velocity was 5 mph, soil moisture was good, and sugarbeet was in the 2 leaf stage. The first half of split treatments beginning at root maggot midfly stage were applied 11:00 am June 2 when the air temperature was 74F, soil temperature at six inches was 60F, relative humidity was 51%, wind velocity was 17 mph, soil moisture was good, and sugarbeet was in the 2 leaf stage. The second half of these treatments were applied 9:30 am June 8 when the air temperature was 60F, soil temperature at six inches was 58F, relative humidity was 73%, wind velocity was 2 mph, soil moisture was good, and sugarbeet was in the 4 to early 6 leaf stage. All herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet was cultivated June 2. Sugarbeet was counted in the center two rows of each plot June 11. Sugarbeet was hand weeded and hand thinned to an eight inch spacing June 11. Ten sugarbeet from each plot were rated July 15 for root maggot damage using the following scale: 0=no damage, 1=1 to 4 small scars, 2=5 to 10 small scars or up to 3 larger scars, 3=more than 3 larger scars, 4=50 to 75% of root blackened by scars, 5=more than 75% blackened or dead beet. The mean of these ten ratings is the sugarbeet root maggot damage rating. Sugarbeet from the center two rows of each plot was harvested September 29.

Treatment	Rate	Sgbt stage*	Root maggot damage rating Lorsban 1lb/A	Root maggot damage rating Lorsban 2lb/A	Prethin sgbt stand** Lorsban 1lb/A	Prethin sgbt stand** Lorsban 2lb/A
	lb/A		----index----		--plts/70ft--	
Desmedipham	0.25/0.33	cotyl	2.7	2.7	271	237
Desmedipham	0.33/0.5	cotyl	2.7	2.7	249	222
Desmedipham	0.5/0.75	cotyl	2.2	2.4	200	186
Desm+Clpy	0.33+0.09/0.5+0.09	cotyl	2.6	2.6	240	202
Desmedipham	0.25/0.33	2 lf	2.3	2.6	250	226
Desmedipham	0.33/0.5	2 lf	2.2	2.2	215	212
Desmedipham	0.5/0.75	2 lf	2.1	2.2	180	184
Desm+Clpy	0.33+0.09/0.5+0.09	2 lf	2.4	2.4	204	184
Untreated	0	--	2.7	2.7	246	236
LSD (0.05)			0.3		21	

* Stage of sugarbeet at first application.
** Sugarbeet plants per 70 feet of row prior to thinning.

(experiment continued on next page)

Interaction of desmedipham with Lorsban insecticide, Crookston, 1992.
(continued)

Treatment	Rate	Sgbt stage*	Root Yield Lorsban 1lb/A	Root Yield Lorsban 2lb/A	Sucrose Lorsban 1lb/A	Sucrose Lorsban 2lb/A	Extrac Sucro Lorsban 1lb/A	Extrac Sucro Lorsban 2lb/A
	lb/A		----Ton/A---		-------%-----		----lb/A----	
Desmedipham	0.25/0.33	cotyl	14.9	13.3	15.2	15.4	4030	3690
Desmedipham	0.33/0.5	cotyl	17.8	10.8	15.5	15.2	4990	2940
Desmedipham	0.5/0.75	cotyl	15.1	12.7	16.2	15.6	4410	3540
Desm+Clpy	0.33+0.09/0.5+0.09	cotyl	13.4	12.2	15.8	15.6	3730	3360
Desmedipham	0.25/0.33	2 lf	16.2	13.5	15.5	15.3	4460	3660
Desmedipham	0.33/0.5	2 lf	13.4	11.9	15.7	15.3	3770	3200
Desmedipham	0.5/0.75	2 lf	12.7	11.8	15.2	15.0	3420	3110
Desm+Clpy	0.33+0.09/0.5+0.09	2 lf	15.1	12.7	16.1	15.5	4410	3470
Untreated	0	--	16.4	15.7	15.6	15.2	4610	4260
LSD (0.05)			2.8		0.7		870	

* Stage of sugarbeet at first application.

Summary

Sugarbeet treated with Lorsban at 2 lb/A yielded less or tended to yield less than sugarbeet treated with Lorsban at 1 lb/A. Sugarbeet stands before thinning were reduced by the two highest rates of desmedipham at each growth stage. The rates were higher than would be normally applied to sugarbeet to deliberately cause sugarbeet injury. Several of the treatments reduced sugarbeet yield in tons and/or extractable sucrose. Root maggot damage was less on sugarbeet treated with the high herbicide rates than on untreated sugarbeet. This suggests that desmedipham injured sugarbeet are affected less by root maggot than undamaged sugarbeet. Perhaps root maggot flies are more attracted to healthy, non-injured plants for egg laying.

Interaction of soil applied herbicides and Lorsban insecticide, Crookston, 1992. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi to the center four rows of six row plots 2:30 pm May 5 when the air temperature was 66F, soil temperature at six inches was 48F, relative humidity was 30%, wind velocity was 7 mph, and soil moisture was fair. Incorporation was with a rototiller set four inches deep for EPTC and cycloate and two inches deep for diethatyl. Lorsban 15G at 6.5 or 13 pounds product per acre was applied modified in-furrow at planting. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Sethoxydim + Dash at 0.2 lb ai/A+1 qt/A was applied to the entire plot area May 21 and July 22. Sugarbeet was cultivated June 2. Sugarbeet injury was evaluated June 3. Sugarbeet was counted in the center two rows of each plot June 11. Sugarbeet was hand weeded and hand thinned to an eight inch spacing June 11. Ten sugarbeet from each plot were rated July 15 for root maggot damage using the following scale: 0=no damage, 1=1 to 4 small scars, 2=5 to 10 small scars or up to 3 larger scars, 3=more than 3 larger scars, 4=50 to 75% of root blackened by scars, 5=more than 75% blackened or dead beet. The mean of these ten ratings is the sugarbeet root maggot damage rating. Sugarbeet from the center two rows of each plot was harvested September 29.

		Sgbt injury		Root maggot* damage rating		Prethin** sgbt stand		Root Yield		Sucrose		Extract Sucrose	
		Lorsban (lb/A)											
Treatment	Rate	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
	lb/A	---%---		--index-		plts/70'		--Ton/A--		----%----		---lb/A--	
Cycloate	6	15	16	2.4	2.6	216	176	14.3	10.2	15.2	14.5	3860	2590
Diethatyl	6	12	12	2.9	2.6	214	184	12.0	12.0	15.1	15.2	3180	3240
Diethatyl	8	10	18	2.8	2.6	220	178	13.8	13.2	15.0	15.3	3610	3570
EPTC	2	25	39	2.5	1.9	239	174	15.6	12.1	15.0	15.2	4080	3200
EPTC	4	66	75	1.7	1.6	148	122	13.0	12.4	15.6	14.9	3640	3250
Untreated	0	0	0	2.5	3.0	252	235	12.2	12.5	14.9	14.9	3250	3260
LSD (0.05)		6		0.3		18		2.6		NS		770	

* 0=no damage, 5=severely injured or dead.
** Sugarbeet plants per 70 feet of row prior to thinning.

Summary

Sugarbeet treated with Lorsban at 2 lb/A plus cycloate or EPTC yielded less or tended to yield less than sugarbeet treated with Lorsban at 1 lb/A plus cycloate or EPTC. All herbicides caused significant sugarbeet injury and reduced pre-thinned sugarbeet stands. However, remaining stands were sufficient to obtain optimum sugarbeet populations after thinning. EPTC at 4 lb/A caused severe sugarbeet injury but the sugarbeet recovered and yielded as much as the untreated check. Sugarbeet root maggot affected herbicide injured sugarbeet less than undamaged sugarbeet. Plots with the most severe herbicide injury had the lowest root maggot damage ratings. Perhaps root maggot flies are more attracted to healthy, non-injured plants for egg laying.

Insecticide influence on simulated spray drift, Fargo, 1992. Diethatyl + cycloate at 3+3 lb ai/A was broadcast over entire plot area April 29 and incorporated with a 'Kongskilde Triple K' field cultivator and a second time with an 'Alloway Seedbetter' field cultivator. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 29. Sugarbeet was hand thinned to an 8 inch spacing May 28. Plots were cultivated May 21 and June 15 and maintained weed free by hand weeding thoughtout 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 40 psi through 8001 nozzles to the center four rows of six row plots at 11:30 am June 11 when the air temperature was 85F, soil temperature at six inches was 68F, relative humidity was 47%, wind velocity was 10 mph, soil moisture was good, and sugarbeet was in the 6 to 8 leaf stage. Sugarbeet injury was evaluated July 10. Sugarbeet was harvested and counted from the center two rows of 35 foot long plots September 15.

Treatment*	Rate	Sugarbeet Injury		Sgbt Harvest Stand		Root Yield		Extract Sucrose	
		Count	Untrt	Count	Untrt	Count	Untrt	Count	Untrt
	(lb/A)	-----%-----		-plts/70ft-		---ton/A---		----lb/A---	
Imazethapyr+Sun-It	0.0005+1.5pt	75	61	39	51	11.6	14.6	1990	2490
Imazethapyr+Sun-It	0.0025+1.5pt	99	100	1	2	0.1	1.0	0	50
Imazethapyr	0.0025	2	2	82	84	24.8	26.1	4450	4820
Nicosulfuron+Scoil	0.01+1.5pt	99	100	2	2	0.9	0.9	50	90
Nicosulfuron+Scoil	0.02+1.5pt	100	100	1	1	0.4	0.4	40	50
Nicosulfuron	0.01	0	5	82	84	23.3	24.4	4290	4460
Thif+trib+X-77	0.0005+0.25%	100	100	2	2	0.7	1.1	70	100
Thif+trib+X-77	0.001+0.25%	94	100	6	2	2.7	0.9	400	50
Thif+trib	0.001	24	24	73	79	22.8	22.6	3940	4290
Untreated	0	0	0	77	85	25.4	25.5	4610	4600
LSD(0.05)		5		6		2.0		480	

* Sun-It and Scoil = methylated seed oil additives from Agsco.
X-77 = non-ionic surfactant from Valent.

Summary

Most treatments either caused too much or too little injury to evaluate the interaction of Counter and simulated spray drift. Only Imazethapyr+Sun-It at 0.0005 gave the desired level of injury. Sugarbeet treated with Counter plus imazethapyr+Sun-It at 0.0005 yielded less than sugarbeet only treated with imazethapyr. This suggests that Counter increased sugarbeet susceptibility to imazethapyr but the effect was not large. Also, sugarbeet treated with Counter plus imazethapyr at 0.0025, nicosulfuron at 0.01, or thifensulfuron+tribenuron at 0.001 lb/A tended to yield less than sugarbeet treated only with herbicide. Herbicides were more toxic to sugarbeet when applied with an adjuvant rather than alone.

Time of cultivation, Fargo, 1992. 'KW 1119' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 30. Sethoxydim + Scoil at 0.1 lb ai/A + 1.5 pt/A, desmedipham at 0.5 lb ai/A, and clopyralid at 0.09 lb ai/A were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots 12:15 pm June 10 when the air temperature was 84F, soil temperature at six inches was 63F, relative humidity was 47%, wind velocity was 9 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, wild oats was 8 to 10 inches tall, and redroot pigweed was in the 2 to 8 leaf stage. Row-crop cultivation was done one and five days before and one and five days after herbicide application. Wild oats and redroot pigweed control and sugarbeet injury were evaluated July 4.

Treatment (date)	Wild Oats control	Redroot Pigweed control	Sugarbeet injury
	------------	(%)	------------
Cultivation (June 5) + Sethoxydim (June 10)	98	0	0
Cultivation (June 9) + Sethoxydim (June 10)	95	0	0
Sethoxydim (June 10) + Cultivation (June 11)	98	0	0
Sethoxydim (June 10) + Cultivation (June 15)	100	0	0
Sethoxydim (June 10)	96	0	0
Cultivation (June 5) + Desmedipham (June 10)	0	90	0
Cultivation (June 9) + Desmedipham (June 10)	0	95	0
Desmedipham (June 10) + Cultivation (June 11)	0	88	0
Desmedipham (June 10) + Cultivation (June 15)	0	90	0
Desmedipham (June 10)	0	88	0
Cultivation (June 5) + Clopyralid (June 10)	0	0	0
Cultivation (June 9) + Clopyralid (June 10)	0	0	0
Clopyralid (June 10) + Cultivation (June 11)	0	0	0
Clopyralid (June 10) + Cultivation (June 15)	0	0	0
Clopyralid (June 10)	0	0	0
HIGH MEAN	100	95	0
LOW MEAN	0	0	0
EXP MEAN	32	30	0
C.V. %	8	12	0
LSD 5%	4	5	NS
LSD 1%	5	7	NS
# OF REPS	4	4	4

Summary

Weed control was evaluated in the non-cultivated band over the rows. Cultivation did not reduce weed control from sethoxydim or desmedipham.

Herbicide soil residual, Fargo (NW section 22), 1989-1992. 'Evans' soybeans were solid seeded at 59 lb/A June 2, 1989 to the entire plot area. Herbicides were applied 10:00 am July 7, 1989 when the air temperature was 79F, soil temperature at six inches was 74F, relative humidity was 47%, wind was 8 mph, soil moisture was poor, and soybean was in the one trifoliolate stage (2 inches tall) to the four trifoliolate stage (6 inches tall). Plots were 14 feet wide and 45 feet long with the center 10 feet treated with herbicides in 8.5 gpa water at 38 psi through 8001 nozzles. The entire experiment was treated with sethoxydim+Dash at 0.2 lb/A + 1 qt/A June 26, 1989 and acifluorfen+sethoxydim+Dash at 0.25+0.2 lb/A + 1 qt/A July 10, 1989. Clopyralid at 0.2 lb/A was spot sprayed to control thistles July 10, 1989. 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. Spring tillage in 1992 was with a 'Kongskilde Triple K' field cultivator operated the same direction as the herbicide plots. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 19, 1992. Seeding was done parallel and perpendicular to plots to ensure a dense sugarbeet population. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.33 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 12, 1992. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.9 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 29, 1992. Sugarbeet injury was evaluated June 29 and July 10, 1992.

Treatment*	Rate	July 24, 1991 Sugarbeet injury	June 29, 1992 Sugarbeet injury	July 10, 1992 Sugarbeet injury
	(lb/A)	(%)	(%)	(%)
Imazethapyr+X-77	0.12+0.25%	85	3	5
Imazethapyr+X-77	0.06+0.25%	58	3	0
Imazethapyr+X-77	0.03+0.25%	14	3	8
Imazethapyr+X-77	0.015+0.25%	0	0	0
Imazamethabenz	0.6	0	0	0
Imazamethabenz	0.3	3	0	0
Imazamethabenz	0.15	0	0	0
Metribuzin-DF	1	0	0	0
Metribuzin-DF	0.5	0	0	3
Metribuzin-DF	0.25	0	0	0
Nicosulfuron	0.125	3	0	0
Nicosulfuron	0.06	5	0	3
Nicosulfuron	0.03	5	0	3
DPX-E9636+Nicosulfuron	0.062+0.062	4	0	0
DPX-E9636+Nicosulfuron	0.03+0.03	3	0	0
DPX-E9636+Nicosulfuron	0.015+0.015	0	0	3
Primisulfuron	0.06	91	45	40
Primisulfuron	0.03	59	36	25
Primisulfuron	0.015	24	8	3
C.V. %		31	106	207
LSD 5%		8	8	14
LSD 1%		11	10	19
# OF REPS		4	4	4

* X-77 = non-ionic surfactant from Valent

SUMMARY: Sugarbeet seeded in 1991 were significantly injured by imazethapyr at 0.12, 0.06, and 0.03 lb/A and by primisulfuron at 0.06, 0.03, and 0.015 lb/A applied in 1989. Sugarbeet seeded in 1992 were significantly injured by primisulfuron at 0.06 and 0.03 lb/A applied in 1989.

Carryover of soybean herbicides, Fargo (NW section 22), 1990-1992. '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. Spring tillage in 1992 was with a 'Kongskilde Triple K' field cultivator operated the same direction as the herbicide plots. 'Seedex Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 19, 1992. Seeding was done parallel and perpendicular to plots to ensure a dense sugarbeet population. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.33 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 12, 1992. Desmedipham&Phenmedipham + sethoxydim + clopyralid at 0.9 + 0.3 + 0.09 lb ai/A was broadcast applied to all plots June 29, 1992. Sugarbeet injury was evaluated June 29 and July 10, 1992.

		June 24, 1991					July 8, 1991				1992	
											6-29	7-10
Treatment	Rate	Sgbt	Wht	Oat	Sufl	Kocz	Sgbt	Wht	Oat	Sufl	Sgbt	Sgbt
	(lb/A)	(% injury)										
Chlorimuron	0.004	94	30	31	54	98	91	30	19	48	70	53
Chlorimuron	0.008	98	33	18	69	97	98	46	15	74	90	76
Nicosulfuron	0.125	63	10	23	31	80	59	21	20	19	0	3
Nicosulfuron	0.06	30	10	3	10	40	33	18	8	8	0	0
Nicosulfuron	0.03	14	0	0	3	20	18	10	3	8	3	5
DPX-E9636+Nico	0.062+0.062	39	5	20	38	65	38	23	15	20	0	3
Primisulfuron	0.06	100	84	84	98	99	100	97	73	99	96	86
HIGH MEAN		100	84	84	98	99	100	97	73	99	96	86
LOW MEAN		14	0	0	3	20	18	10	3	8	0	0
EXP MEAN		62	24	25	43	71	62	35	22	39	37	32
C.V. %		23	61	92	30	16	25	36	49	34	17	33
LSD 5%		22	22	35	19	17	24	18	16	20	9	16
LSD 1%		29	30	48	26	24	32	25	21	27	13	22
# OF REPS		4	4	4	4	4	4	4	4	4	4	4

Summary

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

Multispecies screening of herbicides. Dexter, Alan G., Richard K. Zollinger and John D. Nalewaja. The objective of this experiment was to determine the response of several crop and weed species to new and established herbicides. Experiments were on a silty clay soil with 4% organic matter near Fargo, ND. Preplant incorporated herbicides were applied May 19, 1992 in 17 gpa water at 40 psi through 8002 nozzles to the center 7 feet of 11 foot by 40 foot plots when the air temperature was 70 F, and six-inch soil temperature was 59 F. Incorporation was two passes with a field cultivator plus rolling crumblers operated three inches deep. Canola, crambe, buckwheat (tame), 'BJ1320' sugarbeet, safflower, 'Neche' flax, 'Morex' barley, 'Valley' oats, 'Gus' HRS wheat, 'Vic' durum wheat, 'IS-343A' corn, 'McCall' soybean, 'Othello' pinto bean, and 'IS-3311' sunflower were seeded May 19 across the preplant incorporated herbicide treated plots and across plots that were treated June 22 with postemergence herbicides. Wild mustard, green and yellow foxtail, and kochia populations were natural. Postemergence herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 7 feet of 11 foot by 40 foot plots when air temperature was 70 F, six-inch soil temperature was 64 F and relative humidity was 72%. Size of plants when treated was wild mustard 5 to 10 inches, green and yellow foxtail 3 to 5 inches, kochia 0.5 to 5 inches, canola 5 inches, carmbe 5 inches, buckwheat 7 to 9 inches, sugarbeet 4- to 6-leaf, safflower 4 to 7 inches, flax 7 inches, barley 14 inches, oats 12 inches, HRS wheat 11 inches, durum wheat 11 inches, soybean first trifoliolate, pinto bean second trifoliolate, corn 6 to 10 inches, and sunflower 6-leaf. Percent control or percent injury was evaluated July 8 for preplant incorporated herbicides and July 17 for postemergence herbicides.

Several new postemergnece herbicides gave little injury to small acreage crops. For example, DPX-66037 on sugarbeet, safflower, flax, and pinto bean' MON-12000 on flax and pinto bean; and Quinchloral on buckwheat (tame), pinto bean and sunflower. Preplant incorporated herbicides that were relatively safe on small acreage crops included MON-12000 & MON-13900 on pinto bean; acetochlor on flax, sunflower, and pinto bean; SAN-582 on flax, sunflower, and pinto bean; MON-13200 on canola, crambe, safflower, and sunflower; DE-498 & trifluralin & DE-498 & metolachlor on pinto bean; and clomazone on buckwheat (tame). (Department of Crop and Weed Sciences, North Dakota State University, Fargo).

Table. Injury to or control of several species, Fargo, 1992. (Dexter, Zollinger, and Nalewaja).

Treatment*	Rate	Wimu	Fxtl	KOCZ	Cano	Cram	Buwh	Sgbt	Saff	Flax	Barl	Oats	Hrsw	Duwt	Soyb	Pnto	Corn	Sufl
	lb/A pt/A	- - - - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	percent control or injury	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
Preplant Incorporated																		
MON-12000&MON-13900	0.075	100	53	98	99	100	97	100	93	95	5	0	0	5	17	7	3	98
Acetochlor	1.75	48	82	47	38	30	35	45	48	13	62	85	72	85	10	7	0	0
SAN-582	1.5	63	85	47	47	47	27	27	47	8	70	73	60	78	7	0	0	3
MON-13200	0.25	27	94	80	13	13	63	93	10	22	82	83	83	85	23	30	60	0
DE-498&Trifluralin	0.06+0.85	100	92	99	100	100	97	100	98	97	77	80	75	72	8	15	50	95
DE-498&Metolachler	0.06+2.34	100	95	99	100	100	96	100	97	96	68	57	63	87	5	7	45	92
Alachlor	3	40	63	35	47	50	12	57	33	3	47	60	58	87	0	0	0	0
Trifluralin	1	7	94	87	0	0	83	87	3	40	40	78	73	33	0	0	52	0
Imazethapyr	0.06	100	95	100	100	100	94	100	98	97	80	82	82	92	12	13	78	99
Clomazone	1	43	92	92	53	98	8	33	20	92	73	88	90	80	3	17	92	20
EPTC & Dichlormid	4	50	70	25	5	7	33	12	3	7	93	97	95	97	12	0	0	0
F6285	0.375	98	80	100	83	83	98	100	55	30	57	52	53	53	3	28	57	53
LSD (0.05)		23	10	17	17	16	27	16	23	13	20	15	17	15	NS	16	11	11
Postemergence																		
Rimsulfuron+ X-77	0.0156+ 0.25%	100	80	50	99	99	58	70	55	86	93	82	93	96	78	37	3	96
Rimsulfuron+ Metr+ X-77	0.0156+ 0.125+ 0.25%	100	70	43	99	99	65	77	52	80	87	43	93	96	82	25	0	53
DPX-66037+X-77	0.031+0.25%	100	20	28	22	23	55	10	12	13	58	8	18	37	15	8	7	42
MON-12000+X-77	0.032+0.25%	100	0	30	98	99	35	81	37	8	2	2	3	5	81	3	0	99
Quinclorac+ Sun-It II	0.25+ 1.5 pt	33	23	23	20	22	0	28	68	78	7	0	2	0	2	2	2	4
Lactofen+OC	0.2+2 pt	100	0	88	99	99	99	25	99	99	18	20	20	22	10	17	0	13
Imazethapyr+ Sun-It II	0.047+ 1.5 pt	100	93	97	98	99	82	99	87	55	77	62	87	95	0	5	43	93
Imep+Seth+ Sun-It II	0.047+0.2+ 1.5 pt	100	96	94	98	99	82	99	73	25	93	99	97	97	0	3	99	99
Clim+Thif+ X-77	0.004+0.004+ 0.25%	100	0	65	98	99	43	99	20	35	10	23	12	32	0	18	2	99
Bentazon+ Sun-It II	0.75+ 1.5 pt	65	0	15	63	55	13	62	70	0	0	0	0	0	0	5	0	7
Nicosulfuron+ Sun-It II	0.031+ 1.5 pt	100	95	75	99	99	82	83	67	73	95	96	93	96	15	5	0	10
Dicamba	0.25	91	0	92	67	99	91	88	98	27	12	2	6	3	96	88	0	90
Clopyralid	0.19	0	0	7	0	13	5	0	99	0	0	0	0	0	99	99	0	83
Primisulfuron+ Sun-It II	0.036+ 1.5 pt	100	92	89	96	99	28	82	95	78	92	92	93	96	82	60	0	99
Imazamethabenz+ Sun-It II	0.31+ 1.5 pt	98	18	13	73	98	25	75	10	52	17	48	0	3	27	38	7	2
Thif&Trib+2,4-D+ X-77	0.023+0.25+ 0.25%	100	13	96	99	99	88	99	96	82	2	2	2	1	70	40	2	94
Desmedipham	0.75	43	0	7	0	0	10	0	10	10	6	4	3	4	0	0	0	0
Acifluorfen	0.38	100	37	18	96	99	73	33	83	77	7	10	13	11	0	0	5	14
LSD (0.05)		21	22	18	13	16	20	24	26	22	15	21	8	12	17	21	9	19

* X-77 = non-ionic surfactant from Valent; Sun-It II = methylated seed soil from Agsco; Cano = canola, Cram = crambe, Buwh = buckwheat (tame), Sgbt = sugarbeet, Saff = safflower, Barl = barley, HRSW = Hard Red Spring wheat, Duwt = durum wheat, Soyb = soybean, Pnto = pinto bean, Sunf = sunflower, Fxtl = green and yellow foxtail.

Wild oat control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 4. Treatments (2-3 lf) were applied to 2- to 3-leaf wheat, 2- to 2.5-leaf wild oats, 2-leaf common lambsquarters, 2- to 3-leaf wild mustard, 0.5-inch-tall kochia, and cotyledon- to 1-leaf wild buckwheat on May 14 with 60 F, 48% RH, a partly cloudy sky, and 20 mph wind. Treatments (4-5lf) were applied to 4- to 5-leaf wheat, 3- to 4-leaf common lambsquarters, 3- to 4.5-leaf wild oats, and 1- to 2-leaf green and yellow foxtail with 48 F, 55% RH, a clear sky, and 15 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oats and common lambsquarter 10 plants per square ft and wild mustard 4 per square yard.

		June 6				July 28				Aug 17
Treatment	Rate	Wheat inj	Wioa	Colq	Wimu	Wioa	Colq	KOCZ	Wibu	Yield
	oz/A	-----	-----	-----	-----	%	-----	-----	-----	bu/A
Diclofop (2-3lf)	12	0	90	0	0	85	0	0	0	13.2
Diclofop + Sun-it (2-3lf)	12+.12G	0	94	0	0	93	0	0	0	10.1
Immb-SG + X-77 (2-3lf)	5+.25%	0	90	13	99	84	0	0	99	13.0
Cheyenne® (2-3lf)	7.52	0	96	99	99	84	92	98	88	27.3
Diclofop + Sun-it (4-5lf)	16+.12G	0	69	0	0	68	0	0	40	9.0
Immb-SG + X-77 (4-5lf)	5+.25%	0	66	35	95	48	0	0	0	8.7
Immb-SG + Sun-it (4-5lf)	5+.25G	0	78	49	98	50	0	0	0	8.2
Difenzoquat (4-5lf)	10	0	61	0	0	66	0	0	0	9.8
Dife+Immb-SG+X-77 (4-5lf)	6+2.5+.25%	1	77	0	98	55	0	0	0	9.8
Cheyenne+ (4-5lf)	7.52	4	87	99	99	84	99	99	0	14.4
Tiller®(4-5lf)	9.4	6	91	98	98	95	99	18	0	15.5
Untreated	0	0	0	0	0	0	0	0	0	7.1
C.V. %		113	13	30	2	15	14	35		18.9
LSD 5%		1	13	13	1	13	4	8		3.2
# OF REPS		4	4	4	4	4	4	4	1	4

Summary

None of the herbicide treatments injured wheat. Yields were low because the dense wild oats gave early competition during the dry early season preventing wheat tillering. Cheyenne applied at the 2- to 3-leaf stage gave good control of wild oats and other weeds and a 20 bu/A yield increase compared to the untreated. This treatment applied at the 4- to 5-leaf stage gave good weed control but only increased wheat 8 bu/A. Diclofop and imazamethabenz gave greater wild oats control when applied at the 2- to 4-leaf stage than the 4- to 5-leaf stage. Cheyenne was equally effective at both stages of application.

Wild oats control in wheat, Carrington 1992. 'Amidon' hard red spring wheat was seeded April 30. All treatments were applied to 4-leaf wheat and redroot pigweed, 1- to 2-leaf green foxtail, 4-inch-tall common lambsquarter, and 3-inch tall kochia on June 2 with 65 F, 68% RH, a clear sky, and 11 mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were common lambsquarter 1 plant per square ft, kochia 1 plant per square yard and green foxtail was variable and drought stressed.

Treatment[a]	Rate	July 7 Wheat inj	Grft	Colq	KOCZ
	oz/A	---------	%	---------	
Diclofop	12	0	46	0	0
Diclofop + Sun-it	12+.12G	0	60	0	0
Imazamethabenz-SG + X-77	5+.25%	0	7	0	8
Cheyenne®	7.52	0	75	99	98
Diclofop + Sun-it	16+.12G	0	34	0	0
Imazamethabenz-SG + X-77	5+.25%	0	25	3	5
Imazamethabenz-SG + Sun-it	5+.25G	0	26	6	16
Imazamethabenz-SG + Scoil	5+.25G	0	48	13	5
Difenzoquat	10	0	4	0	0
Difenzoquat + Immb-SG + X-77	6+2.5+.25%	0	34	0	0
Cheyenne	7.52	0	73	99	92
Tiller®	9.4	0	70	92	54
Untreated	0	0	0	0	0
C.V. %		0	50	33	64
LSD 5%		NS	28	11	20
# OF REPS		4	4	4	4

Summary

The area where the experiment was located did not contain wild oats. The herbicide treatments did not injure wheat. Cheyenne gave acceptable (70%) control of grass and broadleaf weeds. Tiller adequately controlled green foxtail and common lambsquarters, but only gave 54% control of kochia.

Wild oat control in wheat, Hettinger 1992. 'Grandin' hard red spring wheat was seeded April 16. Treatments were applied to 3.5-leaf wheat and wild oats on May 19 with 77 F, 62% RH, clear sky, and 5-mph wind. Hard frost occurred on both May 26 and June 6. Bromoxynil + MCPA at 4 + 4 oz/A was applied for broadleaf control on June 9. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat density was 100 per square yard.

		July 5				August 14	
Treatment	Rate	Wheat inj	Wioa	Wioa	hght	Test wght	Wheat yield
	oz/A	--- %	---		cm	lb/bu	bu/A
Diclofop	12	0	50	42	71	69	13.1
Diclofop+Sun-it	12+.12G	0	63	77	68	63	13.3
Diclofop+Sun-it	16+.12G	1	79	70	66	62	15.4
Immb-SG+X-77	5+.25%	0	35	51	65	62	8.8
Immb-SG+Sun-it	5+.25G	0	76	75	68	63	15.5
Immb-SG+Scoil	5+.25G	0	79	79	69	63	15.7
Difenzoquat	10	0	13	13	74	64	12.4
Dife+Immb-SG+X-77	6+2.5+.25%	0	59	51	74	64	15.7
Cheyenne®	7.52	3	88	82	70	62	18.3
Tiller®	9.4	0	55	40	67	63	15.9
Untreated	0	0	0	0	63	61	10.3
C.V. %		310	35	39	12	2	48.8
LSD 5%		NS	28	38	NS	NS	NS
# OF REPS		4	4	4	4	4	4

Summary

None of the herbicide treatments injured wheat. Weed populations were quite variable making evaluation difficult and giving a high LSD.

Wild oats control in wheat, Minot 1992. 'Amidon' hard red spring wheat was seeded on April 16. Treatments were applied to 5-leaf wheat and wild oats, 0.5- to 1-inch tall kochia, 1- to 3-inch tall common lambsquarter, 2- to 4-inch tall Russian thistle, 0.5- to 3.25-inch tall redroot pigweed 3- to 6-leaf green foxtail, and 4-leaf wild buckwheat on June 3 with 78 F, 70% RH, partly cloudy sky, and 4- to 12-mph wind. Treatments were applied with a shielded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. 2-3lf and 4-5lf treatments were applied on the same day.

		July 10					August 19	
Treatment[a]	Rate	Wheat inj	Grft	Ruth	Colq	KOCZ	Height	Yield
	oz/A	-----------		%		----------	inches	bu/A
Diclofop(2-3lf)	12	0	76	10	0	0	30	52.6
Diclofop+Sun-it(2-3lf)	12+.12G	0	83	0	0	0	29	50.2
Immb-SG+X-77(2-3lf)	5+.25%	0	0	23	0	0	30	52.4
Cheyenne® (2-3lf)	7.52	1	99	99	99	88	30	54.0
Diclofop+Sun-it(4-5lf)	16+.12G	0	87	0	0	0	29	51.2
Immb-SG+X-77(4-5lf)	5+.25%	0	0	26	4	7	31	53.1
Immb-SG+Sun-it(4-5lf)	5+.25G	0	19	50	20	10	29	51.4
Immb-SG+Scoil(4-5lf)	5+.25G	1	23	49	0	0	29	52.7
Difenzoquat(4-5lf)	10	0	5	4	0	0	31	50.9
Dife+Immb-SG+X-77(4-5lf)	6+2.5+.25%	0	0	19	0	0	30	51.6
Cheyenne (4-5lf)	7.52	0	99	99	99	89	30	53.4
Tiller® (4-5lf)	9.4	3	87	76	93	17	31	50.5
Untreated	0	0	0	0	0	0	30	54.1
C.V. %		332	22	27	24	63	9	7.8
LSD 5%		NS	14	14	8	15	NS	NS
# OF REPS		4	4	4	4	4	4	4

Summary

The wild oats infestation was too sparce for evaluation. None of the herbicide injured wheat as determined by the visible injury or wheat yield. Cheyenne gave 88% or more control of grass and broadleaf weeds. Tiller was less effective than Cheyenne for kochia and Russian thistle control.

Wild oat control in hard red spring wheat, Williston 1992. 'Amidon' hard red spring wheat was seeded April 29. Treatments (2-3lf) were applied to 3-leaf wheat and 2- to 3-leaf wild oats on May 22 with 51 F, 58% RH, clear sky, and 6 mph wind. Treatments (4-5lf) were applied to 5.5-leaf wheat, 4.5- to 5-leaf wild oats, 2-leaf green foxtail, and 1- to 3-inch tall Russian thistle on June 2 with 70 F, 70% RH, clear sky, and 7 mph wind. All treatments were applied to dry soil and plant surfaces with a soil temperature of 64 F taken at at a depth of 4 inches. A rainfall measuring 0.39 of an inch occurred on June 14. Method of application was a bicycle-type-plot sprayer with a wind shield mounted on a G-Allis Chalmers delivering 8.5 gpa at 32 psi through an 8001 flat fan nozzle to a 7 ft wide area the length of 10 by 25 ft plot. The experiment was a randomized complete block design with 4 replicates.

		July 9		Aug 3	August 27	
Treatment	Rate	Wheat inj	Wild oats	Wild oats	Test wght	Yield
	oz/A	------	%	------	lbs/bu	bu/A
Diclofop(2-3lf)	12	0	89	85	59	55.8
Diclofop+Sun-it(2-3lf)	12+0.12G	0	99	98	59	59.1
Imazamethabenz-SG+X-77(2-3lf)	5+0.25%	0	90	90	59	55.8
Cheyenne® (2-3lf)	7.52	0	99	97	60	55.6
Diclofop+Sun-it(4-5lf)	16+0.12G	6	99	97	59	54.1
Imazamethabenz-SG+X-77(4-5lf)	5+0.25%	3	92	86	59	57.8
Imazamethabenz-SG+Sun-it(4-5lf)	5+0.25G	4	87	90	59	55.9
Imazamethabenz-SG+Scoil(4-5lf)	5+0.25G	1	91	88	59	56.9
Difenzoquat(4-5lf)	10	4	85	83	59	53.8
Dife+Imazamethabenz-SG+X-77(4-5lf)	6+2.5+0.25%	1	88	85	59	52.8
Cheyenne (4-5lf)	7.52	2	98	96	59	58.5
Tiller®(4-5lf)	9.4	4	98	96	59	55.4
Untreated	0	0	0	0	59	51.4
C.V. %		9	5	5		5.9
LSD 5%		4	7	5		NS
# of Reps		4	4	4	1	4

Summary

None of the herbicide treatments caused injury to wheat as measured by visible injury, seed yield, or grain test weight. Wild oats infestation were light (about 1 plant per sq yard) so treatments did not significantly increase yield even though all treatments gave 83% or more wild oat control.

Preemergence wild oat control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 15. Treatments (PPI) were incorporated twice with a field cultivator plus harrow on April 15 with 50 F, 70% RH, cloudy sky, and 15 mph wind. Preemergence treatments (PEI) were incorporated twice with harrow on April 16 with 53 F, 60% RH, cloudy sky, and 10 mph wind. Treatment (Post 2-3lf) was applied to 2- to 3-leaf wheat, 2-leaf wild oats and wild mustard, 0.5 inch kochia, and 1-leaf wild buckwheat on May 14 with 61 F, 48% RH, partly cloudy sky, and 20 mph wind. Treatments (POST 4L) were applied to 4- to 5-lf wheat, 2- to 4-leaf wild oats, 2-inch tall kochia, and 2-leaf green and yellow foxtail on May 23 with 50 F, 50% RH, partly cloudy sky, and 15- to 20-mph wind. All treatments were applied with a bicycle-wheel-type plot sprayer delivering 17 gpa through 8002 flat fan nozzles for all soil applied treatments and 8.5 gpa through 8001 flat fan nozzles for the postemergent treatments at 35 psi to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oats 30 plants per square yd, wild mustard 1 plant per square yard on front replicates and 10 plants per yard yard on back replicates, and kochia was variable at less than 1 plant per square yard.

		June 2				July 31					Sep 10
Treatment	Rate	Wht inj	Fota	Wimu	KOCZ	Wht inj	Wioa	Fota	KOCZ	Colq	Yield
	oz/A	%									bu/A
UCC-C4243-10E(PPI)	1.4	1	85	96	98	0	9	59	98	95	40.5
UCC-C4243-10E(PPI)	1.9	3	97	98	99	0	0	77	99	95	54.9
UCC-C4243-10E(PEI)	1.4	5	89	67	83	0	16	64	79	15	50.8
UCC-C4243-50W(PEI)	1.4	1	91	53	79	1	10	63	78	33	52.2
UCC-C4243-50W(PEI)	1.9	0	92	70	72	0	18	62	75	18	53.5
Triallate(PPI)	16	5	11	5	0	1	95	0	0	0	48.3
Tria+UCC-C4243-50W(PPI)	16+1.9	19	98	98	99	5	96	73	99	99	54.2
Triallate(PEI)	16	1	9	0	0	4	89	0	9	0	44.0
Tria+UCC-C4243-50W(PEI)	16+1.4	5	98	71	92	9	88	59	86	40	60.6
Tria+UCC-C4243-50W(PEI)	16+1.9	5	97	68	93	3	84	50	79	23	58.5
Diclofop+PO(POST 2-3L)	12+.12G	3	66	0	0	1	87	26	0	45	52.5
Tiller®(POST 4L)	9.5	9	93	99	66	10	98	38	34	99	51.2
Immb-SG+Sun-it(POST 4L)	5+.25G	1	29	99	86	0	99	0	92	33	48.1
Untreated	0	0	0	0	0	0	0	0	0	0	51.4
C.V. %		139	15	23	17	147	24	47	23	33	
LSD 5%		8	15	19	15	5	19	27	19	30	
# OF REPS		4	4	4	4	4	4	4	4	2	1

Summary

Triallate + UCC-C4243 PPI and Tiller POST injured wheat, yield probably was not reduced. However, yields were only taken for one replicate because kochia in parts of the other replicates made those plots unharvestable with the small plot combine. Kochia control exceeded 90% at both evaluations when treated with UCC-C4243 PPI or imazamethabenz + Sun-it II. UCC-C4243 PPI or tiller POST gave greater than 90% common lambsquarter control. All UCC-C4243 treatments and tiller gave greater than 85% foxtail control at the early evaluation, control was less than 85% for all treatments at the July 31 evaluation.

Tiller® mixtures for wild oat control, Fargo 1992. 'Morex' barley was seeded April 15. Treatments were applied to 5- to 5.5-leaf barley, 3- to 4.5-leaf wild oats, 1- to 2-leaf green and yellow foxtail, 3- to 7-leaf wild mustard, and 3- to 4-leaf common lambsquarters on May 26 with 48 F, 55% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	June 2 Barley	June 26 Barley	July 28 Barley	July 28 Wioa	Aug 12 Yield
	oz/A	%	%	%	%	bu/A
Tiller®	6.6	17	5	4	90	49.8
Tiller	8.3	16	2	0	97	53.3
Tiller	9.3	21	5	3	98	54.3
Tiller+Thif&Trib	9.3+0.22	16	2	1	86	48.0
Tiller+Thif&Trib+Scoil	9.3+0.22+.18G	17	4	1	86	61.3
Tiller+Thif&Trib+Brox	9.3+.11+2	25	11	6	98	51.8
Tiller+Brox	9.3+3	21	3	2	95	52.8
Tiller+Triasulfuron	9.3+0.22	12	3	0	82	52.8
Fenx&MCPA+Thif&Trib	1.8&6.4+0.22	31	19	6	92	54.3
Untreated	0	0	0	0	0	41.3
C.V. %		19	48	121	4	15.8
LSD 5%		5	4	4	4	NS
# OF REPS		4	4	4	4	4

Summary

All herbicide treatments significantly injured barley at the early (June 2) evaluation. Barley generally recovered from injury and was 6% or less at the July 28 evaluation. Fenoxaprop & MCPA + thifensulfuron & tribenuron and Tiller + thifensulfuron & tribenuron + bromoxynil were the most injurious. Wild oats control exceeded 85% with all but the tiller + triasulfuron treatment.

<u>Imazamethabenz for wild oat and broadleaf weed control in wheat, Fargo 1992</u>. 'Gus' hard red spring wheat was seeded April 15. Treatments were applied to 4-leaf wheat, 2- to 4-leaf wild oats, wild buckwheat, and common lambsquarter and 4- to 6-leaf wild mustard on May 23 with 50 F, 48% RH, a partly cloudy sky, and 17-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oats greater than 100 plants per sq yard, wild mustard 1 plant per sq yard, common lambsquarter, wild buckwheat, and kochia between 10 and 50 plants per sq yard.

		June 7					July 30			
Treatment	Rate	Wheat inj	Wioa	Wibu	Wimu	Colq	Wioa	Colq	Kocz	Wibu
	oz/A	%								
Imazamethabenz+X-77	5+.25%	0	77	79	97	45	56	0	0	0
Imazamethabenz+X-77	7.5+.25%	1	81	85	97	70	67	0	0	0
Imazamethabenz-SG+X-77	5+.25%	0	72	70	96	64	60	0	0	0
Imazamethabenz-SG+X-77	7.5+.25%	1	90	85	98	67	78	0	0	5
Imazamethabenz-SG+Sun-itII	5+.25G	0	88	83	99	67	76	0	0	30
Imazamethabenz-SG+Sun-itII	7.5+.25G	2	90	85	99	72	84	25	0	20
Imazamethabenz-SG+Sun-itII	5+.12G	2	82	84	98	61	68	0	0	13
Imazamethabenz-SG+Sun-itII	7.5+.12G	2	87	82	98	66	82	0	0	23
Imazamethabenz-SG+Dife+X-77	3.7+8+.25%	4	92	89	99	78	67	0	0	0
Imazamethabenz-SG+Dife+Sun-itII	3.7+8+.25G	8	88	83	97	60	69	0	0	8
Imazamethabenz-SG+MCPA-ioe+X-77	5+8+.25%	1	76	72	99	99	59	99	0	8
Imazamethabenz-SG+MCPA-ioe+Sun-itII	5+8+.25G	5	88	80	99	97	72	99	0	18
Imazamethabenz-SG+Brox&MCPA+X-77	5+8+.25%	0	67	99	99	99	18	99	99	92
Imazamethabenz-SG+24-Dbee+X-77	5+8+.25%	15	71	58	98	99	43	99	91	0
Imazamethabenz-SG+Clpy&24-D+X-77	5+9.5+.25%	4	51	95	98	94	31	99	82	98
Immb-SG+Thif&Trib+MCPA-ioe+X-77	5+.5+4+.25%	12	83	99	99	99	55	99	98	73
Immb-SG+Dife+Thif&Trib+MCPA-ioe+X-77	5+8+.5+4+.25%	13	90	99	99	99	57	99	99	63
Imazamethabenz-SG+Trib+MCPA-ioe+X-77	5+.25+4+.25%	12	77	96	99	99	52	99	99	30
Immb-SG+Trib+MCPA-ioe+Sun-itII	5+.25+4+.25G	12	89	98	99	99	72	99	99	23
Immb-SG+Thif&Trib+MCPA-ioe+Sun-itII	5+.5+4+.25%	15	84	99	99	99	69	98	99	49
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		111	9	8	1	12	17	8	13	62
LSD 5%		8	10	9	2	16	14	5	7	23
# OF REPS		4	4	4	4	3	4	4	4	4

Summary

None of the herbicide treatments caused important injury to wheat. The slight injury observed at the early evaluation was not evident at the late evaluation (data not presented). Wild mustard was controlled at 97% or more by all herbicide treatments. Imazamethabenz (liquid fertilizer) and the SG (soluble granule) equally controlled wild oats and broadleaf weeds. Wild oats and broadleaf weed control were greater or equal when imazamethabenz was applied with Sun-it as compared to with X-77 adjuvant. Sun-it II at 0.12 or 0.25 gallons/A equally enhance wild oat control by imazamethabenz. Bromoxynil & MCPA and clopyralid & 2,4-D antagonized wild oat control by imazamethabenz. Kochia control was greater than 90% when bromoxynil or a sulfonylurea was a component of the herbicide treatment.

<u>Imazamethabenz-SG with adjuvant volume, Fargo 1992</u>. 'Gus' hard red spring wheat was seeded April 15. Treatments were applied to 4- to 4.5-leaf wheat, 3- to 4.5-leaf wild oats, 1- to 2-leaf green and yellow foxtail, 3- to 7-leaf wild mustard, and 3- to 4-leaf common lambsquarters on May 26 with 48 F, 55% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oats 10 plants per sq ft, common lambsquarter 5 plants per sq ft, and wild mustard 5 plants per sq yard.

Treatment	Rate	June 9 Wheat inj	June 9 Wioa	June 9 Colq	June 9 Wimu	July 28 Wioa
	oz/A	%				
Imazamethabenz-SG+Sun-it II	2.0+.07G	0	61	0	90	30
Imazamethabenz-SG+Sun-it II	2.0+.13G	0	76	0	93	28
Imazamethabenz-SG+Sun-it II	2.0+.25G	0	76	0	93	34
Imazamethabenz-SG+Sun-it II	3.5+.07G	0	74	0	94	41
Imazamethabenz-SG+Sun-it II	3.5+.13G	0	76	18	94	41
Imazamethabenz-SG+Sun-it II	3.5+.25G	0	80	37	96	51
Imazamethabenz-SG+Sun-it II	5+.07G	0	79	39	96	29
Imazamethabenz-SG+Sun-it II	5+.13G	0	82	33	96	54
Imazamethabenz-SG+Sun-it II	5+.25G	0	83	41	97	58
Imazamethabenz-SG+ExpN	3.5+.25G	0	57	0	91	36
Imazamethabenz-SG+ExpS	3.5+.25G	0	46	0	87	10
Untreated	0	0	0	0	0	0
C.V. %		0	11	71	2	42
LSD 5%		NS	11	14	3	21
# OF REPS		4	4	4	4	4

Summary

None of the herbicide treatments injured wheat. Wild mustard control exceeded 85% with all imazamethabenz treatments. Wild oats control was greater from imazamethabenz applied with Sun-it II than with ExpN or ExpS. Wild oats control generally increased as the volume of Sun-it II increased.

Adjuvants with Imazamethabenz(LC) for wild oat control, Fargo 1992. 'Gus' hard red spring wheat was seeded April 15. Treatments were applied to 3-leaf wheat, 2- to 3-leaf wild oats, 1-inch tall kochia, and 4-leaf wild mustard and common lambsquarters on May 19 with 93 F, 5% RH, a clear sky 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were wild oats, common lambsquarters, and wild buckwheat 5- to 10-plants per sq ft and wild mustard 1 plant per sq ft.

		June 5				
Treatment	Rate	Wheat inj	Wioa	Colq	Wibu	Wimu
	oz/A	----------	----------	%	----------	----------
Imazamethabenz(LC)+X-77	3.7+.25%	0	71	50	44	98
Imazamethabenz(LC)+X-77	5+.25%	0	73	51	59	98
Imazamethabenz(LC)+X-77+Sun-itII	3.7+.25%+.25G	0	88	83	85	99
Imazamethabenz(LC)+X-77+Sun-itII	5+.25%+.25G	0	90	77	82	99
Imazamethabenz(LC)+Sun-itII	3.7+.25G	0	89	79	84	99
Imazamethabenz(LC)+Sun-itII	5+.25G	0	87	76	84	99
Imazamethabenz(LC)+X-77+Mor-act	3.7+.25%+.25G	0	84	73	83	99
Imazamethabenz(LC)+X-77+Mor-act	5+.25%+.25G	0	82	71	78	99
Imazamethabenz(LC)+Mor-act	3.7+.25G	0	81	71	78	99
Imazamethabenz(LC)+Mor-act	5+.25G	0	86	81	84	99
Immb(LC)+X-77+Clean crop	3.7+.25%+.25G	0	78	63	75	99
Immb(LC)+X-77+Clean crop	5+.25%+.25G	0	79	60	73	99
Imazamethabenz(LC)+Clean crop	3.7+.25G	0	78	51	66	99
Imazamethabenz(LC)+Clean crop	5+.25G	0	85	73	80	99
Untreated	0	0	0	0	0	0
C.V. %		0	6	19	9	1
LSD 5%		NS	7	17	10	1
# OF REPS		4	4	4	4	4

Summary

Imazamethabenz did not injure wheat regardless of adjuvant. The inclusion of X-77 with an oil adjuvant did not influence wild oats control from imazamethabenz. The general area of adjuvant effectiveness with imazamethabenz for wild oat control was Sun-it II > Mor-act > Clean crop > X-77. Wild mustard was controlled by imazamethabenz regardless of adjuvant. Adjuvant effectiveness in enhancement of imazamethabenz for common lambsquarters and wild buckwheat was similar for wild oats.

Broadleaf and grass control in small grains, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat and wild mustard and 3-inch tall kochia on May 23 with 50 F, 50% RH, partly cloudy sky, and 10-mph wind. Treatments were applied with a bicycle-wheel -type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed density for kochia was 10 per sq ft.

Treatment	Rate	June 10 Wheat inj	June 10 KOCZ	July 31 Wheat inj	July 31 KOCZ	Aug 27 Yield
	oz/A	%	%	%	%	bu/A
2,4-Ddma	6	1	45	0	31	8.9
2,4-Dbee	6	1	87	3	58	20.4
Dicamba-Na+MCPA-dma	1.5+4	5	90	15	94	30.6
Dicamba-Na+MCPA-bee	1.5+4	5	95	10	97	36.4
Dicamba-dma+MCPA-bee	1.5+4	4	94	5	99	40.3
Bromoxynil+MCPA-ioe	4+4	0	91	1	85	40.5
Bromoxynil-gel+MCPA-ioe	4+4	0	87	0	75	40.7
Bromoxynil+2,4-Dbee	3+6	0	81	6	61	30.9
Clpy&2,4-D	9.5	2	36	0	38	9.9
Thif&Trib+Dicamba-dma+X-77	0.2+1.5+.25%	1	99	3	98	44.9
Flox+2,4-D-dma	1+6	0	91	15	94	33.5
Flox+2,4-Ddma+Picl	1+6+.125	3	92	19	94	32.4
Thif&Trib+2,4-Dbee+X-77	0.2+4+0.25%	0	99	6	95	42.1
Mets+2,4-Dbee+X-77	0.06+4+.25%	1	99	1	96	43.4
Tria+2,4-Dbee+X-77	0.2+4+0.25%	0	99	1	97	46.0
Trib+2,4-Dbee+X-77	0.2+4+0.25%	1	99	1	97	46.6
Dakota®	6.5	2	78	0	46	25.8
Tiller®	6.6	4	72	0	34	13.5
Cheyenne®	7.52	0	99	1	96	46.0
Dakota+Bromoxynil	8.7+4	1	83	0	79	39.4
Dakota+Dicamba-Na	6.5+1	4	94	9	97	39.7
Propanil-DF+MCPA+PO	17+4+.25G	0	67	0	43	21.1
Untreated	0	0	0	0	0	6.7
C.V. %		414	7	121	16	13.2
LSD 5%		NS	8	7	16	6.0
# OF REPS		4	4	4	4	4

Summary

Kochia was the only weed present and extremely competitive. Wheat yield reflects the extent of kochia control and the rapidity with which kochia was controlled. Treatments which gave rapid control allowed the wheat to recover from competition. The July 31 injury values are not a direct response to the herbicide, but indicate late season tillering from delayed kochia control. 2,4-Dbee ester whether alone or with dicamba was more effective than the dma for kochia control. All treatments containing sulfonylurea herbicides effectively controlled kochia and wheat yield was the highest.

Broadleaf and grass control in small grains, Carrington 1992. 'Amidon' hard red spring wheat was seeded April 30. Treatments were applied to 4- to 5-leaf wheat, 3- to 4-leaf green and yellow foxtail, 2-inch tall common lambsquarter and redroot pigweed, 3-inch tall wild buckwheat and wild mustard,1- to 2-inch tall kochia, 1-inch tall prostrate pigweed, and 3-inch-tall Russian thistle on June 3 with 71 F, 64% RH, a partly cloudy sky, 16-mph wind, and 0.03-inch rain occurring 6 h after application. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were green and yellow foxtail 5 plants per sq ft, common lambsquarter 1 plant per sq ft, and kochia less than 1 plant per sq yard.

		July 7			
Treatment	Rate	Wheat inj	Grft& yeft	Colq	KOCZ
	oz/A	----------	%	----------	
2,4-Ddma	6	0	0	74	40
2,4-Dbee	6	0	5	99	40
Dicamba-Na+MCPA-dma	1.5+4	0	0	74	55
Dicamba-Na+MCPA-bee	1.5+4	0	0	99	73
Dicamba-dma+MCPA-bee	1.5+4	0	0	98	-
Bromoxynil+MCPA-ioe	4+4	0	0	98	40
Bromoxynil-gel+MCPA-ioe	4+4	0	0	97	48
Bromoxynil+2,4-Dbee	3+6	0	4	84	40
Clopyralid&2,4-D	9.5	0	0	87	70
Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	0	15	90	60
Fluroxypyr+2,4-Ddma	1+6	0	0	82	84
Fluroxypyr+2,4-Ddma+Picl	1+6+.125	0	15	99	99
Thif&Trib+24-Dbee+X-77	0.2+4+0.25%	0	0	99	99
Metsulfuron+2,4-Dbee+X-77	0.06+4+.25%	0	5	99	92
Triasulfuron+2,4-Dbee+X-77	0.2+4+0.25%	0	6	99	99
Tribenuron+2,4-Dbee+X-77	0.2+4+0.25%	0	0	99	99
Dakota®	6.5	0	76	98	48
Tiller®	6.6	1	66	99	50
Cheyenne®	7.5	1	75	99	99
Dakota+Bromoxynil	8.7+4	1	60	99	99
Dakota+Dicamba-Na	6.5+1	2	53	99	91
Propanil-DF+MCPA+PO	17+4+.25G	0	51	97	45
Untreated	0	0	0	0	0
C.V. %		416	52	14	14
LSD 5%		NS	14	17	19
# OF REPS		4	4	4	2

Summary

None of the herbicides injured wheat. Foxtail control by Dakota was reduced when applied with dicamba or bromoxynil. Common lambsquarters control was greater by 2,4-D ester than amine whether alone or with dicamba. All other treatments gave 80% or more common lambsquarters control. Kochia density was variable and occurred only in two replicates. Kochia control exceeded 80% with all sulfonylureas except thifensulfuron & tribenuron + dicamba-dma + X-77; cheyenne (fenoxaprop + thifensulfuron + tribenuron + MCPA); Dakota + bromoxynil and + dicamba Na.

<u>Broadleaf and grass control in small grains, Dickinson 1992</u>. 'Stoa' hard red spring wheat was seeded May 4. Treatments were applied to 4.5-leaf wheat, 4-leaf redroot pigweed and wild buckwheat, and 1- to 2-inch-tall Russian thistle on May 29 with a clear sky and no wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 28 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 8 Wheat inj	July 8 Rrpw	July 8 Wibu	July 8 Ruth	August 28 Test weight	August 28 Yield
	oz/A	%	%	%	%	%	%
2,4-Ddma	6	0	65	39	98	-	-
2,4-Dbee	6	1	98	75	99	60.8	77.4
Dicamba-Na+MCPA-dma	1.5+4	1	82	65	76	60.5	78.3
Dicamba-Na+MCPA-bee	1.5+4	1	99	99	96	60.0	74.2
Dicamba-dma+MCPA-bee	1.5+4	0	99	75	99	60.6	82.9
Bromoxynil+MCPA-ioe	4+4	0	99	87	99	61.0	75.4
Bromoxynil-gel+MCPA-ioe	4+4	3	85	72	88	60.6	72.2
Bromoxynil+2,4-Dbee	3+6	1	99	77	99	60.5	70.7
Clopyralid&2,4-D	9.5	0	99	99	99	60.8	77.0
Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	0	94	67	99	61.3	72.5
Fluroxypyr+2,4-Ddma	1+6	5	80	76	99	61.1	76.1
Fluroxypyr+2,4-Ddma+Picl	1+6+.125	0	99	98	99	61.1	77.0
Thif&Trib+2,4-Dbee+X-77	0.2+4+0.25%	6	99	99	99	61.0	70.9
Mets+2,4-Dbee+X-77	0.06+4+.25%	1	99	61	99	60.9	71.0
Tria+2,4-Dbee+X-77	0.2+4+0.25%	3	99	99	99	60.9	75.9
Tribenuron+24-Dbee+X-77	0.2+4+0.25%	3	98	98	99	60.9	75.8
Dakota®	6.5	2	75	30	76	61.0	79.5
Tiller®	6.6	4	80	20	87	61.1	78.7
Cheyenne®	7.52	0	99	99	99	61.0	76.4
Dakota+Bromoxynil	8.7+4	6	94	92	97	60.6	73.1
Dakota+Dicamba-Na	6.5+1	1	91	81	99	60.8	75.6
Propanil-DF+MCPA+PO	17+4+.25G	5	90	34	18	60.5	71.0
Untreated	0	1	0	0	0	60.3	76.7
C.V. %		179	15	26	12	.7	5.9
LSD 5%		NS	19	26	15	.6	6.0
# OF REPS		4	4	4	4	4	4

Summary

None of the herbicide injured wheat . The bromoxynil gel formulation tended to be less effective than the liquid formulation for Russian thistle and wild buckwheat control. Clopyralid & 2,4-D, fluroxypyr + 2,4-D + picloram, thifensulfuron & tribenuron, and Dakota + bromoxynil gave greater than 95% control of redroot pigweed, wild buckwheat, and Russian thistle.

Broadleaf and grass control in small grains, Hettinger 1992. 'Grandin' hard red spring wheat was seeded April 16. Treatments were applied to 3.5-leaf wheat and wild oats, 1- to 3.5-leaf green and yellow foxtail, 0.5- to 1.5-inch tall kochia and 1- to 2.5-inch tall Russian thistle on May 19 with 82 F, 70% RH, a clear sky, and 5-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 7						August 14					
Treatment	Rate	Wheat inj	Wioa	Fota	KOCZ	Wibu	Fibw	Brdl	Wioa	Fxtl	Hght	Test wght	Wheat yield
	oz/A	%									cm	lb/bu	bu/A
2,4-Ddma	6	0	0	0	36	0	10	24	8	72	77	63.7	27.2
2,4-Dbee	6	0	0	16	44	0	0	67	13	0	78	63.8	44.4
Dicamba-Na+MCPA-dma	1.5+4	0	0	13	87	99	15	93	3	0	83	63.5	40.6
Dicamba-Na+MCPA-bee	1.5+4	1	0	23	97	99	65	98	0	49	75	63.9	40.2
Dicamba-dma+MCPA-bee	1.5+4	0	0	3	96	98	40	99	0	13	77	63.6	34.3
Bromoxynil+MCPA-ioe	4+4	0	3	0	98	99	15	99	1	69	83	63.8	37.6
Bromoxynil-gel+MCPA-ioe	4+4	0	0	8	89	97	13	94	0	13	77	63.8	36.3
Bromoxynil+2,4-Dbee	3+6	0	0	5	80	43	30	93	0	0	77	63.7	36.1
Clopyralid&2,4-D	9.5	0	4	8	26	91	65	28	3	72	73	63.3	29.5
Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	0	0	0	99	98	0	99	0	0	78	63.3	31.3
Fluroxypyr+2,4-Ddma	1+6	0	0	0	96	93	-	98	3	0	79	63.6	40.6
Fluroxypyr+2,4-Ddma+Picl	1+6+.125	0	0	20	96	92	10	96	3	13	81	63.6	35.5
Thif&Trib+24-Dbee+X-77	0.2+4+0.25%	0	0	15	92	75	-	98	0	43	83	63.2	42.4
Mets+2,4-Dbee+X-77	0.06+4+.25%	0	0	15	86	50	0	92	3	23	80	63.8	36.6
Tria+2,4-Dbee+X-77	0.2+4+0.25%	0	3	9	93	97	40	99	23	13	78	63.7	41.4
Tribenuron+2,4-Dbee+X-77	0.2+4+0.25%	0	0	0	97	94	30	99	3	13	79	63.2	35.4
Dakota®	6.5	0	4	82	28	0	30	17	6	85	79	63.6	28.3
Tiller®	6.6	1	45	86	49	0	40	54	45	82	71	63.8	32.2
Cheyenne®	7.52	5	88	95	98	73	60	98	82	69	67	63.4	68.8
Dakota+Bromoxynil	8.7+4	3	29	68	89	48	20	92	26	0	73	63.2	30.1
Dakota+Dicamba-Na	6.5+1	3	10	89	88	82	20	98	12	23	75	63.6	32.4
Propanil-DF+MCPA+PO	17+4+.25G	0	0	80	82	90	10	94	1	45	73	63.5	28.0
Untreated	0	0	0	0	0	0	0	0	0	0	72	63.6	29.8
C.V. %		211	142	61	15	34		22	133	110	7	0.7	20.8
LSD 5%		2	16	24	16	47		25	26	49	NS	NS	10.7
# OF REPS		4	4	4	4	2	1	4	4	4	4	4	4

Summary

None of the herbicides caused important injury to wheat. Wheat grain test weight or wheat height were not influenced by herbicide treatment. Wheat yield directly related to weed control. The greater weed control with 2,4-D bee (ester) than 2,4-D dma (amine) resulted in a 17 bu/A improved wheat yield. Clopyralid & 2,4-D did not adequately control kochia and yield was not increased beyond that of the untreated wheat. However, Fluroxypyr + 2,4-D controlled kochia and increased yield by 13 bu/A. Cheyenne controlled kochia and wild oats and increased yield by 39 bu/A compared to untreated wheat. Dakota and Tiller were less effective for kochia and wild oats than the Cheyenne.

Broadleaf and grass control in small grains, Langdon, 1992. 'Gus' hard red spring wheat was seeded May 21. Treatments were applied to 5.5-leaf wheat on June 24. Treatments 1 through 8 were applied 70 minutes before a rainfall of 0.1-inch. Sixty minutes after the rain treatments 9 through 23 were applied, followed 30 minutes later by a 0.12-inch rainfall. The experiment was applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through a 8001 flat fan nozzle to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 23 Wheat inj	KOCZ	Wibu	Nfcf
	oz/A	---------	%	-------	
1. 2,4-Ddma	6	0	61	39	60
2. 2,4-Dbee	6	0	86	71	76
3. Dicamba-Na+MCPA-dma	1.5+4	0	86	68	81
4. Dicamba-Na+MCPA-bee	1.5+4	0	95	77	92
5. Dicamba-dma+MCPA-bee	1.5+4	0	96	76	99
6. Bromoxynil+MCPA-ioe	4+4	0	98	98	96
7. Bromoxynil-gel+MCPA-ioe	4+4	0	98	98	99
8. Bromoxynil+2,4-Dbee	3+6	1	99	99	86
9. Clopyralid&2,4-D	9.5	0	39	85	65
10. Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	0	86	59	96
11. Fluroxypyr+2,4-Ddma	1+6	1	92	70	60
12. Fluroxypyr+2,4-Ddma+Picl	1+6+.125	1	94	82	97
13. Thif&Trib+24-Dbee+X-77	0.2+4+0.25%	0	88	56	86
14. Mets+24-Dbee+X-77	0.06+4+.25%	0	75	74	97
15. Tria+24-Dbee+X-77	0.2+4+0.25%	0	89	85	86
16. Tribenuron+24-Dbee+X-77	0.2+4+0.25%	0	85	48	79
17. Dakota®	6.5	0	75	34	87
18. Tiller®	6.6	1	62	35	99
19. Cheyenne®	7.52	0	64	74	79
20. Dakota+Bromoxynil	8.7+4	2	91	99	99
21. Dakota+Dicamba-Na	6.5+1	1	92	70	92
22. Propanil-DF+MCPA+PO	17+4+.25G	1	76	73	60
23. Untreated	0	0	23	13	23
C.V. %		326	26	30	28
LSD 5%		NS	29	29	33
# OF REPS		4	4	4	4

Summary

None of the herbicides injured wheat. 2,4-D bee generally was more effective than the 2,4-D dma for control of all weeds. Bromoxymil liquid or gel + MCPA and Dakota + bromoxymil were the only herbicide treatments giving more than 90% control of all weeds. Weed densities were variable making control evaluation difficult and giving large LSD's. The 0.1-inch rain which occurred immediately following application of the first eight treatments did not appear to reduce weed control. The applications after the rain with the subsequent second rain may have reduced the effectiveness of the herbicides since thifensulfuron & tribenuron did not completely control kochia as in other experiments (identical experiment conducted this year at branch stations). However, some kochia in the Langdon area has bad resistance to sulfonylureas.

<u>Broadleaf and grass control in small grains, Minot 1992</u>. 'Amidon' hard red spring wheat was seeded April 16. Treatments 3, 4, and 5 were applied to 5-leaf wheat, 3- to 6-leaf green foxtail, 2- to 4-inch Russian thistle, 1- to 3-inch common lambsquarter, 0.5- to 1-inch kochia, 0.5- to 3.25-inch tall redroot pigweed, and 4-leaf wild buckwheat on June 5 with 55 F, 80% RH, and 10-mph wind. The remaining treatments were applied to 6-leaf wheat on June 12 with 82 F, 50% RH, and 5- to 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		July 7						August 19	
Treatment	Rate	Wheat inj	Fxtl	Ruth	Colq	KOCZ	Wibu	Hght	Yield
	oz/A	%						inch	bu/A
2,4-Ddma	6	0	8	70	90	75	18	33	53.8
2,4-Dbee	6	0	0	89	97	85	17	31	53.9
Dicamba-Na+MCPA-dma	1.5+4	0	0	80	99	99	95	32	50.0
Dicamba-Na+MCPA-bee	1.5+4	0	0	92	99	99	88	31	49.7
Dicamba-dma+MCPA-bee	1.5+4	0	0	93	99	99	91	30	47.8
Bromoxynil+MCPA-ioe	4+4	2	0	86	99	60	70	31	53.9
Bromoxynil-gel+MCPA-ioe	4+4	0	0	63	97	48	34	30	54.5
Bromoxynil+2,4-Dbee	3+6	0	0	95	99	72	62	29	48.5
Clopyralid&2,4-D	9.5	9	9	84	96	43	91	31	51.4
Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	0	0	74	96	99	58	29	47.0
Fluroxypyr+2,4-Ddma	1+6	3	0	86	98	95	40	31	54.0
Fluroxypr+2,4-Ddma+Picl	1+6+.125	0	0	87	99	99	60	29	48.2
Thif&Trib+2,4-Dbee+X-77	0.2+4+0.25%	0	0	98	99	98	82	29	51.4
Mets+2,4-Dbee+X-77	0.06+4+.25%	0	0	98	98	99	58	29	50.1
Tria+2,4-Dbee+X-77	0.2+4+0.25%	0	0	96	99	91	67	30	51.5
Tribenuron+2,4-Dbee+X-77	0.2+4+0.25%	0	0	98	99	99	71	30	52.0
Dakota®	6.5	0	98	53	96	75	10	30	52.1
Tiller®	6.6	1	80	58	89	80	55	31	52.2
Cheyenne®	7.52	4	99	99	99	99	83	31	52.9
Dakota+Bromoxynil	8.7+4	1	99	96	99	99	89	31	53.3
Dakota+Dicamba-Na	6.5+1	3	98	66	99	92	53	31	49.5
Propanil-DF+MCPA+PO	17+4+.25G	0	0	55	99	87	43	29	47.2
Untreated	0	0	0	0	0	0	0	32	55.2
C.V%		417	22	16	4	20	29	6	6.3
LSD 5%		NS	7	17	5	34	28	2	4.6

Summary

None of the herbicide treatments injured wheat. Wheat from yield was not increased by herbicide treatment as weed densities were low. Common lambsquarter was controlled 90% or more by all herbicide treatments. Kochia and Russian thistle control was generally greater from 2,4-D bee than 2,4-D dma. Bromoxynil gels generally gave greater weed control than the liquid formulation, when applied with MCPA. Bromoxynil at 3 oz/A + 2,4-D gave equal weed control to bromoxynil at 4 oz/A + MCPA. Cheyenne and Dakota + bromoxynil completely controlled grass and broadleaf weeds except for wild buckwheat. Treatments containing sulfonylureas and bromoxynil + Dakota or + 2,4-D bee gave 95% or more Russian thistle control.

Broadleaf weed control in barley, Williston 1992. 'Bowman' barley was seeded April 27. Treatments were applied to 5.5- to 6-leaf barley, 1- to 2-inch tall kochia and Russian thistle and 2- to 4-leaf green foxtail on June 2 with 76 F, 51% RH, clear sky, 10 mph wind, and dry soil and plant surfaces with a soil temperature of 75 F taken at a 4 inch depth. Treatments were applied with a bicycle-type sprayer, with a wind shield, mounted on a G-Allis Chalmers tractor delivering 8.5 gpa at 32 psi throught 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. Rainfall occurred June 14 and 15 with 0.39 and 0.28 inch, respectively. The experiment was a randomized complete block design with 4 replicates. Weed densities were kochia 5 per square ft, Russian thistle 10 per square ft, and green foxtail 2 per square yard.

Treatment	Rate	July 9 Barley inj	July 9 KOCZ	August 3 KOCZ	August 3 Ruth	August 3 Grft	August 5 Test wght	August 5 Yield
	oz/A	%	%	%	%	%	lb/bu	bu/A
2,4-Ddma	6	0	14	4	73	32	52	33.9
2,4-Dbee	6	3	39	18	99	8	53	36.5
Dicamba-Na+MCPA-dma	1.5+4	0	92	89	90	9	53	43.5
Dicamba-Na+MCPA-bee	1.5+4	6	90	95	91	15	52	40.6
Dicamba-dma+MCPA-bee	1.5+4	10	94	94	98	0	52	41.8
Bromoxynil+MCPA-ioe	4+4	8	63	70	99	0	52	48.9
Bromoxynil-gel+MCPA-ioe	4+4	0	26	10	90	9	53	40.4
Bromoxynil+2,4-Dbee	3+6	2	53	70	97	31	52	45.1
Clopyralid&2,4-D	9.5	0	16	13	98	15	53	34.2
Thif&Trib+Dica-dma+X-77	0.2+1.5+.25%	8	96	97	99	8	52	46.7
Fluroxypyr+2,4-Ddma	1+6	1	86	94	98	33	53	42.5
Flox+2,4-Ddma+Picl	1+6+.125	3	92	90	99	8	53	42.9
Thif&Trib+2,4-Dbee+X-77	0.2+4+0.25%	1	55	44	99	0	53	44.7
Mets+2,4-Dbee+X-77	0.06+4+.25%	1	80	85	99	20	53	46.8
Tria+2,4-Dbee+X-77	0.2+4+0.25%	3	48	63	74	0	53	43.2
Trib+2,4-Dbee+X-77	0.2+4+0.25%	3	75	80	99	5	52	48.2
Dakota®	6.5	39	28	6	49	86	50	26.4
Tiller®	6.6	3	14	0	94	93	53	34.8
Cheyenne®	7.52	19	58	61	74	77	50	38.2
Dakota+Brox	8.7+4	5	53	68	99	54	52	49.0
Dakota+Dica-Na	6.5+1	5	95	97	90	56	52	45.5
Propanil-DF+MCPA+PO	17+4+.25G	6	35	16	39	86	52	37.9
Untreated	0	0	0	0	0	0	53	27.9
C.V. %		88	25	21	24	91		10.7
LSD 5%		7	20	17	28	36		6.2
# of Reps		4	4	4	4	4	1	4

Summary

Dakota and Cheyenne caused 19% or more injury to barley. The injury from Dakota probably reduced barley yield when compared to yield of barley treated with 2,4-D dma or propanil with similar weed control. Kochia control was the greatest for treatments which contained dicamba. Barley yield related to weed control or injury. The most effective treatments increased yield by 20 bu/A compared to untreated.

<u>Herbicide evaluations for broadleaf weeds in wheat, Fargo 1992.</u> 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 3-inch tall kochia, and 4- to 6-inch tall wild mustard on May 23 with 50 F, 50% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Kochia at greater than 10 plants per sq ft was the only weed in replicates 1 through 3. Kochia and other weeds in relicate 4 were at 3 plant per sq yard.

		June 5				July 31					Aug 19
Treatment	Rate	Wht inj	KOCZ	Wimu	Colq	Wht inj	KOCZ	KOCZ	Colq	Wibu	Yield
	oz/A	%									bu/A
2,4-Dws(Savage)	4	0	39	94	94	0	10	40	99	0	54.0
2,4-Dws(Savage)+X-77	4+.25%	1	74	97	94	1	18	70	99	0	33.0
2,4-Dws+Scoil	4+1%	0	75	98	94	3	19	80	99	0	38.0
2,4-Dws+Silwet L77	4+.25%	0	67	99	89	1	19	45	99	0	42.0
2,4-Ddma	4	1	39	99	90	1	23	60	99	0	47.0
2,4-Ddma+X-77	4+.25%	0	72	99	89	1	30	65	99	0	52.0
2,4-Ddma+Scoil	4+1%	1	76	98	95	1	20	70	99	0	34.0
2,4-Ddma+Silwet L77	4+.25%	0	75	98	95	1	28	73	99	0	47.0
Fluroxypyr	1	0	81	8	0	5	92	78	0	35	15.0
Fluroxypyr	1.5	1	89	42	0	8	93	95	0	0	50.0
Fluroxypyr	2	0	87	62	0	3	95	92	0	85	46.0
Fluroxypyr+2,4-Ddma	1+6	2	89	96	95	8	90	93	99	0	50.0
Fluroxypyr+2,4-Ddma	1.5+6	1	90	97	89	12	93	90	99	0	42.0
Fluroxypyr+2,4-Ddma	2+6	2	92	99	92	12	96	90	99	0	34.0
Fluroxypyr+2,4-Ddma+Picl	1+6+0.125	2	91	99	95	10	89	95	99	90	55.0
Dica-Na+2,4-Ddma	1.5+6	5	92	98	89	14	94	92	99	99	60.0
Mets+2,4-Ddma+X-77	0.06+4+.25%	3	99	99	99	1	90	99	99	99	61.0
Tribenuron+2,4-Ddma+X-77	0.25+4+.25%	1	99	99	99	4	97	99	99	99	61.0
Untreated	0	0	0	0	0	0	0	0	0	0	17.0
C.V. %		432	10	7		115	20				
LSD 5%		NS	11	8		7	17				
# OF REPS		4	4	4	1	4	4	1	1	1	1

Summary

None of the herbicides injured wheat, at the June 5 evaluation. Pre-harvest, July 31, evaluation indicated injury from fluroxypyr and dicamba treatments which was a retardation of maturity or malformed spikes. The retarded maturity appeared as late developed tillers probably a recovery from the severe competition after weed control. The yield does not reflect the injury because yield was only from replicate 4 which did not have the severe weed density. Most treatments in replicates 1 through 3 were not harvestable because of kochia. In the harvested replicate, herbicides which gave effective weed control increased wheat yield by greater than 40 bu/A compared to untreated wheat. Treatments which contained sulfonylureas, dicamba, or fluroxypyr gave 89% or more kochia control. Kochia and common lambsquarter control was similar from 2,4-Ddma (liquid) and 2,4-Dws (dma solid). The kochia control was greater for the fourth replicate where density was less, and control then related to wheat yield.

Bromoxynil for broadleaf weed control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 3-inch tall kochia, 1-inch tall redroot pigweed, and 4- to 6-leaf wild mustard on May 23 with 50 F, 48% RH, a partly cloudy sky, and 17-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Kochia was at greater than 10 plants per sq ft in replicates 1-3 and the only weed present, weeds in replicate 4 were at 1 plant per square yard.

		June 5					July 31				
Treatment	Rate	Wheat inj	KOCZ	Wimu	COLQ	Wibw	Wheat inj	KOCZ	Colq	Wibw	Aug 19 Yield
	oz/A	----------	----------	----------	----------	----------	%	----------	----------	----------	----------
Bromoxynil	3	0	88	99	85	99	1	81	99	95	59.0
Bromoxynil-gel	3	0	54	58	78	99	0	44	70	99	57.0
Bromoxynil	4	0	91	95	99	99	0	79	99	99	62.0
Bromoxynil-gel	4	0	84	94	99	99	0	79	95	90	54.0
Bromoxynil	8	0	95	99	99	99	1	89	99	99	59.0
Bromoxynil-gel	8	0	96	98	99	99	0	87	99	99	56.0
Bromoxynil+Tiller®	3+9.4	3	89	99	99	99	7	82	99	99	52.0
Bromoxynil+Tiller	6+9.4	5	84	99	99	99	4	88	99	99	62.0
Bromoxynil+Dakota®	6+8.7	1	96	99	99	99	2	91	99	99	65.0
Tiller	9.4	8	68	99	88	60	3	39	99	0	52.0
Dakota	8.7	5	71	99	85	35	1	28	99	0	55.0
Untreated	0	0	0	0	0	0	0	0	0	0	45.0
C.V. %		99	14	5			140	13			
LSD 5%		3	15	6			3	12			
# OF REPS		4	4	4	1	1	4	4	1	1	1

Summary

The gel formulation of bromoxynil was less effective in controlling weeds than the liquid formulation, but the difference was overcome with the higher rates of bromoxynil. None of the herbicide treatments caused important injury to wheat. Treatments which were most effective in controlling kochia increased wheat yield 17 to 20 bu/A compared to untreated wheat. Yields were only from replicate 4 where kochia infestations were less dense and did not prevent harvest with the small combine.

Triasulfuron for Broadleaf weeds in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 1- to 3-inch tall kochia, 3-leaf common lambsquarter, 2-leaf redroot pigweed, and 1- to 2-leaf foxtail on May 26 with 58 F, 50% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were kochia 3 plants per sq ft and common lambsquarter 4 plants per sq yard.

		June 11			July 31			Aug 19
Treatment	Rate	Wheat inj	KOCZ	Colq	Wheat inj	KOCZ	Colq	Yield
	oz/A	-------------	%		-------------			bu/A
Triasulfuron+X-77	0.1+0.25%	0	84	54	0	88	44	38.3
Triasulfuron+Scoil	0.1+0.12G	1	95	83	0	96	54	41.4
Triasulfuron+X-77	0.2+0.25%	1	89	61	0	91	48	39.7
Triasulfuron+2,4-Dbee+X-77	0.2+4+0.25%	1	99	98	4	97	99	48.4
Triasulfuron+2,4-Ddma+X-77	0.2+4+0.25%	1	94	97	2	93	99	46.8
Triasulfuron+2,4-Ddma+Scoil	0.1+4+0.12G	2	99	99	6	98	99	42.7
Triasulfuron+Dica-dma+X-77	0.2+1.5+0.25%	3	98	99	1	99	99	45.4
Triasulfuron+Brox+X-77	0.2+2+0.25%	0	94	81	0	98	73	50.4
Metsulfuron+X-77	0.06+0.25%	3	69	98	1	66	71	39.4
Metsulfuron+2,4-Dbee+X-77	0.06+4+0.25%	1	98	99	2	96	99	48.4
Metsulfuron+Dica-dma+X-77	0.06+1.5+0.25%	3	78	87	2	96	99	40.9
Bromoxoynil&MCPA	8	0	97	99	0	96	99	46.5
2,4-Dbee	4	0	55	98	5	39	99	34.7
Untreated	0	0	0	0	0	0	0	24.7
C.V. %		147	4	7	107	6	18	12.6
LSD 5%		NS	4	8	2	8	20	10.2
# OF REPS		4	4	4	4	4	4	4

Summary

None of the herbicide treatments injured wheat. Wheat yield related to the degree of weed control and effective weed control increased yield by 25 bu/A compared to wheat not treated for weed control. Metsulfuron + X-77 alone did not adequately control kochia and common lambsquarters, but was effective when applied with 2,4-D or dicamba. Triasulfuron at 0.1 oz/A when applied with Scoil gave greater kochia and common lambsquarter control than when applied with X-77. Further, triasulfuron tended to give greater kochia and common lambsquarter control with triasulfuron at 0.1 oz/A alone or with 2,4-D plus Scoil adjuvant than 0.2 oz/A alone or with 2,4-D applied with X-77 adjuvant.

Kochia control with herbicides plus adjuvants in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 1- to 3-inch tall kochia, 3-leaf common lambsquarter, 2-leaf redroot pigweed, 1- to 2-leaf foxtail on May 26 with 58 F, 50% RH, a partly cloudy sky, 10- to 15-mph wind,and rainfall of 0.1 inch occurred after treatment 11 was completed leaving the remainder of treatments to be finished the following day, May 27. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were kochia 10 plants per sq ft, common lambsquarters 2 plants per sq ft, and wild buckwheat was variable at less than 1 plant per sq yard.

Treatment[a]	Rate	June 9			June 26			July 31		
		Wheat inj	KOCZ	Colq	Wheat inj	KOCZ	Colq	Wheat inj	KOCZ	Colq
	oz/A	%								
2,4-Dbee(DW)	4	3	84	95	3	60	99	4	41	97
2,4-Ddma(DW)	4	1	37	86	0	39	72	0	35	99
2,4-Ddma(Na)	4	0	9	20	0	11	75	0	9	87
2,4-Ddma+AMS(Na)	4+11	0	43	62	0	21	97	0	26	98
2,4-Ddma(Ca)	4	0	6	8	0	10	57	0	5	59
2,4-Ddma+AMS(DW)	4+11	0	8	48	0	16	76	0	29	81
Dicamba-dma(DW)	2	0	31	49	2	52	88	5	66	98
Dicamba-dma+AMS(DW)	2+11	1	43	50	2	57	88	3	75	99
Dicamba-Na(DW)	2	8	40	46	1	64	98	6	78	99
Dicamba-Na+AMS(DW)	2+11	1	31	43	1	48	76	2	57	96
Dicamba-dma(Na)	2	0	32	54	2	56	78	8	65	88
Dicamba-dma+AMS(Na)	2+11	5	92	93	7	97	99	6	96	99
Dicamba-Na(Na)	2	3	83	73	4	94	97	5	96	99
Dicamba-Na+AMS(Na)	2+11	5	90	91	6	99	99	3	98	99
Dicamba-dma(Ca)	2	3	74	91	5	91	99	6	94	99
Dicamba-dma+AMS(Ca)	2+11	7	91	92	6	99	99	2	99	99
Dicamba-Na(Ca)	2	0	53	82	1	76	98	3	91	97
Dicamba-Na+AMS(Ca)	2+11	2	90	96	4	99	98	2	99	99
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		196	28	20	94	19	20	151	23	12
LSD 5%		NS	20	17	3	16	24	NS	20	16
# OF REPS		4	4	4	4	4	4	4	4	4

[a] DW=distilled water; Na=NaHCO3,3.6 g/L; Ca=$CaCl_2$, 2.2 g/L.

Summary

2,4-D bee (ester) gave greater weed control than 2,4-D dma. Sodium bicarbonate and calcium chloride antagonized weed control by 2,4-D dma and the ammonium sulfate adjuvant overcame the sodium bicarbonate and tended to overcome the calcium chloride antagonism of 2,4-D dma. Salts appeared to enhance weed control from both dicamba dma and Na. However, data were variable.

Foxtail control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded May 2. Treatments were applied to 3- to 3.5-leaf wheat, 1- to 3-leaf foxtail, 1- to 5-leaf proso millet, 3- to 5-leaf wild mustard, 1- to 2-leaf wild buckwheat, and 2- to 4-leaf common lambsquarter on May 27 with 66 F, 28% RH, a partly cloudy sky, and 3- to 5-mph wind. Tips of foxtail and proso millet leaves were dead from frost at time of treatment. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weeds were variable.

		June 8			August 19			Aug 21
Treatment	Rate	Wht	Prmi	Fxtl	Wht	Fxtl	Prmi	Yield
	oz/A	%						bu/A
BAS-514-34+Sun-itII	2.4+0.25G	0	70	84	0	39	55	36
BAS-514-34+2,4-Dbee+Sun-itII	2.4+4+0.25G	3	48	58	5	53	58	33
BAS-514-34+Dica-dma+Sun-itII	2.4+2+0.25G	4	71	87	0	36	60	37
BAS-514-34+Thif&Trib+Sun-itII	2.4+.22+0.25G	1	69	84	0	53	55	32
2,4-Dbee+Sun-itII	4+0.25G	1	15	5	1	36	57	29
Dicamba-dma+Sun-itII	2+0.25G	1	20	16	0	41	42	35
Thif&Trib+Sun-itII	0.22+0.25G	1	9	29	0	36	47	35
BAS-527-16	22	0	74	93	0	69	64	38
BAS-527-16+Sun-itII	22+0.25G	1	86	95	0	74	80	38
Imazamethabenz-SG+Sun-itII	5+0.25G	0	0	4	0	31	58	40
Immb-SG+Thif&Trib+Sun-itII	5+0.22+0.25G	0	5	5	0	31	68	41
Immb-SG+Tiller+Sun-itII	5+6.6+0.25G	0	89	92	0	53	68	38
Tiller®+Sun-itII	6.6+0.25G	1	91	95	0	75	77	36
Tiller	6.6	0	88	93	0	63	78	39
Untreated	0	13	0	0	0	0	0	32
C.V. %		379	27	22	465	36	31	16
LSD 5%		NS	19	18	NS	24	30	NS
# OF REPS		4	4	4	4	4	3	4

Summary

None of the herbicide treatment injured wheat. Herbicide treatments did not increase wheat yield. The wheat was seeded late to encourage early grass weed emergence with the wheat. However, cool conditions delayed grass weed emergence and reduced their growth relative to wheat. The early evaluation better represents the weed response to herbicides as the weeds were suppressed by the wheat at the late evaluation. Grass weed control from BAS-514 appeared reduced when applied with 2,4-D bee, but not with dicamba or thifensulfuron & tribenuron. BAS-527-16 was equally as effective as BAS-514 for grass weed control. All treatments containing Tiller were effective in controlling grass weeds.

Imazamethabenz plus grass control herbicides, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 1- to 3-inch tall kochia, 3-leaf common lambsquarter, 2-leaf redroot pigweed, 1- to 2-leaf foxtail on May 26 with 58 F, 50% RH, a partly cloudy sky, 10- to 15-mph wind, and 0.1 inch rainfall occurred after treatment 9 was completed. The remaining treatments were applied the following day. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were foxtail 20 plants per sq ft, except sparce in rep 1, common lambsquarter variable in reps 2, 3, and 4, and kochia 1 plant per sq ft.

Treatment	Rate	June 10				August 19		
		Wht	Yeft	KOCZ	Wibu	Wht	Yeft	KOCZ
	oz/A	%						
Imazamethabenz-SG+Thif&Trib+X-77	4.96+.2+.25%	1	19	78	75	1	5	75
Immb-SG+Thif&Trib+X-77	4.96+.3+.25%	1	31	72	80	3	6	69
Immb-SG+Thif&Trib+Sun-itII	4.96+.3+.25G	0	41	98	99	1	18	98
Immb-SG+Thif&Trib+X-77	4.96+.5+.25%	1	35	74	88	2	34	81
Immb-SG+Thif&Trib+MCPA-ioe+X-77	4.96+.2+4+.25%	0	25	88	94	0	5	89
Immb-SG+Thif&Trib+MCPA-ioe+X-77	4.96+.3+4+.25%	0	26	94	99	1	11	87
Immb-SG+Thif&Trib+MCPA-ioe+Sun-itII	4.96+.3+4+.25G	1	50	98	99	0	11	98
Immb-SG+Thif&Trib+MCPA-ioe+X-77	4.96+.5+4+.25%	0	44	97	99	0	23	96
Immb-SG+Thif&Trib+24-Dbee+X-77	4.96+.2+4+.25%	1	18	83	95	3	20	86
Immb-SG+Thif&Trib+24-Dbee+X-77	4.96+.3+4+.25%	0	48	97	99	1	3	99
Immb-SG+Thif&Trib+24-Dbee+Sun-itII	4.96+.3+4+.25G	0	59	99	99	1	15	99
Immb-SG+Thif&Trib+24-Dbee+X-77	4.96+.5+4+.25%	1	23	99	99	1	0	99
Immb-SG+Trib+X-77	4.96+.3+.25%	0	15	92	92	0	4	98
Immb-SG+Trib+MCPA-ioe+X-77	4.96+.3+4+.25%	0	45	98	98	1	16	98
Immb-SG+Tiller®+X-77	4.96+2.7+.25%	4	73	72	88	1	63	58
Dakota®	6.5	5	89	70	90	0	49	30
Cheyenne®	7.52	3	93	99	99	2	68	99
Tiller	6.6	5	84	78	96	6	73	39
Diclofop	12	0	43	8	0	0	74	5
Untreated	0	0	0	0	0	0	0	0
C.V. %		172	58	10	8	180	65	13
LSD 5%		3	35	12	14	NS	23	14
# OF REPS		4	4	4	2	4	4	4

Summary

The objective was to determine foxtail control with imazamethabenz in combination with other herbicides. Foxtail was abundant in the experiment, but did not develop competively in the wheat because of the cool condition and excellent wheat growth. The only imazamethabenz treatment which gave more than 50% yellow foxtail control was when in combination with Tiller. However, yellow foxtail control tended to be greater when imazamethabenz plus thifensulfuron & tribenuron at comparable rates when applied with Sun-itII than X-77. Kochia control was greater from imazamethabenz + thifensulfuron & tribenuron at 0.3 oz/A when applied with Sun-itII adjuvant than X-77 adjuvant and tended to be greater when MCPA was also included in the spray mixture. The inclusion of MCPA or 2,4-D to imazamethabenz + thifensulfuron & tribenuron mixture generally increased kochia control.

Thifensulfuron and tribenuron for foxtail control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 4-leaf wheat, 1- to 3-inch tall kochia, 3-leaf common lambsquarters, 2-leaf redroot pigweed, and 1- to 2-leaf foxtail on May 26 with 58 F, 50% RH, a partly cloudy sky, 10- to 15-mph wind, and 1 h after treatment 0.1 inch rainfall occurred. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weeds were stressed from cold and weed densities were kochia and common lambsquarters 2 plants per sq ft and foxtail 20 plants per sq ft.

		June 11				Aug 19		
Treatment	Rate	Wheat inj	Fxtl	KOCZ	Colq	Wheat inj	Fxtl	KOCZ
	oz/A	%						
Thif&Trib+X-77	0.2+0.25%	0	39	93	96	0	0	97
Thif&Trib+Sun-it	0.2+0.12G	0	30	98	98	0	19	99
Thif&Trib+SCOIL	0.2+0.12G	0	26	90	97	0	5	95
Thif&Trib+Sun-it	0.2+0.25G	0	24	93	99	0	6	92
Thif&Trib+SCOIL	0.2+0.25G	0	40	94	99	0	33	95
Thif&Trib+Immb-SG+X-77	0.2+3+0.25%	1	25	90	94	1	28	80
Thif&Trib+Immb-SG+Sun-it	0.2+3+0.12G	0	38	98	98	0	34	99
Thif&Trib+Immb-SG+SCOIL	0.2+3+0.12G	0	48	92	92	0	36	99
Thif&Trib+Immb-SG+Sun-it	0.2+3+0.25G	0	38	93	98	3	19	99
Thif&Trib+Immb-SG+SCOIL	0.2+3+0.25G	0	30	98	99	0	10	99
Thif&Trib+ExpS2	0.2+2%	0	31	95	99	0	0	95
Untreated	0	0	0	0	0	0	0	0
C.V. %		693	86	10	6	343	111	11
LSD 5%		NS	NS	12	8	2	25	14
# OF REPS		4	4	4	4	4	4	4

Summary

None of the treatments injured wheat. Foxtail control did not differ for the various herbicide treatments at the June 11 evaluation. Foxtail was suppressed in growth by excellent wheat growth with the cool season. The evaluations on August 19 were difficult because of the dense wheat stand and differences maybe a chance occurrence. All herbicide treatments gave 90% or more kochia control at the late evaluation, except for thifensulfuron & tribenuron at 0.2 oz/A + imazamethabenz at 3 oz/A + surfactant X-77.

Difenzoquat for weed control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded April 17. Treatments were applied to 5-leaf wheat, 3- to 5-leaf wild oats, 2-inch tall wild buckwheat, 5-leaf wild mustard, and 2-inch tall common lambsquarter on May 27 with 70 F, 30% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		June 2					July 31
Treatment	Rate	Wheat inj	Wioa	Wibu	Wimu	Colq	Wioa
	oz/A	%					
Difenzoquat(2ASU)	16	0	59	0	0	0	58
Difenzoquat-640sg+X-77	16+.5%	0	68	38	93	10	64
Difenzoquat-640sg+Immb-sg+X-77	8+3.68+.5%	0	86	71	94	33	65
Difenzoquat-640sg+Immb-sg+X-77	8+3.68+.25%	1	75	66	95	49	51
Difenzoquat(2ASU)+Immb+X-77	8+3.68+.25%	1	89	76	96	57	68
Untreated	0	0	0	0	0	0	0
C.V. %		313	13	29	6	66	14
LSD 5%		NS	12	18	6	30	10
# OF REPS		4	4	4	4	3	4

Summary

None of the herbicide treatment injured wheat. Wild mustard was sparse and the control with difenzoquat maybe a chance occurrence, contamination, or effective control with difenzoquat. Wild oats control did not vary greatly with the treatment at the July 31 evaluation. At the June 2 evaluation injury to wild oats generally was greater for treatment with imazamethabenz then without.

Propanil formulations for foxtail control in wheat, Fargo 1992. 'Gus' hard red spring wheat was seeded on May 2. Treatments were applied to 3- to 3.5-leaf wheat, 1- to 3-leaf foxtail, 1- to 4-leaf proso millet, 3- to 5-leaf wild mustard, 1- to 2-leaf wild buckwheat, and 2- to 4-leaf common lambsquarter on May 27 with 66 F, 28% RH, partly cloudy sky, and 3- 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a complete randomized block design with four replicates. Weed densities were green and yellow foxtail and variable proso millet at approximately 3 plants per square ft and common lambsquarters 1 per square ft.

		June 9				August 19			Aug 27
		Wheat				Wheat			Wheat
Treatment	Rate	inj	Fxtl	Prmi	Colq	inj	Fxtl	Prmi	yield
	oz/A	%							lb/bu
Propanil&MCPA	22	0	85	30	99	0	49	63	44.3
Propanil&MCPA	26.4	3	88	64	99	0	76	78	40.2
Propanil-wdg+MCPA-ioe+PO	16+4+.12G	0	80	29	99	2	75	83	44.9
Propanil-wdg+MCPA-ioe	16+4	0	83	49	99	0	50	70	50.2
Propanil-wdg+MCPA-ioe+PO	18+4+.12G	1	85	46	99	0	55	60	53.7
Propanil-wdg+MCPA-ioe	18+4	0	76	35	99	0	53	61	52.1
Propanil-wdg+MCPA-dma+PO	18+4+.12G	0	87	64	99	0	77	68	46.4
Propanil-wdg+MCPA-dma	18+4	1	83	55	99	0	65	59	53.5
Propanil-wdg+Thif&Trib+PO	18+.2+.12G	1	85	50	99	0	57	64	52.0
Propanil-wdg+Trib+PO	18+.2+.12G	3	93	43	99	0	65	64	50.8
Propanil-wdg	18	1	70	19	99	0	55	66	50.6
Diclofop+PO	12+.12G	0	75	41	0	0	66	73	54.2
Tiller®	6.5	5	94	85	99	0	80	78	51.6
Dakota®	8.7	1	91	74	99	0	67	78	49.4
Untreated	0	0	0	0	0	0	0	0	50.9
C.V. %		156	12	37	0	775	29	22	9.3
LSD 5%		2	14	24	0	NS	25	20	6.6
# OF REPS		4	4	4	4	4	4	4	4

Summary

None of the herbicides caused any important injury to wheat. The weeds were sparse and not competitive with the cool conditions which favored wheat growth. The early ratings better indicate the response to the herbicides than the late evaluation when grass weeds were suppressed by the wheat. The results may have also been influenced by frost which occurred shortly before treatment resulting in leaf injury. Propanil control of foxtail was similar to all rates with or without the petroleum oil adjuvant (PO).

Wheat cultivar response to difenzoquat, Langdon 1992. Durum and hard red spring wheat (HRSW) were seeded May 13. Difenzoquat at 14.4 oz ai/A was applied to 6.5-leaf (early varieties) and 5.5-leaf (late varieties) wheat on June 18 with 47 F. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 7.7 gpa at 35 psi through 8001 flat fan nozzles. Evaluation for injury was July 23.

HRSW	Injury %	Durum	Injury %
Baart	0	Ward	2
Len	2	Rugby	2
Marshall	0	Vic	10
Stoa	0	Lloyd	0
Butte 86	0	Cando	0
2375	0	Monroe	2
Amidon	0	Renville	7
Prospect	4	Medora	2
Vance	2	Sceptre	0
Gus	5	Fjord	13
Grandin	6	Laker	4
Bergen	0	Regal	15
2370	0	Plenty	0
Sharp	3	D8460	5
2371	3	D86398	9
Pasqua	0	D86741	5
Dalen	4	D87121	0
Norm	2	D87122	0
Krona	0	D87130	2
AC Minto	0	D87141	15
Nordic	0	D87240	22
Fjeld	0	D87436	0
ND671	4	D87450	0
XW398A4	0	D86-1523	0
ND673	10	D88058	2
ND674	12	D88273	2
ND675	0	D88277	2
ND676	8	D88284	2
ND678	2	D88289	2
ND679	8	D88303	3
ND680	12	D88450	4
ND681	0	D88758	3
XW397A3	0	D88793	10
N87-0306	0	D87-1534	2
SD3056	0		

Summary

None of the cultivars appeared to be severely injured by difenzoquat. The cultivars having an injury rating of 10% or more probably have intermediate tolerence to difenzoquat.

<u>Wheat cultivar response to wild oats control herbicides, Langdon 1992.</u> All varieties were seeded May 19. Treatments were applied to 6.5-leaf early wheat varieties and 5.5-leaf late wheat varieties on June 18 with 47 F and 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 7.7 gpa at 35 psi through 8001 flat fan nozzles. Bromoxynil + MCPA was applied for broadleaf weed contol.

Cultivar	Dife 7.5 oz/A	Tiller 9.4 oz/A	Immb 5 oz/A	Dife+Immb 6+2.5 oz/A
	% injury			
Butte 86	0	0	0	0
Marshall	1	0	0	0
Gus	1.5	2	0	0
Grandin	1	1.5	0	0
2375	0	0	0	0
Bergen	0	1.5	0	1
Prospect	2	3	0	1
Sharp	0	0	0	0
2370	0	1	0	0
2371	2.5	1	0.5	0
Dalen	2	1.5	0	0
Korna	2.5	1.5	0	0
Norm	0	0	0	0
D8460	4	12.5	0	1
D87450	2.5	11.0	0	0
LSD (0.05)	3.7			

Summary

None of the herbicides cause important injury to the wheat cultivar. D8460 and D87450 appeared more susceptible than the other cultivars to Tiller.

Time of grass control with nicosulfuron in corn, Casselton 1992. 'Interstate 343A' corn was seeded May 14. Treatment (spike) was applied to spike corn, 2- to 3-leaf green and yellow foxtail, 0.5-inch tall kochia, and cotelydon- to 2-leaf wild mustard on June 1 with 80 F, 70% RH, partly cloudy sky, and 5-mph wind. Treatment (grass1-2in) was applied to 1- to 2-leaf corn, 2.5- to 3.5-leaf green and yellow foxtail, 0.5- to 1-inch tall kochia, and 1- to 3-leaf wild mustard on June 3 with 70 F, 40% RH, partly cloudy sky, and 15- to 20-mph wind. Treatment (grass2-4in) was applied to 5-leaf corn, 3.5- to 5.5-leaf green and yellow foxtail, 4- to 6-leaf common lambsquarters, and 4-leaf wild mustard on June 12 with 75 F, 60% RH, clear sky and 5-mph wind. Treatment (grass4-6in) was applied to 5- to 6-leaf corn, 3.5- to 6.5-leaf green and yellow foxtail, 2- to 6-inch tall common lambsquarters, 6- to 12-inch tall wild mustard on June 20 with 65 F, 65% RH, partly cloudy sky, and 5-mph wind. Treatment (grass6-10in) was applied to 6 - to 8-inch tall green and yellow foxtail and kochia, 8- to 12-inch tall wild mustard, 4- to 6-inch tall common lambsquarters on June 25 with 67 F, 60% RH, partly cloudy sky, and 22-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with six replicates. Foxtail density was approximately 5 plants per sq ft.

Treatment	Rate	July 31 Corn	July 31 Grft& yeft	Oct 20 Yield
	oz/A	----- %	----	bu/A
Pendimethalin + Cyanazine-DF(spike)	24+32	0	87	60.4
Nicosulfuron + Scoil(grass1-2in)	0.5+1%	0	82	54.4
Nicosulfuron + Scoil(grass2-4in)	0.5+1%	1	95	58.3
Nicosulfuron + Scoil(grass4-6in)	0.5+1%	27	95	52.6
Nicosulfuron + Scoil(grass6-10in)	0.5+1%	37	98	45.8
Weed Free	0	0	99	67.4
Weedy	0	44	0	14.5
C.V. %		29	5	12.0
LSD 5%		5	5	7.1
# OF REPS		6	6	6

Summary

The corn injury was not from the herbicide treatments, but a reduction in growth from weed competition. Treatment when grasses were 4- to 6-inches tall was too late to remove weed competition without supressing the corn. Treatments applied to 1- to 2-inch foxtail only gave 82% control because of subsequent foxtail emergence. Treatment applied to 2- to 4-inch or larger grasses gave 95% more control. Broadleaf weeds were hand pulled from the plots so any response would represent only the grass weeds. The effectiveness of pendimethalin + cyanazine generally decreased with each replicate indicating possible settling in the spray container. Nicosulfuron application to 2- to 4-inch green and yellow foxtail was the optimum for corn yield. Earlier application allowed for new foxtail emergence which apparently competed with the corn and later applications controlled the foxtail, but probably already had competed with the corn. Corn treated with nicosulfuron, when foxtail was 2- to 4-inches tall, yield less than the season long weed free corn indicating that the foxtail may have already caused a yield loss or the uncontrolled plants were competitive. The spike stage corn treated with pendimethalin + cyanazine gave a similar yield with slightly less than the corn with 2- to 4-inch foxtail treated with nicosulfuron.

Nicosulfuron mixture with bromoxynil in corn, Casselton 1992. 'Interstate 343A' corn was seeded May 12. Treatments were applied to 4.5-leaf corn, 3.5- to 5.5-leaf foxtail, 3- to 5-leaf wild mustard, 4- to 6-leaf cocklebur, and 2- to 4-leaf common lambsquarter on June 12 with 86 F, 63% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		July 5					
Treatment	Rate	Coin	Fota	Wimu	Colq	KOCZ	Cocb
	oz/A			%			
Nicosulfuron+Brox+X-77	0.5+6+.25%	14	96	99	97	99	97
Nicosulfuron+Brox+X-77+28N	0.5+6+.25%+4%	13	98	99	99	99	99
Nicosulfuron+Brox+PO	0.5+6+1%	19	95	99	99	99	97
Nicosulfuron+Brox+PO+28N	0.5+6+1%+4%	19	97	99	99	99	99
Nicosulfuron+Brox+Scoil	0.5+6+1%	24	99	99	99	99	99
Nicosulfuron+Brox+Scoil+28N	0.5+6+1%+4%	26	99	99	99	99	99
Nicosulfuron+Brox+Scoil+28N	0.5+6+2%+4%	30	99	99	97	99	99
Nicosulfuron+PO+28N	0.5+1%+4%	6	91	99	30	90	68
Nicosulfuron+Scoil+28N	0.5+1%+4%	0	98	99	89	99	88
Nicosulfuron+Scoil+28N	0.5+2%+4%	3	99	99	95	99	83
Nicosulfuron+X-77+28n	0.5+.25%+4%	1	93	99	58	99	63
Nicosulfuron+Scoil	0.25+1%	1	93	99	73	99	40
Nicosulfuron+Scoil+28N	0.25+1%+4%	0	91	99	61	97	45
Nicosulfuron+Scoil	0.25+2%	0	96	99	82	99	50
Nicosulfuron+Scoil+28N	0.25+2%+4%	0	96	99	83	99	55
Untreated	0	0	0	0	0	0	0
C.V. %		65	3	0	11	2	8
LSD 5%		9	4	NS	12	3	13
# OF REPS		4	4	4	4	4	2

Summary

All treatments containing bromoxynil injured corn and the injury tended to be greater when with Scoil than X-77 or petroleum oil adjvuants. Later observation indicated that the corn recovered from injury. Green and yellow foxtail (Fota) control was greater for nicosulfuron at 0.5 oz/A applied with Scoil then X-77 or petroleum oil, all with 28N. Foxtail control was greater for nicosulfuron at 0.25 oz/A + 28N when applied with Scoil at 2% than at 1%. All broadleaf weeds were completely controlled when bromoxynil was a component of the herbicide treatment.

<u>Nicosulfuron with dicamba in corn, Casselton 1992</u>. 'Interstate 343A' corn was seeded May 12. Treatments were applied to 4.5-leaf corn, 3.5- to 5.5-leaf green and yellow foxtail, 3- to 5-leaf wild mustard, 2- to 4-leaf common lambsquarters, and 4- to 6-leaf cocklebur on June 12 with 86 F, 63% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were green foxtail 100 plants per square ft, wild mustard 3 plants per square ft, common lambsquarter 5 plants per square yard, and kochia 1 plant per square yard.

Treatment	Rate	July 5					
		Corn	Fota	Wimu	Colq	KOCZ	Cobu
	oz/A	%					
Nicosulfuron+Dica-dma+X-77	0.5+4+0.25%	0	88	99	99	99	98
Nicosulfuron+Dica-dma+X-77+28N	0.5+4+0.25%+4%	3	85	99	98	99	99
Nicosulfuron+Dica-dma+PO	0.5+4+1%	1	88	99	99	99	99
Nicosulfuron+Dica-dma+PO+28N	0.5+4+1%+4%	0	91	99	99	99	99
Nicosulfuron+Dica-dma+Scoil	0.5+4+1%	3	99	99	99	99	99
Nicosulfuron+Dica-dma+Scoil+28N	0.5+4+1%+4%	2	99	99	99	99	99
Nicosulfuron+Dica-dma+Scoil+28N	0.5+4+2%+4%	5	99	99	99	99	99
Nicosulfuron+Dica-dma+Scoil+28N	0.25+2+2%+4%	0	98	99	99	99	99
Nicosulfuron+Dica-dma+Scoil	0.25+4+1%	1	97	99	99	99	99
Nicosulfuron+Dica-dma+Scoil+28N	0.25+4+1%+4%	1	95	99	99	99	99
Nicosulfuron+Dica-dma+Scoil	0.25+4+2%	3	97	99	99	99	99
Nicosulfuron+Dica-dma+Scoil+28N	0.25+4+2%+4%	3	97	99	99	99	99
Nicosulfuron+X-77+28N	0.5+0.25%+4%	0	93	99	65	97	75
Nicosulfuron+PO+28N	0.5+1%+4%	1	95	99	41	99	69
Nicosulfuron+Scoil+28N	0.5+1%+4%	2	99	99	94	99	92
Nicosulfuron+Scoil+28N	0.25+2%+4%	1	97	99	84	99	78
Nicosulfuron+ExpN	0.25+2%	0	95	99	75	99	58
C.V. %		410	2	0	6	1	7
LSD 5%		NS	3	NS	7	NS	11
# OF REPS		4	4	4	4	4	3

Summary

None of the herbicide treatments caused important injury to corn. Thus, the inclusion of 28% nitrogen fertilizer with X-77 at 0.25%, petroleum oil (PO) at 1%, or Scoil at 1 or 2% with nicosulfuron + dicamba did not increase injury to corn. Dicamba applied with nicosulfuron and petroleum oil adjuvants reduced green and yellow foxtail control compared to nicosulfuron and petroleum oil alone. However, dicamba did not antagonize foxtail control with nicosulfuron applied with Scoil. The control of green foxtail was high from all treatments containing Scoil even when nicosulfuron was at only 0.25 oz/A, possibly masking an antagonism from the dicamba. Common lambsquarter and common cockelbur control was greatly enhanced by the Scoil adjuvant compared to the petroleum oil or X-77 surfactant adjuvants.

Postemergence weed control in corn, Casselton 1992. 'Interstate 343A' corn was seeded May 4. Treatments were applied to 5- to 6-leaf corn, 2- to 6-inch tall green and yellow foxtail and common lambsquarter, 4- to 10-inch tall kochia, 5- to-10 inch tall cockelbur, and 6- to 12-inch tall wild mustard on June 20 with 70 F, 65% RH, partly cloudy sky, and 5-mph wind. Split treatments (/) were applied to 7-leaf corn, 6- to 11-inch tall green and yellow foxtail, 12- to 20-inch tall wild mustard (injured mustard 10- to 12-inch), 10- to 12-inch tall kochia, and 4- to 10-inch tall common lambsquarter on June 25 with 67 F, 60% RH, a partly cloudy sky, and 22-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 30 Corn	July 30 Grft& yeft	July 30 Colq	July 30 KOCZ
	oz/A	--------	%	--------	
--/Nico+Dica+X-77	--/0.5+2+.25%	8	72	76	79
--/Nico+Dica+Scoil	--/0.125+2+2%	18	61	74	80
Dica/Nico+Scoil	2/0.25+2%	11	88	86	85
--/Nico+Dica+Scoil	--/0.25+2+2%	8	78	81	83
--/Nico+Dica+Scoil	--/0.5+2+2%	19	85	83	86
Nico+Scoil/Dica(5d)	0.125+2%/2	19	70	80	88
Nico+Scoil/Dica(5d)	0.25+2%/2	6	80	75	83
Nico+Dica+Scoil/Nico+Scoil(5d)	0.125+2+2%/0.125+2%	4	84	80	80
Nico+Dica+Scoil/Nico+Dica+Scoil(5d)	0.125+1+2%/0.125+1+2%	5	85	86	85
Nico+Dica+Scoil/Nico+Scoil(5D)	0.25+2+2%/0.25+2%	0	95	94	94
--/Nico+Atra+Scoil	1.25+6+2%	1	78	62	59
C.V. %		87	8	11	10
LSD 5%		11	9	13	12
# OF REPS		4	4	4	4

Summary

None of the treatments caused important injury to corn. The weed control was influenced by the dense canopy of wild mustard. The canopy was reduced when the second application of the split treatments were applied. The greatest weed control was from nicosulfuron at 0.25 oz/A + dicamba + scoil followed in 5 days by nicosulfuron at 0.25 oz/A + scoil. These data indicate that split application of herbicides may be required with dense canopy of large weeds. The type of chemicals in the first part of the split probably should be most effective on the primary weed canopy.

Commercial adjuvants with nicosulfuron, Fargo 1992. Interstate '343A' corn, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 4- to 5-leaf corn, 4- to 6-inch foxtail millet, 3- to 4-inch proso millet, and 4- to 6-leaf foxtail on June 22 with 66 F, 53% RH, cloudy sky, and 5- to 10-mph wind with rainfall occurring 4 hours after application. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 14					August 10		
Treatment	Rate	Corn inj	Fota	Fomi	Prmi	KOCZ	Grft	Yeft	Prmi
	oz/A	%							
Nicosulfuron+CleanC.	0.25+0.18G	4	83	86	80	82	66	44	49
Nicosulfuron+Herbimax	0.25+0.18G	9	73	79	68	78	58	46	49
Nicosulfuron+Mor-act	0.25+0.18G	5	83	85	78	89	74	38	51
Nicosulfuron+Scoil	0.25+0.18G	4	98	98	96	99	93	79	89
Nicosulfuron+Sun-itII	0.25+0.18G	3	92	94	90	96	88	61	72
Nicosulfuron+MSO	0.25+0.18G	1	94	95	91	98	89	70	87
Nicosulfuron+Methoil	0.25+0.18G	5	92	94	90	96	92	73	84
Nicosulfuron+R-11	0.25+0.25%	4	80	80	73	56	71	35	51
Nicosulfuron+X-77	0.25+0.25%	3	65	71	55	45	51	26	28
Nico+Preference	0.25+0.25%	6	61	64	60	56	62	26	43
Nico+Spray Booster S	0.25+0.25%	6	60	65	60	39	55	24	40
Nicosulfuron+ExpN	0.25+2%	3	93	96	93	94	88	58	80
Nico+Scoil+ExpN	0.25+0.18G+2%	2	96	99	96	99	97	88	94
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		89	9	6	8	16	10	17	14
LSD 5%		NS	10	7	9	17	10	12	11
# OF REPS		4	4	4	4	4	4	4	4

Summary

Nicosulfuron did not injure corn regardless of the adjuvants. Scoil, Sun-it II, MSO, and Methoil as a group were more effective than the other adjuvants with nicosulfuron. Among these adjuvants Scoil tended to be more effective and Sun-it II less effective than the other methylated seed oil adjuvants. The next most effective commercial adjuvants were Clean Crop, Herbimax, Mor-act, and R-11; followed by X-77, Preference, and Spray Booster S.

Nicosulfuron plus salts in corn, Fargo 1992. 'Interstate 343A' corn, 'Siberian' foxtail, and 'White' proso millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 4- to 5-leaf corn, 4- to 6-leaf siberian foxtail, 3- to 5-leaf proso millet, and 3- to 4-leaf foxtail on June 22 with 66 F, 53% RH, a cloudy sky, and 5- to 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 14					August 10		
Treatment	Rate	Corn	Fota	Fomi	Prmi	KOCZ	Grft	Yeft	Prmi
	oz/A	%							
Nicosulfuron+Scoil	0.12+2%	0	86	88	82	69	85	41	68
Nicosulfuron+ExpN	0.12+2%	0	78	83	79	44	72	34	59
Nicosulfuron+Scoil	0.25+2%	1	95	97	96	93	89	74	84
Nicosulfuron+ExpN	0.25+2%	1	86	91	88	70	81	51	78
Nicosulfuron+PO	0.25+2%	4	75	79	72	63	51	43	39
Nico+Scoil+28N	0.12+2%+2.5%	1	89	93	91	80	83	56	75
Nico+Scoil+NH4NO3	0.12+2%+4	3	91	93	90	87	85	63	73
Nico+Scoil+UREA	0.12+2%+4	4	91	93	90	82	80	68	72
Nico+Scoil+NaHCO3	0.12+2%+4	1	61	72	69	58	52	35	45
Nico+Scoil+CaCl2	0.12+2%+4	1	84	86	80	60	65	43	51
Nico+PO+28N	0.12+2%+2.5%	3	64	65	58	28	48	29	39
Nico+PO+NH4NO3	0.12+2%+4	1	72	76	72	59	49	38	49
Nico+PO+UREA	0.12+2%+4	1	70	71	58	33	43	33	31
Nico+PO+NaHCO3	0.12+2%+4	1	33	46	41	23	21	21	23
Nico+PO+CaCl2	0.12+2%+4	5	61	60	55	29	35	26	33
C.V. %		146	12	9	10	18	15	19	18
LSD 5%		NS	13	10	10	15	13	12	14
# OF REPS		4	4	4	4	4	4	4	4

Summary

Grass weed control from nicosulfuron generally was enhanced more by Scoil than Exp N and more by Exp N than petroleum oil adjuvant. Scoil was more effective than petroleum oil with nicosulfuron for grass weed control regardless of other salts in the spray solution. Salts did not increase grass control with nicosulfuron applied with Scoil, except for a reduction from sodium bicarbonate and calcium chloride.

Nicosulfuron with EE and/or ME in corn, Fargo 1992. 'Interstate 343A' corn, 'Siberian' foxtail, and 'White' proso millet were seeded in adjacent strips as bioassay species on May 8. Treatments were applied across the species to 4- to 6-leaf corn, 3- to 6-leaf siberian foxtail, 3- to 5-leaf proso millet, and 4- to 6-leaf foxtail on June 22 with 66 F, 53% RH, a cloudy sky, and 5- to 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 14					July 29		
Treatment	Rate	Corn inj	Fota	Fomi	Prmi	KOCZ	Yeft	Grft	KOCZ
	oz/A	%							
Nicosulfuron+ME(DW)	0.25+1%	1	80	81	78	66	47	60	35
Nicosulfuron+ME(DW)	0.5+1%	1	87	87	83	71	55	71	57
Nicosulfuron+EE(DW)	0.25+1%	1	80	82	79	60	52	59	33
Nicosulfuron+EE(DW)	0.5+1%	1	86	87	83	73	54	66	56
Nicosulfuron+ME(Na)	0.25+1%	0	86	89	89	80	59	77	61
Nicosulfuron+ME(Na)	0.5+1%	1	92	94	93	88	71	85	73
Nicosulfuron+EE(Na)	0.25+1%	1	87	88	86	81	62	74	56
Nicosulfuron+EE(Na)	0.5+1%	1	92	93	89	84	69	84	65
Nicosulfuron+ME+28N	0.25+1%+2.5%	1	98	99	97	96	87	96	84
Nicosulfuron+EE+28N	0.25+1%+2.5%	0	98	99	98	96	89	96	79
C.V. %		219	3	2	3	12	14	8	9
LSD 5%		NS	4	3	4	13	13	9	8
# OF REPS		4	4	4	4	4	4	4	4

Summary

Nicosulfuron was equally as effective on controlling weeds when applied with the methyl or ethyl ester of seed oil. The inclusion of 28% liquid nitrogen fertilizer greatly enhanced weed control with nicosulfuron applied with either the methyl or ethyl seed oil. The presence of sodium bicarbonate (Na, 3.6 g/L) in the spray carrier generally enhanced weed control from nicosulfuron applied with either methyl or ethyl ester seed oil adjuvants compared to when in distilled water (DW).

<u>Emulsifier with MS in corn, Fargo 1992</u>. 'Interstate 343A' corn, 'Siberian' foxtail millet, and 'White' proso millet were seeded in adjacent strips as bioassay species on May 8. Treatments were applied across the species to 4- to 5-leaf corn, 3- to 6-leaf foxtail millet, 3- to 5-leaf proso millet, and 4- to 6-leaf foxtail on June 22 with 66 F, 53% RH, a cloudy sky, and 5- to 10-mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 14					July 29	
		Corn	Grft&				Grft&	
Treatment	Rate	inj	Yeft	Fomi	Prmi	KOCZ	Yeft	KOCZ
	oz/A	%						
Nicosulfuron+MSAT(2.5)	0.25+0.18G	0	93	94	88	78	81	78
Nicosulfuron+MSAT(5)	0.25+0.18G	0	95	96	90	81	85	80
Nicosulfuron+MSAT(10)	0.25+0.18G	0	94	95	92	91	87	89
Nicosulfuron+MSAT(15)	0.25+0.18G	0	97	99	96	91	93	87
Nicosulfuron+MSAK(2.5)	0.25+0.18G	1	91	93	84	81	78	80
Nicosulfuron+MSAK(5)	0.25+0.18G	0	92	94	89	79	82	80
Nicosulfuron+MSAK(10)	0.25+0.18G	0	98	98	96	94	90	86
Nicosulfuron+MSAK(15)	0.25+0.18G	0	98	99	97	97	92	89
Untreated	0	0	0	0	0	0	0	0
C.V. %		600	2	2	5	7	4	5
LSD 5%		NS	3	3	5	8	5	5
# OF REPS		4	4	4	4	4	4	4

Summary

Weed control with nicosulfuron generally increased as the percent emulsifier increased for both emulsifiers. However, at the 2.5% grass species control tended to be greater with AT than AK emulsifier.

Comparison of ME/EE with Nicosulfuron, Fargo 1992. 'Interstate 343A' corn, 'white proso millet, and 'Siberian foxtial millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across species to 5- to 6-leaf corn, 4- to 6-inch tall foxtail millet and green foxtail, and 3- to 4-inch tall proso millet on June 22 with 66 F, 53% RH, a cloudy sky, 5- to 10-mph wind and rain occurred 4 h 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 a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 14				
		Corn inj	Grft	Fxmi	Prmi	KOCZ
	oz/A	%				
Nicosulfuron+ME	0.25+.18G	4	94	96	92	95
Nicosulfuron+$NaHCO_3$+ME	0.25+.36%+.18G	1	80	84	79	82
Nicosulfuron+Dicamba+ME	0.25+4+.18G	1	93	94	90	99
Nicosulfuron+2,4-Ddma+ME	0.25+8+.18G	6	90	92	89	96
Nicosulfuron+Bent+ME	0.25+12+.18G	3	68	61	56	78
Nicosulfuron+EE	0.25+.18G	5	94	96	92	95
Nicosulfuron+$NaHCO_3$+EE	0.25+.36%+.18G	1	84	86	81	91
Nicosulfuron+Dicamba+EE	0.25+4+.18G	4	92	93	89	99
Nicosulfuron+2,4-Ddma+EE	0.25+8+.18G	4	91	92	88	97
Nicosulfuron+Bent+EE	0.25+12+.18G	5	61	58	45	71
C.V. %		135	7	8	5	7
LSD 5%		NS	8	10	6	9
# OF REPS		4	4	4	4	4

Summary

None of the nicosulfuron treatments injured corn. Methylesters were similarly effective as adjuvants with nicosulfuron. Sodium bicarbonate was antagonistic to weed control from nicosulfuron. Bentazon was more antagonistic than sodium bicarbonate. Dicamba and 2,4-D applied as a tank mixture with nicosulfuron did not influence weed control.

Nicosulfuron plus adjuvants, Minot 1992. 'Siberian' foxtail millet, 'Excel' barley, and 'McCall' soybeans were seeded in adjacent strips as bioassay species on June 26. Treatments were applied across the species to 6- to 6.5-leaf foxtail millet, flag-leaf barley, and 3rd trifoliolate soybeans on August 6 with 60 F, partly cloudy sky, and 0- to 8-mph wind. Fog and a heavy dew were present at the time of application of treatments. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		August 17				August 27	
Treatment	Rate	Grft	Fomi	Brly	Sobe	Fomi	Sobe
	oz/A	%					
Nicosulfuron+CleanC.	0.25+0.18G	7	7	9	3	13	0
Nicosulfuron+Herbimax	0.25+0.18G	8	8	11	1	15	3
Nicosulfuron+Mor-act	0.25+0.18G	5	5	8	1	33	10
Nicosulfuron+Scoil	0.25+0.18G	7	7	9	4	25	0
Nicosulfuron+Sun-itII	0.25+0.18G	4	4	10	2	23	4
Nicosulfuron+MSO	0.25+0.18G	10	10	15	5	40	18
Nicosulfuron+Methoil	0.25+0.18G	3	3	4	4	29	14
Nicosulfuron+R-11	0.25+0.25%	5	5	6	0	19	0
Nicosulfuron+X-77	0.25+0.25%	5	5	7	1	16	5
Nicosulfuron+Preference	0.25+0.25%	6	6	6	5	24	3
Nicosulfuron+Spray booster S	0.25+0.25%	4	4	8	4	13	6
Nicosulfuron+ExpN	0.25+2%	6	6	10	2	33	3
Nicosulfuron+Scoil+ExpN	0.25+0.18G+2%	6	6	13	8	44	36
Untreated	0	0	0	0	0	0	0
C.V. %		85	85	66	98	59	176
LSD 5%		NS	NS	NS	4	20	18
# OF REPS		4	4	4	4	4	4

Summary

Differences in species control by nicosulfuron applied with the various adjuvants were not generally significantly different, except control tended to be greater with MSO and Scoil + 28% N than with the other adjuvants.

Grass control with nicosulfuron plus dicamba, Fargo 1992. 'Interstate 343A', proso millet, and Siberian foxtail were planted in adjacent 6 to 10 ft wide strips as bioassay species on May 12. The area contained a natural infestation of green and yellow foxtail. Treatments were applied to 5- to 6-leaf corn, 6- to 8-inch proso millet, 7- to 10-inch siberian foxtail, and 5- to 8-inch foxtail species on June 26 with 70 F, 45% RH, clear sky, and 1 to 3 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 14				August 11		
		Grft	Yeft	Fomi	Prmi	Grft	Yeft	Prmi
	oz/A	%						
Nicosulfuron+X-77	0.25+0.25%	75	71	69	64	78	43	67
Nicosulfuron+Dica+X-77	0.25+2+0.25%	74	67	67	64	81	45	71
Nicosulfuron+Dica+X-77	0.25+4+0.25%	74	67	68	67	77	39	63
Nicosulfuron+Dica+X-77	0.25+6+0.25%	74	68	68	65	82	37	68
Nicosulfuron+Dica+X-77	0.25+8+0.25%	75	68	67	66	77	39	63
Nicosulfuron+Dica+X-77	0.25+10+0.25%	75	66	69	67	79	38	70
Nicosulfuron+Scoil	0.25+1%	90	82	86	78	87	61	84
Nicosulfuron+Dica+Scoil	0.25+2+1%	87	81	86	81	87	73	87
Nicosulfuron+Dica+Scoil	0.25+4+1%	88	81	84	77	88	78	88
Nicosulfuron+Dica+Scoil	0.25+6+1%	89	83	81	79	89	72	89
Nicosulfuron+Dica+Scoil	0.25+8+1%	88	82	84	77	85	72	90
Nicosulfuron+Dica+Scoil	0.25+10+1%	86	78	84	77	87	78	90
LSD 5%		8	6	11	8	9	10	7
# of REPS		4	4	4	4	4	4	4

Summary

Nicosulfuron control of all grass species was enhanced more by Scoil than X-77, regardless whether applied with or without dicamba. Grass control by nicosulfuron was not antagonized by dicamba at any rate. Yellow foxtail control was increased by all dicamba rates when tank mixed with nicosulfuron.

Nicosulfuron plus dicamba and adjuvant volumes, Casselton 1992. 'Interstate 343A' corn was planted May 12. Treatments were applied to 5- to 6-leaf corn, 2- to 6-inch foxtail, 4- to 10-inch kochia, 2- to 6-inch common lambsquarters, and 5- to 10-inch common cocklebur on June 20 with 69 F, 70% RH, partly cloudy sky, and 5 mph wind. Treatments were applied with a bicycle wheel type sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzle to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 13					August 4		Oct 20
		Corn inj	Grft	Colq	KOCZ	Cocb	Corn inj	Yeft	Corn yield
	oz/A	%							bu/A
Nico+Dica+Scoil	0.37+4+1%	3	91	95	94	93	0	81	48
Nico+Dica+Scoil	0.37+4+2%	3	93	95	95	96	0	86	47
Nico+Dica+Scoil	0.37+4+3%	1	95	96	96	96	0	92	47
Nico+Dica+Scoil+28N	0.37+4+1%+4%	1	94	95	95	96	0	91	45
Nico+Dica+Scoil+28N	0.37+4+2%+4%	2	91	95	95	96	0	84	45
Nico+Dica+Scoil+28N	0.37+4+3%+4%	1	94	95	95	96	0	91	44
Nico+Dica+X-77	0.37+4+0.25%	1	87	96	96	96	0	78	42
Nico+Dica+X-77+28N	0.37+4+0.25%+4%	0	91	95	95	96	0	88	40
Untreated	0	0	0	0	0	0	0	0	5
LSD 5%		2	3	2	1	2	NS	7	11
# of REPS		4	4	4	4	4	4	4	4

Summary

Corn injury levels were low regardless of the adjuvant or adjuvant volume. Corn injury with 3% Scoil was equal to X-77, indicating that levels of corn injury did not increase with the percent Scoil in the spray solution at the July 13 evaluation. Injury symptoms were not evident from any treatment at the August 4 evaluation. Increasing the Scoil volume increased control of green and yellow foxtail, kochia, and common cocklebur by nicosulfuron+dicamba. Grass control by nicosulfuron with Scoil was generally greater than with X-77, regardless of the Scoil volume. Corn yields tended to be higher with Scoil than X-77. In general level of weed control, corn injury and yield was similiar with or without 28% nitrogen added to the spray solution.

Nicosulfuron with dicamba in corn, Casselton 1992. 'Interstate 343A' was seeded May 12. Treatments were applied to 6-leaf corn, 2- to 5-inch foxtail spp., 2- to 4-inch common lambsquarters, and 3- to 8-inch kochia on June 21 with 60 F, 50% RH, cloudy sky, 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 a 7 ft wide area the length of a 10 by 30 ft plot. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Corn inj	July 13 Grft	July 13 KOCZ	July 13 Colq	August 4 Grft	August 4 Yeft	August 4 KOCZ	August 4 Colq
	oz/A	%							
Nicosulfuron+X-77	0.12+0.25%	0	40	24	16	43	23	11	0
Nicosulfuron+X-77	0.25+0.25%	0	53	32	25	80	35	23	15
Nicosulfuron+X-77	0.50+0.25%	0	79	43	38	90	56	43	38
Nicosulfuron+Scoil	0.12+1%	0	59	52	50	82	35	35	18
Nicosulfuron+Scoil	0.25+1%	0	82	58	50	91	61	45	31
Nicosulfuron+Scoil	0.50+1%	0	95	84	75	92	84	71	58
Nico+Dica-dma+X-77	0.12+1+0.25%	0	43	79	87	46	25	80	87
Nico+Dica-dma+X-77	0.12+2+0.25%	0	41	86	91	44	27	91	95
Nico+Dica-dma+X-77	0.12+4+0.25%	0	44	94	94	38	30	94	97
Nico+Dica-dma+X-77	0.25+1+0.25%	0	53	81	88	68	34	72	90
Nico+Dica-dma+X-77	0.25+2+0.25%	0	62	90	93	54	38	85	94
Nico+Dica-dma+X-77	0.25+4+0.25%	0	59	93	92	53	36	94	99
Nico+Dica-dma+X-77	0.50+1+0.25%	0	87	82	87	84	51	79	90
Nico+Dica-dma+X-77	0.50+2+0.25%	0	83	90	90	81	53	91	95
Nico+Dica-dma+X-77	0.50+4+0.25%	0	75	95	94	86	46	94	97
Nico+Dica-dma+Scoil	0.12+1+1%	0	61	81	90	75	40	83	91
Nico+Dica-dma+Scoil	0.12+2+1%	0	57	93	94	80	30	95	98
Nico+Dica-dma+Scoil	0.12+4+1%	0	64	95	96	79	33	98	99
Nico+Dica-dma+Scoil	0.25+1+1%	0	81	89	88	87	53	88	93
Nico+Dica-dma+Scoil	0.25+2+1%	0	80	93	94	84	53	94	97
Nico+Dica-dma+Scoil	0.25+4+1%	0	74	95	96	85	42	96	99
Nico+Dica-dma+Scoil	0.50+1+1%	0	92	92	91	91	76	85	92
Nico+Dica-dma+Scoil	0.50+2+1%	0	92	93	94	90	76	90	95
Nico+Dica-dma+Scoil	0.50+4+1%	0	91	95	95	89	66	96	98
Dicamba-dma+X-77	1+0.25%	0	0	71	79	0	0	79	85
Dicamba-dma+X-77	2+0.25%	0	0	83	89	0	0	88	94
Dicamba-dma+X-77	4+0.25%	0	0	92	94	0	0	97	99
Dicamba-dma+Scoil	1+1%	0	0	71	86	0	0	83	89
Dicamba-dma+Scoil	2+1%	0	0	88	89	0	0	86	92
Dica-dma+Scoil	4+1%	0	6	93	95	0	0	96	97
Untreated	0	0	0	0	0	0	0	0	0
LSD 5%			11	11	10	12	10	10	8
# of REPS		4	4	4	4	4	4	4	4

Summary

Corn was not injured by any treatment. Green foxtail control by 0.25 oz/A nicosulfuron was antagonized by all dicamba rates when applied with X-77, but not Scoil. Yellow foxtail control by nicosulfuron at 0.25 and 0.5 oz/A was generally reduced by dicamba when applied with Scoil, but not X-77. Kochia and common lambsquarters control by nicoulfuron was increased more by Scoil than X-77, but level of control was poor regardless of the adjuvant used. Dicamba at 2 and 4 oz/A gave greater of control broadleaf weeds than dicamba at 1 oz/A whether applied alone or in combination with nicosulfuron. Control of all weed species was generally greater for herbicide treatments applied with Scoil than X-77.

<u>Nicosulfuron with dicamba in corn, Wyndmere 1992</u>. '4-Star 5200' corn was planted May 2. Treatments were applied to 6-leaf corn, 2- to 3-inch field sandbur, 2- to 4-inch wild-proso millet, 4- to 15-inch Russian thistle and 4-leaf to vining wild buckwheat on June 18 with 78 F, 88% RH, cloudy sky, and 5 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replicates.

Treatment	Rate	Corn inj	July 16				August 14		
			Prmi	Fisb	Ruth	Wibw	Prmi	Fisb	Ruth
	oz/A	%							
Nicosulfuron+X-77	0.12+0.25%	0	45	45	5	4	41	39	0
Nicosulfuron+X-77	0.25+0.25%	0	50	56	0	3	58	68	0
Nicosulfuron+X-77	0.50+0.25%	0	87	89	14	17	85	81	4
Nicosulfuron+Scoil	0.12+1%	0	67	67	16	13	57	62	0
Nicosulfuron+Scoil	0.25+1%	0	88	91	3	6	93	92	8
Nicosulfuron+Scoil	0.50+1%	0	93	98	23	36	97	97	8
Nico+Dica-dma+X-77	0.12+1+0.25%	0	46	50	83	85	49	51	74
Nico+Dica-dma+X-77	0.12+2+0.25%	0	52	52	80	88	47	48	74
Nico+Dica-dma+X-77	0.12+4+0.25%	0	61	58	90	94	53	53	88
Nico+Dica-dma+X-77	0.25+1+0.25%	0	66	65	83	84	55	58	63
Nico+Dica-dma+X-77	0.25+2+0.25%	0	63	64	86	92	67	68	74
Nico+Dica-dma+X-77	0.25+4+0.25%	0	68	64	90	95	62	71	88
Nico+Dica-dma+X-77	0.50+1+0.25%	0	79	83	85	91	70	75	54
Nico+Dica-dma+X-77	0.50+2+0.25%	0	85	87	88	90	73	81	84
Nico+Dica-dma+X-77	0.50+4+0.25%	0	81	83	91	95	75	79	87
Nico+Dica-dma+Scoil	0.12+1+1%	0	53	63	85	91	59	58	66
Nico+Dica-dma+Scoil	0.12+2+1%	0	50	61	88	92	47	54	81
Nico+Dica-dma+Scoil	0.12+4+1%	0	53	56	92	93	48	49	88
Nico+Dica-dma+Scoil	0.25+1+1%	0	50	63	84	88	46	70	70
Nico+Dica-dma+Scoil	0.25+2+1%	0	78	81	89	93	70	74	84
Nico+Dica-dma+Scoil	0.25+4+1%	0	69	72	89	94	63	68	90
Nico+Dica-dma+Scoil	0.50+1+1%	0	85	87	87	87	91	87	77
Nico+Dica-dma+Scoil	0.50+2+1%	0	84	85	91	94	84	82	86
Nico+Dica-dma+Scoil	0.50+4+1%	0	81	83	91	93	75	80	89
Dicamba-dma+X-77	1+0.25%	0	0	0	84	86	0	0	72
Dicamba-dma+X-77	2+0.25%	0	0	0	87	88	0	0	75
Dicamba-dma+X-77	4+0.25%	0	0	0	92	95	0	0	90
Dicamba-dma+Scoil	1+1%	0	0	0	80	87	0	0	62
Dicamba-dma+Scoil	2+1%	0	0	0	86	89	0	0	86
Dicamba-dma+Scoil	4+1%	0	0	0	91	94	0	0	90
Untreated	0	0	0	0	0	0	0	0	0
LSD 5%			13	11	8	8	14	12	12
# of REPS		4	4	4	4	4	4	4	4

Summary

Corn was not injured by any treatment. Wild-proso millet and field sandbur control by nicosulfuron phytotoxicity was antagonized by dicamba at certain rates when applied with the adjuvant Scoil, but not X-77. However, nicosulfuron control of grasses never less when applied with Scoil than with X-77. Russian thistle and wild buckwheat control by nicosulfuron alone was poor. Broadleaf weed control was increased when nicosulfuron was tank mixed with dicamba and similiar regardless of dicamba rate or adjuvant at the July 16 evaluation. At the August 14 evaluation, Russian thistle control generally recovered with dicamba rate.

Weed control in corn from preplant incorporated herbicides, Casselton. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in corn. 'Interstate 343A' corn was seeded May 11, 1992. Treatments were applied on May 11 with 75 F, 51% relative humidity, partly cloudy sky and 7 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates/treatment.

Treatment[a]	Rate	June 26					July 28				
		Fxtl	KOCZ	Wimu	Colq	Cocb	Fxtl	KOCZ	Wimu	Colq	Cocb
	lb/A	% control									
EPTC + Diclormid	4	81	54	66	83	0	98	58	50	89	30
Alachlor	3	77	66	69	57	10	74	51	49	49	13
Alachlor + Cyanazine-DF	3+1.5	75	84	86	89	13	79	60	50	68	0
SAN-582H	1.5	93	73	89	75	15	94	68	72	70	18
SAN-582H + Cyanazine-DF	1.5+1.5	92	88	96	89	40	92	83	95	84	20
Acetochlor + Dichlormid	1.8	86	88	80	88	26	96	84	73	80	18
Acet. + Dichlormid + Cyan-DF	1.8+1.5	92	92	94	90	25	87	85	88	85	15
MON 8421	2	90	76	85	86	23	87	59	55	57	0
MON 8421 + Cyanazine	2+1.5	88	96	94	76	26	91	91	75	86	0
Untreated		0	0	0	0	0	0	0	0	0	0
C.V.%		12	19	15	23	99	14	34	39	32	78
LSD 5%		9	11	12	14	16	7	11	14	11	16

Dichlormid is a safener, SAN-582H - proposed common name = dimethenamide is an acetanilide herbicide, MON-8421 is a microencapsulated formulation of acetochlor.

Alachlor generally gave less control and acetachlor greater control than other acetanalide herbicides tested. However, when cyanazine was added little differences were observed. MON 8421 is a microencapsulated formulation of acetachlor. Weed control from MON 8421 applied alone was lower for the later evaluation than the initial evaluation. This observation was not noted to the same degree with other herbicides including treatments containing cyanazine.

<u>Weed control in corn from preemergence acetanilide herbicides, Casselton.</u> An experiment was conducted to evaluate weed control from acetanilide herbicides with and without cyanazine. 'Interstate 343A' corn was seeded May 12, 1992. Preemergence herbicides were applied on June 13 with 63 F, 56% relative humidity, partly cloudy sky and 6 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized block design with four replicates/treatment.

		June 26					July 28				
Treatment	Rate	Grft& Yeft	KOCZ	Wimu	Colq	Cocb	Grft& Yeft	KOCZ	Wimu	Colq	Cocb
	lb/A	% control									
Alachlor	3.5	76	33	18	48	0	75	80	0	45	13
Alachlor + Cyanazine	3.5+1.5	76	78	66	63	15	73	74	54	55	25
Metolachlor	3	36	8	0	6	0	63	16	0	10	0
Metolachlor + Cyanazine	3+1.5	58	49	59	48	0	70	55	49	35	15
Propachlor	4	65	39	13	23	0	90	61	33	35	0
Propachlor + Cyanazine	4+1.5	85	94	91	94	31	78	78	60	58	25
Acetochlor + Dichlormid	1.2	69	61	30	35	0	71	63	10	30	0
Acetochlor + Dichlormid	1.8	65	45	45	45	0	78	78	60	58	25
Acetochlor + Dichlormid	2.2	87	71	49	57	57	93	96	75	74	35
Acet + Dichlor + Cyan	1.2+1.5	93	96	98	86	72	85	78	73	40	40
Acet + Dichlor + Cyan	1.8+1.5	95	99	90	93	43	93	97	91	66	35
Acet + Dichlor + Cyan	2.2+1.5	97	99	93	96	68	91	99	99	86	45
SAN-582H	1.25	80	63	30	46	0	79	70	32	50	0
SAN-582H	1.38	75	67	20	43	0	86	80	38	65	8
SAN-582H	1.5	89	89	90	78	26	93	89	85	68	18
SAN-582H + Cyanazine	1.25+1.5	81	91	78	76	28	94	97	97	85	46
MON-8421[a]	1.75	69	53	38	28	0	85	79	40	40	0
MON-8421	2	76	56	40	47	0	88	79	50	50	8
Alachlor+MON-12000+MON-13900	1.5+0.075	59	99	97	99	79	64	96	97	96	94
Untreated		0	0	0	0	0	0	0	0	0	0
C.V.%		11	36	30	34	53	8	12	23	24	57
LSD 5%		11	33	22	26	16	9	13	17	18	30

[a]Acetochlor + Dichlormid = Surpass (ICI), SAN-582H = Frontier (proposed common name - dimethenamid), MON-8421 = micro-encapsulated formulation of acetochlor, MON-12000 is a sulfonylurea herbicide - trade name 'Permit'(Monsanto), Dichlormid and MON13900 are safeners, MON-12000+MON-13900 will be marketed as "Battalion", Alachlor+MON-12000+MON13900 will be marketed as "Tophand".

Ten days following herbicide application, a total of 1.75 inches of precipitation had accumulated. No crop injury was recorded from any treatment. Foxtail control was similar from most treatments without cyanazine. Foxtail control was greatest from acetochlor plus cyanazine. Cyanazine generally increased broadleaf weed control with acetanilide herbicides. Treatments containing acetochlor generally had the highest weed control and appeared more active on weed species present than other herbicide treatments. Most herbicide treatments provided poor common cocklebur control. Alachlor plus MON-12000 plus MON 13900 provided excellent control of all broadleaf weeds but gave poor grass control.

Weed control in corn from nicosulfuron with herbicides and adjuvants, Casselton. An experiment was conducted to evaluate weed control from nicosulfuron with various herbicides and commercial adjuvants. 'Interstate 343A' corn was seeded May 12, 1992. The early postemergence treatment was applied to 3-leaf corn, 1- to 2.5-inch foxtail, 0.5 inch redroot pigweed, 3 inch wild mustard, 1- to 3.5-inch kochia, 1- to 2.5-inch common lambsquarters, and 1- to 4-inch common cocklebur on June 9 with 71 F, 64% relative humidity, partly cloudy sky and 4 mph wind. Postemergence treatments were applied to 4-leaf corn, 2- to 5-inch foxtail, 1- to 2-inch redroot pigweed, 4- to 10-inch wild mustard, 2- to 6-inch kochia, 1.5- to 3-inch common lambsquarters, and 2- to 5-inch common cocklebur on June 13 with 72 F, 78% relative humidity, partly cloudy sky and 6 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four reps/treatment.

		June 26			July 28			
Treatment[a]	Rate	Grft& Yeft	KOCZ	Colq	Grft	Yeft	KOCZ	Colq
	oz/A	% control						
Pendimethalin + Cyanazine (EPOST)	16+32	89	98	99	83	75	91	99
Metribuzin + Dicamba dma	1.5+8	35	94	99	44	36	99	99
Metribuzin + 2,4-D dma	1.5+8	20	71	97	29	24	80	99
Nicosulfuron + Scoil + UAN 28%	0.25+2%+4%	95	99	92	97	73	99	70
Nicosulfuron + Bromoxynil + X-77	0.25+4+2%	78	99	99	70	31	73	68
Nico + Bromoxynil + X-77 + UAN 28%	0.25+4+2%+4%	92	99	99	78	40	78	69
Nicosulfuron + Bromoxynil + Mor-Act	0.25+4+2%	68	99	99	85	68	85	83
Nico + Brox + Mor-Act + UAN 28%	0.25+4+2%+4%	88	99	99	83	60	86	84
Nicosulfuron + Bromoxynil + Scoil	0.25+4+2%	80	97	99	90	60	99	99
Nico + Bromoxynil + Scoil + UAN 28%	0.25+4+2%+4%	83	99	99	94	58	99	99
Nico + Bromoxynil (Gel) + Scoil	0.25+4+2%	94	99	99	98	92	99	99
Nico + Bromoxynil (Gel) + Scoil	0.25+6+2%	98	99	99	96	86	99	99
Nicosulfuron + MON-12000 + X-77	0.25+0.25+2%	65	94	21	91	79	99	0
Nico + MON-12000 + X-77 + UAN 28%	0.25+0.25+2%+4%	73	80	20	96	87	90	63
Nicosulfuron + MON-12000 + Scoil	0.25+0.25+2%	90	90	8	91	78	99	59
Nicosulfuron + Atrazine + Scoil	0.25+6+2%	96	99	99	99	94	99	99
Nico + Atrazine + Scoil + UAN 28%	0.25+6+2%+4%	94	99	99	99	94	99	99
Nicosulfuron + 2,4-D dma + X-77	0.25+5.25+0.25%	69	81	66	80	53	73	99
Nicosulfuron + 2,4-D ioe + X-77	0.25+3+0.25%	83	96	84	88	79	96	99
Untreated		0	0	0	0	0	0	0
C.V.%		14	7	23	5	8	4	5
LSD 5%		15	9	26	6	7	4	6

[a]X-77 = nonionic surfactant, Mor-Act = petroleum oil with 17% emulsifier; 2,4-D dma = Savage, 2,4-D ioe = Salvo; and Scoil = methylated seed oil; dma = dimethylamine; ioe = isooctyl ester.

Nicosulfuron did not injure corn regardless of accompanying herbicide or adjuvant. However, nicosulfuron was applied at one-half the commercial rate to provide a control level for differentiation among adjuvants. Complete control of redroot pigweed, wild mustard and common cocklebur was observed with all treatments. Nicosulfuron with Scoil treatments were generally superior to other treatments. Scoil with nicosulfuron and bromoxynil enhanced foxtail and kochia control compared to Mor-Act and X-77. Treatments containing the gel formulation of bromoxynil resulted in greater foxtail control at June 26 and greater yellow foxtail control at July 28. Treatments containing MON-12000 gave poor common lambsquarters control. Treatments containing atrazine showed the greatest long season weed control. Reduction in grass control was observed when some broadleaf herbicides were tank-mixed with nicosulfuron. Nicosulfuron plus bromoxynil plus Scoil gave greater control of green and yellow foxtail on July 28 than nicosulfuron plus broxoxynil plus X-77 plus 28% nitrogen.

Weed control in corn, Carrington. An experiment was conducted to evaluate weed control from available and experimental herbicides and commercial adjuvants. 'Cargill 809' corn was seeded May 21, 1992. Eradicane was applied on May 21 uder clear skies, 58 F air temperature, 56% relative humidity, 19 mph wind, 57 F soil temperature at 2 inches and good subsurface moisture. Incorporation was performed immediatly after application. Preemergence treatments were applied on May 28 with 87 F, 50% relative humidity, no cloudy sky and 23 mph wind. Postemergence treatments were applied to V3-V4 leaf corn, 3- to 5-leaf foxtail, 4 leaf redroot pigweed, 4- to 6 leaf comon lambquarters, 2-inch kochia, and 4-leaf prostrate pigwed on June 12 with 77 F, 46% relative humidity, no cloudy sky and 10 mph wind. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa (8002 flat fan nozzles) for soil applied treatments and 8.5 gpa (8001 flat fan nozzles) for post applied treatments at 40 psi. The experiment was a RCB design with four replications/treatment.

		July 14							
Treatment[a]	Rate	Fxtl	KOCZ	Ruth	Colq	Rrpw	Prpw	Wimu	Wibw
	lb/A	--- % control ---							
EPTC + Dichlormid (PPI)	4	90	23	18	91	86	81	52	25
Propachlor + Cyanazine (PRE)	4+1.5	0	0	0	0	10	3	0	0
Acetochlor + Dichlormid (PRE)	1.2	3	0	0	0	0	8	5	0
Acetochlor + Dichlormid (PRE)	1.8	5	0	0	0	0	5	0	0
Acet + Dichlor + Cyanazine (PRE)	1.2+1.5	8	28	0	0	5	0	0	0
Acet + Dichlor + Cyanazine (PRE)	1.8+1.5	9	21	13	8	9	5	32	10
SAN-582H (PRE)	1.25	0	0	0	0	0	0	10	3
SAN-582H (PRE)	1.5	4	0	0	0	0	0	8	0
SAN-582H + Cyanazine (PRE)	1.25+1.5	8	0	0	11	8	3	8	4
SAN-582H + Cyanazine (PRE)	1.5+1.5	5	0	0	0	5	0	30	0
MON 8421 (PRE)	1.75	0	0	0	0	0	0	8	0
Alachlor+MON-12000+MON-13900 (PRE)	1.5+1.2	0	25	25	13	13	8	50	30
Nicosulfuron + Scoil(POST)	0.25oz+2%	73	91	59	0	90	90	99	43
Nicosulfuron + Scoil+UAN 28% (POST)	0.25oz+2%+4%	81	94	41	0	96	88	74	50
Nico + Bromoxynil+Scoil (POST)	0.25oz+4oz+2%	74	97	99	86	95	88	99	85
Nico + Atra+Scoil+UAN 28% (POST)	0.25oz+6+2%+4%	81	99	76	95	97	86	99	90
Nico + MON-12000+X-77+28%N (POST)	0.25+0.26oz+0.25%	66	87	97	0	98	91	9	62
Nico + MON-12000+Scoil (POST)	0.25+0.26oz+2%	74	96	99	0	94	91	99	82
Alachlor(PRE)/MON-12000+X-77 (POST)	1.5/0.26oz+0.25%	0	5	0	0	0	0	50	5
Alachlor(PRE)/MON-12000 + Scoil(POST)	1.5/0.26oz+2%	0	39	50	0	34	29	50	32
Alachlor(PRE)/2,4-D dma (POST)	1.5/0.33	0	48	71	66	40	28	74	35
Alachlor(PRE)/2,4-D ioe (POST)	1.5/0.188	0	94	98	98	75	55	99	76
Untreated		0	0	0	0	0	0	0	0
C.V.%		25	26	19	16	14	15	18	28
LSD 5%		9	13	13	17	12	19	24	13

[a]Acetochlor + Dichlormid = Surpass (ICI), SAN-582H = Frontier (Sandoz), MON-8421 = microencapsulated formulation of acetochlor, MON-12000 = Permit, X-77 = nonionic surfactant, 2,4-D dma = Savage, 2,4-D ioe = Salvo, Scoil = methylated seed oil, dma = dimethylamine, ioe = isooctyl ester.

Failure of most preemergence herbicides was due to lack of precipitation for several weeks after application. Scoil enhanced foxtail control from nicosulfuron more than X-77. Most postemergence treatments containing nicosulfuron, bromoxynil, or atrazine controlled kochia, redroot pigweed, prostrate pigweed, or wild mustard. Nicosulfuron alone was weak on Russian thistle. MON-12000 is weak on common lambsquarters. Much greater Russian thistle and wild buckwheat control was observed with nicosulfuron+ MON-12000+Scoil than either herbicide alone. Treatments containing atrazine or bromoxynil controlled wild buckwheat. 2,4-D iso gave greater control of drought stressed weeds than 2,4-D dma.

Wild proso millet in corn, Leonard. An experiment was conducted to evaluate weed control, including wild proso millet, from nicosulfuron with various herbicides and commercial adjuvants. 'Dahlgren 5962' corn was seeded May 10, 1992. Early postemergence treatments were applied to 2-leaf corn, 0.5- to 1.5-inch wild proso millet, 0.5- to 1.5-inch foxtail, and 1- to 4-inch Russian thistle on June 9 with 76 F, 56% relative humidity, partly cloudy sky and 5 mph wind. Postemergence treatments were applied to 4-leaf corn, 0.5- to 3.5-inch wild proso millet, 0.5- to 3.5-inch foxtail, and 1- to 4-inch Russian thistle on June 13 with 78 F, 62% relative humidity, partly cloudy sky and 3 mph wind. Post-directed treatments were applied to 9-leaf corn, 3- to 5-inch wild proso millet, 3- to 6-inch foxtail, and 2- to 6-inch Russian thistle on June 26. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles.

Treatment[a]	Rate	July 7		
		Wipm	Yeft	Ruth
	oz/A	----------------	% control	----------------
Pendimethalin + Cyanazine (EPOST)	16+24	70	73	85
Pendimethalin + Cyanazine (EPOST)	24+32	82	87	92
Nicosulfuron + X-77	0.25+0.25%	46	56	41
Nicosulfuron + X-77 + UAN 28%	0.25+0.25%+4%	56	63	63
Nicosulfuron + Preference	0.25+0.25%	46	52	28
Nicosulfuron + Preference + UAN 28%	0.25+0.25%+4%	66	68	56
Nicosulfuron + Mor-Act	0.25+2%	61	65	53
Nicosulfuron + Mor-Act + UAN 28%	0.25+2%+4%	76	78	61
Nicosulfuron + MSO	0.25+2%	85	86	71
Nicosulfuron + MSO + UAN 28%	0.25+2%+4%	90	93	81
Nicosulfuron + Meth-Oil	0.25+2%	91	95	75
Nicosulfuron + Meth-Oil + UAN 28%	0.25+2%+4%	96	97	83
Nicosulfuron + Scoil	0.25+2%	94	97	89
Nicosulfuron + Scoil + UAN 28%	0.25+2%+4%	95	97	94
Nicosulfuron + Bromoxynil + Scoil	0.25+4+2%	90	90	94
Nico + Bromoxynil + Scoil + UAN 28%	0.25+4+2%+4%	95	95	97
Nicosulfuron + MON-12000 + Scoil	0.25+0.25+2%	73	81	91
Nico + MON-12000 + Scoil + UAN 28%	0.25+0.25+2%+4%	86	91	88
Nicosulfuron + Atrazine + Scoil	0.25+6+2%	97	98	98
Nico + Atrazine + Scoil + UAN 28%	0.25+6+2%+4%	98	98	94
Paraquat + X-77 (Directed)	4+0.25%	85	90	75
Paraquat + 2,4-D dma + X-77 (Directed)	4+8+0.25%	95	95	80
Paraquat + Dicamba + X-77 (Directed)	4+2+0.25%	98	95	95
Bromoxynil+Metribuzin (Directed)	4+1.125	43	53	99
Untreated		0	0	0
C.V.%		11	10	16
LSD 5%		12	12	18

[a]X-77 = nonionic surfactant, Preference = surfactant, Mor-Act = petroleum oil with 17% emulsifier (Wilbur-Ellis), MSO, Meth-Oil ans Scoil = methylated seed oil.

No corn injury was recorded from any treatment. Only the highest rate of pendimethalin plus cyanazine gave over 80% weed control. Nicosulfuron did not injure corn regardless of accompanying herbicide or adjuvant. However, nicosulfuron was applied at one-half the commercial rate to provide a control level for differentiation among adjuvants. Nicosulfuron with methylated seed oil adjuvants (Scoil, MSO, Meth-Oil) controlled all species similarly and generally gave control superior to other adjuvants. Mor-Act generally gave greater weed control than nonionic surfactants. However, 28% nitrogen generally improved control more for less effective adjuvants than for more effective adjuvants. Nicosulfuron plus Scoil, MSO, or Meth-Oil without 28% nitrogen gave better grass control than nicosulfuron plus 28% nitrogen plus X-77, Preference, or Mor-Act. Wild proso millet control was less with treatments containing nicosulfuron and MON-12000 compared to treatments containing atrazine or bromoxynil. Post-directed treatments with paraquat adaquately controlled all weed species.

Postemergence grass and broadleaf weed control, Casselton 1992. 'McCall' soybeans were seeded May 12. Treatments were applied to 2nd trifoliolate soybeans, 6- to 12-inch tall kochia, 4- to 8-inch tall common lambsquarter, 6- to 13-inch tall wild mustard, and 2- to 5-inch tall foxtail on June 20 with 72 F, 70% RH, a 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were foxtail 10 plants per sq ft, kochia greater than 3 plants per sq ft, wild mustard 0.1 plant per sq ft, and common lambsquarter 1 plant per sq ft.

		July 17				
Treatment	Rate	Sobe	Fota	KOCZ	Wimu	Colq
	oz/A	%				
Bent&Acif+Poast-Plus®+28N	15+3+2.5%	21	78	80	99	88
Imazethapyr+Sun-itII+28N	0.75+0.18G+2.5%	6	89	98	99	77
Lactofen+PO+Poast-Plus	3+0.25G+3	15	75	87	99	28
Lactofen+Sun-itII+Poast-Plus	3+0.18G+3	16	79	78	99	41
Thif+Bent+Poast-Plus	0.06+8+3	9	94	47	99	95
Thif+Bent+Poast-Plus+Scoil	0.06+8+3+0.18G	4	94	44	99	87
Imep+Bent+Flua&Fenx+Sun-itII	0.3+8+2.5+0.18G	9	99	72	94	46
Imep+Bent+Poast-Plus+Sun-itII	0.3+8+3+0.18G	9	83	78	89	50
Untreated	0	0	0	0	0	0
C.V. %		55	8	13	8	20
LSD 5%		8	9	12	10	17
# OF REPS		4	4	4	4	4

Summary

Lactofen and bentazon & acifluorfen + sethoxydim (Poast-Plus) caused a burn to the soybeans, but plants recovered later in the season. Thifensulfuron + bentazon + Poast-Plus was equally as effective with or without Scoil adjuvant. Imazethapyr + bentazon were more effective for foxtail control when applied with fluazifop & fenoxaprop than Poast Plus. Kochia control was the greatest with imazethapyr + Sunit-II + 28% N. Common lambsquarter control was generally greatest for treatments with bentazon at 15 oz/A or at 8 oz/A when with thifensulfuron, not when with imazethapyr.

Imazethapyr plus bentazon in soybeans, Casselton 1992. 'McCall' soybeans were seeded May 12. Treatments were applied to first trifoliolate soybeans, 1- to 3-inch tall foxtail and common lambsquarter, 1- to 4-inch tall kochia, and 2- to 5-inch tall wild mustard on June 12 with 86 F, 63% 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 5				July 17					August 31		
		Sobe	Fxtl	KOCZ	Colq	Sobe	Fxtl	KOCZ	Wimu	Colq	Fxtl	KOCZ	Colq
	oz/A	%											
Imazethapyr+Sun-itII	.3+.18G	3	77	98	68	3	71	99	95	40	75	97	54
Imazethapyr+X-77	.3+.25%	3	56	95	59	4	53	94	95	27	49	92	31
Imep+Sun-itII+AMS	.3+.18G+19	0	82	99	65	4	77	99	99	30	73	98	38
Imazethapyr+X-77+AMS	.3+.25%+19	1	64	99	70	4	44	99	98	39	54	95	45
Imep+Bent+Sun-itII	.3+12+.18G	0	60	99	99	4	38	99	99	98	48	99	93
Imazethapyr+Bent+X-77	.3+12+.25%	1	48	97	99	3	29	96	98	99	31	86	93
Imep+Bent+Sun-itII+AMS	.3+12+.18G+19	3	73	99	96	4	51	98	99	91	45	97	79
Imep+Bent+X-77+AMS	.3+12+.25%+19	3	58	99	99	1	30	99	96	99	31	94	96
Imep+Sun-itII+NaHCO3	.3+.18G+4	0	71	99	68	1	60	99	98	51	71	94	60
Imep+Sun-it+NaHCO3+AMS	.3+.18G+4+19	1	85	99	76	6	74	99	98	46	76	98	50
Imep+Sun-itII+NaHCO3+AMN	.3+.18G+4+23	1	79	74	53	3	59	99	98	30	69	96	38
Bent+X-77	12+.25%	0	0	99	99	0	0	95	99	99	0	91	96
Bent+Sun-itII	12+.18G	0	1	99	97	0	0	94	97	91	0	90	89
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0
C.V. %		183	17	15	15	143	28	3	3	16	27	6	17
LSD 5%		NS	13	19	16	NS	17	4	4	13	17	7	15
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

Summary

Bentazon generally antagonized foxtail control from imazethapyr applied with X-77 or Sun-it II. Imazethapyr control of foxtail and common lambsquarters was greater when applied with Sun-it II than X-77. The inclusion of ammonium sulfate in the spray solution did not generally influence weed control or overcome bentazon antagonism. These results differ from those in 1991 where ammonium sulfate reduced the antagonism from bentazon. Foxtail control was less in 1992 than 1991 possibly because of their advanced growth and the dense population of kochia may have intercepted the spray from contacting the foxtail. The low control may have prevented expression of differences among treatments.

Bentazon plus sethoxydim in soybeans, Casselton 1992. 'McCall' soybeans were seeded May 12. Treatments were applied to 2nd trifoliolate soybeans, 4- to 6-leaf green and yellow foxtail, 8- to 10-inch tall wild mustard, 3- to 7-inch tall kochia, and 2- to 6-inch tall common lambsquarter on June 20 with 65 F, 65% RH, a partly cloudy sky, and no wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		July 17				
			Grft&			
Treatment	Rate	Sobe	Yeft	KOCZ	Wimu	Colq
	oz/A	%				
Bent+Thif+Poast-Plus®+PO+28N	8+.03+2.9+1.25%+2.5%	6	96	68	96	85
Bent+Thif+Poast-Plus+PO+28N	8+.045+2.9+1.25%+2.5%	5	95	73	96	88
Bent+Thif+Poast-Plus+PO+28N	12+.03+2.9+1.25%+2.5%	1	95	61	95	83
Bent+Thif+Poast-Plus+PO+28N	12+.045+2.9+1.25%+2.5%	8	98	77	92	91
Bent+Thif+Poast-Plus+28N	8+.03+2.9+2.5%	10	96	67	92	88
Bent+Thif+Poast-Plus+28N	8+.045+2.9+2.5%	5	95	72	96	91
Bent+Thif+Poast-Plus+28N	12+.03+2.9+2.5%	4	93	69	92	87
Bent+Thif+Poast-Plus+28N	12+.045+2.9+2.5%	8	96	75	96	88
Bent+Thif+PO+28N/Poast-Plus+Dash	8+.03+1.25%+2.5%/2.9+1.25%	3	95	67	94	76
Bent+Thif+PO+28N/Poast-Plus+Dash	8+.045+1.25%+2.5%/2.9+1.25%	4	97	69	91	81
Bent+Thif+PO+28N/Poast-Plus+Dash	12+.03+1.25%+2.5%/2.9+1.25%	6	94	66	93	76
Bent+Thif+PO+28N/Poast-Plus+Dash	12+.045+1.25%+2.5%/2.9+1.25%	5	94	60	92	79
Imep+Sun-itII+28N	.75+.18G+2.5%	13	89	99	99	75
Untreated	0	0	0	0	0	0
C.V. %		75	3	10	4	10
LSD 5%		6	4	9	5	11
# OF REPS		4	4	4	4	4

Summary

None of the treatments caused important injury to soybeans. Yellow foxtail control exceeded 90% regardless if Poast-Plus was applied with only 28% N; 28% N and petroleum oil adjuvant (PO), or Dash adjuvant. Imazethapyr controlled kochia and wild mustard better than the other treatments, but common lambsquarter control generally was higher with bentazon + thifensulfuron applied as a tank mixture with Poast-Plus.

Bentazon plus thifensulfuron in soybeans at Casselton, 1992. 'McCall' soybeans were seeded May 12. The experiment area was treated with sethoxydim at 3 oz ai/Aplus oil on June 5 for control of grass weeds. Treatments were applied to 2nd trifoliolate soybeans, 4- to 10-inch tall kochia, 8- to 12-inch wild mustard, and 1- to 3-inch redroot pigweed on June 20 with 65 F, 65% RH, a partly cloudy sky, and no wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Weed densities were foxtail greater than 10 plants per square ft, kochia greater than 3 plants per square ft, and wild mustard and common lambsquarters 1 plant per square ft.

Treatment	Rate	July 17			
		Sobe	KOCZ	Wimu	Colq
	oz/A	--------	%	--------	
Bentazon+Thifensulfuron+X-77+28N	8+0.03+0.25%+2.5%	1	31	96	50
Bentazon+Thifensulfuron+X-77+28N	8+0.06+0.25%+2.5%	5	49	98	80
Bentazon+Thifensulfuron+X-77+28N	12+0.03+0.25%+2.5%	6	48	98	50
Bentazon+Thifensulfuron+X-77+28N	12+0.06+0.25%+2.5%	10	56	98	72
Bentazon+X-77+28N	8+0.25%+2.5%	1	35	83	29
Bentazon+X-77+28N	12+0.25%+2.5%	0	38	90	34
Thifensulfuron+X-77+28N	0.3+0.25%+2.5%	7	65	96	75
Thifensulfuron+X-77+28N	0.6+0.25%+2.5%	14	79	99	90
Bentazon&Acifluorfen+28N	15+2.5%	0	33	99	36
Imazethapyr+Sun-itII+28N	1+0.18G+2.5%	19	99	99	83
Bentazon+Imazethapyr+Sun-itII+28N	8+0.5+0.18G+2.5%	8	96	99	60
Imazethapyr+Sun-itII	0.5+0.18G	14	99	99	74
Imazethapyr+Sun-it+28N	0.5+0.18G+2.5%	15	99	99	66
Untreated	0	0	0	0	0
C.V. %		63	12	3	15
LSD 5%		6	10	3	12
# OF REPS		4	4	4	4

Summary

None of the herbicide treatments caused important injury to soybeans. All treatments containing imazethapyr at 0.5 or 1 oz/A gave complete control of kochia. The large weeds at treatment probably accounts for the low control of common lambsquarters with all herbicides and kochia with all herbicides except imazethapypr.

Weed control in soybeans from preplant incorporated herbicides, Casselton. An experiment was conducted to evaluate weed control from existing and recently developed herbicides in soybeans. 'McCall' soybeans was seeded May 12, 1992. Treatments were applied on May 11 with 77 F, 50% relative humidity, partly cloudy sky and 7 mph wind. Treatments were applied to an 8 ft wide area the size of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was a randomized complete block design with four replicates per treatment.

		July 26							
Treatment[a]	Rate	Fxtl	KOCZ	Wimu	Cocb	Colq	Rrpw	Corw	SB inj
	lb/A	% control							
Trific	0.9	98	92	5	0	88	99	99	0
Trific + Bentazon + PO	0.9+0.75+1qt	99	99	99	60	99	99	99	0
Trifluralin	0.9	99	76	15	10	79	99	99	0
F-6285 (4F)	0.38	94	99	98	99	99	99	99	11
F-6285 (75WG)	0.38	99	99	99	99	99	99	99	25
F-6285 (4F) + Trifluralin	0.38+0.5	99	99	99	99	99	99	99	4
F-6285 (75WG) + Trifluralin	0.38+0.5	99	99	99	99	99	99	99	0
Flumetsulam/Trifluralin	0.91	99	99	99	99	99	99	99	0
Flumetsulam/Trifluralin	1.03	99	99	99	99	99	99	99	0
Flumetsulam/Metolachlor	1.68	97	99	99	99	99	99	99	0
Flumetsulam/Metolachlor	1.92	98	92	99	99	97	9	99	0
Flumetsulam/Metolachlor	2.16	9	99	99	99	99	99	99	0
Untreated		0	0	0	0	0	0	0	0
C.V.%		3	10	8	20	5	0	0	47
LSD 5%		4	13	9	21	6	0	0	7

		August 3							
Treatment[a]	Rate	Fxtl	KOCZ	Wimu	Cocb	Colq	Rrpw	Corw	SB inj
	lb/A	% control							
Trific	0.9	99	81	8	3	85	99	49	0
Trific + Bentazon + PO	0.9+0.75+1qt	99	99	99	74	99	99	96	0
Trifluralin	0.9	99	69	8	8	79	99	24	0
F-6285 (4F)	0.38	87	99	99	99	99	99	88	0
F-6285 (75WG)	0.38	97	99	99	99	99	99	99	0
F-6285 (4F) + Trifluralin	0.38+0.5	99	99	99	99	99	99	99	0
F-6285 (75WG) + Trifluralin	0.38+0.5	99	99	99	99	99	99	99	0
Flumetsulam/Trifluralin	0.91	99	99	99	99	99	99	99	0
Flumetsulam/Trifluralin	1.03	99	99	99	99	99	99	99	0
Flumetsulam/Metolachlor	1.68	63	76	99	80	88	99	92	0
Flumetsulam/Metolachlor	1.92	99	90	99	99	80	99	99	0
Flumetsulam/Metolachlor	2.16	98	93	99	99	92	99	99	0
Untreated		0	0	0	0	0	0	0	0
C.V.%		5	8	8	21	8	0	9	0
LSD 5%		7	9	9	22	10	0	11	0

Flumetsulam = will be marketed under the tradename of Broadstrike, Trific = dry flowable formulation of trifluralin.

All treatments containg F-6285 or flumetsulam gave long season control of all weeds. Crop injury was observed from F-6285 in the initial rating but no crop injury was observed in the final rating. Subsequent flushes of cocklebur emerged after bentazon application.

Weed control in soybeans from imazethapyr with lactofen and adjuvants, Casselton. An experiment was conducted to evaluate weed control from imazethapyr with different adjuvants and tank-mixtures with lactofen. 'McCall' soybeans were seeded May 12, 1992. Postemergence treatments were applied to V1 (3-5 inch) soybeans, 4- to 10-leaf (1-4 inch) foxtail, 2 to 10 inch diameter wild mustard, 0.5- to 2 inch comon lambquarters, 1 to 5-inch kochia, 4- to 6-leaf (1.5- to 3-inch cocklebur), and 2- to 3-leaf (1 to 2 inch Venice mallow, on June 11 with 76 F, 79% relative humidity, cloudy sky and 4 mph wind. Bentazon was aplied 7 days before grass herbicides. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replications/treatment.

Treatment[a]	Rate	6-26-92				8-03-92				
		Fxtl	KOCZ	Colq	Vema	Fxtl	KOCZ	Colq	Vema	Cocb
	oz/A	% control								
Imazethapyr + X-77	0.5+0.25%	68	86	30	41	49	99	33	38	43
Imazethapyr + X-77 + 28%N	0.5+0.25%+2%	69	89	24	48	50	99	21	43	46
Imazethapyr + Preference + X-77	0.5+0.25%	64	89	28	36	48	99	16	35	40
Imazethapyr + Preference + 28%N	0.5+0.25%+2%	77	96	45	43	54	99	39	39	45
Imazethapyr + Mor-Act	0.5+1.5pt	85	97	61	43	65	99	48	41	59
Imazethapyr + Mor-Act + 28%N	0.5+1.5pt+2%	83	96	70	54	65	99	51	49	58
Imazethapyr + MSO	0.5+1.5pt	91	96	63	50	74	99	63	50	56
Imazethapyr + MSO + 28%N	0.5+1.5pt+2%	88	97	66	54	81	99	61	49	60
Imazethapyr + Meth-Oil	0.5+1.5pt	87	96	76	51	84	99	79	47	58
Imazethapyr + Meth-Oil + 28%N	0.5+1.5pt+2%	92	97	81	51	85	99	84	48	60
Imazethapyr + Sun-It II	0.5+1.5pt	94	97	82	53	89	99	76	48	64
Imazethapyr + Sun-It II + 28%N	0.5+1.5pt+2%	96	97	84	55	83	99	75	49	65
Imazethapyr + Sethoxydim + Sun-It II	0.5+1.3+1.5pt	92	96	80	50	76	99	89	48	68
Imazethapyr + Fluazifop + Sun-It II	0.5+1.6+1.5pt	88	96	73	54	73	99	78	48	58
Imazethapyr + Fenoxaprop + Sun-It II	0.5+1.3+1.5pt	89	96	60	49	81	99	60	45	65
Imazethapyr + Quizalofop + Sun-It II	0.5+0.54+2%	89	96	91	48	83	99	89	44	71
Imazethapyr + Fusion + Sun-It II	0.5+2+1.5pt	95	97	66	50	84	99	70	46	75
Imazethapyr + Clethodim + Sun-It II	0.5+1.06+1.5pt	75	96	70	48	80	99	85	44	69
Imaz + Lactofen + X-77 + 28%N	0.5+1+0.25%+2%	96	98	71	48	75	99	84	44	78
Imaz + Lactofen + X-77 + 28%N	0.5+1.5+0.25%+2%	91	98	95	61	76	99	94	59	64
Imaz + Lactofen + X-77 + 28%N	0.5+2+0.25%+2%	78	98	83	69	76	99	89	66	85
Bentazon/Sethoxydim + Sun-It II	0.75lb+1.3+1.5pt	93	97	60	96	86	99	58	96	59
Bentazon/Fluazifop + Sun-It II	0.75+1.6+1.5pt	89	99	66	96	79	99	64	96	55
Bentazon/Fenoxaprop + Sun-It II	0.75+1.3+1.5pt	95	97	61	97	92	99	51	97	58
Bentazon/Quizalofop + Sun-It II	0.75+0.54+2%	92	99	75	96	74	99	55	96	56
Bentazon/Clethodim + Sun-It II	0.75+1.06+1.5pt	94	96	63	97	86	99	55	97	54
Bentazon/Fusion + Sun-It II	0.75+2+1.5pt	96	97	65	97	85	99	55	97	58
Bentazon/Fusion + Sun-It II	0.75+2.7+1.5pt	96	96	64	95	88	99	53	95	60
Bentazon/Fusion + Sun-It II	0.5+2.7+1.5pt	95	97	75	95	90	99	56	95	58
Untreated		0	0	0	0	0	0	0	0	0
C.V.%		8	3	15	9	14	0	22	9	15
LSD 5%		9	4	13	8	13	0	15	7	12

[a]X-77 and Preference = nonionic surfactant; Mor-Act = petroleum oil, MSO, Meth-Oil, Sun-It II = methylated seed oil.

No soybean injury was observed with any treatments. Complete control was observed on wild mustard at both ratings and common cocklebur on the first rating. Methylated seed oil adjuvants with imazethapyr generally increased weed control over other adjuvant types. Grass control from imazethapyr and grass herbicides was variable. Foxtail control was reduced when imazethapyr was tank-mixed with lactofen at the high rate in the initial rating.

Weed control in soybeans, Mooreton. An experiment was conducted to evaluate weed control from Broadstrike or imazethapyr with different adjuvants and tank-mixtures with lactofen. 'Dawson' soybeans were seeded May 7. Preplant incorporated herbicides were applied and incorporated on May 6 with 74 F, 25% relative humidity, no clouds and 22 mph wind velocity. Preemergence herbicides were applied May 14 with 72 F, 39% relative humidity, 25% cloud cover, and 8 mph wind. Postemergence treatments were applied to VC to V1 soybeans, 4- to 8-leaf (1-3 inch) foxtail, 1 to 4 inch wild mustard, 1- to 4 inch comon lambquarters, 1 to 2.5 inch redroot pigweed, and 1 to 2 inch cocklebur on June 8 with 71 F, 61% relative humidity, 30% cloudy sky and 6 mph wind. Bentazon was applied 7 days before grass herbicides. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for soil applied treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for post applied treatments. The experiment was a randomized complete block design with four replications/treatment.

Treatment[a]	Rate	6-26-92 Fxtl	Corw	Rrpw	Colq	Cocb	Sb inj
	oz/A	% control					
Trifluralin (PPI)	0.9 lb	98	28	96	84	16	0
Flumetsulam/Trifluralin (PPI)	0.91 lb	99	99	99	99	99	15
Flumetsulam/Trifluralin (PPI)	1.03 lb	99	99	99	99	99	24
Flumetsulam/Metolachlor (PRE)	1.68 lb	93	99	99	99	99	11
Flumetsulam/Metolachlor (PRE)	1.92 lb	96	99	99	99	99	18
Flumetsulam/Metolachlor (PRE)	2.16 lb	96	99	99	99	99	11
Imazethapyr + X-77 + 28%N	0.5+0.25%+2%	78	40	93	15	99	6
Imazethapyr + Preference + 28%N	0.5+0.25%+2%	83	40	95	40	99	0
Imazethapyr + Mor-Act + 28%N	0.5+1.5pt+2%	87	48	99	44	99	0
Imazethapyr + MSO + 28%N	0.5+1.5pt+2%	91	59	99	55	99	0
Imazethapyr + Meth-Oil + 28%N	0.5+1.5pt+2%	84	59	99	41	99	5
Imazethapyr + Sun-It II + 28%N	0.5+1.5pt+2%	96	76	99	64	99	0
Imazethapyr + Sethoxydim + Sun-It II	0.5+1.3+1.5pt	90	54	99	30	99	0
Imazethapyr + Fluazifop + Sun-It II	0.5+1.6+1.5pt	90	65	99	54	99	0
Imazethapyr + Fenoxaprop + Sun-It II	0.5+1.3+1.5pt	97	68	99	61	99	0
Imazethapyr + Quizalofop + Sun-It II	0.5+0.54+2%	97	54	99	33	99	0
Imazethapyr + Fusion + Sun-It II	0.5+2+1.5pt	90	70	99	53	99	0
Imazethapyr + Clethodim + Sun-It II	0.5+1.06+1.5pt	93	59	99	56	99	0
Imaz + Lactofen + X-77 + 28%N	0.5+1+0.25%+2%	94	66	98	56	99	5
Imaz + Lactofen + X-77 + 28%N	0.5+1.5+0.25%+2%	92	81	99	61	99	6
Imaz + Lactofen + X-77 + 28%N	0.5+2+0.25%+2%	95	92	99	83	99	16
Bentazon/Sethoxydim + Sun-It II	0.75lb+1.3+1.5pt	89	76	31	40	99	0
Bentazon/Fluazifop + Sun-It II	0.75+1.6+1.5pt	92	73	19	30	99	0
Bentazon/Fenoxaprop + Sun-It II	0.75+1.3+1.5pt	91	63	18	59	99	0
Bentazon/Quizalofop + Sun-It II	0.75+0.54+2%	88	44	24	45	99	0
Bentazon/Clethodim + Sun-It II	0.75+1.06+1.5pt	99	38	21	45	99	0
Bentazon/Fusion + Sun-It II	0.75+2+1.5pt	96	55	14	36	99	0
Bentazon/Fusion + Sun-It II	0.75+2.7+1.5pt	98	46	14	49	99	0
Bentazon/Fusion + Sun-It II	0.5+2.7+1.5pt	98	46	6	59	99	0
Untreated		0	0	0	0	0	0
C.V.%		9	21	11	16	4	19
LSD 5%		11	19	12	12	5	11

[a]Flumetsulam = DE-498 (Trade name - Broadstrike by DowElanco), X-77 and Preference = nonionic surfactant; Mor-Act = petroleum oil, MSO, Meth-Oil, Sun-It II = methylated seed oil.

Treatments containing flumetsulam adaquately controled all weeds. Some crop injury was observed. However, conditions were extremely wet following application and some part of the study had standing water. Methylated seed oil adjuvants with imazethapyr generally increased weed control over other adjuvant types. Common lambsquarters control was increased when lactofen was added to imazethapyr. Foxtail control was not affected from imazethpyr/grass herbicide tank-mixtures.

Lanceleaf sage control from imazethapyr and lactofen in soybeans, Oriska. An experiment was conducted to evaluate lanceleaf sage control from imazethapyr and lactofen applied alone, in combination, and with various adjuvants. 'Pioneer 9061' soybeans was seeded May 18. Early postemergence herbicides were applied to V2 (4 to 7 inch) soybeans, 2 to 3 inch lanceleaf sage, 2 to 6 inch wild mustard, and 2 to 5 inch marshelder on June 23 with 68 F, 52% relative humidity, partly cloudy sky and 4 mph wind. Postemergence herbicides were applied to V3 (6 to 9 inch) soybeans, 4 to 6 inch lanceleaf sage, 4 to 8 inch wild mustard, and 3 to 7 inch marshelder on June 27, with 72 F, 58% relative humidity, partly cloudy sky and 5 mph wind. Treatments were applied to an 8.5 ft wide area the size of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. Data is an average of two locations. The experiment was a randomized complete block design with four replicates/treatment/location.

Treatment[a]	Rate	August 10			
		2 to 3 inch Lals		4 to 6 inch Lals	
		Lals	SB inj	Lals	SB inj
	oz/A	% control			
Imazethapyr + Sun-It II	0.25+1.5 pt	64	0	73	0
Imazethapyr + Sun-It II	0.5+1.5 pt	90	0	95	0
Imazethapyr + Sun-It II	0.75+1.5 pt	90	0	97	0
Imazethapyr + Sun-It II + 28%N	0.75+1.5pt+2qt	97	0	95	0
Imazethapyr + Sun-It II	1+1.5 pt	96	0	98	0
Imazethapyr + X-77	0.5+0.25%	63	0	44	0
Imazethapyr + X-77 + 28%N	0.5+0.25%+2qt	71	0	53	0
Imazethapyr + Preference	0.5+0.25%	60	0	50	0
Imazethapyr + Preference + 28%N	0.5+0.25%+2qt	66	0	38	0
Imazethapyr + Mor-Act	0.5+1.5pt	76	0	76	0
Imazethapyr + Mor-Act + 28%N	0.5+1.5pt+2qt	80	0	82	0
Imazethapyr + MSO	0.5+1.pt	93	0	88	0
Imazethapyr + MSO + 28%N	0.5+1.5pt+2qt	95	0	93	0
Imazethapyr + Meth-Oil	0.5+1.5pt	90	0	93	0
Imazethapyr + Meth-Oil + 28%N	0.5+1.5pt+2qt	90	0	90	0
Lactofen + Mor-Act	1+1.5pt	21	0	0	2
Lactofen + Mor-Act	1.5+1.5pt	52	3	18	7
Lactofen + Mor-Act	2+1.5pt	70	6	36	13
Lactofen + Mor-Act	2.5+1.5pt	72	9	50	17
Lactofen + Mor-Act	3+1.5pt	86	12	77	21
Imazethapyr + Lactofen + Mor-Act	0.5+1+1.5pt	81	0	90	0
Imazethapyr + Lactofen + Mor-Act	0.5+1.5+1.5pt	90	0	93	0
Imazethapyr + Lactofen + Mor-Act	0.5+2+1.5pt	93	7	93	9
Untreated		0	0	0	0
C.V.		2	7	10	9
LSD (0.05)		4	2	11	4

[a]X-77 and Preference = nonionic surfactant, Mor-Act = petroleum oil with 17% emulsifier, Sun-It II, MSO and Meth-Oil = methylated seed oil.

Lactofen only at 3 oz/A gave over 85% control to lanceleaf sage at the 2 to 3 inch stage. Imazethapyr at 0.5 oz/A plus Sun-It II gave 90% control of 2 to 3 inch or 5 to 6 inch lanceleaf sage. Methylated vegetable oil adjuvants enhanced imazethapyr activity over petroleum oil adjuvants or nonionic surfactants. Imazethapyr applied with methylated vegetable oil adjuvants gave 90% lanceleaf sage control applied with or without 28% liquid nitrogen. Combinations of imazethapyr and lactofen gave greater lanceleaf sage control that either herbicide applied alone at the same rate.

Weed control in dry edible beans, Cavalier. An experiment was conducted to evaluate weed control from Broadstrike or imazethapyr with different adjuvants and tank-mixtures with lactofen. Half of each plot was planted 'Upland' navy and 'Agassiz' dry beans on May 18. Preplant incorporated herbicides were applied and incorporated on May 12 with 53 F, 65% relative humidity, cloudy sky and 10 mph wind velocity. Preemergence herbicides were applied May 22 with 61 F, 63% relative humidity, 85% cloud cover, and 7 mph wind. Postemergence treatments were applied to V1 dry beans, 4- to 10-leaf (1-6 inch) foxtail, 1 to 5 inch wild mustard, 2 to 5 inch field pennycress, 2 to 4 inch sheperdspurse, 0.5 to to 1.5 inch comon lambquarters, 0.5 to 1.5 inch redroot pigweed, 2 to 10 leaf wild buckwheat (1 to 4 inch), 0.5 to 3 inch kochia, 1 inch smartweed, 1 to 3 inch wild oats and 1 to 3 inch barnyardgrass on June 12 with 71 F, 76% relative humidity, 10% cloudy sky and 4 mph wind. Bentazon was applied 7 days before grass herbicides. Treatments were applied to an 8 ft wide area the length of 10 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for soil applied treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for post applied treatments. The experiment was a randomized complete block design with four replications/treatment.

Treatment[a]	Rate	6-26-92						7-23-92					
		Fxtl	Bygr	Wiot	Wibw	Colq	Nfcf	Fxtl	Bygr	Wiot	Wibw	Colq	Nfcf
	oz/A	% control											
Flumetsulam/Trifluralin (PPI)	0.91 lb	79	86	60	91	95	99	95	97	86	87	97	72
Flumetsulam/Trifluralin (PPI)	1.03 lb	81	93	74	87	90	99	95	99	96	94	99	83
Flumetsulam/Metolachlor (PRE)	1.68 lb	25	48	19	5	5	13	0	0	10	0	13	25
Flumetsulam/Metolachlor (PRE)	1.92 lb	33	53	11	10	16	20	0	0	10	0	13	25
Flumetsulam/Metolachlor (PRE)	2.16 lb	42	64	31	24	16	31	20	18	18	0	15	25
Imazethapyr + X-77 + 28%N	0.5+0.25%+2%	85	80	64	53	48	34	75	85	70	38	56	24
Imazethapyr + Preference + 28%N	0.5+0.25%+2%	81	75	78	73	63	36	73	83	71	33	54	21
Imazethapyr + Mor-Act + 28%N	0.5+1.5pt+2%	85	85	79	74	65	34	83	88	76	55	65	43
Imazethapyr + MSO + 28%N	0.5+1.5pt+2%	87	92	81	79	71	39	86	92	88	45	51	39
Imazethapyr + Meth-Oil + 28%N	0.5+1.5pt+2%	91	97	80	76	74	40	89	96	91	66	71	60
Imazethapyr + Sun-It II + 28%N	0.5+1.5pt+2%	98	99	92	91	89	39	97	99	94	74	74	69
Imaz + Sethoxydim + Sun-It II	0.5+1.3+1.5pt	91	90	89	78	78	39	91	94	90	75	74	64
Imaz + Fluazifop + Sun-It II	0.5+1.6+1.5pt	96	99	89	79	79	40	91	90	95	78	66	28
Imaz + Fenoxaprop + Sun-It II	0.5+1.3+1.5pt	84	94	71	85	83	37	93	94	80	74	66	45
Imaz + Quizalofop + Sun-It II	0.5+0.54+2%	85	93	60	86	79	36	94	95	84	80	73	53
Imaz + Fusion + Sun-It II	0.5+2+1.5pt	90	96	88	85	78	39	91	97	91	71	65	48
Imaz + Clethodim + Sun-It II	0.5+1.06+1.5pt	88	90	92	85	75	38	60	85	64	49	34	38
Imaz + Lactofen + X-77 + 28%N	0.5+1+.25%+	82	90	65	87	81	71	76	90	74	75	48	40
Imaz + Lactofen + X-77 + 28%N	0.5+1.5+0.25%+2%	72	88	39	85	88	84	53	76	50	58	39	46
Imaz + Lactofen + X-77 + 28%N	0.5+2+0.25%+2%	68	85	21	89	92	85	41	65	41	81	81	63
Bentazon/Sethoxydim + Sun-It II	0.75lb+1.3+1.5pt	98	99	80	52	63	24	92	97	85	49	45	39
Bentazon/Fluazifop + Sun-It II	0.75+1.6+1.5pt	93	97	56	33	49	29	58	78	95	45	46	45
Bentazon/Fenoxaprop + Sun-It II	0.75+1.3+1.5pt	93	97	56	33	49	29	89	94	91	46	54	36
Bentazon/Quizalofop + Sun-It II	0.75+0.54+2%	83	90	55	39	50	30	90	94	65	40	53	36
Bentazon/Clethodim + Sun-It II	0.75+1.06+1.5pt	99	99	97	31	46	28	94	99	98	28	55	28
Bentazon/Fusion + Sun-It II	0.75+2+1.5pt	95	99	90	49	55	31	89	93	92	40	54	38
Bentazon/Fusion + Sun-It II	0.75+2.7+1.5pt	97	99	96	48	55	36	92	98	95	43	56	41
Bentazon/Fusion + Sun-It II	0.5+2.7+1.5pt	93	99	93	30	49	25	94	95	96	41	52	35
Untreated		0	0	0	0	0	0	0	0	0	0	0	0
C.V.%		9	21	11	16	4	19	16	7	18	23	33	58
LSD 5%		11	19	12	12	5	11	6	8	8	6	11	13

[a]Flumetsulam = DE-498 (Trade name - Broadstrike by DowElanco), X-77 and Preference = nonionic surfactant; Mor-Act = petroleum oil with 17% emulsifier, MSO, Meth-Oil, Sun-It II = methylated seed oil.

Prepalnt incorporated (PPI) treatment of flumetsulam/trifluralin at the highest rate controlled most weeds except wild oats. PRE treatments did not provide same level of control as PPI treatments. Methylated seed oil adjuvants with imazethpyr generally increased weed control over other adjuvant types. Grass control was reduced when lactofen was tank-mixed with imazethapyr. Lactofen incresed common lambsquarters control with imazethapyr. Grass control was variable when imazethapyr/graminice tank-mixures.

Imazamethabenz in weed free sunflower, Fargo 1992 'Interstate 3311' sunflowers were seeded May 18. Ethafluralin at 1 lb/A (Granular formulation) was applied and field cultivator + harrow incorporated on May 14 for general weed control. Treatements (2-4lf) were applied to 2- to 4-leaf sunflowers, 1- to 3-inch tall green foxtail and kochia, and 1- to 2-inch tall redroot pigweed on June 11 with 85 F, 60% RH, clear sky, and 15-mph wind. Treatments (6-8lf) were applied to 6- to 8-leaf sunflowers, 5- to 6-leaf foxtail, 4- to 6-inch tall kochia and redroot pigweed on June 26 with 68 F, 45% RH, clear sky, and 1- to 3-mph wind. Weed populations were less than one plant per square ft. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 9	Aug 21	
		Growth reduction		Malformed heads
	oz/A	------ % -------		
Imazamethabenz-LC + X-77 (2-4lf)	3+0.25%	0	2	0
Imazamethabenz-LC + X-77 (2-4lf)	6+0.25%	0	0	0
Imazamethabenz-LC + Sun-it II (2-4lf)	3+0.25G	3	0	0
Imazamethabenz-LC + Sun-it II (2-4lf)	6+0.25G	3	5	0
Imazamethabenz-SG + X-77 (2-4lf)	3+0.25%	3	0	0
Imazamethabenz-SG + X-77 (2-4lf)	6+0.25%	4	3	0
Imazamethabenz-SG + Sun-it II (2-4lf)	3+0.25G	4	0	0
Imazamethabenz-SG + Sun-it II (2-4lf)	6+0.25G	9	0	0
Imazamethabenz-SG + Sun-it II (2-4lf)	12+0.25G	5	3	0
Imazamethabenz-SG + Sun-it II (6-8lf)	3+0.25G	3	2	0
Imazamethabenz-SG + Sun-it II (6-8lf)	6+0.25G	3	1	0
Imazamethabenz-SG + Sun-it II (6-8lf)	12+0.25G	3	0	0
Untreated	0	4	0	0
C.V. %		157	188	0
LSD 5%		NS	3	NS
# OF REPS		4	4	4

Summary

The experiment was free of weeds so no weed control evaluations were taken. None of the treatments caused important growth reduction or head malformations. The sunflowers were not harvested for seed yield because of excessive depredation by birds. Imazamethabenz LC up to 6 oz/A and the SG up to 12 oz/A did not injure sunflowers. The cool conditions in 1992 may have reduced the potential for injury.

Weed control in flax, Fargo 1992. 'Neche' flax was seeded May 6. Treatments were applied to 4- to 6-inch tall flax, 3-inch green and yellow foxtail, 0.5- to 1-inch redroot pigweed, 2-inch common lambsquarter, and 1- to 2-inch kochia on June 8 with 72 F, 40% RH, clear sky, and 8- to 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was randomized complete block design with four replicates.

Treatment	Rate	July 4					August 21			Sept 13
		Flax	Fota	Rrpw	Colq	KOCZ	Flax	Fota	KOCZ	Yield
	oz/A	%								bu/A
MCPA bee + Seth + Scoil	4+3+0.18G	9	99	75	99	50	1	98	0	18.8
MCPAbee+Thif+Seth+Scoil	4+0.06+3+0.18G	28	97	99	99	99	1	93	94	24.4
MCPA bee+Thif+Seth+PO	4+0.06+3+0.18G	25	97	99	99	99	3	90	98	23.0
MCPAdma+Thif+Seth+Scoil	4+0.06+3+0.18G	19	98	99	99	99	1	93	96	23.7
MCPAdma+Thif+Seth+PO	4+0.06+3+0.18G	21	95	99	99	99	4	90	94	23.4
Brox+Thif+Seth+Scoil	4+0.06+3+0.18G	34	98	99	99	97	1	92	96	21.4
Bromoxynil+Thif+Seth+PO	4+0.06+3+0.18G	38	95	99	99	98	4	89	95	21.0
Sethoxydim + Scoil	3+0.18G	0	99	0	0	0	0	99	0	14.7[a]
MCPA-dma+Thif + Scoil	4+.06+0.18G	16	18	99	99	99	0	0	96	16.8
Imep + MCPA dma + Scoil	0.2+4+0.18G	24	72	98	89	95	3	80	87	20.6
Imazethapyr + Scoil	0.2+0.18G	41	85	94	55	99	4	85	95	21.7
Bent+MCPAdma+Seth+Scoil	8+4+3+0.18G	14	94	80	99	97	0	92	77	21.6
Not-treated	0	0	0	0	0	0	0	0	0	15.1[a]
C.V. %		53	8	6	6	6	158	6	8	14.5
LSD 5%		16	9	7	6	7	NS	6	9	NS
# OF REPS		4	4	4	4	4	4	4	4	4

[a]not part of statistical analysis as two replicates were not harvestable because of excessive weed growth.

Summary

The wild mustard evaluated on July 4 was removed from the table as control was 99% for all treatments except when not treated. Treatments containing bromoxynil and imazethapyr alone caused greater than 30% flax injury at the early evaluation, but recovered for the late evaluation. Thifensulfuron was less injurious to flax when applied without sethoxydim than with sethoxydim. Thifensulfuron at 0.06 oz/A applied with MCPA amine (dma) or ester (bee) or bromoxynil effectively (> 90%) controlled all broadleaf weeds. Flax injury and weed control was similar for comparable herbicides applied with Scoil or petroleum oil (PO) adjuvants. The results indicate that thifensulfuron at 0.06 oz/A in mixture with MCPA + adjuvant would give effective broadleaf weed control (including redroot pigweed and kochia) without important injury to flax. The inclusion of sethoxydim to thifensulfuron and MCPA would provide grass weed control, but also increase potential injury to flax. MCPA applied with imazethapyr generally reduced injury to flax, control of foxtail and kochia,; but increased common lambsquarter control.

Weed control in seedling alfalfa from imazethapyr, Fargo. An experiment was conducted to evaluate weed control and effect of imazethapyr on alfalfa establishment. 'Vernal' alfalfa was seeded April 29, 1992. Early postemergence herbicides were applied to 0.5- to 2-inch alfalfa , 1.5-inch green foxtail, 4-inch diameter waterpod, 1- to 8-inch field pennycress, 1- to 8-inch sheperd's-purse, 1.5- to 2-inch redroot pigweed, 1-inch prostrate pigweed, 0.5- to 1.5-inch common lambsquarters, 1- to 2-inch common purslane, 1- to 2.5-inch kochia, 0.5- to 1-inch diameter prickly lettuce, pre-bolt curly dock, 0.5- to 1.5-inch common mallow, 2- to 6-inch Canada thistle, 4-inch diameter perennial sowthistle, 2- to 7-inch common milkweed on May 27 with 69 F, 58% relative humidity, partly cloudy sky and 3 mph wind. Postemergence herbicides were applied to 1- to 4-inch alfalfa , 2- to 4-inch green foxtail, 4- to 8-inch diameter waterpod, 6- to 14-inch field pennycress, 6- to 14-inch sheperd's-purse, 2- to 4-inch redroot pigweed, 1- to 3-inch prostrate pigweed, 2- to 4-inch common lambsquarters, 1- to 3-inch common purslane, 2- to 8-inch kochia, 0.5- to 1.5-inch diameter prickly lettuce, 14- to 20-inch curly dock, 1- to 2.5-inch common mallow, 1-inch sunflower, 0.5- to 1-inch common ragweed, 4- to 8-inch Canada thistle, 6- to 14-inch diameter perennial sowthistle, 5- to 12-inch common milkweed on June 1, with 74 F, 61% relative humidity, partly cloudy sky and 2 mph wind. Treatments were applied to an 16 ft wide area the size of 20 by 30 ft plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had four replicates/treatment.

Treatment[a]	Rate	July 20						
		Prpw	Colq	Copu	Prle	Cath	Comw	Alfa Inj
	oz/A	% control						
Early Postemergence								
Imazethapyr + Sun-It II + UAN 28%	0.5+2%+2%	98	93	93	97	31	0	0
Imazethapyr + Sun-It II + UAN 28%	0.75+2%+2%	97	96	96	99	40	0	0
Imazethapyr + Sun-It II + UAN 28%	1+2%+2%	99	99	99	98	49	0	0
Imep + Brox + Sun-It II + UAN 28%	0.5+3+2%+2%	99	99	99	99	57	0	0
Imep + Seth + Sun-It II + UAN 28%	0.5+3+2%+2%	99	99	99	97	25	0	0
Untreated		0	0	0	0	0	0	0
C.V.%		3	2	3	3	6	0	0
LSD 5%		3	2	3	3	2	0	0
Postemergence								
Imazethapyr + Sun-It II + UAN 28%	0.5+2%+2%	93	90	90	95	23	0	0
Imazethapyr + Sun-It II + UAN 28%	0.75+2%+2%	94	94	95	99	33	0	0
Imazethapyr + Sun-It II + UAN 28%	1+2%+2%	99	99	99	98	40	0	0
Imep + Brox + Sun-It II + UAN 28%	0.5+3+2%+2%	99	99	99	99	50	0	0
Imep + Seth + Sun-It II + UAN 28%	0.5+3+2%+2%	99	99	99	97	33	0	0
Untreated		0	0	0	0	0	0	0
C.V.%		4	2	3	4	6	0	0
LSD 5%		4	3	3	5	3	0	0

[a]Sun-It II = methylated seed oil, Seth=sethoxydim, Brox = bromoxynil.

Complete weed control was observed for green foxtail and yellow foxtail, waterpod, field pennycress, sheperd's-purse, redroot pigweed, kochia, curly dock, common mallow, common sunflower, common ragweed, and perennial sowthistle. All treatments gave greater than 90% control of prostrate pigweed, common lambsquarters, common purslane, and prickly lettuce. All treatments gave poor control of Canada thistle and had no activity on common milkweed. No crop injury was observed at evaluation and alfalfa was established with minimal impact from weeds.

<u>Nonionic surfactant with glyphosate (Honcho), Fargo 1992</u>. 'Valley' oats, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 6-leaf oats, 4- to 6-leaf proso millet, 5- to 6-leaf foxtail millet, and 3- to 6-inch tall kochia on June 12 with 85 F, 65% RH, partly cloudy sky, and 3- 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 a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		June 19				July 9			
Treatment	Rate	Oat	Fxmi	Prmi	KOCZ	Oats	Fxmi	Prmi	KOCZ
	oz/A	%							
Glyphosate+X-77	1+1%	39	56	50	14	75	86	56	28
Glyphosate+R-11	1+1%	51	59	59	48	95	97	88	69
Glyphosate+Penetrator	1+1%	23	29	30	4	41	63	40	5
Glyphosate+Preference	1+1%	45	60	58	16	85	91	80	24
Glyphosate+Li-700	1+1%	38	43	48	6	73	81	54	10
Glyphosate+Kenetic(silicone)	1+1%	36	50	46	8	72	83	58	13
Glyt+Silwet L-77(silicone)	1+1%	39	70	73	50	68	93	89	69
Glyphosate+Spray BoosterS	1+1%	45	54	55	26	87	92	78	34
Glyphosate+Activator 90	1+1%	49	60	61	18	89	94	86	35
Glyphosate+Spray Fuse90	1+1%	13	18	18	0	10	33	15	0
Glyphosate+Add-wet	1+1%	47	63	60	25	89	93	77	34
Glyphosate+Activator Plus	1+1%	41	49	53	14	80	87	68	28
Glyphosate+SA-90C Maximizer	1+1%	14	23	19	0	14	43	20	0
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		11	17	14	51	10	9	16	40
LSD 5%		5	11	9	12	9	10	13	14
# OF REPS		4	4	4	4	4	4	4	4

Summary

Species control increased from the June 19 to July 9 rating, but relative control with the various adjuvants was similar at both evaluations. Within the silicone, Silwet L-77 appeared more effective than Kenetic for most species except oats. Oats stand was uniform and thus evaluations were precise. Glyphosate (Honcho) control of oats was greater when applied with R-11, Preference, Spray Booster S, Activator 90, and Add-wet than when applied with the other surfactants.

Nonionic surfactant with glyphosate (Honcho), Carrington 1992. 'Grandin' hard red spring wheat, 'Linton' flax, and 'Sunup' proso millet were seeded May 11. Treatments were applied to flag-leaf wheat, 12- to 14-inch tall flax, 5- to 6-leaf proso millet, and 3- to 8-inch tall broadleaf weeds on June 26 with 66 F, 46% RH, clear 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 a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 8 All species	July 18				
			All species	Wht inj	Flax	Prmi	Broadleaf weeds
	oz/A	%					
Glyphosate+X-77	1.5+1%	46	73	95	15	59	10
Glyphosate+R-11	1.5+1%	61	72	98	45	76	15
Glyphosate+Penetrator	1.5+1%	17	27	68	4	24	3
Glyphosate+Preference	1.5+1%	68	76	96	55	84	9
Glyphosate+Li-700	1.5+1%	43	63	93	10	26	0
Glyphosate+Kenetic(silicone)	1.5+1%	38	66	88	5	40	8
Glyphosate+Silwet L-77(silicone)	1.5+1%	78	91	95	44	93	68
Glyphosate+Spray Booster S	1.5+1%	62	84	96	23	66	21
Glyphosate+Activator 90	1.5+1%	68	88	99	26	69	24
Glyphosate+Spray Fuse 90	1.5+1%	26	40	84	6	29	10
Glyphosate+Add-wet	1.5+1%	68	87	93	28	80	28
Glyphosate+Activator Plus	1.5+1%	64	83	99	18	69	6
Glyphosate+SA-90C Maximizer	1.5+1%	13	31	63	0	11	1
C.V. %		33	26	11	61	28	97
LSD 5%		24	25	14	19	23	22
# OF REPS		4	4	4	4	4	4

Summary

Surfactants differed in their enhancement of Honcho (glyphosate formulated without a surfactant) toxicity to plant species. The generally effective adjuvants for enhancement of grass species control by glyphosate were: R-11, Preference, Silwet L-77, Spray Booster S, Activator 90, Add-wet, and Activator Plus. The silicone type surfactants each differed because Silwet L-77 tended to be the most effective adjuvant and kenetic intermediate among surfactants.

Nonionic surfactant with glyphosate (Honcho), Dickinson, 1992. 'Dumont' oats, 'Stoa' hard red spring wheat, 'Common red' proso millet, and 'Neche' flax were seeded in adjacent strips as bioassay species on May 20. Treatments were applied across the species to 6- to 8-inch tall crops on June 25 with 70 F, partly cloudy sky, and 0- to 10-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 20 ft plots. The experiment was a randomized complete block design with four replicates.

		July 8					July 27			
Treatment	Rate	Wheat inj	Flax	Oats	Prmi	Ruth	Wheat inj	Flax	Oats	Prmi
	oz/A	%								
Glyphosate+X-77	1+1%	13	10	20	28	0	23	12	22	22
Glyphosate+R-11	1+1%	46	53	48	38	10	51	39	44	35
Glyphosate+Penetrator	1+1%	11	8	18	16	0	20	9	21	12
Glyphosate+Preference	1+1%	49	38	46	54	10	56	35	52	59
Glyphosate+Li-700	1+1%	16	15	21	35	0	30	15	28	34
Glyphosate+Kenetic(silicone)	1+1%	34	10	41	38	5	39	16	38	27
Glyphosate+Silwet L-77(silicone)	1+1%	75	55	61	70	26	85	23	58	69
Glyphosate+Spray BoosterS	1+1%	35	24	36	39	9	50	28	39	41
Glyphosate+Activator 90	1+1%	38	38	45	45	5	44	26	38	46
Glyphosate+Spray Fuse 90	1+1%	10	3	20	24	0	14	5	17	10
Glyphosate+Add-wet	1+1%	48	49	48	53	11	49	30	42	36
Glyphosate+Activator Plus	1+1%	45	30	41	44	6	48	29	43	39
Glyphosate+SA-90C Maximizer	1+1%	4	1	13	18	0	7	2	14	15
C.V. %		44	41	36	43	127	34	41	31	40
LSD 5%		20	15	18	24	12	19	12	16	20
# OF REPS		4	4	4	4	4	4	4	4	4

Summary

Control was generally low because of the low glyphosate (Honcho) rate and the dry conditions at treatment. Preference and Silwet L-77 generally enhanced glyphosate more than R-11, Kenetic, Spray Booster S, Activator 90, Add-wet and Activator Plus; which generally were more effective than X-77, Penetrator, Li-700, Spray Fuse 90, and Maximizer.

Nonionic surfactant with glyphosate (Honcho), Hettinger 1992. 'Butte 86' hard red spring wheat, 'Hybrid Pearl' proso millet, and a mixture of soybean cultivars were seeded in adjacent strips on various dates around May 26. Treatments were applied to 2- inch tall wheat and flax, 6-inch tall proso millet, 4-leaf sunflowers and barley, and 3.5-leaf oats on July 14 with 84 F, clear sky, and 10-mph wind. Treatments were applied with a bicycle-wheel -type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 20 ft plots. Treatments were not replicated.

		August 5						
Treatment	Rate	Wheat inj	Sufl	Prmi	Oat	Barl	Sobe	Flax
	oz/A	%						
Glyphosate+X-77	1+1%	25	30	0	50	0	0	50
Glyphosate+R-11	1+1%	25	20	20	50	0	0	85
Glyphosate+Penetrator	1+1%	40	50	30	10	10	0	0
Glyphosate+Preference	1+1%	20	75	50	70	0	45	80
Glyphosate+Li-700	1+1%	30	25	50	25	0	0	70
Glyphosate+Kenetic(silicone)	1+1%	50	10	50	80	0	0	75
Glyphosate+Silwet L-77(silicone)	1+1%	80	88	80	0	75	80	75
Glyphosate+Spray BoosterS	1+1%	40	20	50	50	0	0	75
Glyphosate+Activator 90	1+1%	25	30	35	30	20	10	80
Glyphosate+SprayFuse90	1+1%	20	20	20	0	0	10	20
Glyphosate+Add-wet	1+1%	75	30	50	50	30	20	50
Glyphosate+Activator Plus	1+1%	30	25	50	35	0	20	50
Glyphosate+SA-90C Maximizer	1+1%	25	75	50	10	10	20	30
# of Reps		1	1	1	1	1	1	1

Summary

Treatments were not replicated so differences may be a chance occurance, but Silwet L-77 generally was the most effective adjuvant for enhancement of glyphosate (Honcho) for all species except oats. However, Kenetic was the most effective adjuvant with glyphosate for oats, but not for the other species. Preference was one of the generally effective surfactants.

Nonionic surfactant with glyphosate (Honcho), Minot 1992. 'Siberian' foxtail millet, 'Excel' barley, and 'McCall' soybeans were seeded in adjacent strips as bioassay species on June 26. Treatments were applied across the species to 6- to 6.5-leaf foxtail millet, flag-leaf barley, and 3 trifoliolate soybeans on Aug 6 with 60 F, partly cloudy sky, and 0- to 8-mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Soybean stand was poor making evaluation difficult.

		August 17				August 27		
Treatment	Rate	Grft	Fxmi	Brly	Sobe	Fxmi	Brly	Sobe
	oz/A	%						
Glyphosate+X-77	1.5+1%	99	99	89	80	98	96	64
Glyphosate+R-11	1.5+1%	99	99	93	85	94	95	64
Glyphosate+Penetrator	1.5+1%	99	99	81	80	79	83	49
Glyphosate+Preference	1.5+1%	99	99	95	90	99	97	76
Glyphosate+Li-700	1.5+1%	99	99	82	82	97	96	68
Glyphosate+Kenetic(silicone)	1.5+1%	96	99	75	68	96	91	43
Glyphosate+Silwet L-77(silicone)	1.5+1%	99	99	84	81	90	92	48
Glyphosate+Spray BoosterS	1.5+1%	99	99	88	85	96	95	76
Glyphosate+Activator 90	1.5+1%	99	99	93	85	76	97	59
Glyphosate+Spray Fuse 90	1.5+1%	97	97	76	75	76	74	54
Glyphosate+Add-wet	1.5+1%	99	99	86	85	90	94	68
Glyphosate+Activator Plus	1.5+1%	99	99	88	81	95	93	58
Glyphosate+SA-90C Maximizer	1.5+1%	94	94	51	55	71	60	25
C.V. %		2	2	14	16	19	13	36
LSD 5%		3	2	16	17	23	16	28
# OF REPS		4	4	4	4	4	4	4

Summary

Control of grass species generally was high reducing variation among the treatments. However, Penetrator, Spray Fuse 90, and Maximizer were generally less effective than the other surfactants for species control with glyphosate (Honcho), August 27 evaluation.

Nonionic surfactant with glyphosate (Honcho), Williston 1992. 'Grandin' hard red spring wheat, 'Girard' safflower, 'Clark' flax and 'Dawn' proso millet were seeded in adjacent strips as bioassay species on May 27 into a tilled seedbed that was fallow in 1991. Soil was a Max loam with a pH of 6.9 and 2.1% organic matter. Treatments were applied across the species to 4.5 leaf wheat, 2- to 4-leaf safflower and millet, 3- to 4-inch flax, and 1- to 2-inch tall Russian thistle on June 19 with 60 F, 72% RH, 10 mph wind, cloudy sky, 67 F soil temperature taken at a depth of 4 inches, and dry plant and soil surfaces. A hooded motorized-bicycle - type sprayer was used to deliver 8.5 gpa at 32 psi through 8001 nozzles to an 7 ft wide area the length of 10 by 25 ft plots. Rainfall total of 0.4 inch fell on June 27 and another 0.4 inch was received on June 28. The experiment was a randomized complete block design with four replicates. Russian thistle density was approximately 2 plants per square ft.

		July 2					July 28				
Treatment	Rate	Flax inj	Prmi	Wheat inj	Safl	Ruth	Flax inj	Prmi	Wheat inj	Safl	RUTH
	oz/A	%									
Glyphosate+X-77	1.5+1%	98	87	97	98	88	97	70	97	99	83
Glyphosate+R-11	1.5+1%	99	86	95	97	93	99	71	96	98	91
Glyphosate+Penetrator	1.5+1%	93	89	95	97	45	90	88	95	98	30
Glyphosate+Preference	1.5+1%	99	92	97	95	79	99	85	98	96	63
Glyphosate+Li-700	1.5+1%	96	93	97	97	74	99	80	97	99	63
Glyt+Kenetic(silicone)	1.5+1%	98	91	96	98	49	98	86	97	98	29
Glyt+Silwet L-77(silicone)	1.5+1%	99	89	99	99	97	99	68	99	99	93
Glypt+Spray Booster S	1.5+1%	99	88	96	97	83	99	80	97	98	76
Glyphosate+Activator 90	1.5+1%	99	90	97	97	82	99	85	98	97	79
Glyphosate+SprayFuse 90	1.5+1%	94	90	93	98	30	88	88	93	99	14
Glyphosate+Add-wet	1.5+1%	99	91	98	96	94	99	76	98	96	90
Glyphosate+Activator Plus	1.5+1%	99	90	97	97	85	99	83	97	98	81
Glypt+SA-90C Maximizer	1.5+1%	90	79	76	96	20	70	64	73	98	16
C.V.%		3	6	3	2	18	6	14	5	1	21
LSD 5%		4	8	3	2	17	7	15	6	2	18
# Of Reps		4	4	4	4	4	4	4	4	4	4

Summary

Control was generally quite complete which masked differences among surfactants. However, surfactant Maximizer was less effective than the other surfactants with glyphosate (Honcho) for control of most species. Proso millet and Russian thistle control with glyphosate was not complete and Silwet L-77, R-11, and Add-wet were among the most effective for Russian thistle, but not for Proso millet. Glyphosate control of Proso millet was in the 80% range when applied with Penetrator, Preference, Li-700, Kenetic, Spray Booster S, Acitvator 90, Spray Fuse 90, and Activator Plus. The surfactant characteristic for effectiveness apparently differs with the species. For example, glyphosate with Silwet L-77 gave 93% Russian thistle control, but only 68% proso millet control, while with Kenetic Russian thistle control was only 29% and proso millet control 86%.

Salt surfactant with glyphosate (Honcho), Fargo 1992. 'Valley' oats, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 6-leaf oats, 4- to 6-leaf proso millet and common lambsquarter, 5- to 6-leaf foxtail millet, 3- to 6-inch tall kochia, 4-leaf redroot pigweed, 4- to 8-inch tall wild mustard, and 3- to 5-leaf foxtail on June 12 with 85 F, 65% RH, a partly cloudy sky, and 3- 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 a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		June 19				July 9			
	Rate	Oats	Fxmi	Prmi	KOCZ	Oats	Fxmi	Prmi	KOCZ
Treatment	oz/A	%							
Glyphosate+X-77(NIS)	1+1%	45	53	48	21	70	83	61	35
Glyphosate+Cayuse+R-11	1+0.5%+1%	66	71	73	63	96	96	94	91
Glyphosate+CenexSAS(Premix)	1+2%	59	61	65	55	96	97	92	87
Glypt+SulfacDG+Spray fuse 90	1+pH5+1%	15	26	21	6	10	25	20	0
Glyphosate+EXPS	1+2%	70	74	76	69	97	98	96	94
Glyphosate+EXPS2	1+2%	71	75	77	65	98	99	98	95
Glyphosate+EXPDP	1+2%	59	68	69	38	94	95	90	69
Glyphosate+Dispatch	1+2%	58	68	68	55	96	96	94	85
C.V. %		11	13	12	18	2	6	2	16
LSD 5%		7	9	8	10	2	6	2	13
# OF REPS		4	4	4	4	4	4	4	4

Summary

The glyphosate was the Honcho formulation. All salt adjuvants, except Sulfac DG enhanced species control beyond that with only X-77 at the July 9 evaluation. At the June 19 evaluation when control was less complete, cayuse, ExpS, and ExpS2 appeared more effective than the other salt adjuvants in enhancement of glyphosate phytotoxicity.

Salt surfactant with glyphosate (Honcho), Carrington. 'Grandin' hard red spring wheat, 'Linton' flax, and 'Sunup' proso millet were seeded in adjacent strips as bioassay species on May 11. Treatments were applied across the species to flag-leaf wheat, 12- to 14-inch tall flax, 5- to 6-leaf millet, and 3-to 8-inch tall broadleaf weeds on June 26 with 72 F, 42% RH, partly cloudy sky, and 8.5 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 8 All species	July 18				
				Wheat inj	Flax	Prmi	Broadleaf weeds
	oz/A	%					
Glyphosate+X-77(NIS)	1.5+1%	74	87	100	28	85	31
Glyphosate+Cayuse+R-11	1.5+0.5%+1%	93	93	100	69	93	46
Glyphosate+CenexSAS(Premix)	1.5+2%	93	96	100	65	98	42
Glyt+SulfacDG+Spray Fuse 90	1.5+pH5+1%	8	35	64	5	49	5
Glyphosate+AMS+X-77	1.5+11.6+1%	94	97	100	57	100	59
Glyphosate+EXPS	1.5+2%	92	94	100	65	86	64
Glyphosate+EXP S2	1.5+2%	88	91	93	53	85	61
Glyphosate+EXPDP	1.5+2%	84	89	100	51	95	29
Glyphosate+Dispatch	1.5+2%	90	68	99	66	96	20
Glyphosate		-	-	72	11	46	4
C.V. %		8	17	7	25	17	54
LSD 5%		9	21	10	17	20	28
# OF REPS		4	4	4	4	4	4

Summary

Control of most species by glyphosate (Honcho formulation which does not contain a surfactant) was enhanced more by most salt adjuvants compared to glyphosate applied alone except for Sulfac DG + Spray Fuse 90. Glyphosate gave 90% or more proso millet control when applied with Cayuse + R-11, Cenex SAS, Ammonium sulfate (AMS) + X-77, experimental DP and Dispatch.

<u>Salt surfactant with glyphosate (Honcho), Dickinson 1992</u>. 'Stoa' hard red spring wheat, 'Neche' flax, 'Dumont' oats, and 'Common red' proso millet were seeded in adjacent strips as bioassay species on May 20. Treatments were applied across species to 6- to 8-inch tall crops on June 25 with 70 F, a partly cloudy sky, and 0- to 10-mph wind. Treatments were applied with a bicycle-wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 5 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		July 8					July 27			
Treatment	Rate	Wheat inj	Flax	Oats	Prmi	Ruth	Wheat inj	Flax	Oats	Prmi
	oz/A	%								
Glyphosate+X-77(NIS)	1+1%	18	16	20	26	3	32	10	37	22
Glyphosate+Cayuse+R-11	1+0.5%+1%	50	55	43	35	15	62	52	67	54
Glyphosate+CenexSAS(Premix)	1+2%	55	44	41	48	16	55	50	63	36
Glyt+SulfacDG+Spray fuse 90	1+pH5+1% 21	11	11	14	4	20	11	20	12	
Glyphosate+AMS+X-77	1+11.6+1%	23	23	34	35	14	52	32	56	43
Glyphosate+EXP S	1+2%	48	44	58	35	15	63	50	69	59
Glyphosate+EXP S2	1+2%	56	53	64	39	28	92	62	84	72
Glyphosate+EXP DP	1+2%	35	23	35	24	6	63	32	66	48
Glyphosate+Dispatch	1+2%	33	36	41	33	19	61	43	63	57
Glyphosate	1+0	6	6	8	4	1	18	9	18	10
C.V. %		39	32	37	54	76	27	38	24	38
LSD 5%		20	14	19	23	13	20	19	19	23
# OF REPS		4	4	4	4	4	4	4	4	4

Summary

Glyphosate (Honcho) control of most species was enhanced by the salt adjuvants compared to Glyphosate alone, with X-77, or Sulfac + Spray Fuse 90. Exp S2 generally was the most effective adjuvant with Honcho for control of grass species. Ammonium sulfate (AMS) + X-77 similar to most other salt adjuvants. Interpretation based upon the July 22 evaluation as the response to glyphosate was still in progress at the July 8 evaluation.

<u>Salt surfactant with glyphosate (Honcho), Hettinger 1992</u>. 'Butte 86' hard red spring wheat, 'Hybrid Pearl' proso millet, a mixture of soybeans, sunflower, oat, barley, and flax were seeded in adjacent strips May 26. Treatments were applied to 24-inch tall wheat, 6-inch tall proso millet, 4-inch tall soybeans, 4-leaf sunflower and barley, 3.5-leaf oats, and 2-inch tall flax on July 14 with 84 F, clear sky, and 10 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles. One replicate of each specie was treated and evaluated.

Treatment	Rate	Wheat inj	Sufl	Prmi	Oat	Barl	Sobe	Flax
	oz/A	%						
Glyphosate+X-77(NIS)	1+1%	-	70	20	50	10	50	60
Glyphosate+Cayuse+R-11	1+0.5%+1%	50	50	-	75	80	50	85
Glyt+CenexSAS(Premix)	1+2%	75	90	80	85	80	90	90
Glyt+SulfacDG+Spray fuse 90	1+pH5+1%	20	20	10	75	0	-	0
Glyphosate+AMS+X-77	1+11.6+1%	50	85	20	50	85	70	80
Glyphosate+EXPS	1+2%	90	50	85	99	90	90	95
Glyphosate+EXPS2	1+2%	85	90	90	85	85	80	95
Glyphosate+EXPDP	1+2%	50	75	80	85	80	90	90
Glyphosate+Dispatch	1+2%	50	50	90	85	70	50	80
Untreated		0	0	0	10	0	-	10

Summary

All salt adjuvants generally enhanced plant species control by glyphosate (Honcho) compared to when applied with only X-77 or sulfax DG + Spray Fuse 90. Glyphosate at 1 oz/A applied without surfactant was not effective in controlling any of the plant species.

<u>Salt surfactant with glyphosate (Honcho), Minot 1992.</u> 'Siberian' foxtail millet, 'Excel' barley, and 'McCall' soybean were seeded in adjacent strips June 26. Treatments were applied to 6- to 6.5-leaf foxtail millet, 14- to 16-inch tall barley, and 3rd trifoliolate soybean on August 6 with 60 F, a partly cloudy sky with fog, 0- to 8-mph wind, and wet conditions from heavy dew. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		August 17				August 27		
Treatment	Rate	Grft	Sbmi	Brly	Sobe	Fxtl	Brly	Sobe
	oz/A	%						
Glyphosate+X-77(NIS)	1.5+1%	97	97	83	61	70	86	30
Glyphosate+Cayuse+R-11	1.5+0.5%+1%	98	99	97	65	89	97	38
Glyphosate+CenexSAS(Premix)	1.5+2%	99	99	98	79	94	99	64
Glyt+SulfacDG+Spray fuse 90	1.5+pH5+1%	92	92	61	50	73	79	23
Glyphosate+AMS+X-77	1.5+11.6+1%	98	98	97	81	89	98	64
Glyphosate+EXPS	1.5+2%	99	99	99	78	95	99	61
Glyphosate+EXPS2	1.5+2%	99	99	99	76	94	99	55
Glyphosate+EXPDP	1.5+2%	99	99	97	59	93	97	38
Glyphosate+Dispatch	1.5+2%	99	99	98	68	91	98	51
Untreated		0	0	0	0	0	0	0
C.V. %		5	5	11	19	12	5	36
LSD 5%		7	7	14	17	14	7	22
# OF REPS		4	4	4	4	4	4	4

Summary

All salt adjuvants enhanced grass species controlled by glyphosate (Honcho) compared to when applied with X-77, except for Sulfac DG + Spray Fuse 90. However, control of soybean was only enhanced by Cenex SAS, Ammonium sulfate (AMS) and ExpS.

<u>Salts with glyphosate (Honcho), Williston 1992</u>. 'Grandin' hard red spring wheat, 'Girard' safflower, 'Clark' flax and 'Dawn' white proso millet were seeded on May 27 into a tilled seedbed that was fallow in 1991. Soil type was a Max loam soil with a pH of 6.9 and 2.1% organic matter. Treatments were applied to 4.5-leaf wheat, 2- to 4-leaf safflower and proso millet, 3- to 4-inch tall flax, and 1- to 2-inch tall Russian thistle on June 19 with 60 F, 72% RH, 10 mph wind, cloudy sky, and 57 F soil temperature at a depth of 4 inches with dry plant and soil surfaces. A hooded motorized bicycle type sprayer was used to deliver 8.5 gpa at 32 psi through 8001 nozzles to and 7 ft wide area the length of a 10 by 25 ft plots. A total Rainfall of 0.4 inch fell on June 27 and another 0.4 inch was recieved on June 28. The experiment was a randomized complete block design with four replicates. Control ratings were on July 2 and July 28. Russian thistle density was approximately 2 plants per square ft.

Treatment	Rate	July 2					July 28				
		Flax inj	Prmi	Wht inj	Safl	RUTH	Flax inj	Prmi	Wht inj	Safl	RUTH
	oz/A	%									
Glyphosate+X-77(NIS)	1.5+1%	93	88	95	86	66	94	71	96	93	70
Glyphosate+Cayuse+R-11	1.5+0.5%+1%	98	89	98	94	91	99	63	99	96	91
Glyphosate+CenexSAS(Premix)	1.5+2%	98	94	93	95	83	98	58	99	99	86
Glyt+SulfacDG+Spray fuse 90	1.5+pH5+1%	78	88	79	80	23	80	93	91	98	9
Glyphosate+AMS+X-77	1.5+11.6+1%	85	74	89	84	69	85	56	91	94	56
Glyphosate+EXPS2	1.5+2%	99	91	95	92	84	99	65	98	97	82
Glyphosate+EXPDP	1.5+2%	99	91	96	90	85	99	61	98	97	88
Glyphosate+Dispatch	1.5+2%	-	-	-	-	-	-	-	-	-	-
Glyphosate	1.5	51	56	60	64	25	50	61	75	74	6
C. V.%		10	15	13	15	19	11	34	9	14	22
LSD 5%		10	15	13	15	15	11	26	10	15	16
# Of Reps		4	4	4	4	4	4	4	4	4	4

Summary

Glyphosate (Honcho) control of Russian thistle was reduced when applied with Sulfac DG + Spray Fuse 90, and AMS (ammonium sulfate) + X-77 compared to when applied with only X-77. However, Sulfac DG + Spray Fuse 90 increased proso millet control by glyphosate at the July 28 evaluation.

Glyphosate applied with adjuvants in $CaCl_2$ at 2.2 g/L carrier, Fargo 1992. 'Valley' oats, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 9- to 10-leaf oats, 3- to 5-inch tall proso millet, 8-inch tall foxtail millet, 8- to 12-inch tall kochia, 4- to 6-inch tall redroot pigweed and common lambquarters, and 10- to 12-inch tall wild mustard on June 22 with 65 F, 57% RH, cloudy sky, and 5 mph wind. Rain occurred approximately 5 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 a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	July 5 Oats	July 5 Fomi	July 5 Prmi	July 5 KOCZ	July 30 Oats	July 30 Fomi	July 30 KOCZ
	oz/A	%						
Roundup	1	13	5	10	14	11	18	10
Roundup+X-77	1+.25%	73	65	65	34	86	62	38
Roundup+RA-600	1+.25%	54	41	44	20	78	58	48
Roundup+Emurpha 877	1+.25%	33	29	30	18	45	50	30
Roundup+AMS+X-77	1+22+.25%	96	98	97	73	97	97	76
Roundup+SurfacDG+X-77[a]	1+pH5+.25%	78	65	58	40	94	70	44
Roundup+ExpS	1+2%	98	99	99	81	99	99	77
Roundup+ExpN	1+1.5%	79	86	88	66	91	87	50
Roundup+Exp-PM	1+2.6%	95	92	90	64	99	93	80
Roundup+Exp-PD	1+2.6%	95	98	98	77	99	99	77
Roundup+Cayuse+X-77	1+.5%+.25%	71	54	51	39	89	72	51
Honcho+X-77	1+1%	66	61	60	35	82	76	46
Honcho+RA-600	1+1%	90	92	93	60	99	95	49
Honcho+Emurpha 877	1+1%	78	76	74	53	87	82	55
Honcho+SurfacDG+X-77[a]	1+pH5+1%	73	66	55	35	87	81	45
Honcho+ExpS	1+2%	98	99	99	81	99	99	79
Honcho+ExpN	1+2%	76	86	79	54	92	89	54
Honcho+Exp-PD	1+2%	94	96	93	69	99	96	77
C.V. %		8	13	15	27	6	12	19
LSD 5%		9	13	15	19	7	14	15
# OF REPS		4	4	4	4	4	4	4

[a] pH=2.8 pH; was not adjusted to pH 5.

Summary

Surfactants enhanced species control with Roundup, but to a less extent than ammonium sulfate (AMS), ExpS, Exp-PM, or Exp-PD. Surfactant X-77 was more effective than RA-600 or Emurpha 877 with Roundup, but less effective than RA-600 or Emphra 877 with Honcho.

Quizalofop (Pantera) plus adjuvants Experiment 1, Fargo 1992. 'Valley' oats, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 9- to 10-leaf oats, 5-leaf foxtail millet, and 3- to 5-inch tall proso millet on June 22 with 64 F, 57% RH, cloudy sky, and 5-mph wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	June 24			August 30			
		Oat	Ftmi	Prmi	Oat	Ftmi	Prmi	Yeft
	oz/A	%						
Quizalofop(UBI)+X-77	0.12+.25%	61	62	40	85	60	30	25
Quizalofop(UBI)+X-77	0.25+.25%	66	73	55	98	96	60	45
Quizalofop(UBI)+Scoil	0.12+.12G	62	73	53	84	82	27	50
Quizalofop(UBI)+Scoil	0.25+.12G	68	83	75	98	98	86	82
Quizalofop(UBI)+VO	0.12+.12G	63	72	50	77	83	27	52
Quizalofop(UBI)+VO	0.25+.12G	66	82	60	94	97	65	68
Quizalofop(UBI)+PO	0.12+.12G	65	75	50	91	97	33	52
Quizalofop(UBI)+PO	0.25+.12G	68	85	75	98	98	94	79
Quizalofop(UBI)+PO(UBI)	0.12+.12G	62	73	40	87	94	42	53
Quizalofop(UBI)+PO(UBI)	0.25+.12G	68	83	67	96	99	93	84
C.V. %		3	4	20	9	12	20	24
LSD 5%		3	6	19	11	18	19	24
# OF REPS		4	3	3	4	3	3	3

Summary

Quizalofop (Pantera) phytotoxicity was generally greater when applied with an oil than surfactant X-77 adjuvant. Differences among oil adjuvants in enhancement of Pantera generally were not significant at a given Quizalofop rate.

Quizalofop (Pantera) plus adjuvants Experiment 2, Fargo 1992.. 'Valley' oats, 'White' proso millet, and 'Siberian' foxtail millet were seeded in adjacent strips as bioassay species on May 7. Treatments were applied across the species to 5- to 6-leaf oats, 2- to 5-leaf proso millet, and 3- to 5-leaf foxtail millet on June 9 with 82 F, 60% RH, a partly cloudy sky, and 5- to 8-mph wind. Treatments were applied with a bicycle-wheel-type plots sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25ft plots. The experiment was a randomized complete block design with four replicates.

		June 26		
Treatment	Rate	Oats	Fomi	Prmi
	oz/A	-------	%	--------
Quizalofop(UBI)+X-77	0.12+0.25%	67	76	64
Quizalofop(UBI)+X-77	0.25+0.25%	87	95	88
Quizalofop(UBI)+Scoil	0.12+0.12G	80	88	86
Quizalofop(UBI)+Scoil	0.25+0.12G	95	99	99
Quizalofop(UBI)+VO	0.12+0.12G	83	91	90
Quizalofop(UBI)+VO	0.25+0.12G	97	99	99
Quizalofop(UBI)+PO	0.12+0.12G	69	89	82
Quizalofop(UBI)+PO	0.25+0.12G	97	99	99
Quizalofop(UBI)+PO(UBI)	0.12+0.12G	76	93	90
Quizalofop(UBI)+PO(UBI)	0.25+0.12G	97	99	96
C.V. %		6	4	6
LSD 5%		8	5	7
# OF REPS		4	4	4

Summary

Quizalofop (Pantera) at 0.25 oz/A applied with all adjuvants except X-77 gave 95% or more control of all plant species. Control of foxtail and proso millet was similar for quizalofop at 0.12 oz/A when applied with all adjuvants, except X-77 which was less effective. However, oat control with quizalofop at 0.10 oz/A generally was greater with Scoil or emulsifiable vegetable oil adjuvants than petroleum oil or X-77.

Comparison of ME/EE with broadleaf herbicides, Fargo 1992. 'Neche' flax, Amaranth, Quinoa, and safflower were seeded in adjacent strips as bioassay species on May 8. Treatments were applied across the species to 3- to 6-inch tall flax, 1- to 3-inch tall amaranth and redroot pigweed, 2- to 6-inch tall quinoa, 2- to 4-inch tall common lambsquarter, 3- to 5-inch tall safflower, and 1- to 5-inch tall kochia on June 10, with 79 F, 55% RH, a partly cloudy sky, and 5- to 15-mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	June 24			
		Flax	Rrpw	Safl	KOCZ
	oz/A	%			
Bentazon+ME	8+.18G	26	87	99	94
Bentazon+ME	12+.18G	3	85	99	95
Acifluorfen+ME	2+.18G	99	99	99	98
Acifluorfen+ME	4+.18G	99	99	99	98
2,4-Ddma+ME	3+.18G	68	85	93	91
2,4-Ddma+ME	4+.18G	66	88	93	88
Dicamba-Na+ME	2+.18G	82	90	92	99
Bentazon+EE	8+.18G	13	77	99	91
Bentazon+EE	12+.18G	9	78	99	94
Acifluorfen+EE	2+.18G	97	99	99	98
Acifluorfen+EE	4+.18G	99	99	99	98
2,4-Ddma+EE	3+.18G	72	82	94	90
2,4-Ddma+EE	4+.18G	74	92	95	92
Dicamba-Na+EE	2+.18G	87	91	92	99
Untreated	0	0	0	0	0
C.V. %		13	11	2	3
LSD 5%		11	14	3	3
# OF REPS		4	4	4	4

Summary

Redroot pigweed was evaluated and its response to herbicides was similar to that of commercial amaranth. However, commercial amaranth was more tolerant than redroot pigweed to bentazon. All herbicides controlled all species regardless if applied with the methyl (ME) or the ethyl (EE) ester of a seed oil with emulsifier.

Comparison of ME/EE with Imazethapyr, Casselton 1992. 'McCall' soybeans were seeded May 8. Treatments were applied to second trifoliolate soybeans, 4- to 6-leaf foxtail, 3- to 6-inch tall kochia, 2- to 3-inch tall common lambsquarter, 6-inch to bud wild mustard, and 5-inch tall cocklebur on June 21 with 60 F, 50% RH, a cloudy sky, 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 a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		July 17					August 13	
Treatment	Rate	Sobe	Fxtl	KOCZ	Wimu	Colq	Fxtl	KOCZ
	oz/A	%						
Imazethapyr+ME	0.4+.18G	3	89	99	99	63	87	90
Imazethapyr+Bent+ME	0.4+12+.18G	4	60	78	91	45	49	61
Imazethapyr+NAHCO3+ME	0.4+.36%+.18G	6	80	93	99	73	72	63
Imazethapyr+Bent+28N+ME	0.4+12+4%+.18G	0	64	81	93	40	61	68
Imazethapyr+Acif+ME	0.4+4+.18G	10	85	92	99	94	76	53
Imazethapyr+EE	0.4+.18G	4	90	90	97	66	86	83
Imazethapyr+Bent+EE	0.4+12+.18G	3	61	87	91	60	39	56
Imazethapyr+NAHCO3+EE	0.4+.36%+.18G	1	86	90	99	53	76	80
Imazethapyr+Bent+28N+EE	0.4+12+4%+.18G	1	69	55	87	35	65	59
Imazethapyr+Acif+EE	0.4+4+.18G	10	76	90	99	80	66	45
Untreated	0	0	0	0	0	0	0	0
C.V. %		93	11	16	3	25	25	27
LSD 5%		5	11	18	4	31	22	23
# OF REPS		4	4	4	4	2	4	4

Summary

Imazethapyr applied with methyl (ME) or ethyl (EE) ester of seed oils generally was equally as effective for controlling all species. Bentazon generally was antagonistic to imazethapyr control of all species and the inclusion of 28% N fertilizer did not reduce antagonism from bentazon. Acifluorfen antagonized kochia control by imazethapyr at the August 13 evaluation.

Mon-12037 response to oils, Fargo 1992. Amaranth and safflower were seeded on April 20 in an area with a history of high redroot pigweed and kochia infestations. Treatments were applied to 1- to 3-inch tall amaranth, 3-to 6-inch tall safflower, 1- to 3-inch redroot pigweed, and 1- to 5-inch kochia. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Grass species were controlled with a broadcast application of sethoxydim 2 weeks prior to treatment. The data are an average of visual evalutions, 2 and 4 weeks after treatment.

Treatment[a]	Rate	KOCZ	Safl	AMAZ	Rrpw
	oz/A	%			
MON-12037+PO(AT300)	0.512+2%	94	92	94	97
MON-12037+PO(AT300)	0.256+2%	84	86	86	89
MON-12037+PO(A02)	0.512+2%	89	92	94	96
MON-12037+PO(A02)	0.256+2%	90	87	87	91
MON-12037+VO(AT300)	0.512+2%	93	94	95	96
MON-12037+VO(AT300)	0.256+2%	87	89	89	92
MON-12037+VO(A02)	0.512+2%	93	94	96	97
MON-12037+VO(A02)	0.256+2%	85	90	88	90
MON-12037+MSO(AT300)	0.512+2%	91	93	92	93
MON-12037+MSO(AT300)	0.256+2%	83	88	87	88
MON-12037+MSO(A02)	0.512+2%	83	89	88	89
MON-12037+MSO(A02)	0.256+2%	76	86	82	94
MON-12037+AT300F	0.512+.3%	78	84	87	89
MON-12037+AT300F	0.256+.3%	77	80	86	86
MON-12037+A02	0.512+.3%	80	85	86	88
MON-12037+A02	0.256+.3%	74	79	83	85
C.V. %		9	5	4	4
LSD 5%		11	6	5	5

[a]Emulsifiable oils were applied at 2% by vol. PO= petroleum oil (11N); VO= vegetable oil (canola); and MSO= methylated seed oil (canola). Emulsifiers, Atplus 300F and A02 were in the oil (15%) alone at 0.3% by vol.

Summary

Mon-12037 at 0.512 oz/A, generally provided greater species control than Mon-12037 at 0.256 oz/A. Mon-12037 phytotoxicity tended to be enhanced most by vegetable oil and least by methylated seed oil. The emulsifiers Atplus 300F and A02 alone or in combination with oils were similarily effective with Mon-12037 for control of all species.

Mon-12037 response to surfactants, Fargo 1992. Amaranth and safflower were seeded on April 20 in an area with a history of high redroot pigweed and kochia infestations. Treatments were applied to 1- to 3-inch tall amaranth, 3-to 6-inch tall safflower, 1- to 3-inch redroot pigweed, and 1- to 5-inch kochia. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Grass species were controlled with a broadcast application of sethoxydim 2 weeks prior to treatment. The data are an average of visual evalutions, 2 and 4 weeks after treatment.

Treatment	Rate	KOCZ	Safl	AMAZ	Rrpw
	oz/A	%			
MON-12037+X-77	0.512+0.25%	88	88	90	86
MON-12037+X-77	0.256+0.25%	82	84	89	87
MON-12037+MON-0818	0.512+0.25%	95	93	94	91
MON-12037+MON-0818	0.256+0.25%	87	88	90	90
MON-12037+SILWET L-77	0.512+0.25%	89	92	91	90
MON-12037+SILWET L-77	0.256+0.25%	82	87	89	85
MON-12037+DC5309	0.512+0.25%	79	90	89	89
MON-12037+DC5309	0.256+0.25%	78	87	86	81
MON-12037+IGEPAL887	0.512+0.25%	86	84	91	88
MON-12037+IGEPAL887	0.256+0.25%	72	82	89	88
MON-12037+TRITON305	0.512+0.25%	86	84	89	87
MON-12037+TRITON305	0.256+0.25%	76	77	87	84
MON-12037+ETHOMEEN C/20	0.512+0.25%	91	90	92	88
MON-12037+ETHOMEEN C/20	0.256+0.25%	86	85	92	89
MON-12037+ETHOMEEN S/25	0.512+0.25%	91	90	93	92
MON-12037+ETHOMEEN S/25	0.256+0.25%	82	88	91	90
MON-12037+HENKEL5457	0.512+0.25%	79	81	91	89
MON-12037+HENKEL5457	0.256+0.25%	74	73	85	84
MON-12037+HENKEL5451	0.512+0.25%	83	83	92	91
MON-12037+HENKEL5451	0.256+0.25%	74	75	88	88
MON-12037+PLURONIC-L64	0.512+0.25%	91	93	94	94
MON-12037+PLURONIC-L64	0.256+0.25%	86	87	90	88
MON-12037+PLURONIC 10R-5	0.512+0.25%	87	90	91	90
MON-12037+PLURONIC 10R-5	0.256+0.25%	84	82	88	84
C.V.%		5	4	4	5
LSD 5%		6	4	5	5

Summary

Mon-12037 at 0.512 oz/A generally provided greater kochia and safflower control than at 0.256 oz/A. However, the increase in rate did not increase amaranth control and redroot pigweed control was increased only when the silicone (Silwet L-77 and DC-5309) and blockpolymer (Pluronic L64 and (Pluronic 10R-5) surfactants were included in the treatment. Mon-0818, the Ethomeen surfactants, and Pluronic L-64 provide greatest enhancement of kochia control by Mon-12037. These surfactants and the silicones (Silwet L-77 and DC-5309) provided the greatest Mon-12037 enhancement for safflower control. Surfactants of similar chemistry, generally were similar in the enhancement of Mon-12037 except for the silicones. The silicone surfactant, Silwet L-77 provided greater enhancement than DC-5309 for kochia control by Mon-12037.

Mon-12037 response to salts, Fargo 1992. Amaranth and safflower were seeded on April 20 in an area with a history of high redroot pigweed and kochia infestations. Treatments were applied to 1- to 3-inch tall amaranth, 3- to 6-inch tall safflower, 1- to 3-inch redroot pigweed, and 1-to 5-inch kochia. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Grass species were controlled with a broadcast application of sethoxydim 2 weeks prior to treatment. The data are an average of visual evalutions, 2 and 4 weeks after treatment.

Treatment[a]	Rate	KOCZ	Safl	AMAZ	Rrpw
	oz/A	--------------	%	-------------	
MON-12037+X-77	0.512+0.25%	85	86	87	90
MON-12037+X-77	0.256+0.25%	75	77	80	80
MON-12037+X-77+NH4NO3	0.512+0.25%	68	74	81	82
MON-12037+X-77+NH4NO3	0.256+0.25%	53	69	77	77
MON-12037+NH4NO3	0.512	33	56	70	70
MON-12037+NH4NO3	0.256	21	43	66	67
MON-12037+X-77+UREA	0.512+0.25%	69	80	85	87
MON-12037+X-77+UREA	0.256+0.25%	75	77	83	83
MON-12037+UREA	0.512	43	64	74	74
MON-12037+UREA	0.256	37	50	67	65
MON-12037+X-77+NH4SO4	0.512+0.25%	72	78	83	85
MON-12037+X-77+NH4SO4	0.256+0.25%	72	80	79	80
MON-12037+NH4SO4	0.512	41	61	65	74
MON-12037+NH4SO4	0.256	21	45	56	54
MON-12037+X-77+CACL2	0.512+0.25%	76	79	83	89
MON-12037+X-77+CACL2	0.256+0.25%	79	79	81	87
MON-12037+CACL2	0.512	33	62	67	69
MON-12037+CACL2	0.256	23	39	57	56
MON-12037+X-77+NAHCO3	0.512+0.25%	90	85	86	88
MON-12037+X-77+NAHCO3	0.256+0.25%	87	78	82	86
MON-12037+NAHCO3	0.512	38	60	69	69
MON-12037+NAHCO3	0.256	27	48	64	64
CV		14	8	5	7
LSD (5%)		11	7	5	7

[a]NH4NO3, NH4SO4, and urea at 20 g/L, CACL2 at 2.2 g/L and NAHCO3 at 2.7 g/L.

Summary

Control of all species by Mon-12037 at 0.512 and 0.256 oz/A with all salts was enhanced by X-77. Amaranth and redroot pigweed control by Mon-12037 was not influenced by salts, except for a reduction from ammonium nitrate (NH4NO3). Urea, ammonium sulfate (NH4SO4), and ammonium nitrate generally decreased kochia control by Mon-12037 at 0.516 oz/A. However, only ammonium nitrate decreased kochia control with Mon-12037 at 0.256 oz/A. Sodium bicarbonate (NAHCO3) enhanced kochia control at both herbicide rates, while calcium chloride (CACL2) exhibited no effect. Safflower control by Mon-12037 at 0.256 oz/A was not influenced by salts, however at 0.512 oz/A nitrogen salts reduced control.

Mon-12037 response to commercial adjuvants, Fargo 1992. Amaranth and safflower were seeded on April 20 in an area with a history of high redroot pigweed and kochia ingestation. Treatments were applied to 1- to 3-inch tall amaranth, 3- to 6-inch tall safflower, 1- to 3-inch redroot pigweed, and 1-to 5-inch kochia. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Grass species were controlled with a broadcast application of sethoxydim 2 weeks prior to treatment. The data are an average of visual evalutions, 2 and 4 weeks after treatment.

Treatment	Rate	KOCZ	Safl	AMAZ	Rrpw
	oz/A				
MON-12037	0.256	30	44	70	74
MON-12037+X-77	0.256+.25%	65	73	87	85
MON-12037+PREFERENCE	0.256+.25%	74	79	85	84
MON-12037+SILWET L-77	0.256+.25%	73	82	84	83
MON-12037+SILWET L-77	0.256+.125%	66	76	83	82
MON-12037+X-77+28%N	0.256+.25%	59	65	83	82
MON-12037+X-77+UREA+NH4NO3	0.256+.25%	50	64	81	81
MON-12037+HERBIMAX	0.256+1%	72	79	85	85
MON-12037+SUNNITT II	0.256+1%	71	80	83	84
MON-12037+MORACT	0.256+1%	83	86	91	88
MON-12037+SCOIL	0.256+1%	73	80	85	83
MON-12037+LI-700	0.256+1%	58	65	83	82
MON-12037+EXP-60800	0.256+1%	79	78	88	86
C.V. %		12	9	5	4
LSD (5%)		11	9	5	5

Summary

Control of all species by Mon-12037 applied with any adjuvant was greater than when without an adjuvant. Generally, Mor-act provided the greatest enhancement of control of all species by Mon-12037. The addition of 28% N and urea+ammonium nitrate (NH4NO3), generally, reduced control of all species by Mon-12037. Differences among commercial adjuvants in enhancement of Mon-12037 were greater for kochia and safflower than for amaranth and redroot pigweed control.

Fall-applied trifluralin granules in conservation-till wheat, Carrington 1992. An experiment was established on a Heimdal-Emrick loam with pH 6.7, 3.8% organic matter, and 5- to 6-inch standing wheat stubble. Trifluralin granules were applied either on October 18 or on November 16, 1991 using a Gandy airflow applicator. Trifluralin emulsifiable concentrate was applied either on Oct. 18 or Nov. 16 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. 18, air temperature was 37 F with sunny skies and dry soil; on Nov. 16, skies were sunny with 36 F and snowcover was 0 to 2 inches deep. 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 Melroe culti-harrow (2 to 3 inches deep) on May 8, 1992. Glyphosate at 0.56 lb ai/A was applied May 12 to destroy emerged weeds. 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. Thifensulfuron&tribenuron at 0.25&0.125 oz ai/A and 2,4-D at 0.38 lb/A was applied June 8 over the entire experiment for broadleaf weed control. Visual estimates of percentage green foxtail control were taken June 11 and August 18. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined June 13. Plots were combine-harvested Aug. 18 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[b]	Foxtail control		Foxtail density 6/13	Grain yield
Herbicide[a]	Rate (lb/A)	Date			6/11	8/18		
				(plts/m)	(%)	(%)	(plt/m^2)[b]	(bu/A)
Trif-10G	0.5	10/18	Field cultivator	27	84	90	119	40.3
Trif-4EC	0.5	10/18	Field cultivator	24	78	78	253	34.5
Trif-4EC	0.5	11/16	None	27	53	28	274	43.4
Trif-10G	0.5	11/16	None	26	56	62	230	51.6
Trif-10G	0.75	11/16	None	26	69	58	192	47.3
Trif-10G	1	11/16	None	27	82	88	84	46.7
Trif-10G	0.5	10/18	None	18	69	83	96	45.5
Trif-10G	0.5	10/18	Rotary hoe	28	86	86	116	43.2
Trif-10G	0.75	10/18	Rotary hoe	26	89	92	56	38.8
Trif-10G	1	10/18	Rotary hoe	25	90	88	104	48.3
Trif-10G	0.5	10/18	Undercutter	26	74	82	97	41.5
Trif-10G	0.75	10/18	Undercutter	24	80	89	74	42.2
Trif-10G	1	10/18	Undercutter	27	89	95	17	38.8
Trif-10G	0.5	10/18	Undercut/Rotary hoe	24	80	88	136	39.1
Trif-10G	0.75	10/18	Undercut/Rotary hoe	27	90	92	24	37.5
Trif-10G	1	10/18	Undercut/Rotary hoe	22	91	95	24	39.2
Weedy check	0	10/18	Field cultivator	24	0	0	1032	33.4
Weedy check	0	10/18	Undercutter	25	0	0	404	40.1
C.V. %				23	20	18	96	13.0
LSD 5%				NS	22	21	36	7.7

[a] Trif-10G = Treflan 10G granules; Trif-4EC = Treflan emulsifiable concentrate.
[b] Plts/m = wheat plants per m of row.

Fall-applied trifluralin granules in conservation-till wheat, Minot 1992. An experiment was established on a Max-Williams loam with pH 5.6, 3.2% organic matter, 12-inch standing wheat stubble. Trifluralin granules were applied either on October 16 and 17, or on November 15 and 16, 1991 using a Gandy airflow applicator. Trifluralin emulsifiable concentrate was applied either Oct. 16 or Nov. 15 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 61 F with sunny skies and dry soil; on Oct. 17, air temperature was 33 F with sunny skies and dry soil; on Oct. 18 skies were sunny with 28 F and dry soil; on Nov. 15, skies were sunny with 34 F and 4 to 5 inches of snow; on Nov. 16, skies were sunny with 27 F and 4 to 5 inches of snow. Herbicide granules were either left on the surface or were incorporated once on Oct. 16 to 18 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) immediately before planting on May 8, 1992. Lloyd durum was seeded 1.5 to 2 inches deep at 96 lb/A on May 8 using a John Deere single-disc no-till drill. Glyphosate + 2,4-D (0.38 + 0.25 lb ai/A) was applied May 8 over the entire experimental area to control emerged weeds. Wheat plants per m of row was determined May 21. Bromoxynil&MCPA at 0.61&0.61 lb/A was applied June 10 over the entire experiment for broadleaf weed control. Visual estimates of percentage green foxtail control were taken on June 10 and Aug. 19. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined on June 10. Plots were combine-harvested Aug. 19 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[a]	Rate (lb/A)	Date	Herbicide incorporation method	Wheat stand[b] (plts/m)	Foxtail control 6/10 (%)	Foxtail control 8/19 (%)	Foxtail density 6/10 (plt/m2)	Grain yield (bu/A)
Trif-G	0.5	10/18	Field cultivator	35	82	86	220	29.2
Trif-4EC	0.5	10/16	Field cultivator	29	73	76	243	35.1
Trif-4EC	0.5	11/15	None	50	23	0	599	33.7
Trif-G	0.5	11/16	None	43	55	54	296	43.1
Trif-G	0.75	11/16	None	39	77	63	252	39.0
Trif-G	1	11/16	None	36	87	74	208	44.8
Trif-G	0.5	10/18	None	36	84	77	200	39.7
Trif-G	0.5	10/18	Rotary hoe	36	87	84	94	40.1
Trif-G	0.75	10/18	Rotary hoe	43	89	87	96	45.7
Trif-G	1	10/18	Rotary hoe	35	92	95	44	38.3
Trif-G	0.5	10/18	Undercutter	37	76	82	163	38.3
Trif-G	0.75	10/18	Undercutter	43	86	87	74	38.2
Trif-G	1	10/18	Undercutter	37	90	94	106	38.3
Trif-G	0.5	10/18	Undercut/Rotary hoe	40	75	82	172	37.7
Trif-G	0.75	10/18	Undercut/Rotary hoe	32	87	90	66	38.4
Trif-G	1	10/18	Undercut/Rotary hoe	40	90	93	92	39.0
Weedy check	0	10/18	Field cultivator	38	0	0	478	23.5
Weedy check	0	10/18	Undercutter	49	0	0	790	32.7
C.V. %				17	11	7	51	12
LSD 5%				9	12	7	44	6.2

[a]Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate.
[b]Wheat stand measured as plants per m of row.

Fall-applied quinclorac for field bindweed control, Minot 1992. An experiment was established on a loam soil with pH 6.3, 3.4% organic matter, and 1 to 10 field bindweed plants per square m. Treatments were applied September 24, 1991 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles when air temperature was 58 F, relative humidity was 51%, and field bindweed vines were 8 to 15 inches long and very green (slight frost injury in places). Wind was 5 to 12 mph (shield used) initially but later slowed to 0 to 3 mph. Plot size was 15 by 25 ft with a 10- by 25-ft area treated. The experiment was a randomized complete block with four replications.

The entire experiment was fertilized with urea in April 1992 according to soil test recommendations for a 50 bu/A yield goal. The experiment was seeded to 'Stoa' hard red spring wheat at 70 lb/A and 1.5 to 2 inches deep on May 1 with no seedbed preparation tillage and a John Deere no-till drill. Weed control and crop injury were evaluated May 27 when wheat was 3- to 4-leaf, and field bindweed was 2 to 8 inches long. Wheat was bulk-harvested using a production-sized combine. Post-harvest evaluation of field bindweed control was not possible due to extremely low bindweed populations in the untreated check strips.

Treatment[a]	Rate	Wheat injury	Field bindweed control
	(lb/A)	———(%)———	
Quinclorac+SunitII	0.25+0.25G	0	100
Quinclorac+SunitII	0.33+0.25G	0	100
Quinclorac+SunitII	0.375+0.25G	0	100
Quinclorac+SunitII	0.5+0.25G	0	100
Quinclorac+2,4-D-bee+SunitII	0.25+1+0.25G	0	100
Quinclorac+2,4-D-bee+SunitII	0.33+1+0.25G	0	100
Quinclorac+Dicamba+SunitII	0.25+0.25+0.25G	0	100
Quinclorac+Dicamba+SunitII	0.33+0.25+0.25G	0	100
Quinclorac+Dicamba+SunitII	0.375+0.25+0.25G	0	100
Dicamba+SunitII	0.25+0.25G	0	96
Dicamba+SunitII	0.5+0.25G	0	100
2,4-D-bee+SunitII	1+0.25G	0	99
Dicamba+2,4-D-bee+SunitII	0.25+1+0.25G	0	100
Glyphosate+X77+AS	0.75+0.25%+1.5	0	98
Glyphosate&Dicamba+AS	0.545+1.5	0	98
Glyphosate&2,4-D+AS	1.05+1.5	0	98
Untreated	0	0	0
C.V. %		0	1
LSD 5%		NS	2

[a] SunitII = methylated seed oil adjuvant containing emulsifier, by AGSCO; 2,4-D-bee = butoxyethyl ester of 2,4-D; Glyphosate&2,4-D = Landmaster BW herbicide containing 0.9 lb ae/gal glyphosate plus 1.6 lb ae/gal 2,4-D amine; Glyphosate&Dicamba = Fallowmaster herbicide containing 1.1 lb ae/gal glyphosate plus 0.5 lb ae/gal dicamba; AS = ammonium sulfate.

Comments. Although no spring wheat injury or stand reductions were observable May 27, the farmer who combined the wheat noticed about six plots that had wheat significantly shorter than the rest of the plots. Since dicamba (the only herbicide in the experiment besides quinclorac leaving soil residues capable of injuring wheat) residues in the soil injure wheat primarily through stand reductions, and since quinclorac stunted wheat in a similar experiment conducted in 1990/91, quinclorac at 0.375 lb/A may have been the cause of this apparent wheat stunting noticed by the farmer.

Postemergence foxtail and broadleaf weed control in wheat, Minot 1992. Lloyd durum wheat was seeded no-till on May 6. Treatments were applied with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Treatments involving propanil and diclofop were applied May 27 when conditions were as follows: 2.5- to 4-leaf durum (some tillering), 1- to 3-leaf (mostly 2-leaf) green foxtail, and 0.25- to 0.5-inch-tall, 0.25- to 0.5-inch-diameter kochia, 59 F air temperature, 37% relative humidity, sunny skies, and wind 5 to 8 mph (shield used). Other treatments were applied June 3 when air temperature was 78 F, relative humidity was 70%, wind was 4 to 12 mph (shield used), skies were partly cloudy, soil was dry, durum was 3.5- to 5-leaf (tillering), green foxtail was 2- to 3.5-leaf, and kochia was 0.25 to 0.75 inch tall. Visual estimates of percentage crop injury and weed control were taken June 24 when durum was early boot. Plot size was 11 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Durum injury	Weed control: Green foxtail	Weed control: Kochia
	(oz/A)	(%)	(%)	(%)
Fenoxaprop&MCPA	0.5&6	56	74	0
Fenx&MCPA+Dicamba	0.5&6+1	56	62	0
Fenx&MCPA+Tribenuron	0.62&7.4+0.128	4	71	90
Fenx&MCPA(DAKOTA)+Thif&Trib	0.62&7.4+0.17&0.056	7	68	92
Fenx&MCPA+Bromoxynil	0.62&7.4+3	59	75	9
Fenx&MCPA+Metsulfuron	0.62&7.4+0.064	6	72	85
Fenx&MCPA+Dica+Thif&Trib	0.62&7.4+0.75+0.072&0.024	14	74	91
Fenx&MCPA+Triasulfuron	0.62&7.4+0.21	11	69	91
Fenoxaprop&MCPA&2,4-D	0.75&3.5&1.2	61	64	25
Diclofop+Brox+MCPA-bee	16+6+0.8	0	55	59
Fenx&MCPA+Thif&Trib(CHEYENNE)	1.32&6+0.17&0.056	58	78	88
Propanil-DF+MCPA-bee	16+4	0	68	76
Propanil&MCPA	16&4	0	59	55
C.V. %		17	15	27
LSD 5%		6	NS	23

[a]Fenoxaprop&MCPA = DAKOTA containing 0.23 lb/gal fenoxaprop plus 2.81 lb/gal MCPA ester; Fenoxaprop&MCPA&2,4-D = TILLER containing 0.38 lb/gal fenoxaprop plus 1.79 lb/gal MCPA plus 0.6 lb/gal 2,4-D ester; Fenoxaprop&MCPA+Thif&Trib = CHEYENNE containing 0.47 lb/gal fenoxaprop plus 2.13 lb/gal MCPA ester plus dry flowable Thif&Trib which is HARMONY EXTRA with a 2:1 ratio of thifensulfuron and tribenuron; Propanil&MCPA = STAMPEDE CM containing 3.08 lb/gal propanil plus 0.77 lb/gal MCPA ester; Propanil-DF = dry flowable formulation of propanil; MCPA-bee = butoxyethyl ester of MCPA.

Summary. This experiment was intended for hard red spring wheat but was established in durum because no available HRSW field had sufficient foxtail populations. As expected, fenoxaprop treatments caused substantial durum injury, although injury from fenoxaprop mixed with tribenuron, thifensulfuron&tribenuron, metsulfuron, or triasulfuron was low. Foxtail control was only about 60 to 75% for all treatments. Low control probably was due to drought during and after treatment. Conditions were quite dry at time of evaluation and foxtail was strongly drought stressed. Kochia control was about 90% with treatments involving sulfonylurea herbicides (i.e. tribenuron, thifensulfuron&tribenuron, triasulfuron, but lower with other herbicides.

Longterm multi-crop quinclorac carryover study, Fargo 1992. An unreplicated experiment was established April 26, 1991 on a silty clay (4% sand, 53% silt, 43% clay) with pH 7.8 and 4.2% organic matter, cropped in 1990 to soybeans. Three 50- by 380-ft plots were established with a 10-ft alley between each and dedicated to receive the following treatments over a 4-year period:

1. Quinclorac at 0.15 lb ai/A plus Scoil at 1.5 pints/A applied late May to early June when foxtail are 2 to 3 leaf. Crop is continuous wheat.

2. Quinclorac at 0.3 lb/A plus Scoil at 1.5 pints/A applied mid to latter August. Land to be fallowed in 1991 and odd years, cropped to wheat in 1992 and even years. Treatment simulates a late-summer field bindweed application.

3. Untreated check. Crop is continuous wheat.

Beginning in 1992, sugarbeets, flax, alfalfa/red clover, safflower, corn, soybeans, drybeans, sunflowers are to be seeded in a single drill or planter strip across the three treatments and at right angles to the long dimension of the original main plots. The remaining land not seeded to these eight crops is to be handled as indicated by the treatment descriptions. In 1993-95, an additional portion of the original plot will be planted to the eight bioassay crops. Sugarbeets will be seeded with a John Deere beet planter in 22-inch rows. Corn, sunflowers, soybeans, and drybeans will be seeded with a Hiniker no-till planter with disc openers set on 30-inch rows. Other crops will be seeded with a Haybuster no-till drill with 7-inch row spacings.

Wheat will be harvested with a field-scale combine. Plots with wheat residues will be chisel plowed in the fall (6 to 7 inches deep) except for treatment 2 when the subsequent season calls for fallow. The fallow year of treatment 2 will be handled by a glyphosate application in late May to control all emerged vegetation followed by 4- to 5-inch-deep tillage (field cultivator or chisel plow) as needed to control weeds through the end of July. The wheat in all treatments will be treated postemergence as needed with broadleaf or grass herbicides other than quinclorac to reduce weed populations in subsequent bioassay crop plantings. All herbicides are applied with an ATV-mounted sprayer delivering 10 gal/A with 8002 extended range tips, 5 mph, and 28 psi.

Comments on 1992 Results

Early-season dry conditions followed by excessive June rains made growth and evaluation of the eight rotational crops difficult. Heavy rains in June coupled with cool temperatures left all of the experiment under water for significant periods and portions of the experiment for extended periods. Unfortunately, the quinclorac treated areas were lower and under water for longer periods than the untreated check. It was unclear in some cases whether unhealthy crop growth resulted from quinclorac carryover or waterlogging plus cool temperatures or a combination of the two.

Table 1. Field operations for the main plot area not planted to rotational (bioassay) crops.

Operation	Year 1991	1992	1993	1994
Treatment 1 (Quinclorac 0.15 lb/A, cont. wheat)				
Wheat planting				
Date	Apr. 26	Apr. 30		
Rate, lb/A	90	95		
Cultivar	Butte 86	Butte 86		
Quinclorac appl.				
Date	June 3	June 8		
Wheat stage	6-7 in., tillered	6-8 in., 5-6 leaf		
Treatment 2 (Quinclorac 0.3 lb/A, wheat-fallow)				
Wheat planting	-			
Date		Apr. 30		
Rate, lb/A		95		
Cultivar		Butte 86		
Wheat harvest	Aug. 15	Sept. 4		
Quinclorac appl.				
Date	Aug. 21	Sept. 4		
Treatment 3 (Untreated check)				
Wheat planting				
Date	Apr. 26	Apr. 30		
Rate, lb/A	90	95		
Cultivar	Butte 86	Butte 86		

Table 2. Planting information for rotational (bioassay) crops.

Crop	1992	1993	1994
Sugarbeets			
Cultivar	KW1119, BJ 1320[a]		
Date	May 1, May 20		
Rate, seeds/A	114,000		
Depth, inches	1-1.25		
Flax			
Cultivar	Neche		
Date	May 6		
Rate, lb/A	50		
Depth, inches	0.75		
Alfalfa/red clover			
Cultivar	Vernal/Arlington		
Date	May 7		
Rate, lb/A	13		
Depth, inches	0.75		
Corn			
Cultivar	Interstate 343A		
Date	May 12		
Rate, seeds/A	22,000		
Depth, inches	1.75		
Safflower			
Cultivar	Girard		
Date	May 12		
Rate, lb/A	25		
Depth, inches	1-1.5		
Soybeans			
Cultivar	McCall		
Date	May 18		
Rate, seeds/A	180,000		
Depth, inches	1.25-1.5		
Drybeans			
Cultivar	Othello (pinto)		
Date	May 19		
Rate, seeds/A	70,000		
Depth, inches	1.25-1.5		
Sunflowers			
Cultivar	Interstate 3311		
Date	May 20		
Rate, seeds/A	22,000		
Depth, inches	1.25-1.5		

[a] Sugarbeets were seeded twice in 1992. Dry conditions during the first planting resulted in poor stand establishment.

Table 3. Injury to eight crops seeded in 1992 from soil residues of quinclorac applied in 1991.

Quinclorac application Date	Rate (lb/A)	Crop	Evaluated June 10 In-jury	Std red	Stunt-ing	Stage	July 20 Overall injury	Sept. 22 General observation
6/3/91	0.15	Sugarbeets	0	0	0	2 lf	45*	No injury
		Flax	0	0	0	4-6 in	8	No injury
		Alfalfa/clover	0	0	0	2-3 in	85	-
		Corn	0	0	0	4-5 lf	35	No injury
		Safflower	0	0	4	4-5 lf	98	-
		Soybeans	0	0	0	unifol	50	-
		Drybeans	0	0	0	unifol	67	-
		Sunflowers	0	0	0	2 lf	28*	No injury
8/21/91	0.3	Sugarbeets	15	0	0	2 lf	15	No injury
		Flax	0	35	40	4-6 in	70	Delayed mat.,stunted
		Alfalfa/clover	-	99	20	2-3 in	100	-
		Corn	0	0	0	4-5 lf	30	No injury
		Safflower	0	0	50	4-5 lf	100	-
		Soybeans	0	0	0	unifol	60	-
		Drybeans	0	0	4	unifol	78	-
		Sunflowers	0	0	10	2 lf	15	No injury

*45% stunting on sugarbeets unclear because it may have been due to prolonged waterlogging which was not as severe in the untreated plot; 28% stunting and somewhat lighter green color was suspicious given the lower injury in the plot treated with the high rate of quinclorac.

Summer-applied quinclorac for field bindweed control, Minot 1991/92. Plot size was 15 by 25 ft and the experiment was randomized complete block design with three replications. Treatments were arranged in a split plot with treatment application date (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-bicycle wheel sprayer treating a 10-ft-wide area and delivering 8.5 gal/A with 8001 tips. Environmental conditions at application were: Early-summer (E) treatments were applied when field bindweed was 5 to 10 in. tall, air temp was 70 F, relative humidity (RH) was 49%, wind was 0 to 4 mph, and soil was dry. Mid-summer (M) treatments were applied when bindweed was 12 to 18 in. long, air temp was 87 F, RH was 30%, wind was calm, and soil in the rooting zone was moist. Late-summer (L) treatments were applied when bindweed was 6 to 12 in. long, air temp was 72 F, RH was 63%, wind was 2 to 5 mph, and soil was dry.

The entire experiment was fertilized with urea in April 1992 according to soil test recommendations for a 50 bu/A yield goal. 'Stoa' hard red spring wheat was seeded May 1 at 70 lb/A and 1.5 inches deep with a John Deere single disc no-till drill and no spring preplant tillage. Wheat was harvested September 13 with a production sized combine. Post-harvest evaluation of field bindweed control was not possible due to extremely low bindweed populations in the untreated check strips.

No wheat injury attributable to herbicide treatments was observed May 27, 1992.

Herbicide treatment[a]	Rate	1991 application date	1991 tillage dates	Field bindweed evaluation 1991 6/12	7/9	8/7	9/4	9/24	1992 5/27
	(lb/A)			(%)					
Untreated(E)	0	5/30	7/10,8/15,9/24	0	0	-	-	0	2
Qucl+Picl(E)	0.25+0.05	5/30	7/10,8/15,9/24	42	99	-	-	45	33
Qucl+2,4-D-bee(E)	0.25+0.5	5/30	7/10,8/15,9/24	70	98	-	-	29	22
Qucl+Dica(E)	0.25+0.5	5/30	7/10,8/15,9/24	74	98	-	-	54	63
Qucl+Glyt&24D(E)	0.25+1.05	5/30	7/10,8/15,9/24	89	94	-	-	45	43
Glyt&2,4-D(E)	0.38&0.67	5/30	7/10,8/15,9/24	74	96	-	-	50	48
Untreated(M)	0	7/9	5/30,8/15,9/24	-	-	0	-	0	23
Qucl+Picl(M)	0.25+0.05	7/9	5/30,8/15,9/24	-	-	95	-	88	91
Qucl+2,4-D-bee(M)	0.25+0.5	7/9	5/30,8/15,9/24	-	-	99	-	73	80
Qucl+Dica(M)	0.25+0.5	7/9	5/30,8/15,9/24	-	-	98	-	86	96
Qucl+Glyt&24D(M)	0.25+1.05	7/9	5/30,8/15,9/24	-	-	98	-	73	69
Glyt&2,4-D(M)	0.38&0.67	7/9	5/30,8/15,9/24	-	-	98	-	83	90
Untreated(L)	0	8/15	5/30,7/10,9/24	-	-	-	0	0	0
Qucl+Picl(L)	0.25+0.05	8/15	5/30,7/10,9/24	-	-	-	83	93	99
Qucl+2,4-D-bee(L)	0.25+0.5	8/15	5/30,7/10,9/24	-	-	-	99	97	94
Qucl+2,4-D-bee(L)	0.25+1	8/15	5/30,7/10,9/24	-	-	-	98	95	97
Qucl+Dica(L)	0.25+0.5	8/15	5/30,7/10,9/24	-	-	-	98	97	96
Qucl+Glyt&24D(L)	0.25+1.05	8/15	5/30,7/10,9/24	-	-	-	96	93	96
Glyt&2,4-D(L)	0.38&0.67	8/15	5/30,7/10,9/24	-	-	-	97	96	99
Picl+2,4-D-dma(L)	0.25+0.5	8/15	5/30,7/10,9/24	-	-	-	93	97	100
Dica+2,4-D-dma(L)	0.25+1	8/15	5/30,7/10,9/24	-	-	-	98	97	95
C.V. %				8	3	2	7	15	27
Application date effect								**	**
Treatments within an application date								**	**
LSD 5%				8	4	3	10	17	30

[a] All quinclorac treatments were applied with SunitII (methylated seed oil adjuvant containing emulsifier); 2,4-D-dma = dimethylamine formulation of 2,4-D; 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.

Economics of Detectspray in full season fallow, West Fargo 1992. Detectspray[1] sprayer technology consists of sensors that measure infrared light reflected from green plant canopies and, with associated circuitry and a computer microprocessor, trigger solenoid valves to turn on allowing delivery of spray to nozzles on a spray boom. Each nozzle on the boom is fitted with a sensor mounted several inches ahead and facing downward. Nozzles are turned on and off individually with solenoid valves positioned immediately above each nozzle. When sufficient infrared light is reflected from green plant leaves and is detected by a particular sensor, the information is processed (using an ambient light reading taken from a sensor facing upward) and an electric signal is sent to that solenoid valve causing it to open and spray to flow through the nozzle. The sensors respond to all green tissue, so Detectspray has application as a fallow sprayer.

Detectspray hardware was mounted on an all-terrain vehicle (ATV) with 6 nozzles spaced 20 inches apart (10 ft effective spray swath). All treatments were applied at 5 gal spray solution per acre at 5 mph with 8001 extended range flat fan nozzles and 28 psi spray pressure. Plots were arranged in a randomized complete block design with four replications.

The experiment was established on a clay soil with pH 8.0 and 4.9% organic matter. Small grain stubble had been chisel plowed once in the fall of 1991, leaving 3125 lb/A of residue and 54% residue cover. Plot size was 20 by 220 feet with 13-ft alleys between plots as a buffer against spray drift. Plots were treated with two adjacent 10-ft-wide passes with the ATV sprayer, either broadcast or using the "selective" mode of Detectspray.

General treatment descriptions are given in Table 1. Treatments 4 to 8 involved preemergence triasulfuron or quinclorac at 0.21 and 12 oz ai/A, respectively, plus atrazine at 6 oz ai/A applied May 4. Postemergence herbicides to be used and rates needed were determined by the investigator for each individual treatment at time of application. Postemergence herbicide rates, dates, and mode of application are in the tables. All glyphosate applications included nonionic surfactant at 0.5% by vol plus ammonium sulfate at 1.5 lb/A. When dicamba was applied alone, nonionic surfactant was added at 0.5% by vol. The double boom of treatment 4 involves broadcast

Table 1. General description of planned treatments for full-season fallow experiments at West Fargo.

Treatment[a]
1. Postemergence herbicides, broadcast as needed
2. Postemergence herbicides, Detectspray as needed
3. Postemergence herbicides, broadcast once followed by Detectspray as needed
4. Postemergence herbicides, broadcast once followed by double boom as needed
5. Preemergence triasulfuron + atrazine, POST herbicides broadcast as needed
6. Preemergence triasulfuron + atrazine, POST herbicides Detectspray as needed
7. Preemergence quinclorac + atrazine, POST herbicides broadcast as needed
8. Preemergence quinclorac + atrazine, POST herbicides Detectspray as needed

[a]Triasulfuron = AMBER by Ciba-Geigy, quinclorac = FACET by BASF; preemergence herbicides were applied broadcast May 5.

[1]Detectspray is a trademark of Detectspray Limited, 215 Mann St., PO Box 84, Armidale NSW 2350, Australia.

application of a low rate of herbicide (usually glyphosate) required to kill small, more abundant weeds, together with a Detectspray application of a higher rate of herbicide to kill large weeds. A Detectspray operator would have both booms operating on one sprayer. Experimentally, the double boom application was simulated by two separate applications.

At the time of each Detectspray (selective mode) application, a circular, 15-cm-diam, leg-mounted quadrat was used to take 100 readings from each plot for each of the following parameters: frequency of occurrence of one or more weeds greater than 5 cm in height or width, density of weeds greater than 5 cm, density of weeds less than 5 cm, and percentage ground area occupied by green plant material (percentage cover). These readings sampled the entire length of each 220-ft plot.

Assumptions used in the economic calculations

1992 herbicide prices from Ostlund Chemical in Fargo:
Glyphosate costs $37.37/gal as Roundup RT
Dicamba costs $68.83/gal as Banvel
Triasulfuron costs $10.27/oz product as Amber (75DF)
Atrazine costs $2.55/lb product as atrazine (90DF)
Quinclorac cost is unknown but is estimated at $25/lb product as Facet (75DF)
Nonionic surfactant costs $17.25/gal as X-77
Ammonium sulfate costs $.25/lb

Detectspray application done by a custom operator estimated at $3.23/A.
Includes custom broadcast price of $2.48/A (U. of Minn. costs estimates) plus $.75/A premium for Detectspray application (figure supplied by Kelly Johnson, Saskatchewan custom applicator, adjusted for U.S.-Canada exchange rate of approximately $1.00:$.75).

Standard broadcast application:
*1. Sprayer owned and operated by the farmer: $.76/A (this figure used in the calculations below unless otherwise stated)
2. Sprayer owned by farmer, operated by hired labor: $1.28/A
3. Custom application: $2.48/A
(Estimates supplied by University of Minnesota)

Herbicides were applied in 3-L plastic bottles, one bottle per plot. After filling the spray boom with each treatment, a mark was placed on the bottle at inital fluid level, thus enabling a measurement of spray volume required to treat each plot.

Summary comments. Cool temperatures throughout the growing season and dry weather during much of July and August slowed weed growth. Thus, only two postemergence applications were needed on most plots (Table 8). Two of three treatments in which Detectspray was used for the first application in early June required an additional treatment but only on a portion of the field ("spot spray").

Assuming that the farmer applies his own broadcasting treatments, the Detectspray treatments generally saved money, although savings were not excessively large. The standard broadcast chemical fallow costed $16.80 compared to $14.63 for using Detectspray full season, resulting in a dollar savings of $2.17/A (Table 8). In this comparison, full-season Detectspray reduced the amount of postemergence herbicide used by 52%. Broadcasting once followed by Detectspray thereafter saved $1.51 compared to the standard broadcast treatment.

Applying triasulfuron plus atrazine preemergence followed by full-season Detectspray use saved $1.27/A compared to the standard broadcast treatment and reduced postemergence herbicide consumption by 81%. Applying triasulfuron plus atrazine preemergence has excellent promise as a means of reducing the need for subsequent postemergence treatments in fallow. The dry spring of 1992 probably provided insufficient activation of triasulfuron and atrazine.

(Summary continued on page 14)

Table 2. Herbicide and application costs during the first postemergence application in the full-season fallow experiment at West Fargo. Broadcast application cost assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a] PRE	POST	Herbicide treatment applied: Herbicides	Rate (lb/A)	Date	Mode	Spray vol. red. (%)	Cost: Herbicide ($/A)	Application ($/A)	Total ($/A)
None	Brdcst	Glyt+Dica	0.35+0.15	6/8	Brdcst	-	7.75	.76	8.51
None	Select	Glyt+Dica	0.35+0.15	6/8	Select	63.6	2.82	3.23	6.05
None	BCl/Sel	Glyt+Dica	0.35+0.15	6/8	Brdcst	-	7.75	.76	8.51
None	BCl/DB	Glyt+Dica	0.35+0.15	6/8	Brdcst	-	7.75	.76	8.51
Trsu+Atra	Brdcst	Glyt+Dica	0.28+0.13	6/8	Brdcst	-	6.45	.76	7.21
Trsu+Atra	Select	Glyt+Dica	0.28+0.13	6/8	Select	85.4	.94	3.23	4.17
Qucl+Atra	Brdcst	Glyt+Dica	0.28+0.13	6/8	Brdcst	-	6.45	.76	7.21
Qucl+Atra	Select	Glyt+Dica	0.28+0.13	6/8	Select	61.4	2.49	3.23	5.72
C.V.						16.5			
LSD(0.1)						15.4			

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 3. Weed frequency, weed density, and spray volume reduction for the first application at West Fargo.

Herbicide treatment plan[a] PRE	POST	Treatment applied	Date	Freq. of weeds >5 cm (%)	Density of weeds >5 cm (weeds/sq. m)	Density of weeds <5 cm (weeds/sq. m)	Spray vol. red. (%)
None	Brdcst	Brdcst	6/8	18.0	14	6	-
None	Select	Select	6/8	16.8	13	18	63.6
None	BCl/Sel	Brdcst	6/8	15.0	12	7	-
None	BCl/DB	Brdcst	6/8	17.8	13	11	-
Trsu+Atra	Brdcst	Brdcst	6/8	10.8	7	10	-
Trsu+Atra	Select	Select	6/8	7.5	6	8	85.4
Qucl+Atra	Brdcst	Brdcst	6/8	14.2	10	3	-
Qucl+Atra	Select	Select	6/8	9.3	7	6	61.4
C.V.				40.1	40	111	37.7
LSD(0.1)				6.7	5	NS	19.0

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 4. Herbicide and application costs during the second postemergence application in the full-season fallow experiment at West Fargo. Broadcast application cost assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a] PRE	POST	Herbicide treatment applied: Herbicides	Rate (lb/A)	Date	Mode	Spray vol. red. (%)	Cost[a] Herbicide ($/A)	Application ($/A)	Total ($/A)
None	Brdcst	Glyt+Dica	0.28+0.19	7/30	Brdcst	-	7.53	.76	8.29
None	Select	Glyphosate	0.28	7/9	Select	49.8	.54	.81	1.35**
None	BCl/Sel	Glyt+Dica	0.28+0.19	8/1	Select	52.9	3.55	3.23	6.78
None	BCl/DB	Glyphosate	0.28	7/9	Brdcst	-	4.30		
		Dicamba	0.19	8/1	Select	54.0	1.68	3.23	9.21
Trsu+Atra	Brdcst	Glyphosate	0.28	7/30	Brdcst	-	4.30	.76	5.06
Trsu+Atra	Select	Glyphosate	0.28	7/9	Select	62.1	.41	.81	1.22**
Qucl+Atra	Brdcst	Glyt+Dica	0.28+0.13	8/14	Brdcst	-	6.45	.76	7.21
Qucl+Atra	Select	Glyt+Dica	0.28+0.19	8/1	Select	79.2	1.57	3.23	4.80
C.V.									
LSD(0.1)									

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.
**Treatments handled as a "spot spray". Only one of the four replicate plots needed treating. This weedy plot was sprayed and the per-acre costs were calculated as one fourth of the costs required to treat all four plots.

Table 5. Weed frequency, weed density, percentage weed cover, and spray volume reduction for the second application at West Fargo.

Herbicide treatment plan[a] PRE	POST	Treatment applied	Date	Freq. of weeds >10 cm (%)	Density of weeds >10 cm (weeds/sq. m)	Density of weeds <10 cm (weeds/sq. m)	% cover (%)	Freq. of >3% cover (%)	Spray vol. red. (%)
None	Brdcst	Brdcst	7/30	11.3	6.8	6.8	4.4	20.0	-
None	Select	Select	7/9	-	-	-	-	-	49.8**
None	BCl/Sel	Select	8/1	8.3	6.2	7.9	4.6	15.5	52.9
None	BCl/DB	Select	8/1	7.8	5.5	3.1	4.0	16.5	54.0
		Brdcst	7/30	-	-	-	-	-	-
Trsu+Atra	Brdcst	Brdcst	7/30	6.3	4.5	3.0	2.5	11.0	-
Trsu+Atra	Select	Select	7/9	-	-	-	-	-	62.1**
Qucl+Atra	Brdcst	Brdcst	8/14	2.8	1.6	2.5	2.0	6.5	-
Qucl+Atra	Select	Select	8/1	3.8	2.8	4.0	1.2	6.8	77.2
C.V.				95.8	97.7	106.5	107.1	83.2	37.7
LSD(0.1)				NS	NS	NS	NS	NS	19.0

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.
**Treatments handled as a "spot spray". Only one of the four replicate plots needed treating. This weedy plot was sprayed and the per-acre costs were calculated as one fourth of what they would have been if the all four plots were treated.

Normally, this preemergence treatment would be expected to reduce the need for postemergence herbicides more than was observed in this experiment.

Assuming that the farmer pays hired labor to operate the sprayer ($.52/A) or that the farmer has all broadcasting done by a commercial applicator widens the margin of savings in favor of Detectspray.

Growers considering the use of Detectspray on a particular fallow field will have reason to wonder how much chemical they will save compared to a broadcast application. A measurement of weed growth at the time of spraying could be helpful in making this determination if such a measurement correlated well with spray volume needed to treat the field. Several measures of weed growth correlated with volume reduction although the highest correlation coefficient was a modest .78 for the percentage of quadrats having greater than 3% cover (Table 9).

Table 6. Herbicide and application costs during the third postemergence application in the full-season fallow experiment at West Fargo. Broadcast application cost assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a]		Herbicide treatment applied				Spray vol. red.	Cost		
PRE	POST	Herbicides	Rate	Date	Mode		Herbicide	Application	Total
			(lb/A)			(%)	($/A)		
None	Brdcst	None	-	-	-	-	0	0	0
None	Select	Glyt+Dica	0.28+0.19	8/1	Select	46.9	4.00	3.23	7.23
None	BC1/Sel	None	-	-	-	-	0	0	0
None	BC1/DB	None	-	-	-	-	0	0	0
Trsu+Atra	Brdcst	None	-	-	-	-	0	0	0
Trsu+Atra	Select	Glyt+Dica	0.28+0.19	8/1	Select	79.4	1.55	3.23	4.78
Qucl+Atra	Brdcst	None	-	-	-	-	0	0	0
Qucl+Atra	Select	None	-	-	-	-	0	0	0
C.V.									
LSD(0.1)									

[a] Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BC1/Sel = one broadcast application followed by selective mode of Detectspray as needed; BC1/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 7. Weed frequency, weed density, percentage weed cover, and spray volume reduction for the third application at West Fargo.

Herbicide treatment plan[a]		Treatment applied	Date	Freq. of weeds >10 cm	Density of weeds >10 cm	Density of weeds <10 cm	% cover	Freq. of >3% cover	Spray vol. red.
PRE	POST			(%)	(weeds/sq. m)		(%)		
None	Select	Select	8/1	9.8	7.5	2.5	4.9	20.5	46.9
Trsu+Atra	Select	Select	8/1	5.0	3.4	3.3	1.5	10.3	79.4
C.V.				95.8	97.7	106.5	107.1	83.2	37.7
LSD(0.1)				NS	NS	NS	NS	NS	19.0

[a] Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BC1/Sel = one broadcast application followed by selective mode of Detectspray as needed; BC1/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 8. Total costs for full-season fallow experiment at West Fargo.

Herbicide treatment plan[b] PRE	Herbicide treatment plan[b] POST	PRE and POST applications (no.)	Full season costs[a]: Broadcasting by farmer, PRE herbicide	Broadcasting by farmer, POST herbicide	Broadcasting by farmer, Application	Broadcasting by farmer, Total	Brdcst by hired labor, Total	Brdcst by custom applicator, Total
			($/A)					
None	Brdcst	2	0	15.28	1.52	16.80	17.84	20.24
None	Select	2.25	0	7.36	7.27	14.63	14.63	14.63
None	BCl/Sel	2	0	11.30	3.99	15.29	15.81	17.01
None	BCl/DB	2	0	13.73	3.99	17.72	18.24	19.44
Trsu+Atra	Brdcst	3	4.60	10.75	2.28	17.63	19.19	22.79
Trsu+Atra	Select	3.25	4.60	2.90	8.03	15.53	16.05	17.25
Qucl+Atra	Brdcst	3	26.42	12.90	2.28	41.60	43.16	46.76
Qucl+Atra	Select	3	26.42	4.06	7.22	37.85	38.37	39.42

[a]Full season costs were calculated three ways: Broadcasting by farmer assumes the farmer owns his sprayer and operates it (labor is "free"); Broadcast by hired labor assumes the farmer owns his sprayer but pays someone to operate it; Broadcast by custom applicator assumes the farmer hires a commercial applicator to do all broadcasting.

[b]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 9. Correlation coefficients for the relationship between spray volume reduction and five weed variables measured at time of Detectspray application at West Fargo.

Variable[a]	Datum points (no.)	Mean	Minimum value	Maximum value	Correlation coefficient (r)
Frequency of weeds >10 cm	32	8.5	0	29	-.63
Density of weeds >10 cm	32	6.5	0	24	-.62
Density of weeds <10 cm	32	6.5	0	61	-.30
Average cover	20	3.2	0	14	-.76
Frequency of >3% cover	20	13.9	0	50	-.78

[a]Frequency of weeds >10 cm= number of times out of 100 samples that the stem of a weed greater than 10 cm tall or wide occurred inside the 15-cm-diam quadrat; Density of weeds >10 cm or <10 cm = plants/m^2 as determined by counts inside 100 15-cm-diam quadrats; Average cover = estimated percentage ground covered by green vegetation inside 100 15-cm-diam quadrats; Frequency of >3% cover = number of quadrats out of 100 in which percentage ground cover was estimated above 3%.

Economics of Detectspray in full season fallow, Fargo 1992. Detectspray[1] sprayer technology consists of sensors that measure infrared light reflected from green plant canopies and, with associated circuitry and a computer microprocessor, trigger solenoid valves to turn on allowing delivery of spray to nozzles on a spray boom. Each nozzle on the boom is fitted with a sensor mounted several inches ahead and facing downward. Nozzles are turned on and off individually with solenoid valves positioned immediately above each nozzle. When sufficient infrared light is reflected from green plant leaves and is detected by a particular sensor, the information is processed (using an ambient light reading taken from a sensor facing upward) and an electric signal is sent to that solenoid valve causing it to open and spray to flow through the nozzle. The sensors respond to all green tissue, so Detectspray has application as a fallow sprayer.

Detectspray hardware was mounted on an all-terrain vehicle (ATV) with 6 nozzles spaced 20 inches apart (10 ft effective spray swath). All treatments were applied at 5 gal spray solution per acre at 5 mph with 8001 extended range flat fan nozzles and 28 psi spray pressure. Plots were arranged in a randomized complete block design with four replications.

The experiment was established on a silty clay soil with pH 6.6 and 5.4% organic matter. Small grain stubble had been chisel plowed twice in the fall of 1991, leaving 1176 lb/A of residue and 41% residue cover. Plot size was 20 by 220 feet with 13-ft alleys between plots as a buffer against spray drift. Plots were treated with two adjacent 10-ft-wide passes with the ATV sprayer, either broadcast or using the "selective" mode of Detectspray.

General treatment descriptions are given in Table 1. Treatments 4 to 8 involved preemergence triasulfuron or quinclorac at 0.21 and 12 oz ai/A, respectively, plus atrazine at 6 oz ai/A applied May 4. The postemergence herbicides to be used and the rates needed were determined by the investigator for each individual treatment at time of application. Postemergence herbicide rates, dates, and mode of application are given in the tables. All glyphosate applications included nonionic surfactant at 0.5% by vol plus ammonium sulfate at 1.5 lb/A. When dicamba was applied alone, nonionic surfactant was added at 0.5% by vol. The double boom of treatment 4

Table 1. General description of planned treatments for full-season fallow experiments at Fargo.

Treatment[a]
1. Postemergence herbicides, broadcast as needed
2. Postemergence herbicides, Detectspray as needed
3. Postemergence herbicides, broadcast once followed by Detectspray as needed
4. Postemergence herbicides, broadcast once followed by double boom as needed
5. Preemergence triasulfuron + atrazine, POST herbicides broadcast as needed
6. Preemergence triasulfuron + atrazine, POST herbicides Detectspray as needed
7. Preemergence quinclorac + atrazine, POST herbicides broadcast as needed
8. Preemergence quinclorac + atrazine, POST herbicides Detectspray as needed

[a]Triasulfuron = AMBER by Ciba-Geigy, quinclorac = FACET by BASF; preemergence herbicides were applied broadcast May 5.

[1]Detectspray is a trademark of Detectspray Limited, 215 Mann St., PO Box 84, Armidale NSW 2350, Australia.

involves broadcast application of a low rate of herbicide (usually glyphosate) required to kill smaller, more abundant weeds, together with a Detectspray application of a higher rate of herbicide to kill large weeds. A Detectspray operator would have both booms operating on one sprayer. Experimentally, the double boom application was simulated by two separate applications.

At the time of each Detectspray (selective mode) application, a circular, 15-cm-diam, leg-mounted quadrat was used to take 100 readings from each plot for each of the following parameters: frequency of occurrence of one or more weeds greater than 5 cm in height or width, density of weeds greater than 5 cm, density of weeds less than 5 cm, and percentage ground area occupied by green plant material (percentage cover). These readings sampled the entire length of each 220-ft plot.

<u>Assumptions used in the economic calculations</u>

1992 herbicide prices from Ostlund Chemical in Fargo:
- Glyphosate costs $37.37/gal as Roundup RT (3 lb ae/gal)
- Dicamba costs $68.83/gal as Banvel (4 lb ai/gal)
- Triasulfuron costs $10.27/oz product as Amber (75DF)
- Atrazine costs $2.55/lb product as atrazine (90DF)
- Quinclorac cost is unknown but is estimated at $25/lb product as Facet (75DF)
- Nonionic surfactant costs $17.25/gal as X-77
- Ammonium sulfate costs $.25/lb

Detectspray application done by a custom operator estimated at $3.23/A.
Includes custom broadcast price of $2.48/A (U. of Minn. costs estimates) plus $.75/A premium for Detectspray application (figure supplied by Kelly Johnson, Saskatchewan custom applicator, adjusted for U.S.-Canada exchange rate of approximately $1.00:$.75).

Standard broadcast application:
*1. Sprayer owned and operated by the farmer: $.76/A (this figure used in the calculations below unless otherwise stated)
2. Sprayer owned by farmer, operated by hired labor: $1.28/A
3. Custom application: $2.48/A
(Estimates supplied by University of Minnesota)

Herbicides were applied in 3-L plastic bottles, one bottle per plot. After filling the spray boom with each treatment, a mark was placed on the bottle at inital fluid level, thus enabling a measurement of spray volume required to treat each plot.

<u>Summary comments</u>. Cool temperatures throughout the growing season and dry weather during much of July and August slowed weed growth. Thus, only about two postemergence applications were needed on some plots (Table 8). Three Detectspray treatments, however, required four postemergence applications. Two of these four post applications were follow-up treatments to destroy weeds not killed by the August 4 application (Tables 4 and 5). Wind on August 4 was 8 to 10 mph. The treatments were re-applied August 14 (Table 6) when it was apparent that weeds were showing little to no injury from the August 4 application. Wind on August 14 was 5 to 8 mph. On August 27, another re-treatment was required at a lower herbicide rate and many weeds showed only moderate injury. Since spray volume measurements indicate the Detectspray sensors were functioning and spray was being applied, it appears that the wind on August 4 and 14 may have dispersed and displaced the spray, preventing much of it from reaching the target weeds.

Assuming that the farmer applies his own broadcasting treatments, Detectspray treatment results were sometimes more and sometimes less expensive than standard broadcasting. Specifically, in Detectspray treatments receiving the August 4 application that required double re-treatment, costs exceeded those for broadcasting (Table 8). In other Detectspray treatments, however, costs were lower than broadcasting by $2 to $4/A.

Applying triasulfuron plus atrazine preemergence followed by full-season broadcasting saved about $3/A compared to the standard broadcast treatment without preemergence herbicides (Table 8). Applying triasulfuron plus atrazine preemergence has excellent promise as a means of reducing the need for subsequent postemergence treatments in fallow. The dry spring of 1992 probably provided insufficient activation of triasulfuron and atrazine. Normally, this preemergence treatment would be expected to reduce the need for postemergence herbicides even more than was observed in this experiment.

Assuming that the farmer pays hired labor to operate the sprayer ($.52/A) or that the farmer has all broadcasting done by a commercial applicator improves the economics of Detectspray relative to broadcasting. However, the costly double retreatment required in Detectspray plots treated August 4 made standard broadcasting less expensive.

Growers considering the use of Detectspray on a particular fallow field will have reason to wonder how much chemical they will save compared to a broadcast application. A measurement of weed growth at the time of spraying could be helpful in making this determination if such a measurement correlated well with spray volume needed to treat the field. Several measures of weed growth correlated with volume reduction, although the highest correlation coefficient was a modest .80 for the percentage of quadrats having greater than 3% cover (Table 9).

Table 2. Herbicide and application costs during the first postemergence application in the full-season fallow experiment at Fargo. Broadcast application cost assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a]		Herbicide treatment applied				Spray vol. red.	Cost		
PRE	POST	Herbicides	Rate	Date	Mode		Herbi-cide	Appli-cation	Total
			(lb/A)			(%)	($/A)		
None	Brdcst	Glyt+Dica	0.28+0.19	6/13	Brdcst	-	7.53	.76	8.29
None	Select	Glyt+Dica	0.28+0.19	6/13	Select	66.9	2.49	3.23	5.72
None	BCl/Sel	Glyt+Dica	0.28+0.19	6/13	Brdcst	-	7.53	.76	8.29
None	BCl/DB	Glyt+Dica	0.28+0.19	6/13	Brdcst	-	7.53	.76	8.29
Trsu+Atra	Brdcst	Glyt+Dica	0.28+0.19	6/13	Brdcst	-	7.53	.76	8.29
Trsu+Atra	Select	Glyt+Dica	0.28+0.19	6/13	Select	86.0	1.05	3.23	4.28
Qucl+Atra	Brdcst	Glyt+Dica	0.28+0.19	6/13	Brdcst	-	7.53	.76	8.29
Qucl+Atra	Select	Glyt+Dica	0.28+0.19	6/13	Select	80.3	1.48	3.23	4.71
C.V.						19.4			
LSD(0.1)						11.4			

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 3. Weed frequency, weed density, percentage weed cover, and spray volume reduction for the first application at Fargo.

Herbicide treatment plan[a]		Treat-ment applied	Date	Freq. of weeds >5 cm	Density of weeds >5 cm	Density of weeds <5 cm	% cover	Freq. of >3% cover	Spray vol. red.
PRE	POST			(%)	(weeds/sq. m)		(%)		
None	Brdcst	Brdcst	6/13	3.8	2.3	2.7	1.3	5.8	-
None	Select	Select	6/13	6.5	4.1	1.7	2.5	9.8	67
None	BCl/Sel	Brdcst	6/13	4.8	2.8	2.3	0.7	4.8	-
None	BCl/DB	Brdcst	6/13	6.0	3.7	1.3	2.3	9.0	-
Trsu+Atra	Brdcst	Brdcst	6/13	2.8	1.6	2.3	0.6	3.8	-
Trsu+Atra	Select	Select	6/13	3.5	2.0	2.1	0.6	4.8	86
Qucl+Atra	Brdcst	Brdcst	6/13	5.3	3.7	2.7	1.3	7.0	-
Qucl+Atra	Select	Select	6/13	5.0	3.0	0.6	1.3	5.5	80
C.V.				67.8	74.3	110.3	58.7	66.5	19
LSD(0.1)				NS	NS	NS	0.9	NS	11

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application fol-lowed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 4. Herbicide and application costs during the second postemergence application in the full-season fallow experiment at Fargo. Broadcast application assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a]		Herbicide treatment applied				Spray vol. red.	Cost		
PRE	POST	Herbicides	Rate	Date	Mode		Herbi-cide	Appli-cation	Total
			(lb/A)			(%)	($/A)		
None	Brdcst	Glyt+Dica	0.28+0.19	8/4	Brdcst	-	1.88	.19	2.07**
None	Select	Glyt+Dica	0.28+0.19	8/4	Select	68.7	2.36	3.23	5.59
None	BC1/Sel	Glyt+Dica	0.28+0.19	8/14	Select	79.2	1.57	3.23	4.80
None	BC1/DB	Glyphosate	0.14	8/4	Brdcst	-	2.43	-	
		Dicamba	0.19	8/4	Select	88.1	.44	3.23	6.10
Trsu+Atra	Brdcst	Glyt+Dica	0.28+0.19	8/31	Brdcst	-	1.88	.19	2.07**
Trsu+Atra	Select	Glyt+Dica	0.28+0.19	8/4	Select	80.2	1.49	3.23	4.72
Qucl+Atra	Brdcst	Glyt+Dica	0.19+0.19	8/31	Brdcst	-	1.59	.19	1.78**
Qucl+Atra	Select	Glyt+Dica	0.28+0.19	8/4	Select	75.6	1.84	3.23	5.07
C.V.									
LSD(0.1)									

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BC1/Sel = one broadcast application followed by selective mode of Detectspray as needed; BC1/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.
**Treatments handled as a "spot spray". Only one of the four replicate plots needed treating. This weedy plot was sprayed and the per-acre costs were calculated as one fourth of the costs required to treat all four plots.

Table 5. Weed frequency, weed density, percentage weed cover, and spray volume reduction for the second application at Fargo.

Herbicide treatment plan[a]		Treat-ment applied	Date	Freq. of weeds >10 cm	Density of weeds >10 cm	Density of weeds <10 cm	% cover	Freq. of >3% cover	Spray vol. red.
PRE	POST			(%)	(weeds/sq. m)		(%)		
None	Brdcst	Brdcst	8/31	4.0	4.0	1.8	3.7	8.0	-
None	Select	Select	8/4	10.0	5.9	1.6	6.8	19.8	68.7
None	BC1/Sel	Select	8/14	3.8	2.1	1.0	3.1	7.5	79.2
None	BC1/DB	Select	8/4	3.0	1.7	1.1	1.5	7.3	88.1
		Brdcst	8/4	-	-	-	-	-	-
Trsu+Atra	Brdcst	Brdcst	8/31	4.0	4.0	0	3.6	5.0	- **
Trsu+Atra	Select	Select	8/4	7.8	4.5	1.0	6.2	15.0	80.2
Qucl+Atra	Brdcst	Brdcst	8/31	0	0	1.0	0.1	1.0	- **
Qucl+Atra	Select	Select	8/4	8.0	4.5	0.1	6.9	14.8	75.6
C.V.				68.9	71.9	97.3	88.3	75.2	30.2
LSD(0.1)				NS	NS	NS	NS	NS	16.7

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BC1/Sel = one broadcast application fol-lowed by selective mode of Detectspray as needed; BC1/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.
**Treatments handled as a "spot spray". Only one of the four replicate plots needed treating. This weedy plot was sprayed and the per-acre costs were calculated as one fourth of the costs required to treat all four plots.

Table 6. Herbicide and application costs during the third postemergence application in the full-season fallow experiment at Fargo. Broadcast application assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a]		Herbicide treatment applied				Spray vol. red.	Cost		
PRE	POST	Herbicides	Rate	Date	Mode		Herbi-cide	Appli-cation	Total
			(lb/A)			(%)	($/A)		
None	Brdcst	Glyt+Dica	0.28+0.19	8/31	Brdcst	-	7.53	.76	8.29
None	Select	Glyt+Dica	0.28+0.19	8/14	Select	65.7	2.58	3.23	5.81
None	BCl/Sel	Glyphosate	0.19	8/27	Select	85.8	.45	3.23	3.68
None	BCl/DB	None	-	-	-	-	0	0	0
Trsu+Atra	Brdcst	None	-	-	-	-	0	0	0
Trsu+Atra	Select	Glyt+Dica	0.28+0.19	8/14	Select	79.0	1.58	3.23	4.81
Qucl+Atra	Brdcst	None	-	-	-	-	0	0	0
Qucl+Atra	Select	Glyt+Dica	0.28+0.19	8/14	Select	75.8	1.82	3.23	5.05
C.V.						19.8			
LSD(0.1)						NS			

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 7. Herbicide and application costs during the fourth postemergence application in the full-season fallow experiment at Fargo. Broadcast application assumes the sprayer is farmer owned and operated.

Herbicide treatment plan[a]		Herbicide treatment applied				Spray vol. red.	Cost		
PRE	POST	Herbicides	Rate	Date	Mode		Herbi-cide	Appli-cation	Total
			(lb/A)			(%)	($/A)		
None	Brdcst	None	-	-	-	-	0	0	0
None	Select	Glyphosate	0.19	8/27	Select	73.7	.83	3.23	4.06
None	BCl/Sel	None	-	-	-	-	0	0	0
None	BCl/DB	None	-	-	-	-	0	0	0
Trsu+Atra	Brdcst	None	-	-	-	-	0	0	0
Trsu+Atra	Select	Glyphosate	0.19	8/27	Select	86.2	.43	3.23	3.66
Qucl+Atra	Brdcst	None	-	-	-	-	0	0	0
Qucl+Atra	Select	Glyphosate	0.19	8/27	Select	83.3	.53	3.23	3.76

[a]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BCl/Sel = one broadcast application followed by selective mode of Detectspray as needed; BCl/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 8. Total costs for full-season fallow experiment at Fargo.

Herbicide treatment plan[b] PRE	POST	PRE and POST applications (no.)	Full season costs[a]: Broadcasting by farmer: PRE herbicide	POST herbicide	Application	Total	Brdcst by hired labor Total	Brdcst by custom applicator Total
			($/A)					
None	Brdcst	2.25	0	16.94	1.71	18.65	19.82	22.52
None	Select	4	0	8.26	12.92	21.18	21.18	21.18
None	BC1/Sel	3	0	9.55	7.22	16.77	17.29	18.49
None	BC1/DB	2	0	10.40	3.99	14.39	14.91	16.11
Trsu+Atra	Brdcst	2.25	4.60	9.41	1.71	15.72	16.89	19.59
Trsu+Atra	Select	5	4.60	4.55	13.68	22.83	23.35	24.55
Qucl+Atra	Brdcst	2.25	26.42	9.12	1.71	37.25	38.42	41.12
Qucl+Atra	Select	5	26.42	5.67	13.68	45.77	46.29	47.49

[a]Full season costs were calculated three ways: Broadcasting by farmer assumes the farmer owns his sprayer and operates it (labor is "free"); Broadcast by hired labor assumes the farmer owns his sprayer but pays someone to operate it; Broadcast by custom applicator assumes the farmer hires a commercial applicator to do all broadcasting.

[b]Brdcst = standard broadcast application as needed; Select = "selective mode" of Detectspray as needed; BC1/Sel = one broadcast application followed by selective mode of Detectspray as needed; BC1/DB = one broadcast application followed by double boom as needed; Trsu = triasulfuron; Qucl = quinclorac; Atra = atrazine.

Table 9. Correlation coefficients for the relationship between spray volume reduction and five weed variables measured at time of Detectspray application at Fargo.

Variable[a]	Datum points (no.)	Mean	Minimum value	Maximum value	Correlation coefficient (r)
Frequency of weeds >10 cm	30	5.8	1	21	-.85
Density of weeds >10 cm	30	3.4	1	12	-.85
Density of weeds <10 cm	30	1.2	0	6	-.04
Average cover	29	3.7	0	18	-.78
Frequency of >3% cover	29	10.4	0	43	-.80

[a]Frequency of weeds >10 cm = number of times out of 100 samples that the stem of a weed greater than 10 cm tall or wide occurred inside the 15-cm-diam quadrat; Density of weeds >10 cm or <10 cm = plants/m^2 as determined by counts inside 100 15-cm-diam quadrats; Average cover = estimated percentage ground covered by green vegetation inside 100 15-cm-diam quadrats; Frequency of >3% cover = number of quadrats out of 100 in which percentage ground cover was estimated above 3%.

Effect of travel speed on Detectspray efficacy, Fargo 1992. Detectspray[1] sprayer technology consists of sensors that measure infrared light reflected from green plant canopies and, with associated circuitry and a computer microprocessor, trigger solenoid valves to turn on allowing delivery of spray to nozzles on a spray boom. Each nozzle on the boom is fitted with a sensor mounted several inches ahead and facing downward. Nozzles are turned on and off individually with solenoid valves positioned immediately above each nozzle. When sufficient infrared light is reflected from green plant leaves and is detected be a particular sensor, the information is processed (using an ambient light reading taken from a sensor facing upward) and an electric signal is sent to that solenoid valve causing it to open and spray to flow through the nozzle. The sensors respond to all green tissue, so Detectspray has application as a fallow sprayer.

Detectspray hardware was mounted on an all-terrain vehicle (ATV) with six nozzles spaced 20 inches apart. Only the center four nozzles were used in this experiment, however. Treatments were applied at 5 gal spray solution per acre at either 6 mph with 8001 flat fan nozzle tips or 12 mph with 8002 tips. Spray pressure was 41 psi. Treatments were applied July 21 when air temperature was 66 F, skies were clear to partly cloudy, and soybeans had 3 to 3.5 trifoliolate leaves. Plot size was 15 by 40 ft; the experiment was a randomized complete block design with four replications.

The experiment was established on a silty clay soil with 4% organic matter. Ethalfluralin at 1 lb ai/A plus metribuzin at 0.19 lb ai/A plus imazethapyr at 0.016 lb ai/A were applied over the entire experimental area at 8 pm June 1. The area was double-pass incorporated with a field cultivator/harrow by 10 am June 2. McCall soybeans were seeded at 180,000 seeds/A June 2 in rows 5 ft apart. Forty-ft alleys were positioned between replications (tiers) to allow for establishing travel speeds of 6 or 12 mph before entering the plot. These alleys and the entire experimental area was maintained weed free so that Detectspray sensors would be triggered only by soybean foliage.

		6 mph, 8001 tips		12 mph, 8002 tips	
Treatment	Rate	Detect-spray	Broad-cast	Detect-spray	Broad-cast
	(lb/A)	(%)			
Glyphosate+X77	0.28+0.5%	87	84	87	89
Glyphosate+X77	0.1875+0.5%	72	73	82	75
Glyphosate+X77	0.125+0.5%	62	62	72	78
Paraquat+X77	0.25+0.5%	64	67	71	79
C.V. %		8			
LSD 5%		8			

Comments. Sensors were positioned about 12 inches in front of nozzle tips. Detectspray recommendations call for sensors to be 2 inches forward of nozzle tips for every mile per hour of travel speed. Thus, sensors were placed properly for 6 mph but should have been 24 inches in front of the nozzles for 12 mph. Nevertheless, control with Detectspray treatment was as good at 12 as at 6 mph. There was no evidence that sensors responded too slowly at 12 mph to effectively treat the soybean foliage.

Although the volume of spray required to treat each plot was not measured, it was observed that equal volumes of spray were used for broadcast and Detectspray treatments. Apparently, the 5-ft spacing between soybean rows provided non-green gaps insufficient for Detectspray nozzles to shut off.

[1] Detectspray is a trademark of Detectspray Limited, 215 Mann St., PO Box 84, Armidale NSW 2350, Australia.

Postharvest treatments with Detectspray, West Fargo 1992. An experiment was established on a clay with pH 8.0 and 4.9% organic matter. Treatments were applied with an ATV-mounted sprayer delivering 5 gal/A with 8001 nozzles at 28 psi and 5 mph. CO_2 was used as the spray propellant. The 6-nozzle boom (nozzles 20 inches apart) was equipped with Detectspray hardware with sensors positioned 10 inches in front of each nozzle and about 24 inches from the ground surface. When spraying on selective mode, sensors detect green plant foliage and trigger individual nozzles to turn on and off according to the presence or absence of foliage. Maximum sensor sensitivity was achieved by adjusting the master controller slightly above the point where the group of six nozzles began turning on even with the sensors positioned above vegetation-free stubble (sprayed at a monitor setting of 0.88). All selective-mode plots were treated while driving east to minimize effects of shadows from the ATV.

Treatments were applied in 6- to 8-inch standing wheat stubble between 3 and 3:30 pm on September 22 when air temperature was 54 F, wind was 0 to 2 mph, relative humidity was 40%, skies were sunny, and soil was moist. Volunteer wheat was 2 to 5-leaf and 4 to 10 inches tall and was by far the most abundant species. Occasional kochia and common ragweed (each 5 to 12 inches tall) also were present. The same herbicide mixture, glyphosate at 0.23 lb ae/A plus dicamba at 0.125 lb ae/A plus ammonium sulfate at 1.5 lb/A plus X-77 surfactant at 0.5% by vol, was applied to all plots. Plot size was 20 by 220 ft, requiring two passes with the 10-ft sprayer. Treatments were mixed in 2800 ml contained in a 3-L bottle, one bottle per plot. After filling the boom with each treatment, the bottle was marked at fluid level before treating the plot. After spraying, the bottles were brought into the laboratory where initial and final volume were determined. At time of spraying, a 15-cm-diameter leg-mounted quadrat was used to take the following measurements: number of weeds 4 inches or larger, number of weeds less than 4 inches, estimated percentage cover. The quadrat was placed 100 times per plot, sampling the entire 220-ft plot length. Visual estimates of percentage weed control were taken October 2, 10 days after treatment (10 DAT). The experiment was a randomized complete block design with four replications.

Detectspray[a] mode	Spray volume used	Weed control 10 DAT	Freq. weeds >4 in.	Ave. weeds in FOV	Ave. % cover	Freq. >3% cover
	(ml)	(%)	(%)	(no.)	(%)	(%)
Selective	1855	96	77 ± 2	30 ± 1	29 ± 3	91 ± 2
Continuous	1850	97	-	-	-	-
LSD (0.05)	NS	NS				

[a]Selective mode allows a particular nozzle to turn on only when its sensor detects green plant foliage; continuous mode is standard broadcast spraying with all nozzles on continuously.

Soil-applied grass control in corn, Fargo 1992. An experiment was established on a conventionally prepared silty clay with pH 7.8 and 4.1% organic matter. Preplant incorporated (PPI) treatments were applied May 6 with 82 F air temperature, 40% relative humidity, sunny skies, 0 to 2 mph winds, and a moist soil surface (0.3 inch rain received May 5). Granule (-G) treatments were applied with a Gandy airflow applicator to an 8-ft-wide area down the center of each plot. Sprayed treatments were applied with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi to a 6.7-ft-wide area down the center of each plot. All plots were double pass incorporated with a field cultivator/harrow operated 3 inches deep and within 1 hour of EPTC&R25788 application. Interstate 343A was seeded the same day at 22,000 seeds/A and 1.75 inch deep with a Hiniker no-till planter set on 30-inch rows. Preemergence (PRE) treatments were applied May 13 using the airflow applicator or the sprayer described above. Environmental conditions at application on May 13 were as follows: 60 F air temperature, wind 0 to 2 mph, soil dry on surface but moist underneath. Visual estimates of percentage crop injury and weed control were taken June 16. Corn stands were determined June 19 by counting all plants in the two center rows of each plot. The entire experimental area was treated June 29 with clopyralid at 0.09 lb ae/A for Canada thistle control. Plot size was 12.5 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Corn stand	Evaluated June 16					
			Corn injury	Fxtl[b]	KOCZ	Rrpw	Colq	Wibw
	(lb/A)	(plants/A)	(%)					
Acetochlor&safener(PRE)	1.2	12,500	0	57	0	49	22	0
Acetochlor&safener(PRE)	1.8	14,000	0	73	16	66	58	0
Acetochlor&safener(PRE)	2.2	13,800	0	82	81	92	87	36
Acet&safener+Cyanazine(PRE)	1.8+1.5	13,400	0	87	90	96	89	81
Acet&safener+Cyanazine(PPI)	1.8+1.5	13,800	0	88	95	98	100	83
Acet&safener+Cyanazine(PRE)	2.2+1.5	14,100	0	89	92	96	92	88
Alachlor(PRE)	3.5	12,800	0	62	12	75	69	8
Alachlor+Cyanazine(PRE)	3.5+1.5	13,900	0	79	80	80	97	59
Alachlor+Cyanazine(PPI)	3.5+1.5	13,300	0	81	96	96	98	88
Alachlor-G(PRE)	3.5	11,700	0	87	96	96	94	57
Alachlor-G+Cyanazine(PRE)	3.5+1.5	13,900	0	84	92	82	98	77
Alachlor-G+Cyanazine(PPI)	3.5+1.5	12,400	0	71	93	97	98	83
Metolachlor(PRE)	3	14,400	0	62	14	32	4	25
Metolachlor+Cyanazine(PRE)	3+1.5	13,500	0	68	65	46	27	18
Metolachlor+Cyanazine(PPI)	3+1.5	14,100	0	90	91	97	99	22
Metolachlor-G(PRE)	3	12,500	0	87	65	81	48	18
Metolachlor-G+Cyan(PRE)	3+1.5	13,000	0	66	14	23	41	24
Metolachlor-G+Cyan(PPI)	3+1.5	13,600	0	79	89	78	65	54
SAN-582(PRE)	1.5	13,200	0	68	5	75	47	3
SAN-582(PPI)	1.5	13,800	0	83	63	100	99	79
SAN-582+Cyanazine(PRE)	1.5+1.5	12,700	0	84	82	87	90	35
SAN-582+Cyanazine(PPI)	1.5+1.5	14,100	0	75	75	55	63	47
Pendimethalin+Cyan(PRE)	1.5+1.5	14,200	0	40	97	20	39	33
EPTC&R25788(PPI)	4	13,500	0	97	63	94	99	12
EPTC&R25788+Cyanazine(PPI)	4+1.5	13,700	0	96	95	97	100	60
EPTC&R25788-G(PPI)	4	13,200	0	98	75	93	99	49
EPTC&R25788-G+Cyanazine(PPI)	4+1.5	12,800	0	98	92	99	99	95
Untreated	0	14,200	0	0	0	0	0	0
C.V. %		8	0	11	22	19	29	47
LSD 5%		1,400	NS	12	20	20	30	29

[a] Dry flowable formulation of cyanazine was used.
[b] Foxtail was a mixture of yellow (75%) and green (25%) foxtail.

Fall-applied trifluralin and ethalfluralin granules in no-till soybeans, Fargo 1992. An experiment was established on a silty clay with pH 7.8, 4.5% organic matter, and standing wheat stubble. Design was a randomized complete block with four replications and plot size of 15 by 30 ft. Tilled plots were designed to simulate conditions typical of a standard trifluralin application in conventional till and were rototilled before herbicide application to destroy stubble. Trifluralin and ethalfluralin granules were applied Oct. 23, 1991 with a Gandy air-flow applicator applying a 10-ft-wide area when air temperature was 30 F and skies were partly cloudy. Granules were incorporated the day of application. Conventional till plots were tilled once with a field cultivator operated 2 to 3 inches deep. In no-till plots, granules were left on the surface or were incorporated with a Haybuster undercutter (operated 2 inches deep) or a rotary hoe. Trfluralin and ethalfluralin granules also were applied Nov. 13 with 41 F air temperature, sunny skies, and 4 inches of wet snow. McCall soybeans (Rhizobium inoculated) were seeded 1 inch deep on May 18 at 180,000 seeds/A with a Hiniker no-till planter set on 30-inch rows. Immediately before seeding, tilled plots were worked once with a field cultivator/harrow operated 2 to 3 inches deep. The entire experimental area was treated May 26 with glyphosate at 0.75 lb/A to destroy emerged weeds. Handweeded check plots were maintained with sethoxydim plus SUN-IT II at 0.2 lb/A + 1.5 pt/A supplemented with handweeding. Visual estimates of foxtail (90% yellow, 10% green foxtail) control were taken June 24 and July 29. Grain was harvested by machine on Oct. 5, and yields are expressed on a 12% moisture basis.

Herbicide application			Tillage system	Herbicide incorporation method	Sobe inj.	Foxtail control		Grain yield
Herbicide	Rate	Date				6/24	7/29	
	(lb/A)				(%)			(bu/A)
Trifluralin	1	Oct. 23	Tilled	Field cultivator	0	86	86	23.1
Trifluralin	1	Oct. 23	No-till	None	0	95	88	24.9
Trifluralin	1	Oct. 23	No-till	Rotary hoe	0	97	93	23.8
Trifluralin	1	Oct. 23	No-till	Undercutter	0	91	83	22.8
Trifluralin	1	Nov. 13	No-till	None	0	70	67	19.0
Ethalfluralin	1	Oct. 23	Tilled	Field cultivator	0	96	90	24.9
Ethalfluralin	1	Oct. 23	No-till	None	0	98	90	25.5
Ethalfluralin	1	Oct. 23	No-till	Rotary hoe	0	96	88	26.0
Ethalfluralin	1	Oct. 23	No-till	Undercutter	0	70	61	24.0
Ethalfluralin	1	Nov. 13	No-till	None	0	73	59	21.2
Handweeded	0	-	Tilled	Field cultivator	-	-	-	29.0
Handweeded	0	-	No-till	Undercutter	-	-	-	26.6
C.V. %					0	10	10	10.6
LSD 5%					NS	13	12	3.7

Fall-applied trifluralin and ethalfluralin granules in conservation-till soybeans, Carrington 1992. An experiment was established on a Heimdal-Emrick loam with pH 7.8, 3.2% organic matter, and 6 to 8-inch standing wheat stubble. Trifluralin and ethalfluralin granules were applied either Oct. 18 or Nov. 16, 1991 using a Gandy airflow applicator. Trifluralin emulsifiable concentrate was applied either Oct. 18 or Nov. 16 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles. For treatments incorporated with a field cultivator, the plots were first rototilled to destroy most surface crop residues before herbicide application. On Oct. 18, air temperature was 37 F with sunny skies and dry soil; on Nov. 16, skies were sunny with 36 F and 0 to 2 inches of snow. Herbicide granules were either left on the surface or were incorporated once on Oct. 18 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 19, 1992. McCall soybeans were seeded 1.5 to 2 inches deep at 63 lb/A on May 19 using a John Deere MaxEmerge no-till planter with 30-inch row spacing. Glyphosate at 0.75 lb ai/A was applied May 22 to the entire experimental area to control emerged weeds. Soybean plants per m of row was determined June 15. Thifensulfuron + bentazon at 0.0039 + 0.75 lb/A was applied June 19 over the entire experiment for broadleaf weed control. Sethoxydim at 0.25 lb/A was applied to handweeded check plots on June 16. Visual estimates of percentage green foxtail control were taken on June 12 and Aug. 2. Foxtail plants per 0.25 m^2 (3 subsamples per plot) was determined June 13. Plots were combine-harvested on Oct. 2 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

-- See previous page for experiment description --

Herbicide application[a] Chemical	Rate (lb/A)	Date	Herbicide incorporation method	Soybean stand (plt/m)	Foxtail control 6/12 (%)	Foxtail control 8/24 (%)	Foxtail density (plt/m^2)	Grain yield (bu/A)
Trif-10G	1	Oct. 18	Field cultivator	32	89	90	50	18.0
Trif-4EC	1	Oct. 18	Field cultivator	31	83	78	97	17.8
Trif-4EC	1	Nov. 16	None	31	25	1	354	9.5
Trif-10G	1	Nov. 16	None	27	68	11	175	12.6
Trif-10G	1.5	Nov. 16	None	24	84	48	90	15.0
Trif-10G	1	Oct. 18	None	28	79	39	108	14.1
Trif-10G	1	Oct. 18	Rotary hoe	28	81	55	114	15.0
Trif-10G	1.5	Oct. 18	Rotary hoe	28	87	60	48	17.2
Trif-10G	1	Oct. 18	Undercutter	26	91	79	41	19.0
Trif-10G	1.5	Oct. 18	Undercutter	30	95	91	9	17.5
Trif-10G	1	Oct. 18	Undercut/Rotary hoe	26	93	80	43	17.3
Trif-10G	1.5	Oct. 18	Undercut/Rotary hoe	30	94	92	10	17.3
Etha-10G	1	Oct. 18	Field cultivator	33	93	94	15	17.9
Etha-3EC	1	Oct. 18	Field cultivator	35	85	79	66	17.0
Etha-3EC	1	Nov. 16	None	31	25	0	382	9.1
Etha-10G	1	Nov. 16	None	26	73	16	150	12.8
Etha-10G	1.5	Nov. 16	None	31	85	60	73	15.6
Etha-10G	1	Oct. 18	None	28	79	31	103	14.3
Etha-10G	1	Oct. 18	Rotary hoe	28	85	50	81	15.6
Etha-10G	1.5	Oct. 18	Rotary hoe	31	87	75	46	17.2
Etha-10G	1	Oct. 18	Undercutter	30	91	81	39	18.8
Etha-10G	1.5	Oct. 18	Undercutter	25	95	90	7	20.2
Etha-10G	1	Oct. 18	Undercut/Rotary hoe	29	95	92	6	19.3
Etha-10G	1.5	Oct. 18	Undercut/Rotary hoe	29	97	95	4	18.2
Untreated	0	-	Field cultivator	29	0	0	738	6.6
Untreated	0	-	Undercutter	33	0	0	471	9.7
Handweeded	0	-	Field cultivator	33	100	100	0	18.4
Handweeded	0	-	Undercutter	30	100	100	0	22.2
C.V. %				11	6	24	114	14
LSD 5%				5	7	21	110	3.1

[a]Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate; Etha-10G = Sonalan 10G granules; Etha-3EC = Sonalan 3E emulsifiable concentrate.

<u>Fall-applied trifluralin and ethalfluralin granules in conservation-till soybeans, Minot 1992</u>. An experiment was established on a Max-Williams loam with pH 5.6, 3.2% organic matter (0 to 2 inches), and 12-inch standing wheat stubble. Trifluralin and ethalfluralin granules were applied Oct. 16 to 18, or Nov. 15 to 16, 1991 using a Gandy airflow applicator. Trifluralin and ethalfluralin emulsifiable concentrates were applied either Oct. 16 or Nov. 15 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles. For herbicide treatments incorporated with a field cultivator, the plots were first worked with a roto-tiller to destroy most surface crop residues before herbicide application. On Oct. 16, air temperature was 61 F with sunny skies and dry soil; on Oct. 17, skies were sunny with 33 F and dry soil; on Nov. 15, skies were sunny with 34 F and 4 to 5 inches of snow; on Nov. 16, skies were sunny with 27 F and 4 to 5 inches of snow. Herbicide granules were either left on the surface or incorporated once Oct. 16 to 18 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) immediately before planting on May 21, 1992. McCall soybeans were seeded 1.5 to 2 inches deep at 62 lb/A on May 21 using a John Deere single-disc no-till drill with a 15-inch row spacing. Glyphosate + 2,4-D (0.38 + 0.25 lb ai/A) was applied May 10 to control emerged weeds over the entire experimental area. Soybean plants per m of row was determined June 10. Bentazon and acifluorfen at 0.88 and 0.13 lb/A was applied June 25 over the entire experiment for broadleaf weed control. Sethoxydim at 0.25 lb/A was applied to handweeded check plots on June 10 and July 6. 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 Oct. 7 and yields adjusted to 12% moisture. Plot size was 15 by 35 ft and the experiment was a randomized complete block with four replications.

-- See previous page for experiment description --

Herbicide application[a] Chemical	Rate (lb/A)	Date	Herbicide incorporation method	Soybean stand (plt/m)	Foxtail control 6/12 (%)	Foxtail control 8/24 (%)	Foxtail density (plt/m^2)	Grain yield (bu/A)
Trif-10G	1	Oct. 18	Field cultivator	16	81	74	126	1.9
Trif-4EC	1	Oct. 16	Field cultivator	18	64	59	157	2.4
Trif-4EC	1	Nov. 15	None	14	8	0	888	1.8
Trif-10G	1	Nov. 16	None	12	77	58	195	1.9
Trif-10G	1.5	Nov. 16	None	10	84	69	163	2.6
Trif-10G	1	Oct. 18	None	12	85	73	131	2.5
Trif-10G	1	Oct. 18	Rotary hoe	13	85	73	55	4.2
Trif-10G	1.5	Oct. 18	Rotary hoe	11	93	91	12	3.4
Trif-10G	1	Oct. 18	Undercutter	13	87	79	64	4.2
Trif-10G	1.5	Oct. 18	Undercutter	15	96	94	15	6.8
Trif-10G	1	Oct. 18	Undercut/Rotary hoe	16	79	78	114	3.1
Trif-10G	1.5	Oct. 18	Undercut/Rotary hoe	14	94	92	27	3.9
Etha-10G	1	Oct. 18	Field cultivator	16	82	82	58	4.5
Etha-3EC	1	Oct. 18	Field cultivator	16	69	51	184	1.6
Etha-3EC	1	Nov. 15	None	12	13	0	835	1.1
Etha-10G	1	Nov. 16	None	11	74	61	179	1.9
Etha-10G	1.5	Nov. 16	None	13	87	75	114	2.8
Etha-10G	1	Oct. 18	None	13	91	83	51	3.6
Etha-10G	1	Oct. 18	Rotary hoe	13	93	88	26	6.3
Etha-10G	1.5	Oct. 18	Rotary hoe	14	96	95	12	5.0
Etha-10G	1	Oct. 18	Undercutter	13	92	89	40	3.3
Etha-10G	1.5	Oct. 18	Undercutter	13	96	96	8	6.0
Etha-10G	1	Oct. 18	Undercut/Rotary hoe	17	93	93	24	4.9
Etha-10G	1.5	Oct. 18	Undercut/Rotary hoe	14	97	96	10	6.3
Untreated	0	-	Field cultivator	16	0	0	1763	0.6
Untreated	0	-	Undercutter	16	0	0	1346	1.2
Handweeded	0	-	Field cultivator	14	100	100	0	4.3
Handweeded	0	-	Undercutter	11	100	100	0	5.6
C.V. %				26	6	14	71	49
LSD 5%				NS	7	14	272	2.4

[a]Trif-G = Treflan 10G granules; Trif-4EC = Treflan 4E emulsifiable concentrate; Etha-10G = Sonalan 10G granules; Etha-3EC = Sonalan 3E emulsifiable concentrate.

Spring-applied trifluralin and ethalfluralin granules in no-till soybeans, Fargo 1992. An experiment was established on a silty clay with pH 7.8, 4.5% organic matter, and standing wheat stubble. Design was a randomized complete block with four replications and a split plot arrangement of treatments. Main plots were tillage treatment (tilled and no-till). Tilled plots were chisel plowed in October of 1991 and worked once with a field cultivator/harrow in late April 1992. Trifluralin and ethalfluralin granules were applied April 16 in no-till plots with a Gandy air-flow applicator when air temperature was 57 F, skies were sunny, and wind was 5 to 7 mph. Plots receiving granules (including the handweeded check) were undercut once within 3 hours of application with a Haybuster undercutter operated 2 inches deep and leaving most stubble standing. Early preplant (EPP) imazethapyr was applied April 29 with an ATV mounted sprayer delivering 10 gal/A with 8002 tips and 28 psi (no weeds yet emerged). Preplant incorporated (PPI) treatments in tilled plots were applied May 15 with the ATV sprayer when air temperature was 60 F, skies were sunny, wind was calm, and soil was moist. PPI treatments were double-pass incorporated within 4 hours of application using a field cultivator/harrow operated 2 to 3 inches deep. No-till treatments receiving a second undercutter pass were undercut 2 inches deep, as was the weedy check. The entire experiment was then seeded to 'McCall' soybeans May 15 at 180,000 seeds/A and 1 inch deep with a Hiniker no-till planter set on 30-inch rows. No-till plots were treated May 20 with glyphosate at 0.375 lb/A (pre-emergence) to destroy emerged weeds. The entire experiment was sprayed June 2 with bentazon at 1 lb/A plus Sun-ItII adjuvant at 1 quart/A for control of wild mustard and patches of Canada thistle. Subsequent Canada thistle growth was controlled by hand weeding. Handweeded checks were treated July 7 with sethoxydim at 0.14 lb/A plus thifensulfuron at 0.044 oz ai/A plus petroleum oil adjuvant at 1.5 pint/A and otherwise maintained weed free with hand weeding. Plot size was 20 by 60 ft (13.3-ft-wide treated area) for tilled plots and 15 by 60 ft (10-ft-wide treated area) for no-till. Grain was harvested by machine Oct. 5 and yields were expressed on a 12% moisture basis. Foxtail was a mixed population (75% yellow and 25% green foxtail).

Treatment	Rate	Application date	No. of undercuttings	Weed control: Foxtail 6/24	Foxtail 7/29	Wimu 6/24	Wimu 7/29	Rrpw 6/24	Rrpw 7/29	Grain yield
	(lb/A)		(no.)	(%)						(bu/A)
NO-TILL										
Trifluralin-G	1	4-16	1	84	74	0	4	74	75	19.0
Ethalfluralin-G	1	4-16	1	73	66	0	7	92	65	20.0
Trifluralin-G	1	4-16	2	82	75	0	0	98	67	18.7
Ethalfluralin-G	1	4-16	2	84	75	0	26	97	58	21.7
Trif-G/Imep(EPP)	1/0.047	4-16/4-29	1	100	98	0	100	100	100	20.2
Etha-G/Imep(EPP)	1/0.047	4-16/4-29	1	99	99	20	99	100	100	24.5
Weedy check	0	-	1	-	-	-	-	-	-	10.4
Weed-free check Trif-G/Imep(EPP)	0.75/0.031	4-16/4-29	1	-	-	-	-	-	-	23.8
TILLED										
Trifluralin-EC(PPI)	1	5-15	-	91	85	0	21	99	74	15.5
Ethalfluralin-EC(PPI)	1	5-15	-	96	87	0	36	95	69	19.5
Trif-EC+Imep(PPI)	1+0.047	5-15	-	99	98	3	100	100	100	22.2
Etha-EC+Imep(PPI)	1+0.047	5-15	-	98	96	55	100	100	99	21.3
Weedy check	0	5-15	-	-	-	-	-	-	-	7.5
Weed-free check Trif-EC+Imep(PPI)	0.75/0.031	5-15	-	-	-	-	-	-	-	24.1
C.V., %				11	8	249	26	11	14	15.7
LSD (0.05) treatments within a tillage				15	10	NS	20	NS	16	4.6
Tillage effect				NS	*	NS	*	NS	*	NS

PPI treatments for drybeans, Carrington 1992. An experiment was established on a conventionally-tilled loam with pH 6.6 and 3.8% organic matter. Preplant incorporated (PPI) treatments were applied May 26 with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Wind speed at application was 0 to 3 mph, skies were partly cloudy, air temperature was 72 F, relative humidity was 65%, and the soil was dry on the surface but moist in the top 3 inches. The entire experimental area was double pass incorporated with a field cultivator/harrow (about 3 inch depth of tillage) within 1 hour of the EPTC treatments. Nodak pintos were seeded May 27 at 70,000 seeds/A and 1 to 1.25 inch deep with a John Deere MaxEmerge planter set on 30-inch rows. Visual estimates of percentage crop injury and weed control were June 24. Postemergence (PO) treatments were applied June 26 with bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Conditions at application were as follows: drybeans were 1 to 2 trifoliolate, common lambsquarters and redroot pigweed were 2 to 4 inches tall, Russian thistle was 2 to 5 inches tall, wind was 0 to 4 mph, skies were sunny, relative humidity was 40%, air temperature was 75 F, and growing conditions were somewhat dry. Crop injury and weed control were again evaluated July 21. Plot size was 10 by 25 ft and the experiment was a randomized complete block design with four replications.

		Evaluated June 24					Evaluated July 21				
Treatment[a]	Rate	Drybean inj	Fxtl	Colq	Ruth	Rrpw	Drybean inj	Fxtl	Colq	Ruth	Rrpw
	(lb/A)	(%)									
EPTC(PPI)	4	0	95	92	4	84	0	91	82	5	72
Pendimethalin(PPI)	1.25	0	96	89	43	89	0	96	81	9	87
Trifluralin(PPI)	1	0	98	92	31	97	0	97	88	35	92
EPTC+Trifluralin(PPI)	2.2+0.5	0	93	96	12	89	0	94	88	19	96
EPTC+Trif(PPI)/ Bent+Acif(PO)	2.2+0.5/ 0.75+0.13	0	93	95	41	97	7	95	100	100	100
Ethalfluralin(PPI)	1	0	96	95	62	99	0	93	96	53	99
EPTC+Etha(PPI)	2.2+0.75	0	97	99	66	96	0	99	98	60	99
EPTC+Etha(PPI)	2.2+1	0	98	98	65	98	0	99	95	46	99
EPTC+Etha(PPI)/ Bent+Acif(PO)	2.2+0.75/ 0.75+0.13	0	96	96	61	99	10	97	99	100	100
Trif+Clomazone(PPI)	0.5+0.5	1	96	70	38	88	0	94	65	11	98
Trif+Clom(PPI)/ Bent+Acif(PO)	0.5+0.5/ 0.75+0.13	1	93	87	15	86	11	95	98	99	100
Etha+Clomazone(PPI)	0.75+0.5	1	98	96	73	-	0	99	90	57	99
Etha+Clom(PPI)/ Bent+Acif(PO)	0.75+0.5/ 0.75+0.13	2	93	91	48	97	10	96	100	100	100
Untreated	0	0	0	0	0	0	0	0	0	0	0
C.V. %		270	4	7	70	10	56	4	18	42	7
LSD 5%		NS	5	9	40	12	2	6	22	30	9

[a]All postemergence treatments were mixed with 1.5 pint/A of a methylated seed oil adjuvant containing emulsifier (Scoil).

Bentazon injury and drybean growth stage, Fargo 1992. An experiment was established on a silty clay with pH 7.8 and 4.5% organic matter. Ethalfluralin granules at 1 lb ai/A were applied May 14 over the entire experimental area and double-pass incorporated the same day for control of foxtail and certain broadleaf weeds. "Volunteer sunflower" and wild mustard seed was spread over the area before incorporation. Othello drybeans were seeded 1 to 1.25 inch deep on May 19 at 70,000 seeds/acre in 30-inch rows. Unifoliolate (Uni) treatments were applied June 9 when drybeans were 2 to 3 inches tall, volunteer sunflowers were cotyledon to 4 leaf and 0.5 to 2.5 inches tall, wild mustard was 2 to 5 leaf and 0.5 to 2 inches diameter, kochia was cotyledon to 1 inch tall, air temperature was 73 F, relative humidity was 45%, wind was 0 to 7 mph, skies were sunny, and soil surface was dry. First trifoliolate (1Tri) treatments were applied June 23 when drybeans were 6 to 8 inches tall, volunteer sunflowers were 2 to 8 leaf and 2 to 8 inches tall, wild mustard was 2 to 10 leaf (flowering) and 2 to 12 inches tall, kochia was 1 to 10 inches tall, air temperature was 70 F, relative humidity was 40%, wind was 5 mph, skies were partly cloudy, and soil was moist. All treatments were applied with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Visual estimates of percentage crop injury and weed control were taken June 22 for unifoliolate treatments (13 DAT) and July 6 for all treatments. Plot size was 10 by 25 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate	Evaluated June 22				Evaluated July 6			
	(lb/A)	Drybean inj[b]	Vosu	KOCZ	Wimu	Drybean inj	Vosu	KOCZ	Wimu
		(%)							
Untreated	0	0	0	0	0	0	0	0	0
Bentazon+POC(Uni)	0.5+1Q	6	93	95	100	2	90	91	100
Bentazon+POC(Uni)	0.75+1Q	11	93	96	100	2	82	93	94
Bentazon+POC(Uni)	1+1Q	13	92	96	100	2	85	93	97
Bentazon+28%UAN(Uni)	0.5+2Q	1	82	83	100	1	66	73	98
Bentazon+28%UAN(Uni)	0.75+2Q	1	87	82	100	1	74	69	98
Bentazon+28%UAN(Uni)	1+2Q	0	90	83	100	1	82	58	99
Bentazon+POC+28%UAN(Uni)	0.5+1Q+2Q	4	83	97	100	2	71	96	99
Bentazon+POC+28%UAN(Uni)	0.75+1Q+2Q	5	86	97	100	1	68	95	99
Bentazon+POC+28%UAN(Uni)	1+1Q+2Q	7	90	100	100	1	73	98	98
Ben+OC(Uni)/Ben+OC(1Tri)	0.5+1Q/0.5+1Q	-	-	-	-	2	96	97	100
Ben+28(Uni)/Ben+28(1Tri)	0.5+2Q/0.5+2Q	-	-	-	-	1	97	92	100
Bentazon+POC(1Tri)	0.75+1Q	-	-	-	-	2	97	74	99
Bentazon+28%UAN(1Tri)	0.75+2Q	-	-	-	-	1	89	41	98
Bentazon+Scoil(1Tri)	0.75+0.75Q	-	-	-	-	1	90	68	99
Bentazon+POC(1Tri)	1+1Q	-	-	-	-	2	95	72	100
Bentazon+28%UAN(1Tri)	1+2Q	-	-	-	-	2	93	32	99
Acifluorfen+POC(1Tri)	0.188+1Q	-	-	-	-	17	72	55	98
Acifluorfen+POC(1Tri)	0.25+1Q	-	-	-	-	22	76	58	98
Acifluorfen+Scoil(1Tri)	0.188+0.75Q	-	-	-	-	32	87	80	99
Acifluorfen+Scoil(1Tri)	0.25+0.75Q	-	-	-	-	33	83	79	99
Bent+Acif+Scoil(1Tri)	0.75+0.19+0.75Q	-	-	-	-	33	90	86	100
C.V. %		35	10	5	0	34	15	14	1
LSD 5%		2	11	6	NS	4	17	15	2

[a] POC or OC = petroleum oil adjuvant containing 17% emulsifier; 28%UAN or 28% or 28 = urea ammonium nitrate fertilizer solution; Scoil = methylated seed oil adjuvant containing emulsifier.
[b] Q = quarts per acre (i.e. 0.5Q = 0.5 quarts per acre).

Herbicides and cultivation for drybeans, Carrington 1992. The experiment was established May 26 on a conventionally tilled silt loam with pH 6.6 and 3.8% organic matter. Preplant incorporated (PPI) herbicides were applied into somewhat moist soil with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Air temperature was 70 F. The entire experimental area was double pass incorporated with a field cultivator/harrow operated 3 inches deep and within 1 hour of EPTC treatments. Nodak pintos were seeded 1.5 inches deep at 70,000 seeds per acre in 30-inch rows on May 27. High cultivation plots were rotary hoed June 4 when drybeans were in the cracking to crook stage and again on June 12 when in the unifoliolate stage. Visual estimates of percentage weed control and crop injury were taken June 24. All plots were cultivated June 24 and high cultivation plots were cultivated again July 29. Postemergence (PO) treatments were applied June 26 with the sprayer used above but with 8.5 gal/A and 8001 nozzles. Conditions during spraying were: 76 F air temp, sunny skies, 40% relative humidity, foxtail (50% yellow and 50% green foxtail) was 3- to 5-leaf, 2 to 5 inches tall, redroot pigweed was 2- to 4-leaf and 2 to 4 inches tall, wild buckwheat was 2- to 5-leaf and 1.5 to 4 inches tall, and drybeans were 1- to 2-trifoliolate and 4 to 5 inches tall. Visual estimates of weed control and crop injury were taken July 14 and again on September 11 immediately before harvest. Seed yield was taken September 11 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.

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

Culti-vation level	Stand	Injury		Weed control								Seed yield
				Evaluated June 24				Evaluated July 14				
		6/24	7/14	Fxtl	Wibw	Prpw	Rrpw	Fxtl	Wibw	Prpw	Rrpw	(kg/ha)
		(%)										
High	45,600	0	2	98	97	99	98	97	96	96	97	1025
Low	48,300	0	1	90	75	86	90	95	91	92	95	988
F-test	**	NS	NS	**	*	**	**	NS	*	*	*	NS
P value	.009	.089	.388	.004	.040	.005	.005	.145	.041	.026	.025	.512

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

Herbicide[a]	Rate[a]	Cultivation level	Stand	Injury 6/24	Injury 7/14	Seed yield	
	(lb/A)			(%)	(%)	(kg/ha)	(lb/A)
Untreated	0	High	44,600	0	0	652	581
		Low	40,000	0	0	336	299
Etha+Imep(PPI)	0.5+0.031	High	47,400	0	0	1317	1174
		Low	52,400	0	0	1047	934
Clom+Etha(PPI)	0.5+0.75	High	43,600	4	1	1051	938
		Low	47,300	1	0	1050	936
Clom+Etha(PPI)/ Bent&Acif+X77(PO)	0.5+0.75/ 0.57&0.13+0.25%	High	45,900	2	2	1000	891
		Low	49,900	2	1	981	875
EPTC+Etha(PPI)	2.2+0.75	High	46,800	0	4	830	740
		Low	46,000	0	0	983	876
EPTC+Etha(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	48,100	0	0	1180	1052
		Low	48,200	0	0	1329	1185
EPTC+Trifluralin(PPI)	2.2+.75	High	42,500	0	1	1108	988
		Low	48,800	0	0	1129	1006
EPTC+Trif(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	44,700	0	2	1217	1085
		Low	47,900	0	1	1011	901
Alachlor+Etha(PPI)	2+0.75	High	45,800	0	1	1134	1011
		Low	46,600	0	1	985	879
Alac+Etha(PPI)/ Bent&Acif+X77(PO)	2+0.75/ 0.57&0.13+0.25%	High	44,500	0	0	1135	1012
		Low	49,500	1	3	1155	1030
Imazethapyr+Etha(PPI)	0.031+0.75	High	44,500	0	4	975	870
		Low	47,200	0	1	983	876
Imep+Etha(PPI)/ Bent&Acif+X77(PO)	0.031+0.75/ 0.57&0.13+0.25%	High	44,200	0	2	920	821
		Low	50,000	0	0	1314	1172
Etha(PPI)/ Bent&Acif+X77(PO)	0.75/ 0.57&0.13+0.25%	High	45,700	0	2	885	790
		Low	51,100	0	3	1001	892
EPTC(PPI)/ Bent&Acif+X77(PO)	3/ 0.57&0.13+0.25%	High	49,800	0	0	1159	1033
		Low	51,200	0	1	944	842
Bent&Acif+Seth+Sun(PO)	0.57&0.13+0.2+1Q	High	44,600	-	3	791	705
		Low	49,100	-	2	784	699
Imep+Seth+Sunit(PO)	0.031+0.2+1Q	High	47,100	-	3	1042	929
		Low	48,400	-	2	780	695
C.V. %			6.4	140	150	18	18
LSD 5%			4,300	1	3	261	232

[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.

Table 3. Effect of herbicides and level of cultivation on weed control 4 and 8 weeks after planting.

Herbicide[a]	Rate[a]	Cultivation level	Weed control: Evaluated June 24 Fxtl	Wibw	Prpw	Rrpw	Evaluated July 14 Fxtl	Wibw	Prpw	Rrpw
	(lb/A)		(%)							
Untreated	0	High	82	68	85	80	79	79	76	75
		Low	0	0	0	0	69	68	67	69
Etha+Imep(PPI)	0.5+0.031	High	99	100	100	100	100	100	100	100
		Low	98	87	98	99	100	100	100	100
Clom+Etha(PPI)	0.5+0.75	High	100	99	100	100	100	100	100	100
		Low	100	96	94	97	99	97	94	96
Clom+Etha(PPI)/ Bent&Acif+X77(PO)	0.5+0.75/ 0.57&0.13+0.25%	High	99	97	100	99	99	96	99	98
		Low	96	80	93	96	96	97	96	97
EPTC+Etha(PPI)	2.2+0.75	High	100	99	100	100	100	99	100	100
		Low	97	87	99	100	98	93	100	98
EPTC+Etha(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	100	100	100	100	100	99	100	99
		Low	98	87	98	100	100	98	97	100
EPTC+Trif(PPI)	2.2+0.75	High	100	100	100	100	100	98	100	100
		Low	99	89	99	100	100	98	97	100
EPTC+Trif(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	100	95	100	99	99	99	100	99
		Low	96	81	92	97	97	96	95	98
Alachlor+Etha(PPI)	2+0.75	High	100	100	100	100	99	100	100	99
		Low	97	94	98	99	99	98	98	97
Alac+Etha(PPI)/ Bent&Acif+X77(PO)	2+0.75/ 0.57&0.13+0.25%	High	100	100	100	100	98	95	100	100
		Low	99	77	98	99	99	97	97	100
Imep+Etha(PPI)	0.031+0.75	High	100	100	100	100	100	98	99	99
		Low	96	76	95	99	97	88	98	99
Imep+Etha(PPI)/ Bent&Acif+X77(PO)	0.031+0.75/ 0.57&0.13+0.25%	High	99	94	100	99	98	98	100	99
		Low	99	89	96	99	99	94	97	99
Etha(PPI)/ Bent&Acif+X77(PO)	0.75/ 0.57&0.13+0.25%	High	100	96	100	100	100	98	100	99
		Low	97	89	96	97	97	96	98	99
EPTC(PPI)/ Bent&Acif+X77(PO)	3/ 0.57&0.13+0.25%	High	100	94	100	100	99	99	99	100
		Low	96	15	45	76	92	84	88	92
Be&Ac+Seth+Sun(PO)	0.57&0.13+0.2+1Q	High	-	-	-	-	96	90	96	94
		Low	-	-	-	-	94	74	71	81
Imep+Seth+Sunit(PO)	0.031+0.2+1Q	High	-	-	-	-	91	86	66	93
		Low	-	-	-	-	92	80	79	91
C.V. %			3	14	11	7	4	6	9	4
LSD 5%			4	17	14	9	6	8	12	6

[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.

Table 4. Effect of herbicides and level of cultivation on weed control at harvest.

Herbicide[a]	Rate[a]	Cultivation level	Evaluated at harvest			
			Fxtl	Wibw	Prpw	Rrpw
	(lb/A)		(%)			
Untreated	0	High	62	59	60	67
		Low	49	45	44	54
Etha+Imep(PPI)	0.5+0.031	High	100	100	100	100
		Low	100	100	100	100
Clom+Etha(PPI)	0.5+0.75	High	100	100	100	100
		Low	99	100	97	99
Clom+Etha(PPI)/ Bent&Acif+X77(PO)	0.5+0.75/ 0.57&0.13+0.25%	High	98	96	100	100
		Low	90	95	91	93
EPTC+Etha(PPI)	2.2+0.75	High	100	100	98	99
		Low	95	87	99	96
EPTC+Etha(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	100	99	100	100
		Low	97	95	100	100
EPTC+Trif(PPI)	2.2+0.75	High	100	100	100	100
		Low	98	98	97	100
EPTC+Trif(PPI)/ Bent&Acif+X77(PO)	2.2+0.75/ 0.57&0.13+0.25%	High	99	99	100	100
		Low	89	97	92	93
Alachlor+Etha(PPI)	2+0.75	High	100	100	99	99
		Low	95	90	97	99
Alac+Etha(PPI)/ Bent&Acif+X77(PO)	2+0.75/ 0.57&0.13+0.25%	High	99	100	100	100
		Low	97	91	99	100
Imep+Etha(PPI)	0.031+0.75	High	100	99	100	100
		Low	95	83	95	97
Imep+Etha(PPI)/ Bent&Acif+X77(PO)	0.031+0.75/ 0.57&0.13+0.25%	High	98	98	100	100
		Low	99	96	100	100
Etha(PPI)/ Bent&Acif+X77(PO)	0.75/ 0.57&0.13+0.25%	High	100	98	100	100
		Low	92	90	99	100
EPTC(PPI)/ Bent&Acif+X77(PO)	3/ 0.57&0.13+0.25%	High	98	96	99	99
		Low	88	86	73	93
Be&Ac+Seth+Sun(PO)	0.57&0.13+0.2+1Q	High	90	84	91	82
		Low	57	45	40	67
Imep+Seth+Sunit(PO)	0.031+0.2+1Q	High	98	96	95	94
		Low	81	71	82	90
C.V. %			9	11	10	7
LSD 5%			12	14	13	9

[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.

Bentazon-insecticide interactions in drybeans, Fargo 1992. An experiment was established on a conventionally tilled silty clay with pH 7.8 and 4% organic matter. Othello pintos were seeded May 19 at 70,000 seeds/A and 1 to 1.25 inch deep with a Hiniker no-till planter set on 30-inch rows. The entire experimental area was treated June 12 with sethoxydim at 0.2 lb/A plus Scoil at 1 quart/A for foxtail control. Treatments were applied July 6 with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. At application, drybeans were 3rd trifoliolate and 6 inches tall, volunteer sunflower was 6 to 10 inches tall, common lambsquarters was 2 to 4 inches tall, air temperature was 68 F, relative humidity was 70%, skies were partly cloudy, wind was 5 mph, and soil was wet (fourth rep too wet to spray). Visual estimates of percentage crop injury and weed control were taken July 17. Plot size was 10 by 25 ft and the experiment was randomized complete block design with four replications.

Treatment[a]	Rate	Drybean injury	Volunteer sunflower	Common lambsquarters
	(lb/A)	(%)		
Bentazon	1	3	7	3
Bentazon+SEVIN-XLR	1+1	0	11	0
Bentazon+CYGON-4E	1+0.5	4	20	0
Bentazon+ORTHENE-75WP	1+0.5	0	47	0
Bentazon+GUTHION-2E	1+0.5	0	22	0
Bentazon+ASANA	1+0.03	0	21	0
Bentazon+AMBUSH	1+0.1	0	31	0
Bentazon+LANNATE-E	1+0.75	0	54	0
Bentazon+PENNCAP-M	1+0.5	0	21	0
Bentazon+KELTHANE-4E	1+0.5	0	13	0
Bentazon+COMITE	1+1.64	23	4	0
Bentazon+Malathion	1+1	7	2	7
Bentazon+Mefluidide	1+0.25	2	23	8
Bentazon+PB	1+0.5	0	47	0
Bentazon+MGK-264	1+0.5	0	22	1
Untreated	0	0	0	0
C.V. %		110	97	415
LSD 5%		4	NS	NS

[a]All treatments were applied with 1 quart/A petroleum oil adjuvant (containing 17% emulsifier); PB = piperonyl butoxide and MGK-264 is an analogue of PB.

Comments. Extremely heavy rains between late May and early July and cool temperature throughout the season made crop growth, timely treatment application, and evaluation difficult. During treatment and evaluation, the crop was under substantial stress due to low temperature and soil waterlogging. Evaluation was complicated by foliar chlorosis and necrosis due apparently to these environmental stresses. No stand losses occurred with any of the treatments.

Postemergence herbicide treatments for crambe, Minot 1992. The experiment was established on a conventionally-tilled Williams loam. Belenzian crambe was seeded 1 inch deep at 20 lb/A on May 14. Herbicides were applied June 25 with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 35 psi. Conditions at time of spraying were: crambe 7 to 8-leaf and just before bolting, 65 F, 70% relative humidity, wind 5 to 10 mph (sprayer shielded), sunny, fair to good growing conditions. Plot size was 10 by 30 ft with herbicides applied in the center 6.7- by 30-ft area, leaving untreated check strips on the plot borders. The entire experimental area was treated in the fall of 1991 with trifluralin at 0.5 lb/A for foxtail control. Broadleaf weeds were controlled by hand-pulling and the entire site was maintained weed-free. Plant height and visual estimates of percentage injury (stunting and biomass reduction) were taken 11 and 22 days after treatment. Grain yields were machine harvested Sept. 1. The experimental design was a randomized complete block with four replications.

Treatment[a]	Rate[b]	Eval. July 6		Eval. July 17		Grain	Test
		Injury	Height	Injury	Height	yield	weight
	(lb/A)	(%)	(in)	(%)	(in)	(lb/A)	(lb/bu)
DPX-A8771+X77	0.0156+0.25%	0	28	0	48	1930	27.5
DPX-A8771+X77	0.03125+0.25%	0	33	0	50	1850	27.7
Picloram	0.0156	2	31	1	48	1910	24.6
Picloram	0.03125	3	28	10	45	1460	23.1
Clopyralid	0.25	3	28	1	48	1660	24.4
Clopyralid	0.5	3	30	2	48	1680	24.0
Dicamba	0.0625	36	20	76	31	0	-
Dicamba	0.125	44	17	89	31	0	-
Quinclorac+Scoil	0.25+0.75Q	2	32	9	45	1400	23.7
Quinclorac+Scoil	0.5+0.75Q	3	28	9	44	1450	23.7
Bentazon+POC+28%UAN	0.5+1Q+4Q	36	23	16	41	1060	27.5
Bromoxynil	0.25	20	24	11	43	1430	26.9
Imazamethabenz+X77	0.25+0.25%	44	15	95	15	0	-
Imazamethabenz+X77	0.5+0.25%	51	14	95	14	0	-
Difenzoquat	0.62	3	29	5	46	1580	27.6
Difenzoquat	1	5	29	6	46	1670	27.3
Propanil-DF+X77	1+0.5%	11	25	3	46	1530	26.9
Propanil-DF+X77	1.5+0.5%	23	26	14	43	1300	26.5
Sethoxydim+POC	0.2+1Q	0	32	0	49	1560	27.7
Handweeded check	0	0	35	0	50	1480	26.9
C.V. %		32	9	11	6	18	3.5
LSD 5%		7	3	3	4	310	1.0

[a] X77 = surfactant by Valent Corp.; Scoil = methylated seed oil adjuvant containing emulsifier; POC = petroleum oil adjuvant containing 17% emulsifier; 28%UAN = 28% urea ammonium nitrate fertilizer solution; propanil-DF = dry flowable formulation of propanil.

[b] Q = quart per acre (e.g. 0.75Q = 0.75 quart per acre).

Summary. Dicamba and imazamethabenz drastically injured crambe, producing no harvestable grain. Essentially all herbicides reduced crambe height 11 days after treatment, but by 22 days after application, height reductions were no longer evident with sethoxydim, DPX-A8771, clopyralid, and the lower rate of picloram. Bentazon injured crambe about 35 and 15% at the early and late evaluations, respectively, and reduced grain yield. Similarly, propanil at 1.5 lb/A (1.5 times the labeled rate for wheat) injured crambe 23 and 14% (early and late) and reduced yield. Other treatments caused low levels of observable injury and did not reduce grain yield.

<u>Postemergence herbicide treatments for crambe, Prosper 1992</u>. The experiment was established on a silt loam with pH 7.4 and 3.2% organic matter. Meyer crambe was seeded 1 inch deep at 20 lb/A on May 5. Herbicides were applied 7:30 to 9 pm June 8 with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Conditions at time of spraying were: crambe 3 to 5.5 inches tall and 4 to 4.5-leaf, 75 F, 32% relative humidity, wind 0 to 2 mph, sunny, good growing conditions. Plot size was 10 by 27 ft with herbicides applied in the center 6.7- by 27-ft area, leaving untreated check strips on the plot borders. The entire experimental area was treated June 15 with sethoxydim plus SUN-IT II adjuvant at 0.16 lb/A plus 1.5 pt/A for foxtail control. Broadleaf weeds were controlled by hand-pulling and the entire site was maintained weed-free. Visual estimates of percentage injury (injury symptoms only; stunting was ignored) and crop stunting were taken June 22. Visual estimates of percentage stand reduction and injury were taken July 17. Grain yields were machine harvested on Aug. 13, 20, and 31, and on Sept. 14. The experimental design was a randomized complete block with four replications.

Treatment[a]	Rate[b] (lb/A)	Eval. June 22 Injury (%)	Eval. June 22 Stunting (%)	Evaluated July 17 Stand reduction (%)	Evaluated July 17 Stunting (%)	Grain yield (kg/ha)	Grain yield (lb/A)
Ethametsulfuron+X77	0.0156+0.25%	0	0	0	0	1900	1700
Ethametsulfuron+X77	0.03125+0.25%	1	0	0	0	2260	2010
Picloram	0.0156	6	0	0	0	2210	1970
Picloram	0.03125	12	5	0	1	2120	1890
Clopyralid	0.25	5	0	0	0	1980	1770
Clopyralid	0.5	4	0	0	0	1940	1730
Dicamba	0.0625	28	47	0	34	1620	1450
Dicamba	0.125	35	55	4	66	1020	910
Quinclorac+Scoil	0.25+0.75Q	12	11	0	5	1810	1610
Quinclorac+Scoil	0.5+0.75Q	12	10	0	9	1480	1320
Bentazon+POC+28%UAN	0.5+1Q+4Q	15	28	0	0	1690	1510
Bromoxynil	0.25	11	24	0	0	1680	1500
Imazamethabenz+X77	0.25+0.25%	8	38	0	41	2150	1910
Imazamethabenz+X77	0.5+0.25%	12	46	0	70	1980	1770
Difenzoquat	0.62	4	6	0	4	2130	1900
Difenzoquat	1	4	12	0	5	2200	1960
Propanil-DF+X77	1+0.5%	7	13	0	0	2120	1890
Propanil-DF+X77	1.5+0.5%	10	18	0	0	2020	1800
Sethoxydim+POC	0.2+1Q	0	0	0	0	2210	1970
Handweeded check	0	0	0	0	0	2230	1990
C.V. %		37	36	894	57	14	14
LSD 5%		5	8	NS	9	380	340

[a]X77 = surfactant by Valent Corp.; Scoil = methylated seed oil adjuvant containing emulsifier; POC = petroleum oil adjuvant containing 17% emulsifier; 28%UAN = 28% urea ammonium nitrate fertilizer solution; propanil-DF = dry flowable formulation of propanil.

[b]Q = quart per acre (e.g. 0.75Q = 0.75 quart per acre).

<u>Summary</u>. The only treatments that reduced crambe yield were dicamba, quinclorac, bentazon, and bromoxynil. Treatments causing little to no injury were ethametsulfuron, clopyralid, and sethoxydim. Injury by quinclorac was expressed as smaller leaves and a deeper green color. Chlorosis/necrosis was caused by bentazon, bromoxynil, difenzoquat, and propanil. Injury from imazamethabenz was expressed as chlorosis of the younger leaves. Dicamba caused slight epinasty and appeared to result in growing point death.

PPI herbicide treatments for crambe, Prosper 1992. The experiment was established on a silt loam with pH 7.4 and 3.2% organic matter. Herbicides were applied May 5 onto dry soil with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Plot size was 10 by 27 ft with herbicides applied in the center 6.7- by 27-ft area, leaving untreated check strips on the plot borders. Immediately after application, all plots were double-pass incorporated with a field cultivator/harrow set to cut 2.5 to 3 inches deep. Meyer crambe was then seeded (May 5) 1 inch deep at 20 lb/A. The entire experimental area was treated June 15 with sethoxydim plus SUN-IT II adjuvant at 0.16 lb/A plus 1.5 pt/A for foxtail control. Broadleaf weeds were controlled by hand-pulling and the entire site was maintained weed-free. Visual estimates of percentage injury (stunting and injury symptoms only; stand reductions were ignored) were taken May 21. On May 29, crambe plants per meter of row were counted, 2 random 1-m samples per plot. Visual estimates of percentage injury (injury symptoms only), stand reduction, and stunting were taken June 22 and July 17. Grain yields were machine harvested on Aug. 13, 20, and 31. The experimental design was a randomized complete block with four replications.

		5/21	5/29	6/22			7/17				
Treatment	Rate	In-jury	Stand count	In-jury	Std red	Stunt-ing	In-jury	Std red	Stunt-ing	Seed yield	
	(lb/A)	(%)	No./m	(%)						(kg/ha)	(lb/A)
Alachlor	2	0	40.0	0	0	0	0	0	0	1970	1750
Alachlor	3	1	35.3	0	1	0	0	0	0	2150	1920
Metolachlor	2	0	40.4	0	1	0	0	0	0	1740	1550
Metolachlor	3	0	36.6	0	0	0	0	0	0	1640	1460
Propachlor	4	0	38.9	0	0	0	0	0	0	2210	1970
SAN-582H	1.25	1	43.5	0	1	1	0	0	0	1740	1550
SAN-582H	2	2	34.4	0	5	2	0	0	0	1880	1680
Trifluralin	0.75	0	43.9	0	0	0	0	0	0	1950	1740
Trifluralin	1.25	0	44.6	0	0	0	0	0	0	2020	1800
Ethalfluralin	0.75	0	41.0	0	0	0	0	0	0	1910	1700
Pendimethalin	1.5	0	37.9	0	11	0	0	0	0	1660	1480
Pendimethalin	2.25	1	34.0	0	16	3	0	0	0	1530	1360
EPTC	3	0	39.1	0	3	1	0	0	0	2360	2110
Triallate	1	0	41.5	0	0	0	0	0	0	1750	1560
Linuron	1.25	0	42.6	0	1	0	0	0	0	2100	1870
Clomazone	0.5	73	29.8	4	66	13	0	14	0	1780	1590
Quinclorac	0.5	0	43.9	0	1	0	0	0	1	1310	1170
Imazethapyr	0.0469	2	39.6	5	63	29	0	22	0	1750	1560
Handweed check	0	0	45.4	0	0	0	0	0	0	1400	1250
LSD(0.05)		3	7.6	0.3	6	4	NS	7	0.5	500	450

Summary. The chloroacetamide herbicides alachlor, metolachlor, and SAN-582H at the higher rates slightly reduced crambe stands measured May 29, but these reductions were scarcely detectable by visual estimate later in the season and yields were not affected. These higher rates were above labeled rates for this soil type. These results indicate, however, that stand reductions are a potential concern with chloroacetamide herbicides in crambe. Pendimethalin apparently reduced stands slightly while the other dinitroaniline herbicides, trifluralin and ethalfluralin, did not. Pendimethalin stand reductions were evident in mid June but were not visually detectable by mid July. Clomazone dramatically reduced stands and caused considerable injury (foliar bleaching) although yields apparently were not reduced. Imazethapyr also greatly reduced stands with effects most evident in mid June.

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

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

Treatment[a]	Rate	Evaluation date		
		June 91	June 92	Sept 92
	lb/A	% control		
Quinclorac + BAS-090	1 + 1 qt	90	93	77
Quinclorac + Scoil	1 + 1 qt	74	95	77
Quinclorac	1	49	82	53
Quinclorac + picloram	1 + 0.5	85	97	84
Quinclorac + picloram + BAS-090	1 + 0.5 + 1 qt	91	99	87
Picloram + 2,4-D	0.5 + 1	81	92	70
Picloram + 2,4-D + Scoil	0.5 + 1 + 1 qt	43	69	46
Picloram + 2,4-D + BAS-090	0.5 + 1 + 1 qt	57	83	52
Picloram + Scoil	0.5 + 1 qt	71	82	50
Picloram	0.5	60	84	62
LSD (0.05)		28	14	22

[a]Treatments applied annually for 2 yr.

Quinclorac provided approximately 20% better leafy spurge control in June 1992 following a second application compared to June 1991 regardless of adjuvant (Table). Quinclorac at 1 lb/A plus BAS-090 provided better leafy spurge control than quinclorac applied alone or with the methulated-seed-oil adjuvant Scoil 9 months after treatment but control was similar following the second treatment. Control with quinclorac plus BAS-090 or Scoil was similar to picloram plus 2,4-D at 0.5 plus 1 lb/A, the most commonly used fall-applied treatment. Quinclorac applied with picloram or picloram plus BAS-090 provided similar control to picloram plus 2,4-D and quinclorac plus BAS-090 or Scoil. Scoil applied with picloram did not improve leafy spurge control compared to picloram alone and reduced control when applied with picloram plus 2,4-D.

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

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

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

Quinclorac tended to provide the best leafy spurge control at both locations and averaged 97 and 69% control 9 and 12 months after treatment (MAT), respectively, regardless of adjuvant (Table). Control at Chaffee was higher than at Hunter with imazethapyr, imazaquin, and nicosulfuron and averaged 27 and 92, 61 and 93, 42 and 74%, respectively, 9 MAT averaged over rate and adjuvant. The quinclorac treatments and imazaquin plus Scoil (a methulated-seed oil adjuvant) were the only treatments to provide similar control at Chaffee and Hunter.

Nicosulfuron provided an average of 58 and 22% control 9 and 12 MAT, respectively, and control was similar regardless of application rate or adjuvant (Table). Imazaquin and imazethapyr tended to provide better leafy spurge control when applied with Scoil than X-77 surfactant, especially at Hunter. However, control with quinclorac was similar at both locations when applied with BAS-090 or Scoil regardless of herbicide rates.

Retreatment with picloram plus 2,4-D provided 90% control 2 MAT, averaged over both locations, and was similar regardless of the original treatment. In summary, quinclorac and imazethapyr show the most promise for consistent leafy spurge control of the herbicides evaluated. Control was similar to picloram plus 2,4-D at 8 + 16 oz/A, the standard fall-applied treatment. Nicosulfuron may be useful for leafy spurge control in cropland, but previous research has shown this herbicide injures grass and would not be acceptable for pasture and rangeland use. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

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

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

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

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 can cause severe grass injury when fall applied. 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, Chaffee and Valley City in eastern and Dickinson in western North Dakota. 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. Treatments were spring-applied the first week of June and fall-applied the first or second week of September in 1988. 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. Herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. 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, so the experiment was abandoned following the June 1990 evaluation.

Leafy spurge control, averaged across all spring-applied treatments increased from 18 to 49 to 78% 12, 24, and 36 months after the first treatment (MAT), respectively (Table). 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%. There was no advantage to applying sulfometuron following picloram plus 2,4-D or vice versa.

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%.

Sulfometuronm plus picloram at 1.25 plus 4 oz/A fall-applied provided the best long-term control and averaged 77% 48 MAT compared to 11% for the standard treatment of picloram plus 2,4-D at 4 plus 16 oz/A, but grass injury was still 65% (Table). 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 but the sulfometuron combinations were best when fall-applied. However, grass injury was severe when sulfometuron was fall-applied. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table. Leafy spurge control and grass injury from sulfometuron, picloram, and 2,4-D in pastures applied in various combinations spring or fall for 3 consecutive yr. (Lym and Messersmith).

1988 and 1990 Date applied and treatment	Rate	1989 Treatment	Rate	12 MAT Con-trol	12 MAT Grass inj.	24 MAT Con-trol	24 MAT Grass inj.	36 MAT Con-trol	36 MAT Grass inj.	48 MAT Con-trol	48 MAT Grass inj.
	- oz/A -		- oz/A -	Mean[a] %							
Spring											
Sume+picl	1.25+4	Sume+picl	1.25+4	18	12	37	23	79	41	37	4
Sume+picl	1.25+4	Picl+2,4-D	4+16	18	11	46	10	86	24	50	13
Sume+2,4-D	1.25+16	Sume+2,4-D	1.25+16	21	16	28	14	78	26	50	14
Sume+2,4-D	1.25+16	Picl+2,4-D	4+16	28	9	57	7	79	11	53	1
Picl+2,4-D	4+16	Picl+2,4-D	4+16	13	0	56	2	80	1	56	0
Picl+2,4-D	4+16	Sume+picl	1.25+4	17	0	67	55	71	2	49	0
Picl+2,4-D	4+16	Sume+2,4-D	1.25+16	11	0	49	21	76	8	54	0
LSD (0.05)				NS	7	12	16	11	19	18	18
Fall											
Sume+picl	1.25+4	Sume+picl	1.25+4	46	70	80	86	96	94	77	65
Sume+picl	1.25+4	Picl+2,4-D	4+16	52	76	42	56	89	61	58	16
Sume+2,4-D	1.25+16	Sume+2,4-D	1.25+16	31	80	49	89	62	95	32	33
Sume+2,4-D	1.25+16	Picl+2,4-D	4+16	25	89	10	51	35	70	14	57
Picl+2,4-D	4+16	Picl+2,4-D	4+16	10	3	7	3	27	0	11	0
Picl+2,4-D	4+16	Sume+picl	1.25+4	6	0	62	48	44	26	21	13
Picl+2,4-D	4+16	Sume+2,4-D	1.25+16	2	0	38	64	34	33	19	23
LSD (0.05)				12	7	16	19	20	18	20	51

[a]Mean 12, 24, 36, or 48 months after the first treatment averaged over 3 locations.

Comparison of 2,4-D formulations with picloram or glyphosate spring- or fall-applied 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 spurge control is increased 15 to 25% when 2,4-D at 1 lb/A is applied with picloram at 0.5 lb/A or less. 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, several powder formulations of 2,4-D have been formulated to decrease the cost of container shipment and disposal. The purpose of these experiments was to evaluate various 2,4-D formulations plus glyphosate, metsulfuron, or picloram applied annually for leafy spurge control.

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

Leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 1). Control was generally lower 15 MAFT (months after the first treatment) 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 2,4-D was applied at 4 lb/A.

Table 1. 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	24
	— lb/A —	% control			
2,4-D mixed amine[a]	1	27	0	0	0
2,4-D mixed amine[a]	2	33	0	0	0
2,4-D mixed amine[a]	4	29	0	1	6
2,4-D alkanolamine	4	43	0	4	8
2,4-D mixed amine[a] + picloram	2 + 0.25	59	18	26	29
2,4-D alkanolamine + picloram	2 + 0.25	58	13	46	33
2,4-D mixed amine[a] + picloram	2 + 0.5	83	50	54	79
2,4-D alkanolamine + picloram	2 + 0.5	78	47	64	77
Picloram	0.25	62	4	23	22
Picloram	0.5	79	35	60	65
Picloram	1	96	89	93	100
2,4-D alkanolamine + picloram	1 + 0.5	77	29	64	78
LSD (0.05)		18	22	25	22

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

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

As in the previous experiment with spring-applied treatments, leafy spurge control was similar with picloram plus 2,4-D regardless of 2,4-D formulation (Table 2). No treatment provided satisfactory control 12 MAT including picloram plus 2,4-D at 0.5 plus 1 lb/A, the standard fall-applied treatment for leafy spurge. Previous research has shown this treatment will provide 90% or better leafy spurge control following 3 to 4 annual retreatments.

Leafy spurge control with glyphosate 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. The commercial formulation of glyphosate plus 2,4-D even when applied at a lower rate tended to provide better control than the tank-mixed treatments.

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

The water soluble powder CL-782 provided only 68% topgrowth control 1 MAT compared to 97% or better for all other 2,4-D formulations including a second dimethylamine powder (Table 4). Control was similar for all 2,4-D treatments 3 MAT, including CL-782 and averaged 20%.

In general, leafy spurge control was similar with all 2,4-D formulations applied alone or in combination with picloram or glyphosate. CL-782 dimethylamine 80% WSP was the only 2,4-D formulation evaluated that provided less control than other 2,4-D formulations and this occurred only 1 MAT. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

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

Treatment	Rate	Control/MAT 9	Control/MAT 12
	— lb/A —	%	%
2,4-D mixed amine[a]	1	16	0
2,4-D mixed amine[a]	2	15	0
2,4-D mixed amine[a]	4	20	0
2,4-D mixed amine[a] + picloram	2 + 0.25	67	5
2,4-D mixed amine[a] + picloram	2 + 0.5	94	11
2,4-D alkanolamine + picloram	2 + 0.5	97	9
2,4-D alkanolamine + picloram	1 + 0.25	66	0
2,4-D alkanolamine + picloram	1 + 0.5	96	35
LSD (0.05)		30	6

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

Table 3. 2,4-D mixed amine applied alone and with glyphosate or metsulfuron for leafy spurge control in September 1991 (Lym and Messersmith).

Treatment	Rate	Control/MAT 9
	— oz/A —	— % —
2,4-D mixed amine[a]	15.2	18
2,4-D mixed amine[a]	30.4	5
Metsulfuron	0.25	9
Glyphosate	2	0
2,4-D mixed amine[a] + metsulfuron	15.2 + 0.25	0
2,4-D mixed amine[a] + metsulfuron	30.4 + 0.25	0
2,4-D mixed amine[a] + glyphosate	15.2 + 2	4
2,4-D mixed amine[a] + glyphosate	30.4 + 2	0
2,4-D alkanolamine + glyphosate	20.8 + 12.2	13
2,4-D mixed amine[a] + glyphosate	20.8 + 12.2	4
Glyphosate + 2,4-D[b]	0.4 + 0.7	32
LSD (0.05)		20

[a]Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-HiDep.
[b]Commercial formulation (Landmaster BW).

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

Treatment	Rate	Control/MAT 1	Control/MAT 3
	- lb/A -	%	
2,4-D dimethylamine (Weedar 64)	2	98	20
2,4-D dimethylamine + diethanolamine (HiDep)	2	98	13
2,4-D butoxyethylester (Weedone LV4)	2	100	18
2,4-D acid + butoxyethylester (Weedone 638)	2	99	18
2,4-D isooctyl(2-ethylhexyl)ester (Esteron 99)	2	99	18
2,4-D triisopropanolamine + diethylamine (Formula 40)	2	97	17
2,4-D dimethylamine 80% WSP (CL-782)	2	68	28
2,4-D dimethylamine 85% WSP (Savage)	2	99	26
Picloram	0.5	99	89
LSD (0.05)		11	27

Comparison of various picloram formulations applied alone and with adjuvants for leafy spurge control. Lym, Rodney G. Picloram formulated as the potassium (K) salt (Tordon 22K) is the most effective herbicide for leafy spurge control. However, application rates are relatively high because picloram is poorly absorbed by leafy spurge. The purpose of this research was to evaluate various formulations of picloram alone and with additives for improved leafy spurge control compared to the picloram K-salt formulation.

A series of experiments was established in the spring or fall of 1991 at various locations in North Dakota. All treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi either in June or September when the plants were in the true-flower or fall regrowth growth stages, respectively. All experiments were in a randomized complete block design with four replications, and plots were 10 by 30 ft. Treatments were evaluated visually based on percent stand reduction as compared to the control.

The first experiment evaluated picloram formulated as the K-salt or a water-soluble acid powder (XRM-5255) alone or with 2,4-D spring- or fall-applied (Table 1). Picloram K-salt provided a nearly 2-fold increase in leafy spurge control compared to the acid powder when applied at 0.25 and 0.5 lb/A and an average of 32% increase in control at 1 lb/A averaged over application and evaluation dates. In general, adding 2,4-D to picloram regardless of formulation increased leafy spurge control compared to picloram alone, but the K-salt formulation still provided much better control than the acid powder.

The second experiment evaluated picloram K-salt alone or with various adjuvants or 2,4-D and picloram ester for leafy spurge control. The adjuvants evaluated included the commercial surfactants Scoil (a methylated crop oil), LI-700 (an acidified lecithin), Raider II (pyro-phosphate surfactant blend), and the experimental additive BAS-090. Picloram isooctyl ester was formulated with triclopyr butoxethyl ester (1:2) as the commercial product Access. The experiment was established at Valley City and on the Sheyenne National Grasslands in June 1991.

Leafy spurge control increased when picloram at 0.25 lb/A was applied with an adjuvant at Valley City but not Sheyenne (Table 2). BAS-090 and Scoil increased or tended to increase control more than the other adjuvants evaluated and was similar to control from picloram plus 2,4-D at 0.25 plus 1 lb/A. No adjuvant increased control when applied with picloram plus 2,4-D compared to the herbicides alone. In general, picloram plus triclopyr ester did not control leafy spurge regardless of application rate. Plant leaves desiccated rapidly when the ester formulation was applied and regrowth began within 30 days of treatment.

A similar experiment was established in September 1991 at Valley City and Hunter, ND except the commercial surfactant Silwett L-77 (an organosilicone) replaced LI-700 and the picloram rate was 0.5 lb/A. No adjuvant increased leafy spurge control compared to picloram or picloram plus 2,4-D applied alone in the fall (Table 3). Picloram plus triclopyr ester did not provide satisfactory leafy spurge control.

The final experiment compared the picloram K-salt, acid powder and ester formulations applied alone or with adjuvants, 2,4-D plus glyphosate, dicamba, and the experimental herbicide V-53482. The experiments were established near

Hunter, ND when leafy spurge was in the early flowering and the flower to seed-set growth stages.

As in the first experiment, picloram K-salt provided much better leafy spurge control than the acid powder except when XRM-5255 was applied with 2,4-D LVE (Table 4). Leafy spurge control averaged 98 and 70% control 3 and 12 months after treatment (MAT), respectively, with XRM-5255 plus 2,4-D LVE at 4 + 16 oz/A compared to 92 and 38%, respectively, with picloram K-salt plus 2,4-D LVE. Leafy spurge control with 2,4-D amine was similar to 2,4-D LVE when applied with picloram K-salt but declined 50% or more when applied with XRM-5255.

Dicamba at 32 oz/A provided similar leafy spurge control to picloram at 4 oz/A and control was not improved by adding 2,4-D or Scoil (Table 4). Glyphosate plus 2,4-D provided only 40% leafy spurge control 3 MAT. Neither V-53482 nor picloram plus triclopyr ester provided satisfactory leafy spurge control as the topgrowth was killed quickly but the plant regrew within 30 days.

In summary, picloram K-salt formulation provided much better leafy spurge control than the acid powder formulation whether applied alone or with adjuvants or 2,4-D amine. XRM-5255 applied with 2,4-D LVE provided similar leafy spurge control to the K-salt formulation and should be further evaluated. Leafy spurge control, in general, was not improved when picloram was applied with a spray adjuvant: but when an increase did occur, it was similar to picloram applied with 2,4-D, and the latter is a less costly treatment. Picloram applied as an ester killed the top growth rapidly but the plants regrew within 30 days. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table 1. Comparison of picloram formulated as the potassium salt[a] and the dry acid XRM-5255[b] at two application dates near Valley City, ND (Lym).

Application date and treatment	Rate	Control		
		Aug 91	June 92	Aug 92
	— lb/A —	%		
June 1991				
Picloram	0.25	30	12	6
Picloram	0.5	60	48	22
Picloram	1	87	79	50
XRM-5255	0.25	16	6	4
XRM-5255	0.5	35	8	3
XRM-5255	1	53	33	11
Picloram+2,4-D	0.25+1	52	24	13
Picloram+2,4-D	0.5+1	55	36	17
XRM-5255+2,4-D	0.25+1	38	16	10
XRM-5255+2,4-D	0.5+1	45	15	15
LSD (0.05)		19	25	16
September 1991				
Picloram	0.25	.	21	4
Picloram	0.5	.	76	22
Picloram	1	.	95	62
XRM-5255	0.25	.	13	0
XRM-5255	0.5	.	14	4
XRM-5255	1	.	78	19
Picloram+2,4-D	0.25+1	.	50	12
Picloram+2,4-D	0.5+1	.	89	40
XRM-5255+2,4-D	0.25+1	.	6	1
XRM-5255+2,4-D	0.5+1	.	49	11
LSD (0.05)			27	11

[a]Picloram formulated as the potassium salt in Tordon 22K.
[b]Picloram acid formulated as a water soluble powder.

Table 2. Picloram applied as a potassium salt or isooctyl ester formulation with adjuvants in June 1991 for leafy spurge control (Lym).

Treatment	Rate	Location and evaluation date					
		Valley City		Sheyenne		Mean	
		Aug 91	June 92	Aug 91	June 92	Aug	June
	— lb/A —	% control					
Picloram	0.25	19	2	68	17	44	9
Picloram+Scoil	0.25+1 qt	52	25	44	7	48	16
Picloram+BAS-090	0.25+1 qt	76	44	57	8	71	26
Picloram+LI-700	0.25+0.5%	47	23	39	5	43	14
Picloram+RaiderII	0.25+1 pt	30	10	72	12	51	11
Picloram+2,4-D	0.25+1	68	35	59	19	63	27
Picloram+2,4-D+Scoil	0.25+1 +1 qt	55	23	83	6	69	15
Picloram+2,4-D+BAS-090	0.25+1 +1 qt	51	34	69	25	60	30
Picloram+2,4-D+Raider II	0.25+1 +1 pt	48	14	52	4	50	9
Picloram ester+triclopyr ester[a]	0.25+0.5	14	1	52	5	34	3
Picloram ester+triclopyr ester[a] +2,4-D	0.25+0.5+1	25	8	53	3	30	5
Picloram ester+triclopyr ester[a] +Scoil	0.25+0.5 +1 qt	40	18	35	3	37	10
LSD (0.05)		25	23	31	17	20	14

[a]Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2)-Access.

Table 3. Picloram applied as a potassium salt or isooctyl ester formulation with adjuvants in September 1991 for leafy spurge control (Lym).

Treatment	Rate	Location and/ 1992 evaluation date: Valley City May	Valley City Aug	Hunter May	Hunter Aug	Mean May	Mean Aug
	— lb/A —	% control					
Picloram	0.5	92	11	89	46	90	28
Picloram+Scoil	0.5+1 qt	96	13	83	36	89	24
Picloram+BAS-090	0.5+1 qt	95	19	88	44	91	31
Picloram+Silwett L-77	0.5+0.5%	96	18	80	28	88	23
Picloram+Raider II	0.5+1 pt	98	16	74	15	86	15
Picloram+2,4-D	0.5+1	96	15	966	47	96	31
Picloram+2,4-D+Scoil	0.5+1+1 qt	97	32	94	39	95	35
Picloram+2,4-D+BAS-090	0.5+1+1 qt	99	34	86	28	93	31
Picloram+2,4-D+Raider II	0.5+1+1 pt	97	25	88	46	93	36
Picloram ester+triclopyr ester[a]	0.5+1	47	6	8	0	27	3
Picloram ester+triclopyr ester[a]+2,4-D	0.5+1+1	36	2	16	3	26	2
Picloram+triclopyr ester[a]+ Scoil	0.5+1+1 qt	42	4	3	0	22	2
LSD (0.05)		24	16	13	22	13	24

[a]Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2)-Access.

Table 4. Herbicides applied at two growth stages for leafy spurge control near Hunter, ND (Lym).

Treatment	Rate	Application growth stage and evaluation date: Early flower Aug 91	Early flower June 92	Flower to seed-set Aug 91	Flower to seed-set June 92
	— oz/A —	%			
V-53482+Scoil	0.75+1 qt	18	0	47	0
V-53482+Scoil	1+1 qt	19	0	38	0
V-53482+Scoil	1.25+1 qt	11	0	15	0
V-53482+Scoil	1.5+1 qt	34	0	..	..
Picloram	4	34	10	63	26
Picloram+Scoil	4+1 qt	..	..	77	39
Picloram+L-77	4+0.5%	46	15	84	18
XRM-5255[b]	4	12	10	39	18
XRM-5255[b]+Scoil	4+1 qt	22	10	42	4
XRM-5255[b]+L-77	4+0.5%	16	6	30	9
Picloram+2,4-D LVE	4+16	..	..	92	38
Picloram+2,4-D amine	4+16	55	19	94	38
Picloram+2,4-D amine	8+16	98	65	..	..
XRM-5255[b]+2,4-D LVE	4+16	..	..	98	70
XRM-5255[b]+2,4-D amine	4+16	..	..	49	14
Dicamba	32	51	14	..	..
Dicamba+2,4-D amine	32+16	36	23	..	..
Dicamba+2,4-D[a]+Scoil	32+16+1qt	16	30	..	..
Glyphosate+2,4-D[a]	6.5+11	40	28	..	..
Glyphosate+2,4-D[a]+picloram	6.5+11+8	93	65	..	..
Picloram ester+triclopyr ester[c]	4+8	32	16	45	16
Picloram ester+triclopyr ester[c]+2,4-D amine	4+8+16	..	..	48	13
Picloram ester+triclopyr ester[c]+Scoil	4+8+1 qt	..	..	30	13
LSD (0.05)		31	20	31	25

[a]Commerical formulation (Landmaster BW).
[b]Picloram acid formulated as a water soluble powder.
[c]Picloram isooctyl ester plus triclopyr butoxyethyl ester (1:2)-Access.

Various spray additives applied with picloram and 2,4-D in an annual treatment program 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. Retreatments were applied on approximately the same dates in 1991 and 1992. 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 24 months after the first treatment (MAFT) increased when picloram at 0.25 lb/A was applied with X-77 + Silwett L-77, Mapeg 400 MO, Gafac RA-600, and Emulphor ON-877 to picloram alone (Table 1). Leafy spurge control with picloram at 0.25 lb/A alone was 27% averaged over both locations compared to 57% when applied with these spray additives. 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, no additive increased leafy spurge control when applied with picloram plus 2,4-D in the June applied treatments (Table 2). However, several including Triton CSF, LI-700, and Triton N57 tended to decrease control when applied with picloram plus 2,4-D compared to the herbicides applied alone. 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 applied in June but not in September. No additive increased control when applied with picloram plus 2,4-D and several decreased control. 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).

		Location/evaluation date (MAFT)[b]						Mean[c]	
		Valley City			Sheyenne				
Application time and additive	Rate[a]	3/9	12	24	3/9	12	24	12	24
	- % -	%							
June									
None	..	36	5	36	64	11	18	8	27
Pluronic L63	0.5	47	3	60	74	26	27	15	43
Tetronic 1504	0.5	57	7	66	77	22	32	15	49
Triton X-100	0.5	50	4	61	78	15	27	10	44
Triton CS-7	0.5	66	9	52	69	16	21	13	34
Surftac	0.5	50	11	41	56	16	25	14	33
X-77 + L-77[d]	0.25 + 0.25	62	10	55	74	44	54	27	55
Mapeg 400 MO	0.5	63	12	68	78	27	51	20	60
LI-700	0.5	56	3	45	80	31	32	17	38
X-77	0.5	54	6	57	80	21	33	14	45
Gafac RA-600	0.5	57	6	65	86	40	58	23	61
Emulphor ON-877	0.5	60	7	65	78	16	40	12	52
LSD (0.05)		21	NS	14	20	NS	27	NS	27
September									
None	..	74	9	24	93	45	40	27	32
Pluronic L63	0.5	79	12	28	97	45	33	28	30
Tetronic 1504	0.5	84	14	32	95	35	37	24	35
Triton X-100	0.5	81	13	42	97	39	42	26	42
Triton CS-7	0.5	83	10	37	97	62	37	36	37
Surftac	0.5	86	12	31	96	26	26	19	28
X-77 + L-77[d]	0.25 + 0.25	83	11	22	93	23	33	17	27
Mapeg 400 MO	0.5	83	9	22	90	43	42	26	32
LI-700	0.5	83	6	15	97	35	31	21	23
X-77	0.5	90	13	21	92	39	31	26	26
Gafac RA-600	0.5	78	5	11	93	58	35	31	23
Emulphor ON-877	0.5	82	21	40	95	63	52	42	46
LSD (0.05)		9	NS	NS	NS	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 12 or 24 MAFT for spring or fall applied treatments, respectively.
[d] L-77 was Silwett L-77.

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	12	24	Sheyenne 3/9	12	24	Mean[c] 12	24
	- % -	%							
June									
None	..	47	18	49	84	51	80	35	64
Pluronic L63	0.5	56	13	70	90	39	73	26	71
Tetronic 1504	0.5	36	12	45	88	48	75	30	60
Triton X-100	0.5	31	13	46	91	44	74	29	60
Triton CS7	0.5	39	7	51	80	19	33	13	42
Surftac	0.5	38	9	48	87	31	63	20	56
X-77 + L-77	0.25 + 0.25	31	9	44	83	46	70	28	57
Mapeg 400 MO	0.5	38	13	43	84	43	72	28	58
LI-700	0.5	34	9	42	77	24	40	17	41
X-77	0.5	36	8	51	81	25	51	17	51
Gafac RA-600	0.5	38	3	43	85	40	71	22	57
Triton N57	0.5	35	12	47	79	36	47	24	47
LSD (0.05)		NS	NS	13	NS	NS	27	NS	25
September									
None	..	79	10	19	92	20	32	15	26
Pluronic L63	0.5	91	18	38	94	27	37	22	37
Tetronic 1504	0.5	87	8	31	95	10	20	9	25
Triton X-100	0.5	84	13	29	94	3	29	8	29
Triton CS7	0.5	82	11	29	96	23	26	17	27
Surftac	0.5	79	3	11	95	46	49	25	30
X-77 + L-77	0.25 + 0.25	85	24	54	96	23	37	24	45
Mapeg 400 MO	0.5	82	15	30	97	26	46	21	38
LI-700	0.5	89	18	32	96	27	40	23	36
X-77	0.5	88	12	23	93	25	41	19	32
Gafac RA-600	0.5	82	6	16	93	13	43	10	29
Triton N57	0.5	86	13	23	97	21	38	17	31
LSD (0.05)		NS	NS	NS	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 first treatment
[c]Mean 12 or 24 MAFT for spring or fall applied treatments, respectively, (LSD = 0.05).

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 yield 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 each year. Herbage production was determined in July each year 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. The entire plot area was mowed following harvest in 1991. Herbicide retreatments were applied on September 20 or 24, 1991 at Chaffee and Valley City, respectively, to begin the second-year treatment program.

Control varied with glyphosate plus 2,4-D and averaged 3 and 94% at Valley City and Chaffee, respectively (Table 1). Only treatments that included glyphosate in 1990 or 1991 resulted in grass injury. Grass injury from glyphosate plus 2,4-D was very high following two consecutive treatments and averaged 91% over both locations. Picloram at 0.5 lb/A applied alone or with 2,4-D provided the best leafy spurge control and averaged 92% following two annual treatments. Dicamba at 2 lb/A and picloram plus 2,4-D at 0.25 plus 1 lb/A provided an average of 75% control after two consecutive treatments. However, control declined to only an average of 45% when the second year treatment was glyphosate plus 2,4-D.

Herbage production was higher at Chaffee than Valley City the season following the first treatment, 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 applied in 1990 and 1992 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.

Herbage production was higher at Chaffee compared to Valley City again in 1992 (Table 3). Herbage production declined by an average of 53% when picloram, picloram plus 2,4-D or dicamba treatments in 1991 were followed by glyphosate plus 2,4-D in 1992. Only the picloram, picloram plus 2,4-D, or dicamba treatments applied annually provided more herbage production than the control. Leafy spurge yield was similar regardless of treatment when averaged over both locations but was reduced by picloram, picloram plus 2,4-D and dicamba treatments at Valley City.

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

1990 and 1992 Treatment		1991 Treatment		Control 1992(21 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	3	94	48	100	82	91
Glyphosate+2,4-D	0.4+0.6	Picloram+2,4-D	0.5+1	89	83	86	69	11	40
Glyphosate+2,4-D	0.4+0.6	Dicamba	2	55	89	72	66	18	42
Picloram+2,4-D	0.5+1	Glyphosate+2,4-D	0.4+0.6	40	85	62	95	84	89
Picloram+2,4-D	0.5+1	Picloram+2,4-D	0.5+1	96	90	93	0	0	0
Picloram	0.5	Glyphosate+2,4-D	0.4+0.6	16	84	50	95	83	89
Picloram	0.5	Picloram	0.5	90	90	90	0	0	0
Dicamba	2	Glyphosate+2,4-D	0.4+0.6	8	81	44	99	83	91
Dicamba	2	Dicamba	2	68	86	77	6	0	3
Picloram+2,4-D	0.25+1	Glyphosate+2,4-D	0.4+0.6	16	77	46	98	86	92
Picloram+2,4-D	0.25+1	Picloram+2,4-D	0.25+1	72	73	73	4	3	3
Control									
LSD (0.05)				22	12	13	14	10	9

[a]Months after first treatment in 1990.

Table 2. Forage and leafy spurge production following various fall-applied herbicide treatments (Lym and Messersmith).

1990 and 1992 Treatment		1991 Treatment		Yield 1991(10 MAFT)[a]					
				Herbage			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

[a]Months after first treatment.

Table 3. Forage and leafy spurge production following various fall-applied herbicide treatments for 2 yr (Lym and Messersmith).

1990 and 1992 Treatment		1991 Treatment		Yield 1992(22 MAFT)[a]							
				Herbage				Leafy spurge			
Herbicide	Rate	Herbicide	Rate	Valley City	Chaffee	Mean	2 yr Total	Valley City	Chaffee	Mean	2 yr Total
	- lb/A -		- lb/A -	lb/A							
Glyphosate+2,4-D	0.4+0.6	Glyphosate+2,4-D	0.4+0.6	5	740	370	860	1800	270	1030	2250
Glyphosate+2,4-D	0.4+0.6	Picloram+2,4-D	0.5+1	620	1540	1080	1390	490	360	430	1950
Glyphosate+2,4-D	0.4+0.6	Dicamba	2	440	1800	1120	1640	1120	160	640	1480
Picloram+2,4-D	0.5+1	Glyphosate+2,4-D	0.4+0.6	100	990	540	1650	1660	250	920	1670
Picloram+2,4-D	0.5+1	Picloram+2,4-D	0.5+1	1850	1570	1710	3130	520	120	320	710
Picloram	0.5	Glyphosate+2,4-D	0.4+0.6	25	1000	510	1340	1350	260	800	1650
Picloram	0.5	Picloram	0.5	2080	1790	1930	3330	590	280	440	1250
Dicamba	2	Glyphosate+2,4-D	0.4+0.6	10	970	490	1420	1400	460	930	2110
Dicamba	2	Dicamba	2	1450	1690	1570	2720	760	290	530	1330
Picloram+2,4-D	0.25+1	Glyphosate+2,4-D	0.4+0.6	40	870	460	1830	1620	360	990	1875
Picloram+2,4-D	0.25+1	Picloram+2,4-D	0.25+1	1180	1410	1290	2360	940	490	720	1750
Control				850	1510	1180	2380	1300	420	860	2250
LSD (0.05)				600	480	800		650	NS	NS	

[a]Months after first treatment.

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 that may be competitive with leafy spurge in North Dakota.

The experiment was established in a dense stand of leafy spurge (42 stems/ft^2) on the NDSU experiment station at Fargo. The soil was a Fargo silty clay (fine, montmorillonitic, frigid, Vertic Haplaquolls; 3.5% organic matter and pH 8.0). Plots were 10 by 45 ft., and treatments were replicated four times in a completely random design. Initial leafy spurge stand counts were recorded on May 23, 1990, immediately before the first herbicide treatment. Glyphosate plus 2,4-D at 0.4 plus 0.6 lb/A were applied to all plots when leafy spurge was in the flowering growth stage and again on July 27, 1990, to regrowth that was reflowering. Glyphosate plus 2,4-D alone 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. The experimental site was irrigated with 1 inch of water on September 13 and 25, 1990, and 1.25 inches of rain fell on October 7. Initial grass stand establishment was estimated by counting seedlings in three 20-cm by 1-m quadrats placed over the rows on October 30, 1990.

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

'Arthur' Dahurian wildrye, 'Bozoisky' Russian wildrye, 'Hycrest' crested wheatgrass and 'MDN-1813' intermediate wheatgrass established rapidly despite the dry conditions in Fall 1990 (data not shown). 'Killdeer' sideoats grama was the only species that failed to have at least a 10% stand prior to winter.

'Hycrest' crested wheatgrass had the best stand density counts in May 1991 and reduced the leafy spurge stand equal to the herbicide treatment 1 yr after planting (Table 1). 'Killdeer' sideoats grama failed to establish. All established grass species tended to reduce leafy spurge production compared to the control 1 yr after planting (Table 2). 'MDN-1813' intermediate wheatgrass had the highest grass production at 2290 lb/A. However, 'Rodan' western wheatgrass, 'Arthur' Dahurian wildrye, and 'Bozoisky' Russian wildrye provided the best leafy spurge control when visually evaluated in September 1991, averaging 67% control (Table 1).

All established grass species reduced leafy spurge production compared to the control 2 yr after planting and the reduction was similar to the herbicide treatment with all species except 'Rodan' western wheatgrass and T-17596 mountain rye (Table 2). 'Arthur' Dahurian wildrye, 'Rebound' smooth brome and 'MDN-1813' intermediate wheatgrass produced the most herbage and averaged 2830 lb/A. 'Rebound' smooth brome, 'Bozoisky' Russian wildrye, 'Arthur' Dahurian wildrye, and 'Hycrest' crested wheatgrass increased in production from 1991 to 1992.

All grass species evaluated could be considered to be competitive with leafy spurge except 'Killdeer' sideoats grama. However, based on both herbage yield and leafy spurge reduction 'Rebound' smooth brome, 'Arthur' Dahurian wildrye and 'MDN-1813' intermediate wheatgrass would be the best species to plant into a leafy spurge infestation in a clay soil.

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

Grass species/[a] herbicide	Stand count[b] Leafy spurge 1990	Leafy spurge 1991	Leafy spurge 1992	Grass spp. 1991	Control 1991	Control 1992	Total leafy spurge reduction[c]
	no/0.25m²				%		%
'Rebound' smooth brome	45	55	25	5	55	40	45
'Rodan' western wheatgrass	40	70	30	15	70	45	25
'Bozoisky' Russian wildrye	40	60	25	30	60	40	40
'Arthur' Dahurian wildrye	45	70	30	45	70	45	30
MDN-1813 intermediate wheatgrass	40	50	35	35	50	55	15
T-17596 mountain rye	40	50	35	15	50	55	15
'Hycrest' crested wheatgrass	45	45	35	50	45	55	20
'Killdeer' sideoats grama	40	70	..	0	70	..	0
Glyphosate + 2,4-D	40	45	1	0	45	2	95
Control	40	100	65	0			+65
LSD (0.05)	NS	24	12	12	24	12	

[a]2,4-D + bromoxynil at 0.25 + 0.75 lb/A applied to all plots 24 May 91 and 26 May 92.
[b]Three 0.25 m² quadrats counted per plot in May of each year.
[c]Change in leafy spurge stand count from May 1990 until May 1992.

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

Grass species/[a] herbicide	Yield[b] Grass 1991	Grass 1992	Leafy spurge 1991	Leafy spurge 1992	Weedy grasses 1991	Weedy grasses 1992	Forbs 1991	Forbs 1992	Total 1991	Total 1992	Change[c] Grass	Change[c] Leafy spurge
	lb/A										%	
'Rebound' smooth brome	510	3070	290	45	1185	45	45	10	2035	3170	602	16
'Rodan' western wheatgrass	945	325	270	140	650	25	120	10	1990	3440	34	52
'Bozoisky' Russian wildrye	540	1260	230	95	930	270	115	5	1915	1630	233	41
'Arthur' Dahurian wildrye	1180	3240	220	65	595	35	55	5	2045	3350	274	30
MDN-1813 intermediate wheatgrass	2290	2180	215	40	125	5	70	5	2700	2225	95	19
T-17596 mountain rye	355	250	145	130	1855	400	85	50	1810	830	70	90
'Hycrest' crested wheatgrass	1100	1740	210	95	760	70	5	25	2075	1935	158	45
'Killdeer' sideoats grama[d]	1	..	320	..	1390	..	295	..	2005	..	..	..
Glyphosate + 2,4-D	0	0	505	10	1815	935	65	155	2380	1100	0	2
Control	0	0	505	235	795	625	35	105	1330	965	0	47
LSD (0.05)	770	1415	NS	85	NS	305	NS	105	NS	1420		

[a]2,4-D + bromoxynil at 0.25 + 0.75 lb/A applied to all plots 24 May 91 and 26 May 92.
[b]Four 0.25 quadrats harvested per plot 23-24 July 91 and July 92.
[c]1992 yield/1991 yield.
[d]'Killdeer' sideoats gramma did not establish and was not harvested in 1992.

Picloram plus 2,4-D applied annually for 10 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 ten picloram and picloram plus 2,4-D treatments and 20 2,4-D treatments prior to the evaluation in June 1992. 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. However, by June 1992 only control with picloram at 0.25 lb/A was increased by 2,4-D and averaged 68 and 85%, respectively. In general, the 2,4-D rate did not influence control when applied with picloram. Leafy spurge control averaged 73% with 2,4-D alone following 10 yr of biannual treatments.

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 ten annual picloram or picloram plus 2,4-D treatments and biannual 2,4-D treatments in North Dakota (Lym and Messersmith).

Herbicide	Rate	1992 Valley City June	Months after first treatment: 12[a]	24	36	48	60	72	84	96
	lb/A	% control								
Picloram	0.25	68	39	48	48	58	49	38	64	56
Picloram	0.38	91	65	62	52	77	69	67	96	72
Picloram	0.5	91	65	71	81	86	77	71	92	81
2,4-D bian	1	74	22	30	38	50	39	55	77	69
2,4-D bian	1.5	66	22	24	26	45	49	49	62	57
2,4-D bian	2	78	19	30	26	54	54	62	75	67
Picloram + 2,4-D	0.25 + 1	85	52	66	63	85	73	76	92	80
Picloram + 2,4-D	0.25 + 1.5	82	58	66	70	85	77	62	88	73
Picloram + 2,4-D	0.25 + 2	88	57	62	66	83	76	77	91	88
Picloram + 2,4-D	0.38 + 1	89	69	72	70	90	84	76	96	82
Picloram + 2,4-D	0.38 + 1.5	92	68	74	76	93	84	79	88	83
Picloram + 2,4-D	0.38 + 2	95	68	59	76	91	86	82	96	86
Picloram + 2,4-D	0.5 + 1	97	71	75	84	94	87	82	96	84
Picloram + 2,4-D	0.5 + 1.5	98	64	73	80	97	91	88	99	95
Picloram + 2,4-D	0.5 + 2	96	76	75	81	95	91	88	99	90
LSD (0.05)		14	18	14	19	14	14	15	19	17
Mean of treatments		86	52	55	63	79	72	70	87	78

[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.

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. 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 treatment prior to insect introduction on biocontrol agent 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. Because 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 1992 on the forage production plots to establish a research area until insects are available to conduct the establishment and life-cycle experiment.

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 rate for picloram plus 2,4-D fall-applied was increased from 0.25 plus 1 lb/A to 0.5 plus 1 lb/A.

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 but only the annual treatments of 2,4-D were reapplied in 1992. Glyphosate plus 2,4-D was not reapplied in the fall of 1992 because grass injury was severe and Canada thistle, absinth wormwood and various annual weeds were present and becoming more dense than in 1991. The experimental site will be maintained until a sufficient number of biocontrol agents are available to continue the experiment. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105)

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	108
	- lb/A -		- lb/A -		%								
Spring 1984		Spring											
2,4-D	2	2,4-D	2	85-88 90-92	0	0	10	16	30	28	4	26	..
Picloram + 2,4-D	0.25+1	Picloram + 2,4-D	0.25+1	85-88 90-92	24	31	59	58	60	60	43	62	..
Picloram	2	Picloram	2[b]	88 90	99	94	84	68	99	94	98	88	..
Dicamba	8	Dicamba	8[b]	85-87 90	53	30	86	58	45	65	79	55	..
Mowed only	...	Sulfometuron + picloram	0.08+0.25	88									
		Glyphosate + 2,4-D	0.4+0.6	90-92		0	0	0	0	16	0	55	..
LSD (0.05)						20	17	15	20	15	14	16	
Fall 1983		Fall											
2,4-D	2	2,4-D	2	84-88 90-92	0	0	0	0	4	4	0	0	0
Picloram + 2,4-D	0.25+1	Picloram + 2,4-D	0.25+1 0.5+1	84-88 90-92	40	4	8	16	22	15	11	0	21
Picloram	2	Picloram	2[b]	85 90	99	36	94	99	84	80	70	80	79
Dicamba	8	Dicamba	8[b]	86 88 90-91	91	87	58	88	69	91	81	48	93
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	30
LSD (0.05)					17	18	18	10	13	15	14	18	13

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

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

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

Treatment	Rate	Control		
		Aug 91	May 92	Aug 92
	oz/A	%		
2,4-D LVE	8	56	33	28
2,4-D LVE	12	67	45	53
2,4-D LVE	16	78	79	93
2,4-D amine	12	41	37	30
2,4-D mixed amine[a]	12	44	51	56
Imazethapyr + Sun-It II	2 + 1 qt	3	5	3
Picloram	4	28	33	33
Picloram + 2,4-D LVE	2 + 8	81	72	76
Picloram + 2,4-D LVE	4 + 8	84	90	94
Picloram + 2,4-D amine	4 + 8	58	60	73
Dicamba + X-77	8 + 0.25%	35	41	32
Dicamba + X-77	16 + 0.25%	70	79	47
Clopyralid + 2,4-D	1.5 + 8	83	77	85
Clopyralid + 2,4-D	3 + 16	92	95	98
Metsulfuron + X-77	0.10 + 0.25%	4	9	3
Metsulfuron + X-77	0.30 + 8 + 0.25%	17	24	23
Metsulfuron + 2,4-D LVE + X-77	0.10 + 8 + 0.25%	65	45	53
LSD (0.05)		23	34	45

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

Imazethapyr and metsulfuron did not control fringed sagebrush (Table). Clopyralid plus 2,4-D provided excellent long-term control especially when applied at 3 + 16 oz/A which averaged 98% control in August 1992. However, 2,4-D LVE at 16 oz/A provided 93% control and would cost only $3 to $4/A compared to over $25/A for clopyralid plus 2,4-D. Fringed sagebrush control was better with 2,4-D LVE and mixed amine formulations than with 2,4-D amine at the same application rate. Picloram plus 2,4-D LVE at 4 + 8 oz/A provided similar control to 2,4-D LVE at 16 oz/A alone but would have to maintain control much longer than 2,4-D LVE alone to be cost-effective. Dicamba provided similar control to 2,4-D amine. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

Quackgrass control in cropland with various spring-applied herbicides. Maruska, Dean W., Rodney G. Lym, and Calvin G. Messersmith. Many selective and nonselective herbicides are available for quackgrass control in cropland. The objective of this experiment was to evaluate all herbicides registered in North Dakota for postemergence quackgrass control.

The experiment was established at the North Dakota State University experiment station in Fargo using a well established stand of quackgrass. The soil was a Fargo silty clay with 3.5% organic matter and pH 8.0. There were two quackgrass treatment dates, spring or late-spring applied May 15 or June 2, 1992, respectively (Table). Sequential applications for fluazifop-P plus fenoxaprop and clethodim were applied 2 weeks after the initial application date as the manufacturer suggested. Bromoxynil plus 2,4-D plus X-77 and L-77 surfactant (0.75 lb/A + 0.25 lb/A + 0.25% + 0.25%) were applied May 21, 1992 to reduce broadleaf weed competition.

Herbicide treatments were applied with a tractor-mounted sprayer delivering 17 gpa at 35 psi. Plots were 10 by 30 feet. Treatments were replicated four times in a randomized complete block design. Control was visually evaluated 8 or 6 weeks after treatment (WAT) for the spring- and late- spring-applied treatments, respectively, and were based on percent stand reduction compared to the control. Quackgrass was harvested on July 20 to 23.

The spring-applied treatments consistently provided better quackgrass control than the late-spring-applied treatments (Table). Glyphosate provided the best control, averaging 95%, regardless of application rate, date, or adjuvant. Glyphosate treatments also reduced the quackgrass biomass an average of 98%.

Clethodim provided variable control (Table). Clethodim spring-applied at 3 or 4 oz/A plus ammonium sulfate, an adjuvant, provided 59 and 70% control, respectively. However, control with clethodim averaged only 38% over all other application rates, dates, and adjuvants. Nicosulfuron at 0.4 and 0.5 oz/A spring-applied provided 54 and 65% control, respectively, while the late-spring-applied treatments averaged 47% control. Nicosulfuron provided an average 66% reduction in quackgrass biomass.

Primisulfuron provided control averaging 38% across application dates and reduced the quackgrass biomass by 57% (Table). Control with quizalofop varied as the spring-applied treatment averaged 50% control while the late spring-applied treatment averaged 23% control. Fluazifop-P averaged only 16% visible control, but the biomass was reduced by an average of 43%. Fluazifop-P plus fenoxaprop provided an average of 23% control and reduced biomass by 47%. Sethoxydim only provided 26% and 17% visible control for the spring- and late-spring-applied treatments, respectively, and an average biomass reduction of 35%.

In summary, glyphosate provided excellent control but cannot always be used because it is nonselective. Nicosulfuron, clethodim, and primisulfuron provided fair to good control and are selective in corn, soybean, and corn, respectively. Quizalofop, fluazifop-P, fluazifop-P plus fenoxaprop, and sethoxydim did not provide satisfactory control. Control with all herbicides was better with the spring than the late-spring application date. (Published with approval of the Agric. Exp. Stn., North Dakota State University, Fargo 58105).

<u>Table</u>. Quackgrass control with various herbicides in North Dakota cropland (Maruska, Lym, and Messersmith).

Application date and treatment[a]	Rate	Evaluation: Control 8/6 WAT[b]	Evaluation: Yield	Evaluation: Biomass reduction
	- oz/A -	- % -	lb/A	— % —
<u>Spring (May 15, 1992)</u>				
Nicosulfuron + Scoil	0.4 + 2%	54	270	66
Nicoculfuron + Scoil	0.5 + 2%	65	200	75
Primisulfuron + Scoil	0.4 + 2%	35	420	47
Primisulfuron + Scoil	0.6 + 2%	37	310	61
Fluazifop-P + Scoil	3 + 1%	16	360	55
Sethoxydim + Scoil	8 + 1%	26	520	34
Quizalofop + Scoil	1 + 1%	50	300	62
Fluazifop-P + fenoxaprop + Scoil[c]	2 + 0.7 + 1%	22	470	40
Glyphosate + X-77	24 + 0.5%	79	70	91
Glyphosate + X-77	36 + 0.5%	96	10	99
Glyphosate + X-77 + AMS	24 + 0.5% + 16	94	20	98
Glyphosate + X-77 + AMS	36 + 0.5% + 16	98	10	99
Clethodim + Scoil[c]	3 + 1%	37	490	38
Clethodim + Scoil[c]	4 + 1%	43	190	76
Clethodim + Scoil + AMS[c]	3 + 1% + 16	59	250	68
Clethodim + Scoil + AMS[c]	4 + 1% + 16	70	190	76
Control	0	0	790	0
<u>Late Spring (June 2, 1992)</u>				
Nicosulfuron + Scoil	0.4 + 2%	47	310	60
Nicosulfuron + Scoil	0.5 + 2%	47	310	61
Primisulfuron + Scoil	0.4 + 2%	43	260	68
Primisulfuron + Scoil	0.6 + 2%	36	380	51
Fluazifop-P + Scoil	3 + 1%	16	540	31
Sethoxydim + Scoil	8 + 1%	17	510	35
Quizalofop + Scoil	1 + 1%	23	430	46
Fluazifop-P + fenoxaprop + Scoil[c]	2 + 0.7 + 1%	23	360	54
Glyphosate + X-77	24 + 0.5%	96	20	98
Glyphosate + X-77	36 + 0.5%	99	5	100
Glyphosate + X-77 + AMS	24 + 0.5% + 16	99	5	100
Glyphosate + X-77 + AMS	36 + 0.5% + 16	99	5	100
Clethodim + Scoil[c]	3 + 1%	40	370	54
Clethodim + Scoil[c]	4 + 1%	31	390	51
Clethodim + Scoil + AMS[c]	3 + 1% + 16	38	330	59
Clethodim + Scoil + AMS[c]	4 + 1% + 16	36	270	66
Control	0		790	0
LSD (0.05)		13	180	

[a]AMS, diammonium sulfate.
[b]Weeks after treatment, 8 and 6 WAT for spring and late-spring treatments, respectively.
[c]Sequential application made 2 WAT as manufacturer suggested.