1990
NORTH DAKOTA WEED CONTROL RESEARCH

WEED SCIENCE

BIOLOGICAL CULTURAL CHEMICAL

NDSU

Weed Research Projects, Department of Agronomy
NORTH DAKOTA STATE UNIVERSITY
Fargo, N.D. 58105

<u>NOT FOR PUBLICATION</u>

SUMMARY OF 1990
WEED CONTROL EXPERIMENTS

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Synergistic Interactions with Herbicides

CLIMATIC DATA - CARRINGTON 1990

Date	Precipitation April	May	June	July	Aug.	Sept.	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	.40			.23			51	27	50	23	85	56	90	62	92	55	85	48
2			2.52				47	18	56	30	79	41	90	69	91	59	89	49
3		.04	.67				60	28	71	29	58	35	88	69	88	59	89	66
4	.07						59	28	68	27	65	41	71	57	83	46	88	55
5			.09			.72	36	15	66	32	65	52	70	53	82	49	82	54
6							37	13	79	36	75	45	81	52	88	59	85	61
7			.02	.13		.46	52	22	72	45	69	51	82	65	88	58	84	51
8			.39	.10			57	24	64	34	69	50	73	53	92	58	83	58
9				T			54	30	57	28	82	47	82	53	90	54	77	48
10	.03		.05	.01			47	23	63	23	88	51	81	57	81	49	78	44
11			.09	.64	.17		41	21	64	36	85	65	74	54	55	48	92	60
12			.01				51	18	67	28	79	49	76	48	69	50	91	50
13		.14	.19				55	25	67	32	75	48	78	52	84	46	82	57
14					T		54	24	66	42	74	48	84	53	83	55	75	37
15			.14				62	18	63	38	65	45	81	56	88	47	74	38
16	.05	.21					59	25	56	35	73	55	85	53	94	66	64	30
17		.18	.27	.17			56	17	58	35	73	59	85	62	94	58	70	41
18				.02	.85	.75	64	20	57	27	85	51	75	52	71	57	66	52
19			.94				74	39	65	40	84	57	78	50	76	56	74	38
20			.04	.45		.06	79	35	67	38	78	52	77	54	74	53	70	52
21			.08			.02	85	51	75	42	76	53	75	49	81	49	57	39
22	T	.03	.05				91	49	79	45	73	51	74	47	86	63	55	34
23							87	50	79	42	79	47	81	49	90	66	69	28
24	.05						86	43	80	44	87	55	82	50	91	55	83	47
25	.35	.07		.33	.50		66	50	74	49	87	67	82	60	82	55	85	49
26	.08	.69					56	43	65	51	91	59	82	66	81	60	84	45
27	.13		1.05		.01		47	21	75	46	89	61	87	64	81	55	74	37
28	.43		3.05			.15	35	21	78	47	84	61	85	60	82	51	62	34
29			.02				40	31	81	46	84	64	76	57	88	47	54	36
30	.01						39	23	78	50	83	57	76	45	92	50	66	33
31									76	49			86	55	91	60		

CLIMATIC DATA - CASSELTON 1990

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.26	T					64	33	42	25	78	60	83	58	84	62	89	69
2			1.71	.09	.74		44	23	49	30	85	61	85	67	93	61	85	53
3			.72	T			41	23	63	30	69	38	92	67	87	62	88	58
4	T						46	16	74	35	61	40	90	75	89	53	78	62
5			.22			.02	39	20	68	40	67	49	75	57	78	46	83	59
6						.09	39	12	66	33	72	47	73	54	80	48	84	60
7			T			.17	41	14	79	47	76	49	82	55	86	53	89	56
8			.10	.08		.44	56	23	85	72	71	49	84	71	89	56	78	55
9							55	32	69	33	71	46	78	53	92	53	88	54
10							49	26	46	23	84	52	86	53	85	56	82	50
11	T		.18	.25			41	23	65	29	90	65	75	61	77	43	77	53
12			.62		.22		41	17	69	31	86	55	77	48	66	41	94	56
13			.13				54	21	72	41	80	52	79	52	74	50	91	57
14		.96					61	24	67	42	80	43	79	43	82	61	83	44
15			.30	.06			58	17	65	43	67	49	83	54	81	47	75	40
16	.10	.16	.32				65	28	57	48	65	45	83	52	86	50	65	37
17		.06	.05	.18			42	14	58	39	70	52	87	62	96	61	63	43
18					.52	.33	57	16	59	27	75	56	83	52	92	65	72	54
19		.04	.95	T		.50	67	30	57	38	85	61	83	59	70	58	67	42
20			.82	.02			79	30	65	37	80	56	82	55	69	52	74	58
21		.04	T			.06	79	40	67	51	77	56	78	56	75	60	63	44
22	.12		.31			T	85	47	67	49	79	54	73	51	75	59	61	40
23		.08			.11		90	58	76	44	78	56	79	48	82	62	54	29
24							92	42	76	50	79	57	84	51	88	63	65	37
25	T				1.02		87	51	82	50	82	64	87	58	90	59	87	44
26	.10	.41	T	T	.72		79	47	74	53	91	61	82	65	87	69	88	47
27	.22		.86				41	27	75	46	90	64	84	68	86	62	91	42
28	.96		.09				41	27	86	53	90	64	85	64	88	59	64	37
29	.13					.10	37	28	84	52	85	66	90	62	87	51	62	37
30					.14		40	26	82	47	87	60	80	44	88	54	59	28
31									81	55			85	62	92	60		

CLIMATIC DATA - CROOKSTON 1990

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	Precipitation Sept.	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			2.33	.01	.38		35	22	48	31	85	60	83	63	92	66	83	54
2			.81				40	24	54	35	58	39	92	72	88	64	89	62
3							52	30	73	37	57	40	88	55	87	53	87	61
4			.07				38	17	65	35	65	46	76	53	75	44	80	55
5						.18	31	11	64	31	70	49	72	46	79	49	76	57
6				.05		.05	38	15	77	48	76	51	80	61	86	58	87	53
7			.13	.04			50	24	84	42	72	54	80	59	87	62	78	56
8	.06		.21		.85		49	34	62	34	64	47	76	54	90	54	84	52
9							46	24	46	22	82	52	82	56	86	51	74	41
10			.02				30	23	60	32	84	62	77	59	70	41	74	45
11			.23		.38		33	21	65	37	79	58	78	50	60	44	92	49
12		.03					50	26	66	44	78	52	80	45	72	44	72	57
13		.11					54	29	68	40	78	53	80	53	79	54	77	49
14							50	22	68	38	64	50	82	53	82	46	73	49
15	.07	.04	.02				59	28	66	47	64	51	82	49	82	46	64	34
16		.38	.02	.27	.06		37	22	60	34	78	58	85	61	94	61	63	41
17		.01	.52		.33	.53	54	25	46	30	74	59	80	50	87	63	70	41
18			.69			.08	65	36	61	36	79	60	79	58	69	57	66	36
19			.33	.07			76	36	63	35	75	55	78	58	77	52	71	40
20		.03	.22	.04		.03	76	44	69	46	72	55	76	51	80	53	66	45
21							85	53	66	49	78	54	72	50	81	60	58	41
22			.03		.05		86	65	74	46	71	54	79	46	86	66	52	25
23					.05		89	53	77	50	73	51	81	56	88	67	65	28
24	.16	.08			.30		81	59	72	47	72	62	85	60	91	62	85	43
25	.01	.02			.60		71	40	75	54	93	59	82	63	87	63	72	42
26		.01	.07				43	28	65	42	88	60	82	66	81	60	86	39
27	1.34		.05				38	28	80	52	79	61	84	65	83	55	63	34
28	.11		.04				33	27	82	44	84	64	89	61	83	51	59	35
29							38	28	78	50	88	59	76	46	86	51	55	30
30					.01	.04	38	27	79	57	80	54	77	50	90	59	63	34
31									80	61			85	57	88	57		

CLIMATIC DATA - FARGO 1990

Date	Precipitation April	May	June	July	Aug.	Sept.	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	.20	T	1.70	.01			48	28	49	27	85	62	86	65	93	61	85	54
2			.28	.25	.37		40	24	62	32	69	42	92	71	88	66	88	58
3	T	T	.28	T		T	59	28	74	33	58	40	90	65	91	62	80	66
4	.04						43	26	69	39	68	41	79	57	78	53	84	63
5	T		.23			.10	35	19	67	34	73	53	73	54	80	46	87	62
6			T				35	15	78	37	76	43	82	55	86	52	88	63
7			.05	.04		.82	54	19	84	50	73	52	84	71	88	58	77	56
8			T	T			54	26	67	45	72	52	77	61	92	61	87	59
9		T					48	34	46	27	84	48	85	54	85	57	82	55
10	T			.02			36	25	62	22	91	63	76	63	76	49	76	50
11	T	T	.42	.15	.11	T	38	24	68	38	83	66	77	58	66	42	94	59
12			T				53	20	68	38	79	57	79	49	73	54	88	58
13		.55				T	59	26	70	49	79	55	79	53	82	50	84	58
14		T	.07				56	27	64	47	66	51	82	54	80	58	74	49
15	T	.08	.44			T	62	20	57	49	66	51	82	57	86	50	68	44
16	.10	.06	T		.09		40	20	59	40	78	57	86	56	96	63	63	35
17		.09	.01	.10	.07		56	17	56	35	73	61	83	60	92	65	71	48
18				T		.77	66	33	57	27	85	55	82	53	73	63	65	46
19		.02	1.73				78	41	57	45	79	62	82	60	70	58	73	40
20			.03	.21		.04	78	34	67	37	77	56	73	54	75	53	60	54
21		T	.11			T	85	45	65	54	78	56	73	52	73	61	59	42
22	.06	.08	.01	T		T	89	56	73	50	75	54	78	50	85	62	52	33
23	T				.04		91	67	75	43	76	52	83	51	88	69	64	29
24					T		87	57	78	51	80	56	86	58	87	66	87	43
25	.09	.04	T	T	.16		79	50	71	53	92	64	81	67	91	60	86	48
26	.08	.60			.14		53	37	62	48	91	62	82	68	85	64	89	50
27	.55		.69				37	29	76	43	80	66	86	69	89	65	64	40
28	.47		T			.02	37	30	83	53	84	67	91	68	87	58	62	36
29	.18						40	28	78	52	87	67	80	55	87	54	60	37
30	.01						42	30	80	53	82	61	77	48	93	57	67	35
31					.01				78	58			84	53	91	64		

CLIMATIC DATA - HETTINGER 1990

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
1							69	33	39	27	78	53	89	67	91	63	83	48
2			.12			.04	52	22	56	25	75	46	92	69	92	55	87	60
3				.04			57	27	64	32	69	41	101	66	89	59	96	62
4							65	30	69	35	62	42	83	54	80	49	96	61
5		.20	.05				54	16	58	37	78	44	78	52	78	43	88	61
6							40	10	65	36	71	39	81	61	84	55	99	60
7			.10	.02			48	20	79	50	78	53	96	66	88	56	91	49
8			.05				53	29	58	72	76	49	83	46	94	51	85	54
9							70	30	57	29	76	41	81	55	89	52	92	49
10	.02	.10					37	19	45	22	86	59	88	59	89	60	88	46
11		.06		.04			31	11	63	22	89	60	88	56	72	49	84	51
12					T		39	11	63	27	80	44	73	46	82	51	95	51
13							52	22	64	34	76	46	76	47	74	43	97	55
14							55	31	61	36	75	45	82	47	89	57	72	37
15			.60				54	22	63	45	57	50	87	54	82	55	78	41
16			.03				63	28	62	41	57	53	84	51	91	59	72	40
17			.63				43	11	59	30	66	51	95	60	93	65	69	45
18					.07		57	30	68	40	76	47	95	56	95	59	69	48
19			.85	.18			71	41	59	41	85	53	80	51	73	60	69	40
20				.12		.06	75	34	66	44	77	47	82	54	71	52	68	51
21		T					77	52	56	43	75	50	70	52	75	55	63	37
22			.06	.08			82	45	71	40	66	45	69	41	89	62	67	36
23							83	45	75	40	74	46	76	41	93	52	57	25
24		.10					77	49	80	39	82	51	83	56	88	60	76	40
25	.39	.20		.41			64	50	70	54	90	57	88	58	90	57	85	44
26	.06				.67		61	35	69	41	88	60	80	65	86	54	90	46
27	.10	.57		.19			60	28	70	47	96	60	86	54	84	59	86	46
28							31	22	68	47	93	61	83	56	82	55	67	44
29	.15		.45				35	23	71	54	87	63	82	52	85	50	67	31
30	.03						40	22	71	54	86	61	76	45	90	48	57	34
31									70	53			79	54	96	59		

CLIMATIC DATA - LANGDON 1990

Date	Precipitation April	May	June	July	Aug.	Sept.	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	.29			.25			54	24	35	18	77	54	78	57	85	55	81	50
2			.59	.09	.26		33	16	44	25	85	47	86	60	90	60	83	51
3		.08	.72	.24			36	20	41	30	47	35	90	65	85	57	88	65
4		T				T	50	28	48	30	56	36	78	55	78	47	89	51
5		.01	.11				36	14	58	36	65	47	63	50	70	43	73	54
6			T				28	12	59	36	63	45	63	45	80	49	80	59
7				.04		.33	31	13	76	47	73	50	76	55	88	55	80	45
8			.81	.13			45	25	64	36	76	52	75	53	88	60	75	47
9	.02		.21	T		.15	37	27	55	30	65	46	74	52	86	51	78	45
10	T		.04				40	20	49	24	74	54	75	52	78	45	68	39
11	T		.27		.08		27	17	60	35	83	61	74	52	68	47	74	46
12			.02		.75		34	21	54	29	80	51	72	48	63	43	86	45
13			.64				45	27	62	33	78	45	77	48	69	46	78	45
14		.10			.02		44	27	52	25	72	45	77	49	81	51	64	37
15							50	24	62	34	58	44	83	55	72	50	71	39
16	.04	.31					50	22	59	44	62	46	76	48	85	50	59	29
17		.36	.24	.09			32	18	53	32	70	51	83	57	88	53	61	33
18			1.27		T	.32	53	25	46	28	70	50	75	48	71	51	67	48
19		T		.05			62	34	54	33	78	57	68	49	63	53	64	37
20			.08				70	41	63	37	77	55	75	53	75	49	71	43
21			.09			.05	73	41	67	46	70	52	72	44	77	53	61	41
22		T	.02	.21			82	47	69	47	75	52	69	47	82	57	52	36
23			.08		.04		87	53	74	41	69	47	75	47	87	64	50	25
24							88	45	72	48	75	53	81	51	87	55	68	27
25	.35				.59		75	45	77	46	81	60	85	55	88	53	81	45
26	.01			.98	T		57	34	73	48	85	57	83	61	74	57	80	51
27	T		.02				40	19	73	40	81	60	81	64	74	55	78	38
28	.55		.01		.01		27	20	76	50	77	59	86	60	75	50	59	29
29	.04			T		.09	29	21	78	48	82	59	83	55	78	48	54	31
30							35	18	77	50	83	53	73	45	85	51	55	30
31									81	55			75	48	90	55		

CLIMATIC DATA - MINOT 1990

Date	Precipitation						April		May		June		July		August		September	
	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.20			.81			64	30	40	19	79	57	85	64	90	59	81	48
2			.74	.05		.05	46	21	50	29	82	46	90	66	91	58	83	50
3			.56	2.19	.20		51	23	60	31	46	37	88	66	88	59	89	66
4	T	T				.22	56	28	64	34	59	37	79	52	77	46	92	50
5	.05	.07	.63			.37	42	14	61	40	71	47	65	52	76	50	70	54
6			.01				37	13	67	40	62	46	71	54	84	56	86	59
7		T				.55	42	14	81	53	76	50	86	59	89	63	83	52
8			.49	.96			50	25	60	34	76	51	78	56	91	60	80	53
9				T			61	25	58	26	73	51	77	56	87	58	80	50
10	.07						41	19	52	30	83	56	81	59	80	50	71	46
11			.01		.25		29	18	61	30	88	56	78	55	77	52	78	45
12		T	.08	.11	.08		42	19	60	30	79	54	72	50	70	51	87	49
13		.01		.01			53	22	65	34	76	50	77	55	74	52	85	49
14					.06		55	28	59	30	73	49	81	58	88	57	63	43
15			.17				45	28	67	37	53	48	83	55	77	54	75	44
16	.14	1.05	.02				56	25	54	43	61	48	77	52	93	56	66	35
17		.07	.81				40	21	48	36	64	55	87	59	95	54	65	38
18			.01	.05	.05	.17	56	26	56	34	73	55	77	51	79	53	63	38
19		.08	.19		.11		68	35	52	40	82	56	77	49	63	54	66	38
20		.02	.01	.02	.04	.05	72	41	63	41	77	53	76	53	75	52	72	42
21			.01	.24		.02	81	55	63	41	78	55	71	52	79	52	59	39
22	.03		.09			T	87	58	74	45	73	51	72	52	86	57	54	36
23							87	52	74	44	75	52	76	55	90	63	51	33
24			.03				81	44	73	50	79	58	81	56	85	57	72	39
25	.42				.10		74	43	74	51	90	58	86	56	82	55	83	49
26	.40	1.36			T		58	42	68	51	88	61	84	60	79	55	85	50
27		.10	1.54	.39	.07		44	21	62	44	92	51	84	60	68	56	75	40
28	T	T	.22	.02			27	20	71	44	81	62	83	59	76	54	61	39
29	T	.01	.09				33	20	78	49	85	60	77	54	81	51	54	39
30	.01					.09	40	19	79	51	84	56	77	48	86	55	52	38
31						.01			79	57			80	48	92	58		

CLIMATIC DATA - OLIVIA 1990

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
1	.09						52	35	48	30	76	57	97	64	76	53		
2			.20				46	27	49	27	84	62	85	69	82	56		
3			.97		.01		44	21	68	35	70	43	89	72	73	63		
4				.03	.27		61	24	73	43	54	39	102	68	89	62		
5			.50	.02			56	20	71	49	65	46	73	57	73	52		
6							37	9	67	39	76	53	79	59	74	53		
7				.66			39	17	78	46	77	52	82	65	80	54		
8		.12		.14			50	30	92	51	74	57	88	70	78	54		
9	.06						66	37	70	50	80	54	81	61	79	59		
10					.08		58	27	57	31	82	54	78	62	86	62		
11			.73				45	22	59	35	90	63	81	65	82	49		
12		.18	.15	.55			37	19	70	48	89	66	70	54	74	58		
13			.12				54	20	64	45	85	64	72	48	70	51		
14		1.20					56	32	63	46	85	57	77	50	76	48		
15	.09	.05					70	23	66	53	83	63	81	56	87	57		
16	.08	1.24	1.35				59	33	67	50	78	59	84	60	80	63		
17	.05	.02	1.01	.08			37	19	69	43	66	59	85	66	85	67		
18			.01		.12		51	28	62	37	77	61	92	57	84	69		
19		.25	.47	.84	.03		62	50	62	47	86	64	87	62	75	57		
20		.53	.09		.17		65	48	74	43	80	61	76	56	65	57		
21					.20		74	48	61	44	78	58	80	60	60	58		
22			.06				84	52	63	45	78	56	76	53	76	59		
23	.04	.64	.05		.04		85	62	76	52	75	55	77	55	76	64		
24							86	61	69	55	80	66	80	54	76	66		
25	.03	.23			.22		81	62	75	56	84	62	79	62	75	64		
26	.03	.07		2.31	.11		83	64	59	56	92	67	76	67	86	64		
27	.12			.15	.01		78	48	73	53	91	70	71	67	85	65		
28	.84		.11	.87			50	33	73	53	85	69	81	64	84	67		
29	.70		.95				41	36	81	49	82	67	84	64	81	58		
30	.26						42	30	76	48	87	69	79	54	83	60		
31									77	50			74	52	85	60		

CLIMATIC DATA - PROSPER 1990

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
1		.02	1.81	.04	.12				48	26	86	61	85	59	92	58	85	54
2			.39	.08	.67				62	30	66	41	90	67	85	62	89	53
3			.39						75	45	56	39	88	61	89	59	81	65
4									67	38	66	41	77	55	77	52	83	51
5			.20			.24			67	37	70	52	72	53	82	46	82	61
6									79	33	75	48	81	51	87	47	87	61
7			.04	.24		.75			85	49	71	48	83	68	89	53	77	56
8									67	43	70	52	76	59	92	57	87	56
9									47	28	83	46	84	53	86	57	79	54
10									63	22	88	58	72	61	77	44	77	50
11			.83	.12	.08				69	31	82	67	77	55	64	41	94	57
12					.04				69	31	78	45	79	48	74	49	89	56
13		.47							72	49	78	53	79	47	82	42	82	58
14			.04						64	43	65	50	83	47	80	52	75	43
15		.12	.47						56	44	64	49	81	51	86	47	69	44
16		.08							58	40	76	56	87	50	96	56	64	38
17		.04		.16					56	36	71	58	80	57	94	62	71	45
18					.20	.91			59	28	83	55	81	51	72	62	66	45
19			1.14						57	43	77	61	81	57	69	57	73	42
20				.20		.04			67	36	74	56	73	55	77	52	60	51
21		.04	.08						66	52	76	56	74	51	73	57	58	43
22		.04	.08						74	48	73	55	76	49	83	60	53	32
23					.04				77	42	76	54	86	47	89	68	65	28
24					.47				78	49	78	52	86	51	89	63	85	41
25				.08	.24				72	60	89	58	79	64	90	60	87	48
26		.54			.16				66	48	92	61	82	66	82	62	91	46
27		.01	.71						76	43	76	65	84	68	88	62	64	41
28			.08			.04			83	55	84	65	90	66	87	55	62	35
29									79	47	85	66	79	52	88	51	58	35
30									80	47	81	60	78	47	94	51	68	29
31					.08				79	55			86	45	90	59		

CLIMATIC DATA - WILLISTON 1990

	Precipitation						April		May		June		July		August		September	
Date	April	May	June	July	Aug.	Sept.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min
1	.01	.11	.07	.23			58	28	52	25	81	56	91	64	92	63	90	48
2		.01	.05				63	25	69	34	72	50	97	70	93	55	95	59
3				.04			64	42	67	30	60	35	86	66	91	57	94	64
4		.05	T				58	34	65	43	71	46	81	49	82	46	85	50
5							42	15	70	36	71	50	76	45	89	52	93	56
6				.10			50	14	86	46	77	41	92	60	95	55	94	56
7		.25	.01	T			53	26	86	46	78	52	93	61	100	62	92	48
8			.12				64	35	57	33	75	46	82	50	100	64	91	50
9	T						60	29	53	29	82	47	86	54	91	61	88	52
10	.04						43	13	64	29	93	61	95	55	86	53	89	45
11			T	.03	.08		42	16	64	36	86	58	93	57	82	57	91	58
12			.10				62	17	62	30	76	47	81	51	80	49	97	54
13		.03					58	30	61	41	75	45	90	49	95	59	95	52
14							59	35	67	32	69	49	90	59	85	54	80	40
15		.19	.32				61	31	65	44	61	49	86	51	99	58	80	48
16	.09	.21	T				59	22	56	41	63	54	93	50	100	62	75	39
17			.12	T		.07	60	20	62	33	80	57	91	55	99	53	67	53
18		.06	T	.02	.32		73	29	62	41	81	56	82	51	84	49	71	38
19			T		.02	.26	77	43	71	41	78	53	79	49	70	57	77	39
20				.02			82	43	70	48	78	52	75	46	82	55	74	48
21			T	.10			87	46	72	46	78	48	74	47	87	58	62	38
22					.11		83	48	72	43	81	49	79	53	90	64	61	33
23							80	52	75	47	87	55	87	51	90	56	77	32
24					.29		76	41	78	55	96	58	91	55	84	59	86	47
25	.41	1.28		.05	.11		71	41	75	49	95	66	89	65	81	56	88	48
26	T	.02		.32	.24		65	39	66	44	98	62	87	65	71	59	87	49
27	T		T	.08	.03	T	48	29	75	46	96	64	83	55	80	56	71	43
28		.15	T			.07	40	23	75	49	91	63	83	59	83	54	67	42
29	T		.68				37	24	78	50	90	59	80	54	87	53	65	35
30	.01	T					42	20	77	63	88	57	81	49	96	48	67	37
31									80	56			93	55	88	57		

CLIMATIC DATA - WILMAR 1990

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	Precipitation Sept.	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							53	34	46	30	75	58	86	63	77	57		
2	.10		.14				45	27	44	26	83	62	89	69	80	63		
3			.52				44	24	55	34	71	39	88	71	79	66		
4			.08	.03	.65		56	26	71	41	56	39	101	69	87	59		
5			.42				55	23	71	47	64	48	76	59	74	55		
6							37	15	67	35	74	52	76	57	75	50		
7				.16			35	17	76	48	75	50	80	63	78	53		
8		.15		.16			53	22	90	50	70	58	83	67	78	55		
9	.03						62	34	69	51	76	54	80	59	80	55		
10		.01					54	32	57	33	83	59	81	64	87	56		
11			.75	.01			44	23	59	35	88	62	81	65	83	52		
12		.03	.92	.62	.05		36	19	67	35	81	65	67	53	74	55		
13			.28				52	24	65	43	84	64	71	52	69	48		
14		1.03					55	30	64	52	82	53	76	52	76	58		
15			.10				67	25	64	50	81	62	80	52	84	57		
16		.81	2.39				58	27	55	49	81	58	83	60	79	58		
17	.01		2.03	.12	.17		41	24	57	42	64	57	83	66	86	67		
18					2.18		50	27	58	37	75	61	91	57	83	67		
19		.15	.39	.49	.01		63	35	56	39	84	64	83	63	71	56		
20		.74			1.22		65	43	47	43	79	61	76	54	59	55		
21					.01		75	46	62	45	77	61	78	61	62	55		
22							83	54	62	45	77	58	74	55	76	58		
23	.05	.63	.18		.03		85	58	75	48	75	58	76	53	76	62		
24	.02		.03		.34		85	61	73	54	82	62	79	63	77	63		
25	.15	.05		.01	.55		83	62	57	34	90	69	70	67	83	66		
26	.24	.73	.35	.82	.31		76	45	67	53	80	69	70	67	83	66		
27	.05	.01		.03			49	35	74	54	80	67	82	51	83	57		
28	.82		.17	.10			40	33	81	49	82	68	82	68	78	57		
29	.39		.62				38	29	73	46	85	68	82	68	82	60		
30	.46								75	48			75	50	85	63		
31																		

KEY TO ABBREVIATIONS AND EVALUATIONS

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

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

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

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

Species

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

Methods

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

Miscellaneous

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

LIST OF HERBICIDES TESTED IN 1990

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
AC22949	AC22949	American Cyanamid	2.5 lb/gal	None
AC 310,448	AC310448	American Cyanamid	3 lb/gal	None
AC7084-005A	AC005A	American Cyanamid	2.5 lb/gal	None
AC7084-042A	AC042A	American Cyanamid	2.5 lb/gal	None
Acetochlor	Acet	Monsanto	7.5 lb/gal	Harness
Acifluorfen	Acif	BASF	2 lb/gal E,S	Blazer
Alachlor	Alac	Monsanto	4 lb/gal E 4 lb/gal MT, 15% G	Lasso
Amitrole	Amit	Rhone-Poulenc	2 lb/gal S	Amitrole T
Atrazine	Atra	Various	80% WP, 90% DF, 4 lb/gal F	Numerous
BAS-51400H	BAS514	BASF	50%	Facet
Bentazon	Bent	BASF	4 lb/gal S	Basagran
Bromoxynil	Brox	Rhone-Poulenc	2 lb/gal E	Buctril
Butylate + Safener	Buty	ICI	6.7 lb/gal L 10% G	Sutan+
C 4243	C4243	Uniroyal	0.83 lb/gal E	None
CGA-131036	CGA131	Ciba Geigy	75% WP	Amber
CGA-136872	CGA136	Ciba Geigy	75% DF	Beacon
CGA-144155	CGA144	Ciba Geigy	3.3 lb/gal F	None
Chloramben	Clam	Rhone-Poulenc	75% SP	Amiben
Chlorimuron	Clim	DuPont	25% DF	Classic
Chlorsulfuron	Clsu	DuPont	75% DF	Glean
Clethodim	Clet	Valent	2 lb/gal	Select
Clomazone	Clom	FMC	4 lb/gal E	Command
Clopyralid	Clpy, Clop	Dow Elanco	3 lb/gal S	Stinger
Clopyralid+2,4-D	Clpy&2,4-D	Dow Elanco	0.38 + 2 lb/gal S	Curtail

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
Cyanazine	Cyan	DuPont	80% WP, 90% DF 4 lb/gal F	Bladex
Cycloate	Cycl	ICI	6 lb/gal E	Ro-Neet
Desmedipham	Desm	Nor-Am	1.3 lb/gal E	Betanex
Desmedipham + Phenmedipham	Des & Phen	Nor-Am	0.65+0.65 lb/gal E	Betamix
Dicamba	Dica	Sandoz	4 lb/gal S	Banvel
Dichlorprop		Rhone-Poulenc	4 lb/gal EC	Weedone 2,4-DP
Diclofop	Difp	Hoechst-Roussel	3 lb/gal E	Hoelon
Diethatyl	Diet	Nor-Am	4 lb/gal E	Antor
Difenzoquat	Dife	American Cyanamid	2 lb/gal S	Avenge
Diquat	Diqu	Valent	2 lb/gal S	Diquat
DPX-79406 (DPX-E9636,&DPX-V9360)	DPX79406	DuPont	25% WP	None
DPX-A7881	DPX-A7	DuPont	75% DF	Muster
DPX-E9636	DPX-E9	DuPont	25% DF	None
DPX-V9360	DPX-V9	DuPont	75% DF	Accent
Endothall	Endo	Pennwalt	3 lb/gal S	Herbicide 273
EPTC	EPTC	ICI	7 lb/gal E	Eptam
Ethalfluralin	Etha	Dow Elanco	3 lb/gal E	Sonalan
Ethofumesate	Etho	Nor-Am	4 lb/gal F 1.5 lb/gal E	Nortron
Fenoxaprop	Fenx	Hoechst-Roussel	1.5 lb/gal E	Whip
Fluazifop-P	Flfp-P	ICI	1 lb/gal E	Fusilade 2000
Fluroxypyr	Flox	Dow Elanco	1.7 lb/gal	Starane
Fomesafen	Fome	ICI	2 lb/gal	Reflex
Fosamine	Fosa	DuPont	4 lb/gal S	Krenite

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
Glyphosate	Glyt	Monsanto	3 lb/gal S	Roundup
Glyphosate & 2,4-D	Glyt & 2,4-D	Monsanto	0.9 + 0.8 lb/gal S	Landmaster II
Glyphosate & dicamba	Glyt & Dica	Monsanto	1.1 + 0.5 lb/gal S	Fallowmaster
Haloxyfop	Halx	Dow Elanco	2 lb/gal	Verdict
HOE-7125 (fenoxaprop+MCPA + 2,4-D)		Hoechst-Roussel	0.75 lb/gal	Tiller
HOE-6001	HOE6001	ICI	0.58 lb/gal	Puma
ICIA-5676	ICIA5676	ICI	6.4 lb/gal	None
Imazaquin	Imqn	American Cyanamid	1.5 lb/gal	Scepter
Imazethapyr	Imep	American Cyanamid	2.0 lb/gal	Pursuit
Imazamethabenz	Immb	American Cyanamid	2.5 lb/gal E	Assert
Lactofen	Lact	PPG	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
Oryzalin	Oryz	Dow Elanco	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	Prowl
Picloram	Picl	Dow Elanco	2 lb/gal S	Tordon 22K
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
Quizalofop	Qufp	DuPont	0.75 lb/gal EC	Assure

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
Quizalofop-UB	Qufp-UB	Uniroyal	1 lb/gal	Pantera
R-25788, Dichlormid	Dcmd	ICI	6 lb/gal E	None
Sethoxydim	Seth, Sth	BASF	1.5 lb/gal E	Poast
Sulfometuron	Sume	DuPont	75% DF	Oust
Thifensulfuron	Thif	DuPont	25% DF	Pinnacle
Thifensulfuron & Tribenuron	Thif & Trib	DuPont	75% DF	Harmony Extra
Tribenuson	Trib	DuPont	75% DF	Express
Triallate	Tria	Monsanto	4 lb/gal E, 10% G	Far-go
Triclopyr	Trcp	Dow	4 lb/gal	Garlon
Tridiphane	Trid	Dow	4 lb/gal E	Tandem
Trifluralin	Trif	Elanco	4 lb/gal E	Treflan
2,4-D	2,4-D	Various	Various E, S	Numerous
2,4-DB	2,4-DB	Various	2 lb/gal	Numerous

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

SOIL TEST RESULTS AT VARIOUS WEED EXPERIMENT LOCATIONS

	Soil Texture	Organic matter	pH	N (lb/A)	P (lb/A)	K (lb/A)
Carrington, ND	Loam	3.6	7.2	Fertilized by test		
Casselton, ND (Dalrymple)	Silty clay	5.0	7.9	Applied 80 lb N		
Chaffee, ND	Fine sandy loam	6.7	7.4	20	36	950
Crookston, MN	Silt loam	2.8	8.0	98	10	410
Dickinson (East)	Sandy loam	4.3	6.3	10	31	1200
Dickinson Ranch HQ	Clay loam	4.4	6.0	5	14	630
Fargo, ND (Sec. 22)	Silty clay	6.0	7.5	190	26	1095
Hillsboro, ND	Silty clay loam	4.7	7.8	283	53	1570
Hunter, ND	Sand	7.4	6.8	14		
Langdon, ND	Clay loam	4.6	7.8	Fertilized by test		
Minot, ND	Loam	2.7	7.0	Fertilized by test		
Mooreton, ND	Silty clay	3.9	7.0	78	38	970
New England, ND	Clay loam	5.8	6.7			
Clara City, MN	Silty clay	4.8	7.9	170	37	450
St. Thomas, ND	Silt loam	3.4	8.1	217	16	565
Valley City, ND	Stony loam	9.4	6.7	5	5	1415
(Sec 22)	Silty clay	3.2	7.5	137	25	850
West Fargo, ND	Silty clay	3.6	7.2	8	42	1460
Williston, ND	Loam	2.3	6.8	Fertilized by test		
Cavalier, ND	Silty clay	5.8	6.9	135	30	720
Casselton, ND (Sugarbeet)	Silty clay	4.0	7.8	129	18	675
Casselton, ND (Spray drift)	Silty clay	3.5	7.9	120	12	425
Fargo (Canada thistle)	Silty clay	4.4	7.9	55	27	425
Fargo Sec. 22 (Carryover)	Silty clay	3.9	7.9	151	61	1097
Moorhead, MN (Canada thistle)	Silty clay	4.5	7.8	193	29	340

Fall and spring incorporated herbicides, Casselton, 1989-1990. Fall treatments were applied 12:30 pm October 25, 1989 when the air temperature was 73F, soil temperature at six inches was 50F, relative humidity was 54%, wind was 10 mph, and soil moisture was poor. Spring treatments were applied 12:30 pm April 25, 1990 when the air temperature was 73F, soil temperature at six inches was 55F, relative humidity was 54%, wind was 20 mph, and the soil moisture was fair. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Treatments containing EPTC or cycloate were incorporated with a rototiller set four inches deep. All other PPI treatments were incorporated with a rototiller set two inches deep. 'Bush Johnson BJ1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. Counter 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. Sugarbeet injury and common lambsquarters control were evaluated June 20.

Treatment	Rate (lb/A)	Sugarbeet injury ---(%)---	Common Lambsquarters control -----(%)-----
EPTC+Cycloate (fall)	1.5+2.5	0	69
EPTC+Cycloate (fall)	2+2	0	63
EPTC+Cycloate (fall)	2.5+2.5	1	81
Diethatyl (fall)	6	0	23
Ethofumesate (fall)	3.75	0	90
Cycloate (fall)	4	0	58
Cycloate+Triallate (fall)	4+1	0	71
Cycloate+Triallate (fall)	4+2	0	81
EPTC+Cycl+Triallate (fall)	2+2+1	4	79
EPTC+Cycl+Triallate (fall)	2+2+2	6	89
EPTC+Cycl+Diethatyl (fall)	2+2+4	5	80
EPTC (spring)	2	3	69
EPTC+Cycloate (spring)	1.5+1.5	6	80
EPTC+Cycloate (spring)	1+2	1	76
EPTC+Cycloate (spring)	1+2.5	9	76
EPTC+Cycloate (spring)	2+2	15	91
EPTC+Cycloate (spring)	1.5+2.5	9	86
Cycloate (spring)	4	5	78
Diethatyl (spring)	4	4	53
Diethatyl (spring)	6	9	65
Ethofumesate (spring)	3.75	0	93
EPTC+Cycl+Diethatyl (spring)	1+2+4	16	92
EPTC+Cycl+Triallate (spring)	1+2+2	6	89
Cycloate+Triallate (spring)	4+2	3	91
C.V. %		98	8
LSD 5%		6	9
LSD 1%		8	11
# OF REPS		4	4

Summary

Fall applied EPTC+cycloate, diethatyl, cycloate, and cycloate+triallate gave less control of common lambsquarters than the same herbicide treatment applied in the spring. Ethofumesate gave similar common lambsquarters control with fall or spring application. EPTC+cycloate, diethatyl, and EPTC+cycloate +diethatyl caused greater sugarbeet injury when spring applied rather than fall applied. Triallate in combination with cycloate or EPTC+cycloate gave better control of common lambsquarters than cycloate alone or EPTC+cyloate alone.

Postemergence herbicides applied over soil applied herbicides, Cavalier, 1990. Soil applied herbicides were applied in 22 foot strips across the postemergence plots. A strip was treated with diethatyl at 5 lb/A, another with EPTC+cycloate at 1.5+2 lb/A, and a third strip had no soil applied herbicide. Soil applied herbicides were applied in 18 gpa water at 40 psi through 8002 nozzles and incorporated twice with a tandem disk and harrow 3:30 pm May 11 when the air temperature was 57F, soil temperature at six inches was 51F, relative humidity was 46%, wind was 8-14 mph, and the soil moisture was fair. 'Maribo 862' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 11. The first postemergence herbicide application was 12:30 pm May 29 when the air temperature was 78F, soil temperature at six inches was 58F, relative humidity was 25%, wind was 4-6 mph, soil moisture was good, sugarbeet was in the cotyledon stage, wild oats was just emerging to 3 inches tall, wild buckwheat was in the cotyledon to 1 leaf stage, and redroot pigweed was in the cotyledon stage. The second postemergence application was 10:30 am June 5 when the air temperature was 69F, soil temperature at six inches was 55F, relative humidity was 55%, wind was 3-10 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, wild oats was just emerging to 4 inches tall, wild buckwheat was in the cotyledon to 3 leaf stage, and redroot pigweed was in the cotyledon to 2 leaf stage. The third postemergence application was 10:30 am June 14 when the air temperature was 51F, soil temperature at six inches was 59F, relative humidity was 75%, wind was 8-13 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, wild oats was 6 to 10 inches tall, wild buckwheat was in the 1 leaf stage to 2 inches tall, and redroot pigweed was in the cotyledon to 6 leaf stage. All postemergence treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and wild oats, wild buckwheat, and redroot pigweed control were evaluated in the untreated, EPTC+cycloate, and diethatyl strips June 30.

Treatment*	Rate (lb/A)	Untreated Sgbt inj	Untreated Wioa cntl	Untreated Wibw cntl	Untreated Rrpw cntl	EPTC+Cycloate Sgbt inj	EPTC+Cycloate Wioa cntl	EPTC+Cycloate Wibw cntl	EPTC+Cycloate Rrpw cntl	Diethatyl Sgbt inj	Diethatyl Wioa cntl	Diethatyl Wibw cntl	Diethatyl Rrpw cntl
		(%)											
No Postemergence Treatment	0	0	0	0	0	8	64	18	45	0	40	18	58
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	1	100	47	71	15	100	81	68	1	100	67	85
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	1	100	44	59	18	100	74	64	0	100	50	81
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	4	99	82	95	26	100	98	96	6	100	86	96
De&Ph/De&Ph/Seth+Sun-It	0.16/0.25/0.2+0.25G	5	100	78	60	13	100	92	73	4	100	75	85
De&Ph/De&Ph/Seth+Sun-It	0.25/0.33/0.2+0.25G	6	100	80	68	18	100	90	71	6	100	81	75
De&Ph/De&Ph/De&Ph+Seth+Sun-It	0.16/0.25/0.33+0.2+0.25G	8	100	96	94	25	100	97	95	15	100	98	98
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.09/0.2+0.25G	1	100	74	78	15	100	95	89	1	100	82	79
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.19/0.2+0.25G	8	100	92	85	25	100	98	95	10	100	97	98
Des+Clpy/Des+Clpy/Seth+Dash	0.16+0.09/0.25+0.09/0.2+0.25G	4	100	91	79	23	100	97	91	5	100	90	91
Des+Endo/Des+Endo/Seth+Dash	0.16+0.25/0.25+0.25/0.2+0.25G	0	100	50	76	10	100	80	79	1	100	61	80
De&Ph/De&Ph+Clpy/Seth+Sun-It	0.16/0.25+0.09/0.2+0.25G	1	100	74	68	14	100	95	78	9	100	86	85
DP+Clpy/DP+Clpy/Seth+Sun-It	0.16+0.09/0.25+0.09/0.2+0.25G	3	99	93	75	21	100	99	91	5	100	98	87

(experiment continued on next page)

Postemergence herbicides applied over soil applied herbicides, Cavalier, 1990. (continued)

Treatment*	Rate (lb/A)	Untreated Sgbt inj	Untreated Wioa cntl	Untreated Wibw cntl	Untreated Rrpw cntl	EPTC+Cycloate Sgbt inj	EPTC+Cycloate Wioa cntl	EPTC+Cycloate Wibw cntl	EPTC+Cycloate Rrpw cntl	Diethatyl Sgbt inj	Diethatyl Wioa cntl	Diethatyl Wibw cntl	Diethatyl Rrpw cntl
		(%)											
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	1	100	52	81	11	100	66	86	0	100	47	83
Des+DC1/Des+DC1/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	0	100	53	54	11	100	84	60	0	100	60	80
Des+DC2/Des+DC2/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	0	100	50	51	13	100	83	71	0	100	66	73
Des+DC3/Des+DC3/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	0	100	53	58	13	100	76	75	0	100	49	83
C.V. %		140	1	21	19	36	3	11	15	94	3	16	11
LSD 5%		5	1	20	18	8	4	13	17	5	4	16	13
LSD 1%		NS	2	26	24	11	5	17	23	7	5	21	18
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

* Dash = BASF adjuvant; Sun-It = sunflower methyl ester from Agsco; FB = 'Foam Buster' antifoaming agent; DC1 = X2 5309 surfactant from Dow Corning; DC2 = DC 193 surfactant from Dow Corning; DC3 = DC 1315 surfactant from Dow Corning

Summary

Sethoxydim gave nearly total control of wild oats. Sugarbeet injury from postemergence herbicides was greater when the sugarbeets were previously treated with EPTC+cycloate as compared to diethatyl or no treatment. Foam Buster plus desmedipham over EPTC+cycloate gave better control of redroot pigweed than desmedipham over EPTC+cycloate. Three applications of desmedipham or desmedipham&phenmedipham gave control of wild buckwheat and redroot pigweed superior to two applications. Addition of clopyralid to desmedipham or desmedipham & phenmedipham gave or tended to give better wild buckwheat control than desmedipham or desmedipham&phenmedipham alone.

Postemergence herbicides applied over soil applied herbicides, Hillsboro, 1990. Soil applied herbicides were applied in 22 foot strips across the postemergence plots. A strip was treated with diethatyl at 5 lb/A, another with EPTC+cycloate at 1.5+2 lb/A, and a third strip had no soil applied herbicide. Soil applied herbicides were applied in 18 gpa water at 40 psi through 8002 nozzles and incorporated twice with a tandem disk and harrow 11:30 am May 15 when the air temperature was 59F, soil temperature at six inches was 56F, relative humidity was 73%, wind was 10-17 mph, and the soil moisture was fair. 'Maribo 862' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 15. The first postemergence herbicide application was 1:30 pm May 30 when the air temperature was 80F, soil temperature at six inches was 62F, relative humidity was 30%, wind was 7-12 mph, soil moisture was good, sugarbeet was in the cotyledon stage, green foxtail was just emerging to 0.5 inches tall, and prostrate pigweed and redroot pigweed were in the cotyledon to 2 leaf stage. The second postemergence application was 5:30 pm June 6 when the air temperature was 71F, soil temperature at six inches was 63F, relative humidity was 45%, wind was 3-9 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, green foxtail was 0.5 to 1.5 inches tall, and prostrate pigweed and redroot pigweed were in the cotyledon to 4 leaf stage. The third postemergence application was 10:15 pm June 13 when the air temperature was 73F, soil temperature at six inches was 64F, relative humidity was 74%, wind was 4-8 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, green foxtail was 0.5 to 2 inches tall, and prostrate pigweed and redroot pigweed were in the cotyledon to 6 leaf stage. All postemergence treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Prostrate pigweed and redroot pigweed and green foxtail control and sugarbeet injury were evaluated in the untreated, EPTC+cycloate, and diethatyl strips June 23.

		Untreated			EPTC+Cycloate			Diethatyl		
Treatment*	Rate	Prpw or Rrpw cntl	Grft cntl	Sgbt inj	Prpw or Rrpw cntl	Grft cntl	Sgbt inj	Prpw or Rrpw cntl	Grft cntl	Sgbt inj
	(lb/A)	(%)								
No Postemergence Treatment	0	0	0	0	75	85	0	71	50	0
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	84	100	6	86	100	11	86	100	6
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	84	100	16	91	100	18	93	100	19
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	97	100	26	100	100	30	100	100	30
De&Ph/De&Ph/Seth+Sun-It	0.16/0.25/0.2+0.25G	78	100	9	83	100	10	85	100	9
De&Ph/De&Ph/Seth+Sun-It	0.25/0.33/0.2+0.25G	78	100	18	88	100	25	89	100	24
De&Ph/De&Ph/De&Ph+Seth+Sun-It	0.16/0.25/0.33+0.2+0.25G	95	100	25	96	100	31	97	100	29
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.09/0.2+0.25G	83	100	14	88	100	19	90	100	16
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.19/0.2+0.25G	83	100	16	91	100	23	90	100	21
Des+Clpy/Des+Clpy/Seth+Dash	0.16+0.09/0.25+0.09/0.2+0.25G	80	100	11	90	100	16	91	100	15
Des+Endo/Des+Endo/Seth+Dash	0.16+0.25/0.25+0.25/0.2+0.25G	79	100	8	86	100	13	89	100	10
De&Ph/De&Ph+Clpy/Seth+Sun-It	0.16/0.25+0.09/0.2+0.25G	84	100	18	89	100	19	91	100	20
DP+Clpy/DP+Clpy/Seth+Sun-It	0.16+0.09/0.25+0.09/0.2+0.25G	85	100	24	91	100	25	90	100	23

(experiment continued on next page)

Postemergence herbicides applied over soil applied herbicides, Hillsboro, 1990. (continued)

Treatment*	Rate	Untreated Prpw or Rrpw cntl	Untreated Grft cntl	Untreated Sgbt inj	EPTC+Cycloate Prpw or Rrpw cntl	EPTC+Cycloate Grft cntl	EPTC+Cycloate Sgbt inj	Diethatyl Prpw or Rrpw cntl	Diethatyl Grft cntl	Diethatyl Sgbt inj
	(lb/A)	(%)								
De+FB/De+FB/Seth+Dash	0.16+0.0625G/0.25+0.0625G/0.2+0.25G	79	100	1	83	100	9	85	100	4
Des+DC1/Des+DC1/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	80	100	9	88	100	11	88	100	9
Des+DC2/Des+DC2/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	78	100	9	86	100	14	89	100	10
Des+DC3/Des+DC3/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	81	100	6	89	100	10	90	100	9
C.V. %		8	0	41	5	2	28	5	0	34
LSD 5%		9	NS	7	6	2	7	6	0	7
LSD 1%		12	NS	10	9	3	9	8	0	10
# OF REPS		4	4	4	4	4	4	4	4	4

* Dash = BASF adjuvant; Sun-It = sunflower methyl ester from Agsco; FB = 'Foam Buster' antifoaming agent; DC1 = X2 5309 surfactant from Dow Corning; DC2 = DC 193 surfactant from Dow Corning; DC3 = DC 1315 surfactant from Dow Corning

Summary

Foam Buster and the Dow Corning surfactants did not improve pigweed spp. control from desmedipham. Three applications of desmedipham or desmedipham&phenmedipham gave or tended to give greater pigweed spp. control and sugarbeet injury than two applications. Sethoxydim + Dash gave total control of green foxtail.

<u>Postemergence herbicides applied over soil applied herbicides, Mooreton, 1990.</u> Soil applied herbicides were applied in 22 foot strips across the postemergence plots. A strip was treated with diethatyl at 5 lb/A, another with EPTC+cycloate at 1.5+2 lb/A, and a third strip had no soil applied herbicide. Soil applied herbicides were applied in 18 gpa water at 40 psi through 8002 nozzles and incorporated twice with a tandem disk and harrow 11:30 am May 18 when the air temperature was 53F, soil temperature at six inches was 49F, relative humidity was 48%, wind was 4-8 mph, and the soil moisture was good. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 18. The first postemergence herbicide application was 9:45 am June 7 when the air temperature was 64F, soil temperature at six inches was 58F, relative humidity was 70%, wind was 5-11 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, and redroot pigweed was in the 2 leaf stage. The second postemergence application was 3:00 pm June 13 when the air temperature was 83F, soil temperature at six inches was 74F, relative humidity was 43%, wind was 4-9 mph, soil moisture was good, sugarbeet was in the 2 to 4 leaf stage, and redroot pigweed was in the 1 to 6 leaf stage. The third postemergence application was 6:00 pm June 18 when the air temperature was 86F, soil temperature at six inches was 76F, relative humidity was 37%, wind was 3-5 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, and redroot pigweed was in the 4 to 6 leaf stage. All postemergence treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Redroot pigweed control and sugarbeet injury were evaluated in the untreated, EPTC+cycloate, and diethatyl strips June 29.

		Untreated		EPTC+Cyclo		Diethatyl	
Treatment*	Rate (lb/A)	Rrpw cntl	Sgbt inj	Rrpw cntl	Sgbt inj	Rrpw cntl	Sgbt inj
		(%)					
No Postemergence Treatment	0	0	0	74	13	91	1
Des/Des/Seth+Dash	.16/.25/.2+.25G	83	3	94	15	98	1
Des/Des/Seth+Dash	.25/.33/.2+.25G	81	5	93	16	99	3
Des/Des/Des+Seth+Dash	.16/.25/.33+.2+.25G	89	3	98	18	100	3
De&Ph/De&Ph/Seth+Sun-It	.16/.25/.2+.25G	76	0	92	13	97	1
De&Ph/De&Ph/Seth+Sun-It	.25/.33/.2+.25G	76	0	89	14	99	1
De&Ph/De&Ph/De&Ph+Seth+Sun-It	.16/.25/.33+.2+.25G	88	3	96	20	100	5
Des/Des+Clpy/Seth+Dash	.16/.25+.09/.2+.25G	88	0	95	14	100	1
Des/Des+Clpy/Seth+Dash	.16/.25+.19/.2+.25G	87	5	96	16	100	1
Des+Clpy/Des+Clpy/Seth+Dash	.16+.09/.25+.09/.2+.25G	88	10	96	25	100	4
Des+Endo/Des+Endo/Seth+Dash	.16+.25/.25+.25/.2+.25G	76	10	91	26	99	13
De&Ph/De&Ph+Clpy/Seth+Sun-It	.16/.25+.09/.2+.25G	79	4	93	15	100	1
DP+Clpy/DP+Clpy/Seth+Sun-It	.16+.09/.25+.09/.2+.25G	80	3	93	18	100	4
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	79	0	92	15	100	3
Des+DC1/Des+DC1/Seth+Dash	.16+.25%/.25+.25%/.2+.25G	84	3	95	20	100	4
Des+DC2/Des+DC2/Seth+Dash	.16+.25%/.25+.25%/.2+.25G	81	1	95	16	100	1
Des+DC3/Des+DC3/Seth+Dash	.16+.25%/.25+.25%/.2+.25G	79	1	93	15	100	1
C.V. %		6	126	3	33	1	97
LSD 5%		7	5	4	8	2	4
LSD 1%		9	7	5	NS	2	5
# OF REPS		4	4	4	4	4	4

* Dash = BASF adjuvant; Sun-It = sunflower methyl ester from Agsco; FB = 'Foam Buster' antifoaming agent; DC1 = X2 5309 surfactant from Dow Corning; DC2 = DC 193 surfactant from Dow Corning; DC3 = DC 1315 surfactant from Dow Corning

Summary

Postemergence herbicides over EPTC+cycloate caused greater sugarbeet injury than postemergence herbicides alone or postemergence herbicides over diethatyl. Postemergence herbicides over diethatyl gave nearly total control of redroot pigweed. Desmedipham & phenmedipham applied twice without a soil applied herbicide tended to give less redroot pigweed control than desmedipham applied twice. Foam Buster and the Dow Corning surfactants did not improve redroot pigweed control from desmedipham.

Postemergence herbicides applied over soil applied herbicides, combined data from Cavalier, Hillsboro, and Mooreton, 1990.

		3 locations combined						Cavalier		
		Untreated		EPTC+Cycl		Diethatyl		Untrt	EP+Cy	Diet
Treatment*	Rate	Sgbt inj	Rrpw cntl	Sgbt inj	Rrpw cntl	Sgbt inj	Rrpw cntl	Wibw cntl	Wibw cntl	Wibw cntl
	(lb/A)	(%)								
No Postemergence Treatment	0	0	0	7	65	0	73	0	18	18
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	3	79	14	82	3	90	47	81	67
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	8	75	17	83	7	91	44	74	50
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	11	94	25	98	13	98	82	98	86
De&Ph/De&Ph/Seth+Sun-It	0.16/0.25/0.2+0.25G	5	71	12	82	5	89	78	92	75
De&Ph/De&Ph/Seth+Sun-It	0.25/0.33/0.2+0.25G	8	74	19	83	10	88	80	90	81
De&Ph/De&Ph/De&Ph+Seth+Sun-It	0.16/0.25/0.33+0.2+0.25G	12	92	25	96	16	98	96	97	98
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.09/0.2+0.25G	5	83	16	91	6	90	74	95	82
Des/Des+Clpy/Seth+Dash	0.16/0.25+0.19/0.2+0.25G	10	85	21	94	11	96	92	98	97
Des+Clpy/Des+Clpy/Seth+Dash	0.16+0.09/0.25+0.09/0.2+0.25G	8	82	21	92	8	94	91	97	90
Des+Endo/Des+Endo/Seth+Dash	0.16+0.25/0.25+0.25/0.2+0.25G	6	77	16	85	8	89	50	80	61
De&Ph/De&Ph+Clpy/Seth+Sun-It	0.16/0.25+0.09/0.2+0.25G	8	77	16	86	10	92	74	95	86
D&P+Clpy/D&P+Clpy/Seth+Sun-It	0.16+0.09/0.25+0.09/0.2+0.25G	10	80	21	91	10	92	93	99	98
Des+FB/Des+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	1	80	12	87	2	89	52	66	47
Des+DC1/Des+DC1/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	4	73	14	81	4	89	53	84	60
Des+DC2/Des+DC2/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	3	70	14	84	4	87	50	83	66
Des+DC3/Des+DC3/Seth+Dash	0.16+0.25%/0.25+0.25%/0.2+0.25G	3	73	13	86	3	91	53	76	49
C.V. %		44	7	21	5	32	4	21	11	16
LSD 5%		4	7	5	6	3	5	20	13	16
LSD 1%		5	10	7	8	4	7	26	17	21
# OF REPS		4	4	4	4	4	4	4	4	4

* Dash = BASF adjuvant; Sun-It = sunflower methyl ester from Agsco; FB = 'Foam Buster' antifoaming agent; DC1 = X2 5309 surfactant from Dow Corning; DC2 = DC 193 surfactant from Dow Corning; DC3 = DC 1315 surfactant from Dow Corning

Postemergence herbicides over soil applied herbicides, Clara City, 1990. Preplant incorporated herbicides were applied 5:50 pm May 4 when the air temperature was 71F, soil temperature at six inches was 58F, relative humidity was 34%, wind was 5-10 mph, and soil moisture was good. Incorporation was with a rototiller set four inches deep. 'Maribo 862' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Preemergence treatments were applied May 4 after planting. All soil applied herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. The first postemergence herbicide application was 9:30 am May 29 when the air temperature was 60F, soil temperature at six inches was 59F, relative humidity was 69%, wind was 5 mph, soil moisture was good, and sugarbeets were in the 2 leaf stage. The second postemergence application was 11:00 am June 6 when the air temperature was 65F, soil temperature at six inches was 62F, relative humidity was 55%, wind was 8-10 mph, soil moisture was good, and sugarbeets were in the 4 leaf stage. The third postemergence application was 3:20 pm June 13 when the air temperature was 82F, soil temperature at six inches was 79F, relative humidity was 48%, wind was 10 mph, soil moisture was good, and sugarbeets were in the 6 leaf stage. All postemergence treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and green foxtail control were evaluated June 22.

Treatment*	Rate	Sgbt inj	Grft cntl
	(lb/A)	--- (%)	---
EPTC (ppi)	2.5	6	87
Cycloate (ppi)	4	1	93
EPTC+Cycloate (ppi)	1.5+2.5	6	98
Diethatyl (pre)	5	4	88
Ethofumesate (pre)	3.5	6	89
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	7	99
Des/Des+Clpy/Seth+Dash	0.25/0.33+0.09/0.2+0.25G	4	92
Des/Des+Clpy/Seth+Dash	0.25/0.33+0.19/0.2+0.25G	13	99
Des+Clpy/Des+Clpy/Seth+Dash	0.25+0.09/0.33+0.09/0.2+0.25G	4	82
Des/Des/Des+Seth+Dash	0.25/0.33/0.5+0.2+0.25G	11	90
Des+Endo/Des+Endo/Seth+Dash	0.25+0.25/0.33+0.25/0.2+0.25G	6	92
Des+FB/Des+FB/Seth+Dash	0.25+0.0625G/0.33+0.0625G/0.2+0.25G	12	99
EPTC (ppi)/Des/Des/Seth+Dash	2.5/0.16/0.25/0.2+0.25G	15	99
Cycl (ppi)/Des/Des/Seth+Dash	4/0.16/0.25/0.2+0.25G	9	99
EPTC+Cycl (ppi)/Des/Des/Seth+Dash	1.5+2.5/0.16/0.25/0.2+0.25G	6	91
Diet (pre)/Des/Des/Seth+Dash	5/0.16/0.25/0.2+0.25G	5	92
Etho (pre)/Des/Des/Seth+Dash	3.5/0.16/0.25/0.2+0.25G	6	99
EP+Cy(ppi)/D/D+Clpy/Seth+Dash	1.5+2.5/0.16/0.25+0.09/0.2+0.25G	10	93
EP+Cy(ppi)/D+Clp/D+Clp/Sth+Dsh	1.5+2.5/.16+.09/.25+.09/.2+.25G	10	99
EP+Cy(ppi)/De/De/De+Seth+Dash	1.5+2.5/0.16/0.25/0.33+0.2+0.25G	6	97
C.V. %		79	12
LSD 5%		NS	NS
LSD 1%		NS	NS
# OF REPS		4	4

* Dash = adjuvant from BASF; FB = 'Foam Buster' antifoaming agent

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative.

Summary

All treatments gave similar control of green foxtail and similar sugarbeet injury.

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

1990 Treatment*	Rate	Canada Thistle control, July 14, 1990
	(lb/A)	----- (%) ----
Clopyralid	0.09	55
Clopyralid	0.19	79
Clopyralid	0.25	85
Clopyralid+Dash	0.19+0.25G	70
Clopyralid+Sun-It	0.19+0.25G	76
Clopyralid/Clopyralid	0.095/0.095	95
Clopyralid/Clopyralid	0.125/0.125	96
--/Glyphosate+X-77	1.5+0.25%	93
--/Glyt+Clpy+X-77	1+0.19+0.25%	98
DPX-L5300+X-77	0.015+0.25%	51
Clopyralid+2,4-D	0.09+0.5	65
Clopyralid+Desmedipham	0.19+0.5	80
Dicamba+MCPA	0.12+0.25	38
Clopyralid (tilled 3 DAT)	0.19	70
Clopyralid (tilled 9 DAT)	0.19	69
Clopyralid (tilled 14 DAT)	0.19	83
HIGH MEAN		98
LOW MEAN		38
EXP MEAN		75
C.V. %		10
LSD 5%		10
LSD 1%		14
# OF REPS		4

* X-77 = non-ionic surfactant from Valent; Dash = adjuvant from BASF; Sun-It = sunflower methyl ester from Agsco

Summary

Dash and Sun-It as adjuvants did not improve Canada thistle control compared to clopyralid alone. Two applications of clopyralid gave Canada thistle control superior to a single application. Tillage 3 or 9 days after clopyralid application reduced or tended to reduce Canada thistle control compared to no tillage. Combining desmedipham with clopyralid did not affect Canada thistle control. Clopyralid+2,4-D gave better control than clopyralid alone at the same rate.

Canada thistle control, Fargo, 1989-1990. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12, 1989. Plots 34 feet long and nine rows wide were established in a dense population of Canada thistle. The single application treatments and the first half of split application treatments were applied May 31, 1989 when Canada thistle was emerging to six inches tall. The second half of split treatments was applied June 14, 1989 when Canada thistle was 5 to 10 inches tall. The bud stage treatments were applied June 26, 1989. Sugarbeets were cultivated June 8, June 14, and June 29, 1989. Canada thistle control was evaluated September 26, 1989. Sugarbeets were not harvested in 1989 due to gopher damage in the plot area. Ethofumesate at 5.0 lb/A was applied to the whole plot area and incorporated October 17, 1989. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 20, 1990. Desmedipham&Phenmedipham at 0.16 lb/A was applied to the whole plot area May 23, 1990. Treatments were applied 8:00 pm June 12, 1990 when the air temperature was 76F, soil temperature at six inches was 76F, relative humidity was 52%, wind was 2-4 mph, soil moisture was good, sugarbeets were in the 6 to 8 leaf stage, and Canada thistle was 3 to 10 inches tall. The second half of split application treatments and bud stage treatments were applied 9:00 am July 6, 1990 when the air temperature was 69F, soil temperature at six inches was 65F, relative humidity was 72%, wind was 5-12 mph, soil moisture was good, sugarbeets were in the 16 to 20 leaf stage, and Canada thistle was 16 to 28 inches tall. All treatments were applied in 8.5 gpa water at 38 psi through 8001 nozzles to eight rows of nine row plots. Sugarbeets were cultivated June 26, 1990. Plots were hand weeded throughout the 1989 and 1990 growing season to remove all weeds except Canada thistle. Canada thistle control was evaluated June 9 and September 12, 1990. Canada thistle was counted in 40 square feet of each plot July 19, 1990. Two center rows of sugarbeets 34 feet long were harvested and counted September 17, 1990.

Table 1.

		Evaluation after one application		Evaluation after two applications	
Treatment*	Rate	9/18/89 CATH cntl	6/09/90 CATH cntl	9/12/90 CATH cntl	7/19/90 CATH Plants
	(lb/A)	------------	(%)	------------	($40ft^2$)
Untreated Check	0	0	0	0	83
Clopyralid	0.09	66	68	98	6
Clopyralid	0.19	84	95	100	2
Clopyralid	0.25	64	67	100	3
Clopyralid+Desmedipham	0.19+0.5	82	87	100	3
Clopyralid+Desmedipham	0.25+0.5	87	87	100	3
Clopyralid+Dash	0.09+0.25G	53	68	100	9
Clopyralid+Dash	0.19+0.25G	88	83	100	1
Clopyralid+Dash	0.25+0.25G	86	88	98	3
Clopyralid+Endothall	0.19+0.75	79	87	100	3
Clopyralid+Sun-It	0.19+0.25G	74	92	99	2
Clopyralid+OC	0.19+0.25G	81	85	99	2
Clopyralid/Clopyralid	0.095/0.095	79	80	100	0
Clopyralid/Clopyralid	0.125/0.125	88	90	100	1
Glyphosate+X-77 (bud stage)	1.5+0.25%	59	85	97	4
Glyt+Dicamba+X-77(bud stage)	1+0.25+0.25%	64	80	99	11
Glyt+Clpy+X-77 (bud stage)	1+0.19+0.25%	60	72	96	19
Untreated Check	0	0	0	13	81
C.V. %		22	18	6	87
LSD 5%		20	22	9	19
LSD 1%		27	29	13	26
# OF REPS		4	3	3	3

(experiment continued on next page)

Canada thistle control, Fargo, 1989-1990. (continued)

Table 2.

Treatment*	Rate	Sgbt Popl	Sucrose	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	(lb/A)	(/68ft)	(%)	(%)	(ton/A)		(lb/A)
Untreated Check	0	48	17.4	2.1	10.6	906	3210
Clopyralid	0.09	66	16.6	2.1	14.9	940	4218
Clopyralid	0.19	75	17.1	2.4	16.6	1059	4798
Clopyralid	0.25	70	16.9	2.4	17.3	1056	4922
Clopyralid+Desmedipham	0.19+0.5	63	17.7	2.5	14.5	1025	4345
Clopyralid+Desmedipham	0.25+0.5	61	16.1	2.5	15.0	1134	4025
Clopyralid+Dash	0.09+0.25G	72	17.5	2.3	14.8	953	4443
Clopyralid+Dash	0.19+0.25G	62	16.9	2.1	12.3	923	3603
Clopyralid+Dash	0.25+0.25G	78	17.7	2.2	15.8	921	4772
Clopyralid+Endothall	0.19+0.75	65	17.1	2.2	13.1	932	3828
Clopyralid+Sun-It	0.19+0.25G	69	16.9	2.4	14.8	1025	4236
Clopyralid+OC	0.19+0.25G	50	16.7	2.2	11.1	976	3283
Clopyralid/Clopyralid	0.095/0.095	72	17.3	2.3	14.8	977	4386
Clopyralid/Clopyralid	0.125/0.125	79	16.2	2.3	16.9	1057	4599
Glyphosate+X-77 (July 6)	1.5+0.25%	--	----	---	----	----	----
Glyt+Dicamba+X-77(July6)	1+0.25+0.25%	--	----	---	----	----	----
Glyt+Clpy+X-77 (July 6)	1+0.19+0.25%	--	----	---	----	----	----
Untreated Check	0	40	16.7	2.2	6.8	988	1944
C.V. %		21	5.4	11.0	23.9	14	24
LSD 5%		NS	NS	NS	5.6	NS	NS
LSD 1%		NS	NS	NS	NS	NS	NS
# OF REPS		3	3	3	3	3	3

* Dash = BASF adjuvant; Sun-It = sunflower methyl ester from Agsco;
OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis;
X-77 = non-ionic surfactant from Valent

Summary

Canada thistle control was evaluated in September 1989 about four months after the first herbicide application, and in June 1990, about one year after the first application but prior to the second herbicide application. Canada thistle control in June 1990 was similar to or greater than control in September 1989. In June 1990, clopyralid at 0.19 lb/A gave better control than 0.09 lb/A but 0.25 lb/A gave less control than 0.19 lb/A for reasons unknown. Adding desmedipham, endothall, or oil additive to clopyralid had no significant effect on control of Canada thistle. Split application of clopyralid gave control of Canada thistle similar to single full rate applications. Glyphosate+X-77 at 1.5 lb/A+0.25% gave Canada thistle control similar to clopyralid at 0.19 lb/A. Glyphosate+clopyralid+X-77 at 1+0.19lb/A + 0.25% gave less Canada thistle control than clopyralid at 0.19 lb/A. Canada thistle control in September of 1990 after two applications of each treatment was excellent with all treatments. Sugarbeet yields were variable in the experiment and no significant differences were detected.

Common cocklebur control with postemergence herbicides, Clara City, 1990. This experiment was established in a commercial sugarbeet field seeded with 'KW 3265' May 10, 1990. The first herbicide application was 1:00 pm June 4 when the air temperature was 61F, soil temperature at six inches was 62F, relative humidity was 67%, soil moisture was good, sugarbeet was in the cotyledon stage, and common cocklebur was in the 2 leaf stage. The second application was 9:30 am June 14 when the air temperature was 68F, soil temperature at six inches was 65F, relative humidity was 75%, wind was 0-5 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, and common cocklebur was in the 2 to 4 leaf stage. The third application was 10:30 am June 21 when the air temperature was 68F, soil temperature at six inches was 73F, relative humidity was 72%, wind was 0 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, and common cocklebur was in the 4 to 6 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common cocklebur control were evaluated June 22.

Treatment*	Rate	Sugarbeet injury	Common Cocklebur control
	(lb/A)	--------- (%)	---------
Des&Phen/Des/--	0.2/0.33/--	0	28
Des&Phen/Des+Clpy/--	0.2/0.33+0.09/--	0	86
Des&Phen/Des&Phen/--	0.2/0.33/--	0	51
Des&Phen/Des&Phen+Clpy/--	0.2/0.33+0.09/--	0	63
Des&Phen/Des/Des	0.2/0.33/0.5	0	35
Des&Phen/Des/Des+Clpy	0.2/0.33/0.5+0.19	0	80
Des&Phen/Des+Clpy-WSG/--	0.2/0.33+0.09/--	0	84
Des&Phen/Des+Endo/--	0.2/0.33+0.25/--	0	56
De&Ph/Clpy/--	0.2/0.09/--	0	68
De&Ph/Clpy/--	0.2/0.19/--	0	85
De&Ph/Clpy-WSG/--	0.2/0.09/--	0	54
De&Ph/Clpy+Enhance/--	0.2/0.09+0.5%/--	0	68
De&Ph/Clpy-WSG+Enhance/--	0.2/0.09+0.5%/--	0	64
De&Ph/Clpy+L-77/--	0.2/0.09+0.25%/--	0	73
De&Ph/Clpy-WSG+L-77/--	0.2/0.09+0.25%/--	0	65
De&Ph/Clpy+Sun-It/--	0.2/0.09+0.25G/--	0	80
De&Ph/Clpy-WSG+Sun-It/--	0.2/0.09+0.25G/--	0	66
De&Ph/Clpy+Endo/--	0.2/0.09+0.5/--	0	89
De&Ph/Clpy+Endo/--	0.2/0.19+0.5/--	0	95
C.V. %		0	14
LSD 5%		NS	13
LSD 1%		NS	18
# OF REPS		4	4

* WSG = water-soluble granule; Sun-It = sunflower methyl ester from Agsco; L-77 = adjuvant from Dow; Enhance = adjuvant from Dow

Summary

The treatment including clopyralid water soluble granules used alone with no adjuvant gave or tended to give less control of common cocklebur than treatments including clopyralid, clopyralid+desmedipham, or clopyralid water soluble granules plus the adjuvants L-77, Enhance, or Sun-It. Clopyralid + endothall at 0.09+0.5 lb/A gave common cocklebur control superior to clopyralid at 0.09 lb/A.

<u>Common sunflower control with clopyralid, Benson, 1990.</u> This experiment was established in a commercial sugarbeet field seeded with 'Hilleshog 5135' sugarbeet May 11. The first half of split application treatments and all single application treatments were applied May 28 when the air temperature was 62F, relative humidity was 85%, wind was 0 to 5 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, and common sunflower was in the 4 leaf stage. The second half of split treatments was applied June 4 when the air temperature was 63F, relative humidity was 80%, wind was 5 to 10 mph, soil moisture was good, sugarbeet was in the 4 to 8 leaf stage, and common sunflower was in the 4 to 8 leaf stage. All treatments were applied in 10 gpa water at 40 psi to the center four rows of six row plots. Sugarbeet injury was evaluated June 12. Common sunflower control was evaluated June 12 and July 2.

Treatment	Rate	- June Sgbt inj	12 - Cosf cntl	July 2 Cosf cntl
	(lb/A)	--------	(%)	--------
Clopyralid/--	0.0625/--	1	51	90
Clopyralid/--	0.125/--	0	59	94
Clopyralid/--	0.19/--	0	59	91
Clopyralid/Clopyralid	0.0625/0.0625	0	61	94
Clopyralid+Desmed&Phenmed/--	0.125+0.25	6	73	95
Clpy+Des&Phen/Clpy+Des&Phen	0.0625+0.25/0.0625+0.33	13	90	96
Clpy+Des&Phen/Clpy+Des&Phen	0.09+0.25/0.09+0.33	16	88	97
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	13	33	3
Clopyralid/Desmedipham&Phenmedipham	0.125/0.33	6	84	97
Desmedipham&Phenmedipham/Clopyralid	0.25/0.125	0	66	94
Clopyralid+Des&Phen/Des&Phen	0.125+0.25/0.33	13	85	96
Des&Phen/Clopyralid+Des&Phen	0.25/0.125+0.33	16	81	94
Untreated Check	0	0	0	0
HIGH MEAN		16	90	97
LOW MEAN		0	0	0
EXP MEAN		6	64	80
C.V. %		54	14	5
LSD 5%		5	13	6
LSD 1%		7	18	8
# OF REPS		4	4	4

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative.

Summary

Visual evaluations of control were greater on July 2 than on June 12, except for desmedipham&phenmedipham. All treatments that included clopyralid gave over 90% control of common sunflower on July 2.

Giant ragweed control with clopyralid, Stewart, 1990. This experiment was established in a commercial sugarbeet field seeded with 'Hilleshog 5135' sugarbeet May 6. The first half of split application treatments and all single application treatments were applied May 22 when the air temperature was 70F, relative humidity was 55%, wind was 15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, and giant ragweed was 2 inches tall. Heavy rains (1.5 to 2 inches) fell 3.5 hours after herbicide application May 22. The second half of split treatments was applied June 4 when the air temperature was 67F, relative humidity was 59%, wind was 5 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, and giant ragweed was in the 4 to 6 leaf stage. All treatments were applied in 10 gpa water to the center four rows of six row plots. Sugarbeet injury was evaluated June 11. Giant ragweed was evaluated June 11 and June 19.

Treatment	Rate	- June Sgbt inj	11 - Girw cntl	June19 Girw cntl
	(lb/A)	--------	(%)	--------
Clopyralid/--	0.0625/--	0	56	76
Clopyralid/--	0.125/--	0	74	90
Clopyralid/--	0.19/--	0	81	93
Clopyralid/Clopyralid	0.0625/0.0625	0	71	89
Clopyralid+Desmed&Phenmed/--	0.125+0.25	0	81	84
Clpy+Des&Phen/Clpy+Des&Phen	0.0625+0.25/0.0625+0.33	0	80	94
Clpy+Des&Phen/Clpy+Des&Phen	0.09+0.25/0.09+0.33	0	86	96
Desmed&Phenmed/Desmed&Phenmed	0.25/0.33	3	25	36
Clopyralid/Desmedipham&Phenmedipham	0.125/0.33	0	84	94
Desmedipham&Phenmedipham/Clopyralid	0.25/0.125	0	68	90
Clopyralid+Des&Phen/Des&Phen	0.125+0.25/0.33	3	83	88
Des&Phen/Clopyralid+Des&Phen	0.25/0.125+0.33	0	60	93
Untreated Check	0	0	0	0
HIGH MEAN		3	86	96
LOW MEAN		0	0	0
EXP MEAN		0	65	79
C.V. %		488	14	11
LSD 5%		NS	14	13
LSD 1%		NS	18	17
# OF REPS		4	4	4

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative.

Summary

Visual evaluations of control were greater on June 19 than on June 11. On June 19, clopyralid at 0.125 lb/A gave giant ragweed control superior to clopyralid at 0.0625 lb/A and similar to 0.19 lb/A. Split application of clopyralid gave control similar to a single full rate application. Clopyralid plus desmedipham&phenmedipham gave giant ragweed control similar to clopyralid alone but superior to desmedipham&phenmedipham.

Postemergence grass herbicides, Casselton, 1990. 'ND810104' oats at 61 lb/A and 'Siberian' foxtail millet at 15 lb/A were seeded in 12 foot strips across herbicide plots April 25. 'Bush Johnson BJ1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. Counter 15G was applied at 12 lb/A product using a modified in-furrow system at planting. Herbicides were applied 10:00 pm June 6 when the air temperature was 68F, soil temperature at six inches was 68F, relative humidity was 72%, wind was 1-3 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, oats was 10 to 12 inches tall, and foxtail millet was 5 to 6 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 23. Oats and foxtail millet were evaluated June 23 and July 7.

		------ June 23 -----			-- July 7 --	
Treatment*	Rate	Oats cntl	Ftmi cntl	Sgbt inj	Oats cntl	Ftmi cntl
	(lb/A)	---------------		(%)	---------------	
Fluazifop-P+OC	0.125+0.25G	99	64	0	99	74
Fluazifop-P+OC	0.18+0.25G	100	81	0	100	86
Sethoxydim+Dash	0.1+0.25G	98	99	0	98	100
Sethoxydim+Dash	0.2+0.25G	99	99	0	99	100
Sethoxydim+Dash+AMS	0.1+0.25G+2.5	99	99	0	98	100
Sethoxydim+Sun-It	0.1+0.25G	99	99	0	98	100
Sethoxydim+Sun-It+AMS	0.1+0.25G+2.5	99	99	0	99	100
Fenoxaprop-P+OC	0.05+0.25G	83	99	0	76	100
Fenoxaprop-P+OC	0.1+0.25G	99	100	0	93	100
Clethodim+OC	0.05+0.25G	100	100	0	100	100
Clethodim+OC	0.1+0.25G	100	100	0	100	100
DPX-Y6202-38+OC	0.05+0.25G	91	94	0	86	100
DPX-Y6202-38+OC	0.1+0.25G	99	100	0	98	100
HIGH MEAN		100	100	0	100	100
LOW MEAN		83	64	0	76	74
EXP MEAN		97	95	0	96	97
C.V. %		2	4	0	3	4
LSD 5%		3	5	NS	4	5
LSD 1%		4	6	NS	6	7
# OF REPS		4	4	4	4	4

* AMS = ammonium sulfate; Sun-It = sunflower methyl ester from Agsco;
OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis;
Dash = adjuvant from BASF

Summary

Fenoxaprop at 0.05 or 0.1 lb/A and DPX-Y6202-38 at 0.05 lb/A gave less oats control than the other treatments. Fluazifop at 0.125 or 0.18 lb/A gave less foxtail millet control than the other treatments.

Russian thistle control with postemergence herbicides, Euclid, 1990. This experiment was established in a commercial sugarbeet field with a dense population of Russian thistle. Herbicide treatments were applied 10:00 am May 24 when the air temperature was 71F, soil temperature at six inches was 58F, relative humidity was 57%, wind was 5 to 8 mph, soil moisture was fair, sugarbeet was in the cotyledon to 2 leaf stage, and Russian thistle was 0.5 to 1.5 inches tall. Russian thistle control was evaluated June 14 and June 26. The mean of the two evaluations is presented here.

Treatment*	Rate (lb/A)	Russian Thistle control (%)
Clopyralid	0.09	49
Clopyralid	0.19	61
Clopyralid+Sethoxydim+OC	0.09+0.2+0.25G	64
Clopyralid+Sethoxydim+OC	0.19+0.2+0.25G	74
Clopyralid+Desmed&Phenmed	0.09+0.25	87
Clopyralid+Desmed&Phenmed	0.19+0.25	95
HIGH MEAN		95
LOW MEAN		49
EXP MEAN		72
C.V. %		11
LSD 5%		12
LSD 1%		16
# OF REPS		4

* OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis

Summary

Clopyralid+sethoxydim+OC gave Russian thistle control superior to clopyralid alone and clopyralid+desmedipham&phenmedipham gave Russian thistle control superior to clopyralid+sethoxydim+OC.

Velvetleaf and common sunflower control with postemergence herbicides, Benson, 1990. This experiment was established in a commercial field seeded to 'Hilleshog 5135' sugarbeet May 15. The first herbicide application was 10:30 am June 5 when the air temperature was 62F, soil temperature at six inches was 55F, relative humidity was 85%, wind was 5 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, velvetleaf was in the cotyledon to 4 leaf stage, and common sunflower was in the 4 leaf stage. The second herbicide application was 8:30 am June 8 when the wind was 5-10 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, velvetleaf was in the 2 to 4 leaf stage, and common sunflower was in the 4 to 6 leaf stage. The third herbicide application was applied 4:30 pm June 18 when the wind was 0-5 mph, soil moisture was good, sugarbeet was in the 6 to 8 leaf stage, velvetleaf was in the 4 to 6 leaf stage, and common sunflower was in the 6 to 8 leaf stage. Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles. Sugarbeet injury and velvetleaf control were evaluated June 21. Common sunflower control was evaluated June 21 and July 2.

		----June	21----		July2
Treatment*	Rate	Sgbt inj	Vele cntl	Cosf cntl	Cosf cntl
	(lb/A)	---------	(%)	--------	
Des/Des/--	0.25/0.33/--	0	3	3	3
Des/Des+Clopyralid/--	0.25/0.33+0.09/--	1	60	83	97
Des+Clpy/Des+Clpy/--	0.25+0.09/0.33+0.09/--	3	71	94	96
Des&Phen/Des&Phen/--	0.25/0.33/--	3	25	0	18
Des&Phen+Clpy/Des&Phen+Clpy/--	0.25+0.09/0.33+0.09/--	0	51	96	95
Des/Des/Des	0.25/0.33/0.5	4	34	3	5
Des/Des/Des+Clopyralid	0.25/0.33/0.5+0.19	9	79	94	98
Des+Clpy-WSG/Des+Clpy-WSG/--	0.25+0.09/0.33+0.09/--	0	56	93	92
Des+Endo/Des+Endo/--	0.25+0.25/0.33+0.25/--	1	28	44	14
--/Clopyralid/--	--/0.09/--	0	0	83	97
--/Clopyralid/--	--/0.19/--	0	0	84	96
--/Clopyralid-WSG/--	--/0.09/--	0	0	74	86
--/Clopyralid+Enhance/--	--/0.09+0.5%/--	0	0	74	92
--/Clopyralid-WSG+Enhance/--	--/0.09+0.5%/--	0	0	70	95
--/Clopyralid+L-77/--	--/0.09+0.25%/--	0	0	84	93
--/Clopyralid-WSG+L-77/--	--/0.09+0.25%/--	0	0	86	95
--/Clopyralid+Sun-It/--	--/0.09+0.25G/--	0	0	85	95
--/Clopyralid+Endo/--	--/0.09+0.5/--	0	41	93	94
--/Clopyralid+Endo/--	--/0.19+0.5/--	1	33	91	94
C.V. %		269	54	10	10
LSD 5%		4	19	10	10
LSD 1%		NS	26	14	14
# OF REPS		4	4	4	4

* WSG = water-soluble granule; Sun-It = sunflower methyl ester from Agsco; L-77 = adjuvant from Dow; Enhance = adjuvant from Dow

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative.

SUMMARY: Desmedipham+clopyralid or desmedipham&phenmedipham+clopyralid gave better control of velvetleaf than desmedipham, clopyralid, or desmedipham & phenmedipham alone. Clopyralid water soluble granules in combination with desmedipham tended to give less velvetleaf control than desmedipham in combination with clopyralid. Common sunflower control from treatments that included clopyralid generally was greater on July 2 than on June 21. On July 2, treatments without clopyralid gave poor common sunflower control. All clopyralid treatments except clopyralid water soluble granules at 0.09 lb/A gave 92% or greater control of common sunflower. Clopyralid water soluble granules plus Enhance or L-77 adjuvants tended to give common sunflower control superior to clopyralid water soluble granules without adjuvant.

Wild buckwheat control, Casselton, 1990. Wild buckwheat was seeded with a grain drill at 15 lb/A in 25 foot strips across the 40 foot long herbicide plots April 25. 'Bush Johnson BJ1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. The first herbicide application was 11:15 am May 25 when the air temperature was 72F, soil temperature at six inches was 58F, relative humidity was 57%, wind was 10-15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, common lambsquarters was in the 2 to 8 leaf stage, and wild buckwheat was in the cotyledon to 1 leaf stage. The second herbicide application was 8:30 pm June 6 when the air temperature was 68F, soil temperature at six inches was 68F, relative humidity was 72%, wind was 1-3 mph, soil moisture was good, sugarbeet was in the 4 to 6 leaf stage, common lambsquarters was 4 leaf to 2.5 inches tall, and wild buckwheat was in the 1 to 5 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 20. Common lambsquarters and wild buckwheat control were evaluated June 20 and July 3. The means of the two evaluations are presented here.

Treatment*	Rate	Sugarbeet injury	Common Lambsquarters control	Wild Buckwheat control
	(lb/A)		(%)	
Clopyralid/--	0.09/--	0	67	64
Clopyralid/--	0.19/--	0	94	88
Endothall/--	0.5/--	0	0	9
Endothall/--	0.75/--	0	0	16
Desmed&Phenmed/--	0.33/--	0	85	29
Clopyralid+Dash/--	0.09+0.25G/--	0	85	75
Clopyralid+Dash/--	0.19+0.25G/--	3	97	86
Clopyralid+Sun-It/--	0.19+0.25G/--	0	97	90
Clopyralid+OC/--	0.19+0.25G/--	3	95	83
Clopyralid+Endothall/--	0.09+0.5/--	0	68	66
Clopyralid+Endothall/--	0.09+0.75/--	0	73	74
Clopyralid+Endothall/--	0.19+0.5/--	0	89	90
Clopyralid+Endothall/--	0.19+0.75/--	0	87	87
Clopyralid+Des&Phen/--	0.09+0.33/--	3	94	67
Clopyralid+Des&Phen/--	0.19+0.33/--	0	95	81
--/Clopyralid	--/0.09	0	16	71
--/Clopyralid	--/0.19	3	56	94
--/Endothall	--/0.75	8	3	98
--/Endothall	--/1	5	1	99
--/Desmed&Phenmed	--/0.5	3	70	73
--/Clopyralid+Dash	--/0.09+0.25G	3	45	79
--/Clopyralid+Dash	--/0.19+0.25G	0	74	94
--/Clopyralid+Sun-It	--/0.19+0.25G	0	72	92
--/Clopyralid+OC	--/0.19+0.25G	3	65	95
--/Clopyralid+Endothall	--/0.09+0.5	4	37	98
--/Clopyralid+Endothall	--/0.09+0.75	13	18	100
--/Clopyralid+Endothall	--/0.19+0.5	13	68	100
--/Clopyralid+Endothall	--/0.19+0.75	18	58	100
--/Clopyralid+Des&Phen	--/0.09+0.5	0	83	94
--/Clopyralid+Des&Phen	--/0.19+0.5	0	87	99
C.V. %		170	15	8
LSD 5%		6	13	9
LSD 1%		8	18	11
# OF REPS		4	4	4

* Dash = BASF adjuvant; OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis; Sun-It = sunflower methyl ester from Agsco

(experiment continued on next page)

Summary

Clopyralid at 0.19 lb/A gave surprisingly good control of 2 to 8 leaf common lambsquarters. Clopyralid plus desmedipham&phenmedipham gave better control of 1 to 2.5 inch tall common lambsquarters than clopyralid alone or desmedipham&phenmedipham alone. Endothall gave very poor control of 1 leaf wild buckwheat but nearly total control of 1 to 5 leaf wild buckwheat. Clopyralid at 0.19 lb/A gave 88% control of 1 leaf wild buckwheat and 94% control of 1 to 5 leaf wild buckwheat. Clopyralid+endothall gave or tended to give better wild buckwheat control than clopyralid alone.

Wild buckwheat control, Casselton, 1990. Wild buckwheat was seeded with a grain drill at 15 lb/A in 25 foot strips across the 40 foot long herbicide plots April 25. 'Bush Johnson BJ1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. The first herbicide application was 11:15 am May 25 when the air temperature was 72F, soil temperature at six inches was 58F, relative humidity was 57%, wind was 10-15 mph, soil moisture was good, sugarbeet was in the 2 leaf stage, common lambsquarters was in the 2 to 8 leaf stage, and wild buckwheat was in the cotyledon to 1 leaf stage. The second herbicide application was 8:25 am May 31 when the air temperature was 66F, soil temperature at six inches was 60F, relative humidity was 62%, wind was 7-12 mph, soil moisture was good, sugarbeet was in the 4 leaf stage, common lambsquarters was in the 4 to 8 leaf stage, and wild buckwheat was in the 1 to 2 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 20. Common lambsquarters and wild buckwheat control were evaluated June 20 and July 3. The means of the two evaluations are presented here.

Treatment*	Rate	Sgbt inj	Wibw cntl	Colq cntl
	(lb/A)	-----------	(%)	----------
Clopyralid/--	0.09/--	0	61	58
Clopyralid/--	0.19/--	8	86	82
--/Clopyralid	--/0.09	0	64	9
--/Clopyralid	--/0.19	4	83	53
Clpy/Clpy	0.09/0.09	8	88	81
Clpy+Dash/Clpy+Dash	0.09+0.25G/0.09+0.25G	9	96	91
Des&Phen/Des&Phen	0.25/0.33	14	56	93
De&Ph+Endo/De&Ph+Endo	0.25+0.25/0.33+0.33	14	80	93
De&Ph+Clpy/De&Ph+Clpy	0.25+0.09/0.33+0.09	15	91	99
De&Ph+Clpy/De&Ph+Clpy	0.25+0.19/0.25+0.19	24	99	100
Endothall/Endothall	0.5/0.5	0	75	0
Endothall/--	0.75/--	0	14	1
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.09	13	68	97
Des&Phen+Clpy/Des&Phen	0.25+0.09/0.33	14	81	98
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.19	18	77	99
C.V. %		35	9	8
LSD 5%		5	10	8
LSD 1%		6	13	11
# OF REPS		4	4	4

* Dash = BASF adjuvant

Summary

Clopyralid at 0.09 lb/A plus desmedipham&phenmedipham gave sugarbeet injury similar to desmedipham&phenmedipham alone. However, clopyralid at 0.19 lb/A plus desmedipham&phenmedipham gave more sugarbeet injury than desmedipham & phenmedipham alone. Split applied clopyralid plus desmedipham&phenmedipham gave better wild buckwheat control than endothall plus desmedipham & phenmedipham. Two applications of clopyralid at 0.09 lb/A gave weed control and sugarbeet injury similar to the early single application of clopyralid at 0.19 lb/A.

Wild buckwheat control, St. Thomas, 1990. Wild buckwheat was seeded with a grain drill at 15 lb/A in 18 foot strips across the 32 feet long herbicide plots May 10. 'Hilleshog 5135' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 14. The first herbicide application was 12:55 pm June 6 when the air temperature was 75F, soil temperature at six inches was 61F, relative humidity was 41%, wind was 8-16 mph, soil moisture was good, sugarbeet was in the 2 leaf stage and wild buckwheat was in the 1 leaf stage. The second herbicide application was 3:00 pm June 14 when the air temperature was 62F, soil temperature at six inches was 68F, relative humidity was 64%, wind was 2-6 mph, soil moisture was good, sugarbeet was in the 4 leaf stage and wild buckwheat was in the cotyledon to 4 leaf stage. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 30. Wild buckwheat control was evaluated June 30 and July 6. The means of the two wild buckwheat evaluations are presented here.

Treatment*	Rate (lb/A)	Sugarbeet injury	Wild Buckwheat control
		---------- (%)	---------
Clopyralid/--	0.09/--	3	53
Clopyralid/--	0.19/--	5	79
--/Clopyralid	--/0.09	1	49
--/Clopyralid	--/0.19	3	75
Clpy/Clpy	0.09/0.09	6	79
Clpy+Dash/Clpy+Dash	0.09+0.25G/0.09+0.25G	11	93
Des&Phen/Des&Phen	0.25/0.33	1	43
De&Ph+Endo/De&Ph+Endo	0.25+0.25/0.33+0.33	9	72
De&Ph+Clpy/De&Ph+Clpy	0.25+0.09/0.33+0.09	11	90
De&Ph+Clpy/De&Ph+Clpy	0.25+0.19/0.25+0.19	24	98
Endothall/Endothall	0.5/0.5	6	74
Endothall/--	0.75/--	6	25
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.09	4	73
Des&Phen+Clpy/Des&Phen	0.25+0.09/0.33	6	79
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.19	11	81
C.V. %		81	10
LSD 5%		8	10
LSD 1%		11	13
# OF REPS		4	4

*Dash = BASF adjuvant

Summary

Clopyralid at 0.19 lb/A plus desmedipham and phenmedipham applied twice gave more sugarbeet injury than other treatments and gave greater wild buckwheat control than all treatments except clopyralid+Dash applied twice and clopyralid at 0.09 lb/A plus desmedipham and phenmedipham applied twice.

Wild buckwheat control, St. Thomas, 1990. Wild buckwheat was seeded with a grain drill at 15 lb/A in 18 foot strips across the 32 feet long herbicide plots May 10. 'Hilleshog 5135' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 14. The first herbicide application was 12:55 pm June 6 when the air temperature was 75F, soil temperature at six inches was 61F, relative humidity was 41%, wind was 8-16 mph, soil moisture was good, sugarbeet was in the 2 leaf stage and wild buckwheat was in the 1 leaf stage. The second herbicide application was 2:30 pm June 22 when the air temperature was 73F, soil temperature at six inches was 71F, relative humidity was 61%, wind was 5-12 mph, soil moisture was good, sugarbeet was in the 6 to 8 leaf stage and wild buckwheat was in the 2 leaf stage to 6 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury was evaluated June 30. Wild buckwheat control was evaluated June 30 and July 6. The means of the two evaluations are presented here.

Treatment*	Rate (lb/A)	Sugarbeet injury (%)	Wild Buckwheat control (%)
Clopyralid/--	0.09/--	4	44
Clopyralid/--	0.19/--	1	77
Endothall/--	0.5/--	0	17
Endothall/--	0.75/--	1	51
Desmed&Phenmed/--	0.33/--	0	21
Clopyralid+Dash/--	0.09+0.25G/--	1	66
Clopyralid+Dash/--	0.19+0.25G/--	13	85
Clopyralid+Sun-It/--	0.19+0.25G/--	6	90
Clopyralid+OC/--	0.19+0.25G/--	9	82
Clopyralid+Endothall/--	0.09+0.5/--	5	66
Clopyralid+Endothall/--	0.09+0.75/--	5	69
Clopyralid+Endothall/--	0.19+0.5/--	6	88
Clopyralid+Endothall/--	0.19+0.75/--	0	73
Clopyralid+Des&Phen/--	0.09+0.33/--	4	64
Clopyralid+Des&Phen/--	0.19+0.33/--	8	77
--/Clopyralid	--/0.09	0	48
--/Clopyralid	--/0.19	3	70
--/Endothall	--/0.75	9	87
--/Endothall	--/1	6	91
--/Desmed&Phenmed	--/0.5	3	39
--/Clopyralid+Dash	--/0.09+0.25G	3	52
--/Clopyralid+Dash	--/0.19+0.25G	10	72
--/Clopyralid+Sun-It	--/0.19+0.25G	9	73
--/Clopyralid+OC	--/0.19+0.25G	10	72
--/Clopyralid+Endothall	--/0.09+0.5	8	92
--/Clopyralid+Endothall	--/0.09+0.75	14	97
--/Clopyralid+Endothall	--/0.19+0.5	18	95
--/Clopyralid+Endothall	--/0.19+0.75	20	97
--/Clopyralid+Des&Phen	--/0.09+0.5	4	72
--/Clopyralid+Des&Phen	--/0.19+0.5	15	84
C.V. %		71	11
LSD 5%		6	11
LSD 1%		8	14
# OF REPS		4	4

* Dash = BASF adjuvant; OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis; Sun-It = sunflower methyl ester from Agsco

(experiment continued on next page)

Summary

Combination treatments that included clopyralid at 0.19 lb/A gave or tended to give greater sugarbeet injury than clopyralid alone at 0.19 lb/A, clopyralid at 0.09 lb/A whether alone or in combination, or desmedipham and phenmedipham. Endothall gave very poor control of 1 leaf wild buckwheat but good control of 2 leaf to 6 inch long wild buckwheat. Clopyralid plus endothall controlled 2 leaf to 6 inch long wild buckwheat better than clopyralid plus desmedipham and phenmedipham but clopyralid plus desmedipham and phenmedipham was similar to clopyralid plus endothall on 1 leaf wild buckwheat.

Biological control of common mallow, Fisher and Shelly, 1990. Experimental plots were established in a wheat field with a dense population of common mallow near Fisher, Minnesota. The Fisher plots were 40 feet long and 15 feet wide with the center 7 feet of each plot treated. Another plot site was established in a sugarbeet field with 22 inch rows and a dense population of common mallow near Shelly, Minnesota. The Shelly plots were 8 rows wide with the center four rows of each plot treated. All BioMal treatments were 0.56 grams of BioMal in 1200 milliliters of water applied at 8.5 gallons per acre. The Fisher plots were evaluated July 18. The Shelly plots were evaluated several times throughout the growing season but no common mallow control was observed.

Treatment	Early (PM)		Early (AM)		Late (AM)		Late (PM)	
Location	Fisher	Shelly	Fisher	Shelly	Fisher	Shelly	Fisher	Shelly
Date	June 4	June 4	June 6	June 6	June20	June20	June28	June28
Time of Day	3:00pm	4:30pm	8:20am	7:45am	10:30a	9:40am	2:45pm	3:40pm
Air Temperature	65F	67F	56F	56F	67F	68F	79F	85F
Soil Temp.(6 in)	55F	61F	55F	55F	61F	62F	69F	67F
Rel. Humidity	57%	54%	77%	77%	62%	63%	79%	63%
Wind Velocity	6-11	8-13	3-6	3-6	5-11	7-13	1-2	3-6
Soil Moisture	good	good	good	good	good	good	good	good
Common Mallow	2-4 lf	4-6 lf	2-5 lf	4-6 lf	cot-6lf	3lf-6"	0.5-12"	12"tall
Fisher(wheat)	8"tall	--	8-10"tall	--	18-20"tall	--	heading	--
Shelly(sgbt)	--	4-6 lf	--	4-6 lf	--	8-12 lf	--	12-18 lf

Treatment	Fisher-wheat Common Mallow control	Shelly-Sugarbeet Common Mallow control
BioMal (early application - morning)	100	0
BioMal (early application - afternoon)	100	0
BioMal (late application - morning)	100	0
BioMal (late application - afternoon)	100	0
Untreated Check	100	0
C.V. %	0	0
LSD 5%	NS	NS
LSD 1%	NS	NS
# OF REPS	4	4

Summary

None of the treatments controlled common mallow in the sugarbeet field at Shelly. The common mallow in the wheat field at Fisher was totally controlled. The disease had spread over the untreated check by July 18, when the plots were evaluated. Common mallow within several yards of the plot area also was controlled by the disease on July 18.

Bivert and herbicide antagonism, Casselton, 1990. 'ND810104' oats at 61 lb/A and 'Siberian' foxtail millet at 15 lb/A were seeded in 12 foot strips across herbicide plots April 25. 'Bush Johnson BJ1320' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 25. Counter 15G was applied at 12 lb/A product using a modified in-furrow system at planting. Herbicides and additives were added to the spray solution in groups. Chemicals to the left of the first parenthesis were added first, then chemicals to the left of the second parenthesis, and finally chemicals to the left of the third parenthesis. The spray solution was mixed thoroughly after each group of chemicals was added and allowed to set 15 minutes before adding the next group of chemicals. Herbicides were applied 1:25 pm June 18 when the air temperature was 81F, soil temperature at six inches was 73F, relative humidity was 58%, wind was 1-3 mph, soil moisture was good, sugarbeet was in the 6 to 10 leaf stage, oats was 20 inches tall, and foxtail millet was 8 to 12 inches tall. All herbicides were applied in 8.5 gpa water at 38 psi through 8001 nozzles to the center four rows of six row plots. Oats and foxtail millet control and sugarbeet injury were evaluated July 7.

Treatment (rate) * (lb/A)	Oats cntl	Ftmi cntl	Sgbt inj
	---------	(%)	--------
Sethoxydim+Dash(0.1+2pt)	79	100	0
Clopyralid+Sethoxydim+Dash(0.19+0.1+2pt)	83	100	0
Seth+Bivert(0.1+0.15pt)+Dash(2pt)+Clpy(.19)	83	100	0
Desmed+Sethoxydim+Dash(0.5+0.1+2pt)	60	99	0
Sethoxydim+Bivert(0.1+0.15pt)+Dash(2pt)	83	100	0
Seth+Bivert(0.1+0.15pt)+Dash(2pt)+Desm(0.5)	63	99	0
Seth+Biv(.1+.15pt)+Des+Biv(.5+.75pt)+Dash(2pt)	61	98	0
Bentazon+Sethoxydim+Dash(1+0.1+2pt)	54	98	88
Seth+Bivert(0.1+0.15pt)+Dash(2pt)+Bent(1)	45	95	83
Seth+Biv(.1+.15pt)+Bent+Biv(1+.5pt)+Dash(2pt)	56	100	88
Fluazifop-P+OC(0.1+2pt)	90	92	0
Desmedipham+Fluazifop-P+OC(0.5+0.1+2pt)	79	64	0
Fluazifop-P+Bivert(0.1+0.2pt)+OC(2pt)	90	88	0
Flfp-P+Bivert(0.1+0.2pt)+OC(2pt)+Desm(0.5)	79	60	0
Flfp-P+Biv(.1+.2pt)+Des+Biv(.5+.75pt)+OC(2pt)	78	70	0
Bentazon+Fluazifop-P+OC(1+0.1+2pt)	88	55	80
Flfp-P+Bivert(0.1+0.2pt)+OC(2pt)+Bent(1)	84	59	81
Flfp-P+Biv(.1+.2pt)+Bent+Biv(1+.5pt)+OC(2pt)	86	53	83
Fenoxaprop-P+OC(0.07+2pt)	75	100	0
Desmedipham+Fenoxaprop-P+OC(0.5+0.07+2pt)	65	98	0
Fenoxaprop-P+Bivert(0.07+0.25pt)+OC(2pt)	78	100	0
Fenx-P+Bivert(0.07+0.25pt)+OC(2pt)+Des(0.5)	63	98	0
Fenx-P+Biv(.07+.25pt)+Des+Biv(.5+.75pt)+OC(2pt)	63	98	0
Bentazon+Fenoxaprop-P+OC(1+0.07+2pt)	56	99	75
Fenx-P+Bivert(0.07+0.25pt)+OC(2pt)+Bent(1)	74	100	68
Fenx-P+Biv(.07+.25pt)+Bent+Biv(1+.5pt)+OC(2pt)	71	100	66
DPX-Y6202-38+OC(0.05+2pt)	81	100	0
Desmedipham+DPX-Y6202-38+OC(0.5+0.05+2pt)	72	93	0
DPX-Y6202-38+Bivert(0.05+0.15pt)+OC(2pt)	85	100	0
DPX-Y6202-38+Biv(.05+.15pt)+OC(2pt)+Desm(.5)	65	90	0
DPX-Y-38+Biv(.05+.15pt)+Des+Biv(.5+.75pt)+OC(2pt)	73	92	0
Bentazon+DPX-Y6202-38+OC(1+0.05+2pt)	70	96	71
DPX-Y6202-38+Bivert(.05+.15pt)+OC(2pt)+Bent(1)	81	96	74
DPX-Y-38+Biv(.05+.15pt)+Bent+Biv(1+.5pt)+OC(2pt)	82	96	75
C.V. %	7	5	19
LSD 5%	7	7	7
LSD 1%	9	9	10
# OF REPS	4	4	4

* Bivert = adjuvant from Stull Chemical Co.; OC = Mor-Act petroleum oil concentrate from Wilbur-Ellis; Dash = adjuvant from BASF

SUMMARY. Bivert reduced the antagonism between bentazon and fenoxaprop and between bentazon and DPX-Y6202-38. Bivert had no influence on antagonism between other grass herbicide - broadleaf herbicide combinations.

Economic impact of pesticide application in sugarbeet production, Casselton, 1990. 'Maribo Ultramono' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Counter 15G insecticide at 10 lb/A was applied modified in-furrow at planting to plots receiving an insecticide treatment. Experimental plots were 40 feet long and 6 rows wide. Diethatyl + Ro-Neet at 4+3 lb/A was applied to the center four rows of each PPI treated plot and incorporated with a rototiller set four inches deep. Sethoxydim+oil at 0.2 lb/A+1 qt/A was applied June 20 to the plots receiving a postemergence grass treatment. Desmedipham & Phenmedipham at 0.5 lb/A was applied June 14 and again June 25 to plots receiving a postemergence broadleaf treatment. Hand weeding was done July 10. The amount of time to hand weed each plot was converted to dollar cost per acre using a $6.00 per hour rate. Sugarbeet injury and common lambsquarters control were evaluated July 7. Sugarbeets from the center two rows of each plot were harvested and counted September 25.

Planting Date	Seed Trt	Insec-ticide	Herbicide PPI	Herbicide Post Grass	Herbicide Post Brdlf	Hand Weed	Colq cntl (%)	Sgbt inj (%)	Sgbt Popl (80ft)	Sugar (%)	Loss to Mol (%)	Cost of Labor ($/A)	Root Yield (ton/A)	Impur Index	Extrac Sucros (lb/A)
Normal	No	No	No	No	No	No	0	0	85	17.9	1.6	0	12.2	668	3967
Normal	No	No	No	No	No	Yes	96	0	91	17.2	1.7	48.57	17.5	749	5360
Normal	Yes	No	No	No	No	No	18	0	72	16.8	1.8	0	9.2	774	2753
Normal	Yes	No	No	No	No	Yes	96	0	81	17.1	1.9	55.47	13.2	795	3970
Normal	No	Yes	No	No	No	No	0	0	83	17.5	1.6	0	12.4	662	3930
Normal	No	Yes	No	No	No	Yes	95	0	97	17.4	1.7	48.40	18.0	701	5605
Normal	Yes	Yes	No	No	No	No	8	0	80	17.6	1.7	0	11.1	692	3506
Normal	Yes	Yes	No	No	No	Yes	95	0	90	17.3	1.6	56.71	16.4	687	5087
Normal	Yes	Yes	No	Yes	No	No	0	0	83	17.7	1.7	0	11.2	677	3566
Normal	Yes	Yes	No	Yes	No	Yes	95	0	90	17.8	1.7	46.64	16.4	680	5263
Normal	Yes	Yes	No	No	Yes	No	99	10	97	17.5	1.9	0	16.0	799	4945
Normal	Yes	Yes	No	No	Yes	Yes	100	8	93	17.8	1.8	21.07	16.6	759	5233
Normal	Yes	Yes	No	Yes	Yes	No	100	8	88	17.3	1.9	0	16.6	807	5089
Normal	Yes	Yes	No	Yes	Yes	Yes	100	8	96	17.6	1.8	15.79	16.5	754	5167
Normal	Yes	Yes	Yes	Yes	Yes	No	100	34	75	17.4	2.0	0	15.4	823	4708
Normal	Yes	Yes	Yes	Yes	Yes	Yes	100	26	77	17.3	1.9	10.47	15.5	808	471[illegible]
Delayed	Yes	Yes	No	No	No	No	0	0	84	16.9	1.8	0	11.8	772	3589
Delayed	Yes	Yes	No	No	No	Yes	95	0	90	17.5	1.7	52.25	15.9	708	4990
HIGH MEAN							100	34	97	17.9	2.0	56.71	18.0	823	5605
LOW MEAN							0	0	72	16.8	1.6	0	9.2	662	2753
EXP MEAN							66	5	86	17.4	1.7	19.74	14.6	740	4525
C.V. %							13	85	9	4.1	8.9	31.65	14.6	12	18
LSD 5%							12	6	11	NS	.2	8.87	3.0	NS	1136
LSD 1%							17	8	15	NS	NS	11.83	4.0	NS	1515
# OF REPS							4	4	4	4	4	4	4	4	4

Summary

At Casselton sugarbeet seed treatment significantly reduced harvest sugarbeet population and yields. Use of postemergence herbicides for broadleaf weed control increased sugarbeet yield and greatly reduced cost of hand labor required for weed control. Use of insecticide significantly increased sugarbeet plant population and yield.

Herbicide application methods, Crookston, 1990. 'Hilleshog 5135' sugarbeet was seeded in 22 inch rows April 23 in a commercial sugarbeet field. Test plots 1840 feet long and 24 rows wide were established. A 'Hardy Twin' broadcast sprayer traveling 5.5 mph and delivering 17 gpa at 35 psi through 4110-18 nozzles was used for the low pressure applications. The high pressure applications were at 110 psi using 4110-12 nozzles and traveling 5.5 mph to deliver 17 gpa. The high and low pressure treatments were applied with and without the air blast system on the Hardy sprayer. The band sprayer application was in a seven inch band over the sugarbeet row using two 400067 nozzles at 40 psi and traveling 5 mph to deliver 19 gpa. The first application of desmedipham&phenmedipham was 11:30 am May 18 when the air temperature was 53F, wind was 5-10 mph, and the soil surface was dry with good soil moisture below the surface. The second application was applied 10:00 am May 24 when the air temperature was 71F, wind was 5-8 mph, soil temperature at six inches was 58F, relative humidity was 57%, sugarbeet was in the two leaf stage, wild buckwheat was in the 1 to 2 leaf stage, common lambsquarters was in the 2 to 6 leaf stage, and kochia was 0.5 to 1.5 inches tall. Common lambsquarters, kochia, and wild buckwheat control and sugarbeet injury were evaluated May 24 and June 1.

Treatment	Desmed&Phenmed Rate May 18	May 24	May 24 Sgbt inj	Colq cntl	Kocz cntl	Wibw cntl	June 1 Sgbt inj	Colq cntl	Kocz cntl	Wibw cntl
	(pints)		(%)							
Low Pressure-No Air	1.5	2.0	8	88	20	73	10	100	43	76
Low Pressure-Air	1.5	2.0	5	78	10	80	5	96	33	51
Low Pressure-Air	1.0	1.5	3	50	3	40	0	87	17	43
Weedy Check	0.0	0.0	0	0	0	0	0	0	0	0
Band Application	1.5	2.0	10	90	20	75	3	100	50	88
High Pressure-No Air	1.0	1.5	7	78	10	63	0	95	23	61
High Pressure-Air	1.0	1.5	10	77	10	47	10	96	30	61
HIGH MEAN			10	90	20	80	10	100	50	88
LOW MEAN			0	0	0	0	0	0	0	0
EXP MEAN			6	66	10	54	4	82	28	55
C.V. %			37	13	56	22	141	7	30	25
LSD 5%			4	15	10	21	NS	10	15	24
LSD 1%			6	22	15	29	NS	14	21	34
# OF REPS			3	3	3	3	3	3	3	3

Summary

The high pressure application plus air assist gave weed control and sugarbeet injury similar to high pressure with no air. The band application gave weed control and sugarbeet injury similar to low pressure application. Air assist did not improve weed control from the low pressure application.

Herbicide soil residual, Fargo (NW section 22), 1989-1990. 'Evans' soybeans were solid seeded at 59 lb/A June 2, 1989 to the entire plot area. Herbicides were applied 10:00 am July 7, 1989 when the air temperature was 79F, soil temperature at six inches was 74F, relative humidity was 47%, wind was 8 mph, soil moisture was poor, and soybeans were in the one trifoliolate stage (2 inches tall) to the four trifoliolate stage (6 inches tall). Plots were 14 feet wide and 45 feet long with the center 10 feet treated with herbicides in 8.5 gpa water at 38 psi through 8001 nozzles. The entire experiment was treated with sethoxydim+Dash at 0.2 lb/A + 1 qt/A June 26, 1989 and acifluorfen+sethoxydim+Dash at 0.25+0.2 lb/A + 1 qt/A July 10, 1989. Clopyralid at 0.2 lb/A was spot sprayed to control thistles July 10, 1989. The plot area was tilled with a field cultivator in the fall of 1989 and spring of 1990. A 12 foot strip of 'Van der Have Puressa II' sugarbeet in 11 inch rows, four 30 inch rows of 'Dekalb DK397' corn, a six foot strip of 'Len' wheat at 81 lb/A, and a six foot strip of 'ND810104' oats at 60 lb/A were seeded across herbicide plots May 21, 1990. Green and yellow foxtail were evaluated June 25, 1990. Sugarbeet, oats, wheat, and corn control were evaluated June 25 and July 14, 1990.

1989 Treatment*	Rate	June 25, 1990 Gr&Yel Fxtl	June 25, 1990 Sgbt	June 25, 1990 Oats	June 25, 1990 Wht	June 25, 1990 Corn	July 14, 1990 Sgbt	July 14, 1990 Oats	July 14, 1990 Wht	July 14, 1990 Corn
	(lb/A)	(percent control)								
Imazethapyr+X-77	0.12+0.25%	85	100	64	15	0	100	33	15	0
Imazethapyr+X-77	0.06+0.25%	76	100	41	9	0	99	13	5	0
Imazethapyr+X-77	0.03+0.25%	56	88	38	8	0	89	10	3	0
Imazethapyr+X-77	0.015+0.25%	51	69	26	5	0	69	0	0	0
AC 222,293	0.6	16	78	25	3	0	68	10	0	0
AC 222,293	0.3	18	26	24	0	0	24	0	0	0
AC 222,293	0.15	5	16	19	0	0	16	0	0	0
Metribuzin-DF	1	41	41	19	4	0	30	3	1	0
Metribuzin-DF	0.5	25	33	23	8	0	35	6	0	0
Metribuzin-DF	0.25	5	16	10	3	0	18	3	0	0
DPX-V9360	0.125	40	73	45	20	0	66	31	35	0
DPX-V9360	0.06	43	29	34	10	0	24	3	3	0
DPX-V9360	0.03	23	24	23	6	0	19	0	4	0
DPX-79406	0.125	30	76	33	8	0	71	19	6	0
DPX-79406	0.06	11	34	21	5	0	19	8	0	0
DPX-79406	0.03	15	23	18	5	0	38	5	0	0
CGA-136872	0.06	70	100	76	68	10	100	75	76	0
CGA-136872	0.03	33	99	58	30	0	99	50	33	0
CGA-136872	0.015	43	90	35	10	0	88	8	3	0
C.V. %		48	14	44	59	0	21	85	90	0
LSD 5%		24	12	21	9	NS	17	17	12	NS
LSD 1%		33	16	27	13	NS	23	23	16	NS
# OF REPS		4	4	4	4	4	4	4	4	4

* X-77 = non-ionic surfactant from Valent

Summary

All herbicides carried over from 1989 to 1990 in sufficient amounts to damage one or more of the species evaluated. All tested rates of all herbicides caused visible injury to sugarbeet.

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

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

Summary

Imazethapyr applied at the normal application rate of 0.06 lb/A in 1987 caused very little sugarbeet injury in 1990. However, the double rate of 0.12 lb/A still caused severe injury. This suggests that imazethapyr which had been overlapped during application could cause severe sugarbeet injury three years after application.

Simulated spray drift, Casselton, 1990. The objective of this experiment was to measure the influence of insecticide applied to sugarbeet on sugarbeet injury from herbicides applied after the insecticides. Counter and Fortress were modified in-furrow applied during planting on April 24. Lorsban was applied postemergence on June 21 just before the herbicides were applied at 3:00 pm when the air temperature was 78F, six inch soil temperature was 69F, relative humidity was 72%, soil moisture was good, wind was west at 5 to 10 mph, and sugarbeets had 8 to 10 leaves. The experiment was cultivated June 7 and hand weeded as needed throughout the season. Sugarbeet injury was evaluated July 5. Sugarbeet from the center two rows of the four treated rows of each plot were harvested and counted September 26.

		Insecticide											
		Counter 1.8 lb ai/A			Fortress 0.85 lb ai/A			Lorsban 1 lb ai/A			Untreated		
Herbicide	Rate	Extr Sucr	Sgbt Popl	Sgbt Inj	Extr Sucr	Sgbt Popl	Sgbt Inj	Extr Sucr	Sgbt Popl	Sgbt Inj	Extr Sucr	Sgbt Popl	Sgbt Inj
	(lb/A)	(lb/A)	(/70')	(%)	(lb/A)	(/70')	(%)	(lb/A)	(/70')	(%)	(lb/A)	(/70')	(%)
Untreated	0	6119	88	0	6295	85	0	6629	87	0	6359	85	0
Thif&Trib+X-77	0.002+0.25%	2633	42	90	2642	41	88	2286	36	92	2536	46	89
Thif&Trib+X-77	0.001+0.25%	3578	58	69	3656	55	67	3280	54	74	3573	61	63
Thif&Trib+X-77	0.0005+0.25%	5941	84	27	5565	78	28	5625	77	38	5638	81	28
Thif&Trib+X-77	0.00025+0.25%	6238	85	9	6108	87	7	6449	82	15	5955	88	4
Thif&Trib+X-77	0.0001+0.25%	6586	84	0	6110	85	2	6489	81	1	5967	85	1
Imazethapyr+X-77	0.01+0.25%	2066	42	87	2247	43	85	1839	39	88	3052	49	86
Imazethapyr+X-77	0.005+0.25%	4345	70	56	3885	67	58	3855	70	66	4821	76	52
Imazethapyr+X-77	0.001+0.25%	6750	85	0	6583	88	0	6548	83	2	6050	84	0
Imazethapyr+X-77	0.0005+0.25%	6367	85	0	6408	86	0	6270	82	0	6159	83	0

LSD(0.05) Extractable sucrose = 718 for all in column and between column comparisons.
Sugarbeet population = 8 for all in column and between column comparisons.
Sugarbeet injury = 9 for all in column and between column comparisons.

Rain fell shortly after the herbicides were applied and the amount of injury to the sugarbeets was less than has been observed from the same herbicide rates in past years. However, thifensulfuron&tribenuron generally reduced sugarbeet yields at 0.0005, 0.001, or 0.002 lb/A and Imazethapyr reduced sugarbeet yields at 0.005 or 0.01 lb/A. Yield losses were similar regardless of insecticide treatment. Yield losses closely followed reductions in sugarbeet population. Yield losses also generally followed percent sugarbeet injury but plots with injury evaluated as 4 to 15% yielded as much as untreated plots.

Simulated spray drift, Renville, 1990. 'Maribo 862' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Treatments were applied 4:30 pm July 6 when the air temperature was 83F, soil temperature at six inches was 78F, relative humidity was 54%, wind was 5-10 mph, soil moisture was good, and sugarbeets were in the 10 leaf stage. Each herbicide treatment was applied to an untreated block of sugarbeets and to a block treated with foliar applied Lorsban at 1 lb/A one hour prior to herbicide application. Sugarbeet injury was evaluated July 18.

Treatment*	Rate	Untreated Sugarbeet injury	Lorsban Sugarbeet injury
	(lb/A)	(%)	(%)
Untreated	0	0	0
DPX-M6316&DPX-L5300+X-77	0.002+0.25%	88	95
DPX-M6316&DPX-L5300+X-77	0.001+0.25%	28	83
DPX-M6316&DPX-L5300+X-77	0.0005+0.25%	45	63
DPX-M6316&DPX-L5300+X-77	0.00025+0.25%	9	25
DPX-M6316-60+X-77	0.002+0.25%	88	90
DPX-M6316-60+X-77	0.001+0.25%	74	81
DPX-M6316-60+X-77	0.0005+0.25%	43	40
DPX-M6316-60+X-77	0.00025+0.25%	6	16
Imazethapyr+X-77	0.01+0.25%	94	90
Imazethapyr+X-77	0.005+0.25%	86	89
Imazethapyr+X-77	0.001+0.25%	46	59
Imazethapyr+X-77	0.0005+0.25%	10	6
DPX-V9360	0.02	35	46
DPX-V9360	0.01	13	23
DPX-V9360	0.005	13	6
DPX-V9360	0.0025	6	5
24-D	0.12	50	9
24-D	0.06	6	8
Bentazon	0.25	13	11
Dicamba	0.12	48	44
Dicamba	0.06	9	21
Desmedipham	0.75	1	0
HIGH MEAN		94	95
LOW MEAN		0	0
EXP MEAN		35	40
C.V. %		19	17
LSD 5%		10	10
LSD 1%		13	13
# OF REPS		4	4

* X-77 = non-ionic surfactant from Chevron Chemical Co.

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative.

Summary

Sugarbeet injury from DPX-M6316&DPX-L5300 was greater when sugarbeets were pretreated with Lorsban as compared to untreated. Injury to Lorsban treated or untreated sugarbeets generally was similar from other tested herbicides except 2,4-D injured untreated sugarbeets more than Lorsban treated.

Imazamethabenz with adjuvants for wild oat control, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on April 19. Treatments were applied to 2.5 leaf wheat, 1.5- to 3-leaf wild oats, 2- to 4-leaf wild mustard, 4-leaf common lambsquarters and 1 inch tall kochia on May 23 with 65 F, 50% RH, 5 to 10 mph southeast wind, and clear sky. All treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel-type plot sprayer to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. The first evaluation was on July 6 and a second evaluation was on July 31. Harvest for wheat yield was on August 4.

		7-06		7-31		8-04
Treatment[a]	Rate[a]	Wheat inj	Wild oat control	Wheat inj	Wild oat control	Wheat yield
	oz/A	%	%	%	%	bu/A
Imazamethabenz+MSF	2+0.25G	1	64	0	84	35
Imazamethabenz+MSF	3+0.25G	0	82	0	84	36
Imazamethabenz+MSF	4+0.25G	1	76	0	94	36
Imazamethabenz+MSF	5+0.25G	3	88	0	96	44
Imazamethabenz+MS1	2+0.25G	0	79	0	85	37
Imazamethabenz+MS1	3+0.25G	0	75	0	84	38
Imazamethabenz+MS1	4+0.25G	0	76	0	94	39
Imazamethabenz+MS1	5+0.25G	1	92	0	98	48
Imazamethabenz+PO	2+0.25G	0	74	0	90	45
Imazamethabenz+PO	3+0.25G	1	66	0	90	43
Imazamethabenz+PO	4+0.25G	1	79	0	93	45
Imazamethabenz+PO	5+0.25G	1	89	0	95	42
Imazamethabenz+X-77	2+0.25%	0	56	0	70	26
Imazamethabenz+X-77	3+0.25%	0	68	0	86	44
Imazamethabenz+X-77	4+0.25%	0	68	0	73	35
Imazamethabenz+X-77	5+0.25%	3	77	0	79	31
Imazamethabenz	2	0	43	0	65	31
Imazamethabenz	3	0	63	0	62	29
Imazamethabenz	4	1	57	0	76	28
Imazamethabenz	5	1	76	0	81	31
Untreated	0					15
C.V. %		283	23	0	11	18
LSD 5%		NS	23	NS	13	11
# OF REPS		4	4	4	4	3

[a] MSF=Sun-it, MS1=Sun-it II, PO=petroleum oil (Mor-act), G in rate column= gallons/A, and X-77=nonionic surfactant at 0.25% of the total spray volume.

Summary

Imazamethabenz did not injure wheat regardless of adjuvants or rate of imazamethabenz. Results were quite variable because of areas in the experiment with Canada thistle and variation in wild oats infestation. All adjuvants tended to enhance imazamethabenz toxicity to wild oats at both evaluations. The enhancement by adjuvants at the final evaluation generally was PO > MS1 > MS > X-77. Imazamethabenz at 2 oz/A applied with the three oil adjuvants gave wild oats control at the final evaluation equal to imazamethabenz at 5 oz/A applied alone. Wheat yield generally followed wild oats control and was from only three replicates because of lodging in the fourth replicate.

Wild oat control in wheat, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on April 19. S1 treatments were applied to 2- to 3-leaf wheat, 1.5- to 3-leaf wild oats, 2- to 4-leaf wild mustard, 4-leaf common lambsquarters, and 1 inch tall kochia on May 23 with 65 F, 70% RH, 1 to 8 mph southeast wind, and clear sky. S2 treatments were applied to 5- to 5.5 leaf wheat, 3- to 4-leaf wild oats, 4- to 6-leaf wild mustard, and 2 inch tall kochia on June 1 with 70 F, 70% RH, 10 to 15 mph south wind, and overcast sky. All treatments were applied with a bicycle wheel type plot plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 16 and 30 and a harvest for wheat yield was on August 4.

Treatment	Rate	7-16-90 Wheat inj	7-16-90 Wioa	7-30-90 Wheat inj	7-30-90 Wioa	8-4-90 Yield
	oz/A	---------	%		----------	bu/A
Diclofop(S1)	12	3	96	1	95	38.3
Diclofop(S1)	16	2	95	1	95	40.1
Diclofop+PO(S1)	12+0.125G	3	97	0	97	43.2
Diclofop+MS(S1)	12+0.125G	8	98	2	95	36.6
Diclofop+MS2(S1)	12+0.125G	0	99	0	98	43.5
Imazamethabenz	4	0	86	0	85	33.5
Imazamethabenz(S1)	5	0	94	0	93	43.1
HOE-6001(S1)	1.3	2	99	0	99	40.2
Diclofop(S2)	16	0	83	0	91	27.9
Diclofop+PO(S2)	16+0.125G	1	88	1	94	33.2
Diclofop+MS(S2)	16+0.125G	3	90	1	94	29.7
Diclofop+MS2(S2)	16+0.125G	1	89	1	96	34.5
Imazamethabenz(S2)	4	0	74	0	75	33.5
Imazamethabenz(S2)	5	0	81	0	77	38.8
Difenzoquat(S2)	10	1	89	1	90	33.3
Difenzoquat(S2)	12	5	94	2	93	32.3
HOE-6001(S2)	1.3	4	99	1	99	36.0
HOE-7125(S2)	10.5	5	99	1	99	33.8
HOE-7125(S2)	12.5	7	99	0	99	38.1
HOE-7125+Bromoxynil(S2)	12.5+4	2	98	1	98	42.3
Untreated	0	0	0	0	0	22.1
C.V. %		141	4	260	6	22.1
LSD 5%		4	5	NS	7	11.2
# OF REPS		4	4	4	4	4

[a] PO = petroleum oil adjuvant with 17% Atplus 300F emulsifier; MS = methylated seed oil with emulsifier (Sun-it); MS2 = Sun-it II; HOE-7125 = fenoxaprop&2,4-D&MCPA (1.3:1:3); and G in the rate column = gallons/A.

Summary

Wheat yield generally related to wild oat control. The wild oats density was more than 100 plants per sq yd. The later treatments (S2) generally caused lower wheat yields even though wild oats was controlled, indicating a loss from the longer period of competition. The greater wild oats control with the later evaluation for diclofop applied at the S2 stage indicates delayed control. Enhancement of diclofop for wild oats control was similar with all adjuvants. Tall wild oats were present, but lodged, in the plots treated with diclofop at the second stage. All herbicide treatments provided 85% or more wild oats control on July 30, except imazamethabenz applied at the second stage. These results differ from those of previous years when imazamethabenz controlled wild oats completely. None of the treatments caused important injury to wheat.

Wild oat control in barley, Langdon 1990. 'Robust' barley was seeded May 15. S1 treatments were applied to 2- to 2.5-leaf barley, 2-leaf wild oats, 1- to 2-leaf foxtail, 1-leaf wild buckwheat, and 1 inch kochia on June 6 with 70 F. Rainfall after treatment was 1.9 inch of rain occurring in six consecutive rains over the next 7 days. S2 treatments were applied to 5.5-leaf barley and wild oats and 1- to 2-leaf foxtail on June 18 with 75 F and 2 hours after treatment 0.08 inch of rain occurred followed by 0.30 inch over the next 10 day period. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gap at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Barley inj	Wioa
	oz/A	----- %	------
Diclofop(S1)	12	0	91
Diclofop(S1)	16	1	91
Diclofop+PO(S1)	12+0.125G	1	71
Diclofop+MS(S1)	12+0.125G	2	94
Diclofop+MS2(S1)	12+0.125G	1	94
Imazamethabenz	4	1	95
Imazamethabenz(S1)	5	3	99
HOE-6001(S1)	1.3	5	93
Diclofop(S2)	16	6	94
Diclofop+PO(S2)	16+0.125G	28	83
Diclofop+MS(S2)	16+0.125G	9	82
Diclofop+MS2(S2)	16+0.125G	20	86
Imazamethabenz(S2)	4	0	88
Imazamethabenz(S2)	5	0	95
Difenzoquat(S2)	10	0	99
Difenzoquat(S2)	12	1	98
HOE-6001(S2)	1.3	1	99
HOE-7125(S2)	10.5	6	99
HOE-7125(S2)	12.5	6	98
HOE-7125+Brox(S2)	12.5+4	11	99
Untreated	0	0	0
C.V. %		97	11
LSD 5%		6	13
# OF REPS		4	4

[a]PO = petroleum oil adjuvant with 17% Atplus 300F emulsifier; MS = methylated seed oil with emulsifier (Sun-it); MS2 = Sun-it II; HOE-7125 = fenoxaprop&2,4-D&MCPA (1.3:1:3); and G in the rate column = gallons/A.

Summary

Diclofop injured barley when applied at the 5.5-leaf stage. Wild oats population was sparce at 5 plants per sq yd. Wild oat control exceeded 80% except for when treated with diclofop at 12 oz/A with petroleum oil adjuvant (PO).

Wild oats control in wheat, Hettinger 1990. 'Len' hard red spring wheat was seeded on May 11. S1 treatments were applied to 4.5-leaf wheat, 5-leaf wild oats, and 0.5 to 3 inch tall kochia on June 1 with 60 F and partly cloudy sky. S2 treatments were applied to 5.5-leaf wheat and 5-leaf wild oats on June 19. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 16. Kochia density was 10 to 25 plants per sq yd.

Treatment	Rate	Wheat inj	KOCZ
	oz/A	----- %	------
Diclofop(S1)	12	0	16
Diclofop(S1)	16	0	20
Diclofop+PO(S1)	12+0.125G	0	35
Diclofop+MS(S1)	12+0.125G	0	18
Diclofop+MS2(S1)	12+0.125G	0	54
Imazamethabenz(S1)	4	0	20
Imazamethabenz(S1)	5	0	48
HOE-6001(S1)	1.3	0	15
Diclofop(S2)	16	0	14
Diclofop+PO(S2)	16+0.125G	0	4
Diclofop+MS(S2)	16+0.125G	0	6
Diclofop+MS2(S2)	16+0.125G	0	12
Imazamethabenz(S2)	4	0	6
Imazamethabenz(S2)	5	0	14
Difenzoquat(S2)	10	0	1
Difenzoquat(S2)	12	0	4
HOE-6001(S2)	1.3	0	3
HOE-7125(S2)	10.5	0	31
HOE-7125(S2)	12.5	0	25
HOE-7125+Bromoxynil(S2)	12.5+4	0	14
Untreated	0	0	0
C.V. %		0	91
LSD 5%		NS	22
# OF REPS		4	4

Summary

The experimental area did not contain adequate wild oats for evaluation. The wild oats control herbicides did not injure wheat. The herbicides did not control kochia. The kochia control values may represent random variation because of the drought.

Wild oat control in wheat, Minot 1990. 'Stoa' Hard Red Spring wheat was seeded May 7. The wet weather delayed application of S1 treatments until the 3-leaf wheat and 3- to 4-leaf wild oats stage on May 29 with 68 F, 60% RH, 14 to 15 mph wind, and a clear sky. S2 treatments were applied to 3-leaf wheat and 3- to 4-leaf wild oats on May 30 with 70 F, 60% RH, 14 to 15 mph wind, and cloudy sky. Rainfall of 2.44 inches occurred 10 days after both the S1 and S2 treatments. All treatments were applied with a bicycle wheel type plot sprayer using a bonnet type shield and delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft. plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was on August 9.

Treatment	Rate	Wheat Inj	Wheat Yield	Wioa
	oz/A	%	bu/A	%
Diclofop(S1)	12	0	66.5	97
Diclofop(S1)	16	0	66.5	95
Diclofop+PO(S1)	12+0.125G	0	57.1	99
Diclofop+MS(S1)	12+0.125G	0	71.7	99
Diclofop+MS2(S1)	12+0.125G	0	68.7	99
Imazamethabenz(S1)	4	0	70.0	99
Imazamethabenz(S1)	5	0	73.9	99
HOE-6001(S1)	1.3	0	71.8	99
Diclofop(S2)	16	0	58.7	96
Diclofop+PO(S2)	16+0.125G	0	72.8	99
Diclofop+MS(S2)	16+0.125G	0	76.7	99
Diclofop+MS2(S2)	16+0.125G	0	68.8	97
Imazamethabenz(S2)	4	0	59.1	97
Imazamethabenz(S2)	5	1	63.2	99
Difenzoquat(S2)	10	1	75.4	79
Difenzoquat(S2)	12	1	68.8	78
HOE-6001(S2)	1.3	0	63.6	91
HOE-7125(S2)	10.5	0	68.4	99
HOE-7125(S2)	12.5	0	75.7	98
HOE-7125+Bromoxynil(S2)	12.5+4	0	70.1	98
Untreated	0	0	73.0	0
C.V. %		535	13.7	5
LSD 5%		NS	NS	6
# OF REPS		4	4	4

[a] PO = petroleum oil adjuvant with 17% Atplus 300F emulsifier; MS = methylated seed oil with emulsifier (Sun-it); MS2 = Sun-it II; HOE-7125 = fenoxaprop&2,4-D&MCPA (1.3:1:3); and G in the rate column = gallons/A.

Summary

All herbicides except difenzoquat gave 90% or more wild oats control. Yield varied greatly because of flooding at one end of the experiment. None of the herbicides caused any important injury to wheat. Wild oat density was only about 10 plants per sq. yd. so yields were not increased by wild oats control.

Wild oat control in Hard Red Spring wheat, Williston 1990. 'Stoa' Hard Red Spring wheat was seeded on April 24. S1 treatments were applied to 3-leaf wheat, 2- to 2.5-leaf wild oats, 1 to 1.5 inch tall kochia and Russian thistle, and less than 1 inch tall common lambsquarters on May 23 with 57 F, 72% RH, 6 mph northeast wind and clear sky. The soil and plant surface was dry and soil temperature at 4 inches was 58 F. S2 treatments were applied to 5-leaf wheat 4 to 4.5-leaf wild oats, 1 to 1.5 inch tall kochia, 1 to 3 inch tall Russian thistle and 2 to 3 inch tall common lambsquarters with 62 F, 81% RH, 6 mph east-southeast wind, and a clear sky on June 1, soil and plant surface damp and soil temperature at 4 inches was 64 F. Rainfall for 10 days after the S1 treatment was 1.49 inches and 0.25 inch after the S2 treatments. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wheat Yield	Wheat Inj	Ruth	KOCZ	Colq
	oz/A	bu/A	----------	%	----------	
Diclofop(S1)	12	10.1	0	0	0	0
Diclofop(S1)	16	12.9	0	0	0	8
Diclofop+PO(S1)	12+0.125G	10.5	0	0	0	0
Diclofop+MS(S1)	12+0.125G	10.8	0	0	0	0
Diclofop+MS2(S1)	12+0.125G	10.7	0	0	0	0
Imazamethabenz(S1)	4	15.9	0	87	30	30
Imazamethabenz(S1)	5	15.2	0	87	45	36
HOE-6001(S1)	1.3	10.9	0	0	0	0
Diclofop(S2)	16	12.9	0	5	0	0
Diclofop+PO(S2)	16+0.125G	10.5	0	0	0	0
Diclofop+MS(S2)	16+0.125G	9.9	0	0	0	0
Diclofop+MS2(S2)	16+0.125G	12.7	0	21	26	0
Imazamethabenz(S2)	4	12.5	0	67	45	13
Imazamethabenz(S2)	5	12.3	0	60	10	8
Difenzoquat(S2)	10	13.1	1	40	15	0
Difenzoquat(S2)	12	14.7	1	74	34	5
HOE-6001(S2)	1.3	14.0	0	4	0	8
HOE-7125(S2)	10.5	14.1	1	96	31	66
HOE-7125(S2)	12.5	17.9	1	97	85	98
HOE-7125+Bromoxynil(S2)	12.5+4	15.6	4	99	96	96
Untreated	0	12.0	0	0	0	0
C.V. %		19.8	362	37	108	89
LSD 5%		3.6	2	18	30	22
# OF REPS		4	4	4	4	4

[a] PO = petroleum oil adjuvant with 17% Atplus 300F emulsifier; MS = methylated seed oil with emulsifier (Sun-it); MS2 = Sun-it II; HOE-7125 = fenoxaprop&2,4-D&MCPA (1.3:1:3); and G in the rate column = gallons/A.

Summary

The experiment area did not contain enough wild oats to evaluate control with the various treatments. Treatments which controlled Russian thistle and kochia generally increased wheat yield. None of the herbicide treatments caused any important injury to wheat. HOE-7125 (Tiller) plus bromoxynil gave more than 95% control of Russian thistle, kochia, and common lambsquarters.

Diclofop with adjuvants for wild oat control in wheat, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on April 19. Treatment were applied to 2- to 3-leaf wheat, 1.5- to 3-leaf wild oats, 2- to 4-leaf wild mustard, 4-leaf common lambsquarters, and 1 inch tall kochia on May 23 with 65 F, 60% RH, 5 to 8 mph southeast wind and a clear sky. All treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 6 and July 31. Harvest for yield was on August 4.

		7-06		7-31		8-04
Treatment[a]	Rate[a]	Wheat inj	Wild oat control	Wheat inj	Wild oat control	Wheat Yield
	oz/A	%				bu/A
Diclofop+MSF	8+0.125G	0	95	0	92	47.1
Diclofop+MSF	8+0.18G	0	91	0	92	47.3
Diclofop+MSF	8+0.25G	0	93	0	91	46.0
Diclofop+MS1	8+0.125G	0	94	0	92	47.3
Diclofop+MS1	8+0.18G	0	93	0	96	44.3
Diclofop+MS1	8+0.25G	0	94	0	93	47.4
Diclofop+PO	8+0.25G	1	93	1	95	46.7
Diclofop	8	0	75	0	84	40.3
Diclofop+MSF	12+0.125G	3	98	0	94	43.4
Diclofop+MSF	12+0.18G	0	91	0	95	41.1
Diclofop+MSF	12+0.25G	1	91	0	95	41.6
Diclofop+MS1	12+0.125G	0	95	0	97	42.7
Diclofop+MS1	12+0.18G	0	94	1	97	40.4
Diclofop+MS1	12+0.25G	0	94	0	97	42.0
Diclofop+PO	2+0.25G	0	95	0	97	44.4
Diclofop	12	0	78	0	86	38.6
Untreated	0	0	0	0	0	14.2
C.V. %		279	6	589	3	16.6
LSD 5%		1	7	NS	4	10.0
# OF REPS		4	4	4	4	4

[a]MSF=Sun-it, MS1=Sun-it II, and PO=Mor-act petroleum oil.

Summary

Diclofop did not injure wheat regardless of adjuvants or diclofop rate. Wheat yield generally followed wild oats control. Wild oat control was similar with both rates of diclofop alone or with adjuvants. Adjuvants all similarly enhanced wild oat control with diclofop. MSF (Sun-it) and MSI (Sun-it II) were equally as affective at 0.125 gal/A as at 0.25 gal/A. Petroleum oil adjuvant (PO, Mor-act) was only included at 0.25 gal/A.

Antagonism of wild oat herbicides. 'Wheaton' hard red spring wheat was seeded on April 19, 1990. Treatments were applied to 3-leaf wheat, 3.5- to 4-leaf wild oats, 1 inch tall kochia and common lambsquarters, and 1 to 2 inch tall wild mustard on June 25 with 70 F, 60% RH, and partly cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replicates. Evaluations were on July 6 and 31. Harvest for yield was on August 4. Wild oats population was 100 plants per square yard.

		7-06	7-31		8-04
Treatment[a]	Rate	Wioa	Wht inj	Wioa	Wheat yield
	oz/A	------(%)------			bu/A
DPX-R9674+HOE-6001	0.30+1.3	99	1	99	53.5
DPX-R9674+HOE-6001	0.45+1.3	99	2	99	43.2
DPX-R9674+MCPA-be+HOE-6001	0.30+4+1.3	98	1	98	63.6
DPX-R9674+MCPA-be+HOE-6001	0.45+4+1.3	97	2	98	52.5
DPX-R9674+Diclofop+PO	0.30+16+0.12G	87	0	90	42.0
DPX-R9674+Diclofop+PO	0.45+16+0.25G	76	0	80	33.1
HOE-6001	1.3	99	1	99	49.0
HOE-7125	4.64	79	1	86	40.6
HOE-7125+Bromoxynil	10.6+4	93	4	95	42.7
HOE-7125	10.6	79	0	93	44.5
Diclofop	10	66	0	78	31.7
Imazamethabenz	5	69	0	82	32.9
Imazamethabenz+Tribenuron	5+0.12	48	0	67	25.8
Imazamethabenz+Tribenuron	5+0.25	57	0	69	30.5
Imazamethabenz+MCPA-be	5+4	46	0	71	26.6
Imazamethabenz+MCPA-be	5+8	49	0	75	31.8
Imazamethabenz+Bromoxynil&MCPA	5+2	67	0	75	35.2
Imazamethabenz+Bromoxynil&MCPA	5+4	55	0	71	30.5
Imazamethabenz+Bromoxynil&MCPA	5+8	53	0	73	34.9
Imazamethabenz+DPX-R9674	5+0.37	49	0	64	28.8
Imazamethabenz+DPX-R9674	5+0.18	60	0	72	35.5
Imazamethabenz+HOE-7125	5+1.6	63	0	76	37.3
Imazamethabenz+HOE-7125	5+3.0	61	0	74	36.7
Imazamethabenz+HOE-7125	5+4.6	73	0	80	42.5
Imazamethabenz+HOE-7125	5+6.2	70	1	80	35.9
Bromoxynil&MCPA	8	0	0	0	13.6
MCPA	8	0	0	0	12.6
Tribenuron+X-77	0.25+0.25%	3	0	6	15.4
DPX-R9674+X-77	0.37+0.25%	0	0	5	13.6
Untreated	0	0	0	0	14.9
C.V. %		23	281	14	25.2
LSD 5%		20	2	14	12.1

[a] DPX-R9674 = thifensulfuron&tribenuron (2:1); be = butoxyethyl ester; PO = petroleum oil adjuvant with 17% Atplus 300F emulsifier; HOE-7125 = fenoxaprop&2,4-D&MCPA (1.3:1:3) and G in rate column = gallon per acre.

Summary

None of the herbicide caused any important injury to wheat. Wheat yield generally related to the degree of wild oat control. Wild oat control generally increased from the first to second rating indicating delayed control with certain herbicide treatments. Imazamethabenz was generally antagonized by the herbicide for broadleaf control. The antagonism had not been evident in other years when imazamethabenz generally gave a higher degree of wild oat control. The rains after application may have removed imazamethabenz from the foliage and reduced control. Wild oat control with HOE-6001 was not antagonized by DPX-R9674 alone or with MCPA.

Imazamethabenz and AC-compounds for wild oats control, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on April 19. Treatments were applied to 3-leaf wheat, 2- to 3-leaf wild oats, 1 inch tall kochia and common lambsquarters, and 1 to 2 inch wild mustard on May 24 with 78 F, 45% RH, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa with 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 6 and 30. Harvest for wheat yield was taken on August 4.

		7-06-90	7-30-90		8-04
Treatment	Rate	Wioa	Wheat inj	Wioa	Wheat Yield
	oz/A	---------	%	--------	bu/A
Imazamethabenz	5	91	0	94	48.5
AC7084-005A+S1(X-77)	5+0.25%	80	0	86	44.8
AC7084-005A+S2(R-11)	5+0.25%	91	0	94	51.5
AC7084-005A+S3(Ag-98)	5+0.25%	78	0	86	47.4
AC7084-005A+S4(Li-700)	5+0.25%	52	0	74	39.2
AC7084-042A+NaHSO4	4+4	90	0	95	52.1
AC7084-042A+NaHSO4	6+6	94	0	97	51.0
AC7084-042A+NaHSO4+MS	4+4+0.25G	89	0	91	50.0
AC22949+NaHSO4	4+4	93	0	95	53.8
AC22949+NaHSO4	6+6	97	0	99	55.6
AC22949+NaHSO4+MS	4+4+0.25G	99	0	98	59.6
Untreated	0	0	0	0	27.0
C.V. %		10	0	6	12.6
LSD 5%		12	NS	7	8.8
# OF REPS		4	4	4	4

Summary

Wheat yield generally related to the degree of wild oats control with the various herbicide treatments. AC7084-005A varied with adjuvants in effectiveness for wild oats control. Li-700 was antagonistic to wild oat control with AC7084-005A. Methylated seed oil adjuvant tended to enhance AC22949 for wild oats control.

Wild oat control with HOE-7125 and bromoxynil, Fargo 1990. 'Wheaton' hard red spring wheat was seeded on April 19. Treatments were applied to 3-leaf wheat, 3.5- to tillering wild oats, 1 inch tall kochia and common lambsquarters, and 1 to 2 inch tall wild mustard on May 25 with 70 F, 60% RH, and partly cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through an 8001 flat fan nozzle to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 6 and 31. Harvest for yield was on August 4.

		7-6-90	7-31-90		8-4-90
Treatment	Rate	Wioa	Wheat inj	Wioa	Wheat Yield
	oz/A	---------	%	---------	bu/A
HOE-7125	10.5	98	0	98	50.4
HOE-7125	12.5	97	0	97	45.5
HOE-7125+Bromoxynil	10.5+2	93	0	96	48.4
HOE-7125+Bromoxynil	10.5+3	92	0	95	50.1
HOE-7125+Bromoxynil	10.5+4	91	0	94	52.2
HOE-7125+Bromoxynil	12.5+2	97	0	99	56.0
HOE-7125+Bromoxynil	12.5+3	93	0	97	49.6
HOE-7125+Bromoxynil	12.5+4	97	0	96	52.2
Bromoxynil	2	0	0	0	16.0
Bromoxynil	3	0	0	0	16.7
Bromoxynil	4	0	0	0	15.9
Untreated	0	0	0	0	13.5
C.V. %		3	0	2	19.0
LSD 5%		3	NS	2	10.6
# OF REPS		4	4	4	4

Summary

The broadleaf weeds present at treatment were not evident at evaluation. The excellent wheat stand and dense wild oats apparently prevented the broadleaf weeds from developing. None of the herbicides caused any injury to wheat Wheat yield related directly to the degree of wild oats control. Wild oats control with HOE-7125 tended to decrease with the higher amounts of bromoxynil. However the effect of bromoxynil was probably of no practical importance. Thus, the inclusion of bromoxynil with HOE-7125 should increase broadleaf weed control.

Broadleaf and grass control in wheat, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded April 20. Treatments were applied to 4- to 5-leaf wheat, 3- to 4-leaf wild mustard and 2 inch tall kochia on May 29 with 75 F, 50% RH, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on June 13. Weed density was kochia 5 per sq yd and wild mustard 1 per sq yd. Harvest for yield was on August 6.

		6-13-90			8-6-90
Treatment[a]	Rate	Wheat inj	Kocz	Wimu	Yield
	oz/A	-------	%	------	bu/A
2,4-Ddma	6	1	78	94	50.4
2,4-D dma + MS	4+0.25G	1	70	98	51.4
MCPA-dma	6	1	65	92	49.6
2,4-Dbee	6	1	89	98	50.7
Dicamba-Na + MCPA-dma	1.5+4	1	89	96	54.7
Bromoxynil&MCPA	8	3	99	99	56.0
Fluroxypyr + 2,4-Ddma	1+6	4	87	95	54.0
Clopyralid&2,4-D	9.5	1	83	97	55.3
Clopyralid&MCPA	9.5	0	66	96	52.3
DPX-R9674 + X-77	0.37+0.25%	9	97	99	50.8
DPX-L5300 + 2,4-Dbee + X-77	0.05+6+0.12%	5	99	99	54.0
DPX-R9674 + 2,4-Dbee + X-77	0.3+6+0.12%	2	99	99	59.4
DPX-R9674 + Dicamba-Na + X-77	0.3+1.5+.12%	6	99	99	57.0
DPX-R9674 + Clopyralid&2,4-D + X-77	0.3+3.6+0.12%	3	99	99	52.0
Metsulfuron + 2,4-Dbee + X-77	0.06+6+0.12%	2	99	99	51.8
Diclofop + Bromoxynil	12+4	3	96	99	52.6
Diclofop + PO	6+0.12G	1	0	6	52.5
HOE-7125	6.25	8	68	94	50.6
HOE-6001(sp)	0.4	1	5	0	47.8
HOE-6001(sp)	0.56	0	0	0	47.6
HOE-6001(sp)	0.72	0	0	0	49.0
Prnl&MCPA	19	1	88	99	52.5
Untreated	0	0	0	0	51.5
C.V. %		136	13	5	9.5
LSD 5%		4	13	6	NS
# OF REPS		4	4	4	4

[a]dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

None of the treatments cause important wheat injury. Wheat yield was not increased by controlling kochia with the herbicides. The lack of yield response may relate to the favorable moisture conditions early in the season which probably favored wheat growth over kochia. Kochia control exceeded 95% with bromoxynil&MCPA, bromoxynil + diclofop, and treatments containing sulfonylureas (DPX-R9674, DPX-L5300, metsulfuron). Methylated seed oil adjuvant (MS, Scoil) did not enhance kochia control with 2,4-D dma. In previous years MS enhanced Kochia control with 2,4-D dma so that control was equal to that with 2.4-D ester.

<u>General weed control in wheat, Carrington 1990</u>. 'Butte 86' Hard Red Spring wheat was seeded on May 14. Treatments were applied to 4- to 6-leaf wheat, 1 to 3 inch tall prostrate pigweed, and 1- to 3-leaf green foxtail on June 13 with 68 F. A total of 1.7 inches of rain occurring in 10 days post treatment. All treatments were applied with a bicycle wheel type plot sprayer with carbon dioxide pressure of 35 psi, and 8001 flat fan nozzles applying 8.5 gpa. Treatments were to a 7 ft wide area the length of 8 by 25 ft plots. The experiment designed as a randomized complete block with four replicates. Evaluation was July 11.

Treatment[a]	Rate	Wheat inj	Wibu	Prpw	Grft
	oz/A	----------	%	----------	
2,4-Ddma	6	0	36	45	0
2,4-D dma + MS	4+0.25G	0	20	40	45
MCPA-dma	6	0	10	41	0
2,4-Dbee	6	0	25	43	0
Dicamba-Na + MCPA-dma	1.5+4	3	88	65	0
Bromoxynil&MCPA	8	0	79	59	0
Fluroxypyr + 2,4-Ddma	1+6	0	63	55	0
Clopyralid&2,4-D	9.5	0	94	69	40
Clopyralid&MCPA	9.5	0	94	88	0
DPX-R9674 + X-77	0.37+0.25%	3	98	99	0
DPX-L5300 + 2,4-Dbee + X-77	0.05+6+0.12%	3	80	98	0
DPX-R9674 + 2,4-Dbee + X-77	0.3+6+0.12%	0	99	99	0
DPX-R9674 + Dicamba-Na + X-77	0.3+1.5+.12%	0	99	99	50
DPX-R9674 + Clopyralid&2,4-D + X-77	0.3+3.6+0.12%	0	98	99	0
Metsulfuron + 2,4-Dbee + X-77	0.06+6+0.12%	1	94	99	0
Diclofop + Bromoxynil	12+4	0	75	59	85
Diclofop + PO	6+0.12G	0	0	0	78
HOE-7125	6.25	3	5	20	90
HOE-6001(sp)	0.4	0	0	0	99
HOE-6001(sp)	0.56	0	0	0	99
HOE-6001(sp)	0.72	0	0	0	99
Propanil&MCPA	19	6	74	99	99
Untreated	0	6	0	0	0
C.V. %			22	32	
LSD 5%			17	25	
# OF REPS			4	4	1

[a] dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

None of the herbicide treatments cause any important injury to wheat. Wild buckwheat control exceeded 90% with clopyralid treatments, DPX-R9674 treatments, and metsulfuron. All treatment containing sulfonylurea (DPX-R9674, DPX-L5300, Metsulfuron) and propanil&MCPA gave 99% prostrate pigweed control. Green foxtail only occurred in one replication and was controlled at 90% or more by HOE-7125 and HOE-6001.

Broadleaf and grass control in wheat, Minot 1990. 'Stoa' Hard Red Spring wheat was seeded on May 23. Treatments were applied to 5-leaf wheat and Russian thistle, cutleaf nightshade, kochia, common lambsquarters and frenchweed all 1 to 2.5 inches tall on June 1 with 70 F, 68% RH, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 11.

Treatment[a]	Rate	Wheat inj	KOCZ	Clns	Ht	Wheat yield
	oz/A	------	%	------	cm	bu/A
2,4-Ddma	6	1	15	55	78	26.5
2,4-Ddma	4	0	21	30	81	27.9
MCPA-dma	6	0	8	50	79	23.9
2,4-Dbee	6	0	44	84	78	28.0
Dicamba-Na + MCPA-dma	1.5+4	0	83	93	75	28.0
Bromoxynil&MCPA	8	1	95	94	75	33.4
Fluroxypyr + 2,4-Ddma	1+6	0	96	97	77	30.0
Clopyralid&2,4-D	9.5	0	23	65	82	25.4
Clopyralid&MCPA	9.5	1	34	93	80	26.7
DPX-R9674 + X-77	0.37+0.25%	2	97	60	78	32.7
DPX-L5300 + 2,4-Dbee + X-77	0.05+6+0.12%	3	98	97	77	31.5
DPX-R9674 + 2,4-Dbee + X-77	0.3+6+0.12%	1	99	96	74	28.9
DPX-R9674 + Dicamba-Na + X-77	0.3+1.5+.12%	1	99	55	82	37.2
DPX-R9674 + Clpy&2,4-D + X-77	0.3+3.6+0.12%	1	99	83	79	30.6
Metsulfuron + 2,4-Dbee + X-77	0.06+6+0.12%	4	99	87	77	31.6
Diclofop + Bromoxynil	12+4	2	97	93	82	35.7
Diclofop + PO	6+0.12G	1	16	10	79	28.8
HOE-7125	6.25	1	15	10	78	26.9
HOE-6001(sp)	0.4	0	4	8	78	30.3
HOE-6001(sp)	0.56	0	5	13	83	28.4
HOE-6001(sp)	0.72	0	0	0	78	30.5
Propanil&MCPA	19	1	51	48	75	25.9
Untreated	0	0	0	0	82	28.9
C.V. %		232	20	44	NS	5.8
LSD 5%		NS	15	53	NS	7.8
# OF REPS		4	4	2	1	2.4

[a]dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

None of the herbicides caused any important injury to wheat. Wheat yields did not always relate to the degree of weed control. However, yields were generally highest when kochia control was also high. Cutleaf nightshade were variable and only occurred in two replicates. Kochia control was inadequate (<80%) with 2,4-D amine or ester, MCPA, clopyralid with MCPA or 2,4-D, and propanil&MCPA.

Broadleaf and grass control in wheat, Langdon 1990. 'Cando' durum wheat was seeded on May 23. Treatments were applied to 5.5-leaf wheat, 5-leaf wild buckwheat, 1 inch tall redroot pigweed, and 2-leaf smartweed on June 21 with 75 F, and 0.02 inch of rain occurring 1 day after treatment with a 10 day total rain of 0.22. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Experiment was a randomized complete block design with four replicates. Evaluation was on July 13.

Treatment[a]	Rate	Wheat inj	Weed control Smwd	Weed control Rrpw	Weed control Wibu
	oz/A	%	%	%	%
2,4-Ddma	6	0	73	87	63
2,4-Ddma+MS	4+0.25G	0	66	88	65
MCPA-dma	6	0	40	87	43
2,4-Dbee	6	0	88	97	80
Dicamba-Na+MCPA-dma	1.5+4	0	92	86	91
Bromoxynil&MCPA	8	0	97	85	94
Fluroxypyr+2,4-Ddma	1+6	1	89	74	97
Clopyralid&2,4-D	9.5	0	79	75	77
Clopyralid&MCPA	9.5	0	79	87	85
DPX-R9674+X-77	0.37+0.25%	0	97	93	96
DPX-L5300+2,4-Dbee+X-77	0.05+6+0.12%	0	94	97	94
DPX-R9674+2,4-Dbee+X-77	0.3+6+0.12%	1	99	99	98
DPX-R9674+Dicamba-Na+X-77	0.3+1.5+.12%	0	97	92	96
DPX-R9674+Clopyralid&2,4-D+X-77	0.3+3.6+0.12%	0	98	97	97
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.12%	0	96	98	91
Diclofop+Bromoxynil	12+4	0	98	89	97
Diclofop+PO	6+0.12G	0	20	60	30
HOE-7125	6.25	78	40	60	48
HOE-6001(sp)	0.4	0	0	36	30
HOE-6001(sp)	0.56	0	8	53	15
HOE-6001(sp)	0.72	0	25	38	13
Propanil&MCPA	19	3	96	92	61
Untreated	0	0	0	0	15
C.V. %		38	24	22	27
LSD 5%		2	23	24	26
# OF REPS		4	4	4	4

[a]dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

HOE-7125 caused severe injury to the durum wheat, but none of the other herbicides caused any important injury to durum wheat. Treatments containing dicamba, bromoxynil, propanil, or sulfonylureas (DPX-R9674, DPX-L5300, metsulfuron) all gave more than 90% smartweed control. These same herbicides gave 90% or more wild buckwheat control, except for propanil&MCPA. Fluroxypyr + 2,4-D also controlled wild buckwheat. 2,4-D bee, sulfonylureas, and propanil&MCPA gave 89% or more redroot pigweed control.

Broadleaf and grassy weed control in HRS wheat Exp 1, Williston 1990. 'Grandin' hard red spring wheat was seeded on May 14. Treatments were applied to 4.5-leaf wheat and green foxtail 2- to 6-leaf on June 12 with 69 F, 33% RH, 9 mph northeast wind, clear sky and a soil temperature of 64 F at a 4 inch depth. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 12. Harvest for yield was on July 31.

		7-12-90				7-31-90
		Wheat	Control		Test	Wheat
Treatment[a]	Rate	inj	Grft	Ruth	weight	yield
	oz/A	------	%	------	lb/bu	bu/A
2,4-Ddma	6	0	31	81	59	14.0
2,4-Ddma+MS	4+0.25G	0	44	96	60	13.2
MCPA-dma	6	0	41	40	58	13.2
2,4-Dbee	6	0	43	98	60	13.3
Dicamba-Na+MCPA-dma	1.5+4	0	63	73	60	12.5
Bromoxynil&MCPA	8	0	33	90	60	13.4
Fluroxypyr+2,4-Ddma	1+6	0	45	93	60	13.7
Clopyralid&2,4-D	9.5	0	40	92	61	12.1
Clopyralid&MCPA	9.5	0	36	71	61	11.4
DPX-R9674+X-77	0.37+0.25%	0	36	99	60	13.7
DPX-L5300+2,4-Dbee+X-77	0.05+6+0.12%	0	40	97	59	13.2
DPX-R9674+2,4-Dbee+X-77	0.3+6+0.12%	0	35	99	60	14.0
DPX-R9674+Dica-Na+X-77	0.3+1.5+.12%	0	38	98	60	13.3
DPX-R9674+Clopyralid&2,4-D+X-77	0.3+3.6+0.12%	0	24	98	60	14.6
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.12%	0	36	99	60	14.1
Diclofop+Brox	12+4	0	83	96	60	14.9
Diclofop+PO	6+0.12G	0	83	26	58	14.0
HOE-7125	6.25	0	94	55	59	14.0
HOE-6001(sp)	0.4	0	66	35	57	13.7
HOE-6001(sp)	0.56	0	76	21	57	13.8
HOE-6001(sp)	0.72	0	92	16	58	13.7
Propanil&MCPA	19	0	66	23	57	13.0
Untreated	0	0	0	0	57	12.6
C.V. %		0	30	28		7.4
LSD 5%		NS	21	27		1.4
# OF REPS		4	4	4	1	4

[a] dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

Weed populations were sparse so weed control by herbicides did not greatly increase yields. However, treatments which were effective in controlling Russian thistle generally related to the higher yields. None of the heribicides caused any injury to wheat. 2,4-D dma at 4 oz/A with methylated seed oil adjuvant (MS-Scoil) gave equal Russian thistle control exceeding 90% with 2,4-D dma + MS, 2,4-D bee, bromoxynil&MCPA, fluroxypyr + 2,4-D, sulfonylurea treatments (DPX-R9674, DPX-L5300, metsulfuron), and dicamba + bromoxynil. Green foxtail control exceed 80% with diclofop treatments, HOE-7125, and HOE-6001 at 0.72 oz/A.

Broadleaf and grassy weed control in HRS wheat Exp 2,Williston 1990. 'Stoa' hard red spring wheat was seeded on April 24. Treatments were applied to 5.5- leaf wheat, 2 to 4 inch tall kochia, 3 to 4 inch tall common lambsquarters, 4 to 8 inch tall tansymustard and 2 to 3 inch tall Russian thistle on June 4 with 71 F, 47% RH, 6 mph southeast wind, cloudy sky and a soil temperature, 4 inches beneath the dry surface, of 68 F. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations was on July 12. Harvest for grain yield was on July 31.

Treatment	Rate	7-12-90 Wheat inj	Weed control Ruth	KOCZ	Colq	Tymu	Test weight	7-31-90 Wheat yield
	oz/A	-----------	-----------	%	----------	----------	lbs/bu	bu/A
2,4-Ddma	6	0	86	69	99	99	57.1	9.0
2,4-Ddma+MS	4+0.25G	0	94	78	99	99	58.4	8.3
MCPA-dma	6	0	35	56	93	98	55.1	7.9
2,4-Dbee	6	0	97	75	99	99	58.5	7.7
Dicamba-Na+MCPA-dma	1.5+4	0	71	93	81	99	58.6	7.4
Bromoxynil&MCPA	8	0	91	80	99	99	56.9	10.4
Fluroxypyr+2,4-Ddma	1+6	0	95	95	98	99	57.9	7.6
Clopyralid&2,4-D	9.5	0	90	51	99	99	58.4	8.9
Clopyralid&MCPA	9.5	0	74	63	99	99	57.8	8.9
DPX-R9674+X-77	0.37+0.25%	0	98	91	97	99	58.2	8.2
DPX-L5+2,4-Dbee+X-77	0.05+6+0.12%	0	95	88	94	99	58.2	7.7
DPX-R9674+2,4-Dbee+X-77	0.3+6+0.12%	0	99	92	99	99	59.2	9.7
DPX-R9674+Dica-Na+X-77	0.3+1.5+.12%	0	98	95	99	99	59.7	7.6
DPX-R9674+Clpy&2,4-D+X-77	0.3+3.6+0.12%	0	97	97	99	99	58.8	9.6
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.12%	0	78	76	78	74	59.4	7.5
Diclofop+Brox	12+4	0	93	80	78	99	57.8	10.3
Diclofop+PO	6+0.12G	0	3	9	37	0	53.3	7.1
HOE-7125	6.25	0	65	46	84	99	57.8	8.6
HOE-6001(sp)	0.4	0	14	40	13	15	52.7	5.8
HOE-6001(sp)	0.56	0	4	21	57	25	55.1	7.7
HOE-6001(sp)	0.72	0	49	65	99	99	56.7	5.6
Propanil&MCPA	19	0	24	16	4	47	55.2	6.6
Untreated	0	0	0	0	0	0	53.0	5.1
C.V. %		0	24		26	24	-	25.9
LSD 5%		NS	23		29	27	-	2.9
# OF REPS		4	4		4	4	1	4

[a]dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

Methylated seed oil adjuvant (MS = Scoil) tended to enhance Russian thistle and kochia control with 2,4-D dma so the control with 2,4-Ddma at 4 oz/A + MS = 2,4-D bee at 6 oz/A ≥ 2,4-D dma at 6 oz/A without adjuvant. Fluroxypyr + 2,4-D, DPX-R9674 alone, DPX-R9674 + 2,4-D, dicamba or clopyralid&2,4-D all gave 90% or more control of all broadleaf weeds. Yields were low because of drought, but most treatments which gave about 75% or more control of all weeds significantly increased wheat yield.

<u>Broadleaf and grass control in wheat, Hettinger 1990.</u> 'Len' hard red spring wheat was seeded on May 11. Treatments were applied to 5.5-leaf wheat and 1 to 6 inch tall kochia on June 9. Rainfall for 10 days after treatment was 3 inches occurring between days 3 and 10. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Experiment was a randomized complete block design with four replicates. Evaluation was on July 16.

Treatment[a]	Rate	Kochia	Russian thistle
	oz/A	---- % control ----	
2,4-Ddma	6	6	80
2,4-Ddma+MS	4+0.25G	33	55
MCPA-dma	6	5	45
2,4-Dbee	6	19	68
Dicamba-Na+MCPA-dma	1.5+4	81	78
Bromoxynil&MCPA	8	50	60
Fluroxypyr+2,4-Ddma	1+6	73	75
Clopyralid&2,4-D	9.5	45	30
Clopyralid&MCPA	9.5	26	65
DPX-R9674+X-77	0.37+0.25%	94	80
DPX-L5300+2,4-Dbee+X-77	0.05+6+0.12%	93	90
DPX-R9674+2,4-Dbee+X-77	0.3+6+0.12%	97	99
DPX-R9674+Dica-Na+X-77	0.3+1.5+.12%	99	92
DPX-R9674+Clopyralid&2,4-D+X-77	0.3+3.6+0.12%	97	80
Metsulfuron+2,4-Dbee+X-77	0.06+6+0.12%	95	82
Diclofop+Brox	12+4	30	78
Diclofop+PO	6+0.12G	3	35
HOE-7125	6.25	9	58
HOE-6001(sp)	0.4	4	40
HOE-6001(sp)	0.56	1	28
HOE-6001(sp)	0.72	4	53
Propanil&MCPA	19	4	10
Untreated	0	0	0
C.V. %		39	26
LSD 5%		23	33
# OF REPS		4	2

[a]dma = dimethylamine, MS = Scoil from Agsco, bee = butoxyethyl ester, Na = sodium salt, and sp = R isomer;

Summary

Weed population was variable and wheat was not harvested because poor growth caused by the extreme drought. The sulfonylureas (DPX-R9674, DPX-L5300, metsulfuron) all gave 90% or more kochia and 80% or more Russian thistle control even with the extremely dry conditions.

Fluroxypyr for broadleaf weed control, 1990. 'Wheaton' hard red spring wheat was seeded on April 20. Treatments were applied to 4-leaf wheat, 1 inch tall kochia, and 2 to 4 inch wild mustard on May 29 with 70 F, 40% RH, and 4 to 6 mph, and clear sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replicates. Evaluations were June 18 and July 31. Harvest for yield was August 6.

		June 18			July 31		8-06
Treatment	Rate	Wht inj	KOCZ	Wimu	Wht inj	KOCZ	Yield
	oz/A	------------		%	------------		bu/A
2,4-D dma	6	0	59	97	1	49	63.6
2,4-D dma+MS	4+0.25G	2	95	99	0	93	62.8
Fluroxypyr	0.5	1	85	45	0	92	54.8
Fluroxypyr	1.0	0	95	45	0	98	61.8
Fluroxypyr	1.5	1	97	96	0	97	62.0
Fluroxypyr+2,4-D dma	0.5+6	0	94	99	1	99	63.4
Fluroxypyr+2,4-D dma	1.0+6	2	99	99	0	99	67.2
Fluroxypyr+2,4-D dma	1.5+6	2	98	99	1	98	65.3
Fluroxypyr+Picloram	1+0.13	0	93	99	0	99	67.1
Fluroxypyr+Picloram	1+0.25	0	90	44	1	94	65.7
Fluroxypyr+2,4-D dma+Picl	1+6+0.13	0	96	99	0	99	64.0
Fluroxypyr+2,4-D dma+Picl	1+6+0.25	3	99	99	0	99	65.5
Picloram+2,4-D dma	0.25+6	0	55	99	0	62	65.6
Dicamba-Na+2,4-D dma	1.5+6	3	95	99	1	99	67.1
Bromoxynil&MCPA	8	1	99	99	1	98	61.8
Untreated	0	0	0	0	0	0	56.5
C.V. %		199	8	21	296	11	7.5
LSD 5%		NS	9	24	NS	13	6.8
# OF REPS		4	4	4	4	4	4

Summary

None of the treatments caused any significant injury to wheat. Fluroxypyr alone or in combination with 2,4-D or picloram gave commercially acceptable kochia control. However, fluroxypyr at 0.5 oz/A applied alone only gave 85% kochia control at the early evaluation, but control increased to 93% at the pre-harvest evaluation. Wheat yield were increased by all herbicide treatments, except fluroxypyr at 0.5 oz/A applied alone.

Adjuvant with fluroxypyr in wheat, 1990. 'Wheaton' hard red spring wheat was seeded on April 20. Treatments were applied to 4-leaf wheat, 1 inch tall kochia, and 2 to 4 inch tall wild mustard on May 29, with 70 F, 40% RH, 4 to 6 mph wind, and clear sky. All treatments were applied 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replicates. Evaluations were on June 13 and July 5. Weed density was kochia greater than 3 plants per sq yd and common lambsquarters and wild mustard 1 plant per sq yd and variable. Harvest for yield was August 6.

		6-13				7-05		8-06
Treatment[a]	Rate	Wheat inj	KOCZ	Wimu	Colq	Wheat inj	Wioa	Wheat yield
	oz/A	%						bu/A
Fluroxypyr	0.5	0	86	69	15	0	99	60.3
Fluroxypyr	1	1	89	38	0	0	96	61.1
Fluroxypyr+24-Ddma	0.5+6	1	91	98	99	1	98	64.2
Fluroxypyr+24-Ddma	1+6	2	95	99	98	0	99	61.6
Fluroxypyr+L77	0.5+0.1%	0	90	3	15	0	98	63.3
Fluroxypyr+24-Ddma+L77	0.5+6+0.1%	3	94	98	99	3	99	63.5
Fluroxypyr+PO	0.5+0.25G	0	90	0	0	0	99	61.4
Fluroxypyr+24-Ddma+PO	0.5+6+0.25G	5	97	99	99	2	99	62.9
Fluroxypyr+MS	0.5+0.25G	0	87	7	0	0	99	59.8
Fluroxypyr+24-Ddma+MS	0.5+6+0.25G	3	98	99	99	3	99	60.0
Fluroxypyr+X-77	0.5+0.25%	0	83	41	0	0	99	61.1
Fluroxypyr+24-Ddma+X-77	0.5+6+0.25%	3	94	98	95	2	99	63.7
Fluroxypyr+MS1	0.5+0.25G	0	90	45	8	0	99	61.7
Fluroxypyr+24-Ddma+MS1	0.5+6+0.25G	3	94	98	99	3	99	62.0
Fluroxypyr+Enhance	0.5+0.12G	1	75	0	0	0	98	62.5
Flox+24-Ddma+Enhance	0.5+6+0.12G	3	94	98	96	3	99	60.6
Fluroxypyr+DC5309	0.5+0.1G	1	91	53	10	1	99	59.3
Flox+24-Ddma+DC5309	0.5+6+0.1G	2	94	96	97	1	99	63.3
Untreated	0	0	0	0	0	0	0	49.8
C.V. %		116	8	38	15	121	1	5.9
LSD 5%		2	10	37	16	2	2	5.1
# OF REPS		4	4	3	2	4	4	4

[a]dma = dimethylamine; L77 = Silwett; PO = petroleum oil adjuvant (Mor-act); MS = methylated seed oil (Scoil); X-77 = nonionic surfactant; MS1 = Sun-it II; and DC5309 = silocone surfactant.

Summary

None of the herbicide - adjuvant treatments cause any important injury to wheat. All treatments gave nearly complete control of kochia at the July 5 evaluation. Adjuvants did not increase kochia control at the early evaluation, except Enhance reduced control when with fluroxypyr applied without 2,4-D. Wheat yield was increased similarly by all treatments.

Wide response to BAS-514, Fargo 1990. Crops were seeded in 20 ft wide adjacent strips on April 24. Treatments were applied to 4.5-leaf crops on May 30 with 60 F, 40% RH, 10 to 15 mph southeast wind, and clear sky. Treatments were applied with a shielded bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on June 7 and July 6. Harvest for crop yields were on August 9.

		Eval 6-07-90							
							HRS wheat		
		Oats	Barley		Durum			Butte	
Treatment	Rate	810104	Bowman	Robust	Renville	Monroe	Stoa	86	Len
	oz/A	% injury							
BAS-514+MS	4+0.25G	16	14	23	10	7	7	8	15
BAS-514+MS	8+0.25G	20	25	28	12	11	10	11	15
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		57	23	10	54	45	24	44	33
LSD 5%		12	5	3	7	5	2	5	6
		Eval 7-06-90							
	oz/A	% injury							
BAS-514+MS	4+0.25G	10	4	11	1	3	1	3	5
BAS-514+MS	8+0.25G	19	10	21	4	6	5	6	9
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		41	119	37	104	139	130	82	60
LSD 5%		7	NS	7	3	NS	NS	4	5
		Yield							
	oz/A	bu/A							
BAS-514+MS	4+0.25G	41.3	61.9	57.4	68.3	61.7	62.6	50.3	49.6
BAS-514+MS	8+0.25G	24.2	56.1	48.0	60.9	56.5	54.6	43.8	41.0
Untreated	0	106.7	62.9	64.7	65.4	60.3	67.7	63.7	52.6
C.V. %		16.3	9.1	6.4	3.9	5.3	4.8	6.8	12.7
LSD 5%		16.2	NS	6.2	4.4	NS	5.1	6.2	NS
# OF REPS		4	4	4	4	4	4	4	4

Summary

BAS-514 at 4 and 8 oz/A caused moderate injury to all crops soon after treatment. Crops generally recovered from injury, except for 810104 oats and Robust barley which had 19 to 21% injury from BAS-514 at 8 oz/A on July 6. All BAS-514 treatments completely controlled green and yellow foxtail which was abundant in the alley between crop. However, foxtail was not present within the crops and broadleaf weeds were controlled with bromoxynil+MCPA at 4+4 oz/A. Oats yield was reduced by BAS-514 at 4 or 8 oz/A. Barley, durum wheat, and HRS wheat generally were not reduced by BAS-514 at 4 oz/A except for Butte 86 HRS wheat and Robust barley.

BAS-514 for weed control in wheat, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on April 23. Treatments (1-2lf) were applied to 2.5-leaf wheat, 1 inch tall kochia, 2- to 4-leaf wild mustard, and 2-leaf common lambsquarters on May 23 with 65 F, 60% RH, 5 to 10 mph southeast wind, and clear sky. Treatments (3-4lf) were applied to 4-leaf wheat, 1 inch tall kochia, and 2- to 4-leaf wild mustard on May 29 with 65 F, 50% RH, 5 mph southeast wind, and clear sky. Bromoxynil & MCPA at 4+4 oz/A was applied on the back one-third of the plots to 4.5-leaf wheat on May 31 with 60 F, 80% RH, and partly cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa with 35 psi to an 8 ft wide area the 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on June 7 and July 31. Harvest for wheat yield was on August 7.

		6-7-90				7-31-90				11-7-90
Treatment	Rate	Wheat inj	Kocz	Wimu	Kocz[a]	Wimu[a]	Wheat inj	Kocz	Wimu	Yield
	oz/A				%					bu/A
BAS-514+MS(1-2lf)	2.4+0.25G	1	76	4	99	99	2	96	0	58.9
BAS-514+MS(1-2lf)	3.2+0.25G	0	81	2	99	98	0	99	20	61.5
BAS-514+MS(1-2lf)	4.0+0.25G	0	84	8	98	99	0	99	0	60.5
BAS-514+MS(1-2lf)	4.8+0.25G	1	85	11	99	99	1	99	20	62.5
BAS-514+MS(3-4lf)	2.4+0.25G	5	52	7	96	98	1	99	14	60.3
BAS-514+MS(3-4lf)	3.2+0.25G	6	54	20	99	98	1	99	31	59.5
BAS-514+MS(3-4lf)	4.0+0.25G	9	58	21	99	99	2	99	24	59.9
BAS-514+MS(3-4lf)	4.8+0.25G	9	63	14	99	98	1	99	24	60.5
BAS-514+Dife+MS(3-4lf)	3.2+10+0.25G	6	76	13	99	98	1	99	50	59.4
BAS-514+Immb+MS(3-4lf)	3.2+5+0.25G	13	88	91	99	99	0	99	99	61.2
Difenzoquat	10	2	31	8	99	99	1	4	63	52.9
Imazamethabenz	5	2	92	98	99	99	1	65	99	57.6
BAS-514+DPX-R96+MS	3.2+0.2+0.25G	7	99	99	99	99	1	99	99	65.7
DPX-R9674+MS	0.2+0.25G	6	99	99	99	99	0	99	99	60.8
Untreated	0	0	0	0	99	97	0	0	0	55.0
C.V. %		72	20	23	1	1	184	6	56	9.3
LSD 5%		4	20	11	NS	NS	NS	7	34	NS
# OF REPS		4	4	4	4	4	4	4	4	4

[a] Weed control rating for the area which received bromoxynil & MCPA in addition to the other treatments.

Summary

Weed density was sparse so wheat yield was not increased by herbicide treatment which effectively controlled weeds. None of the treatment caused any important injury to wheat. All BAS-514 treatments controlled kochia, but control was slow as control was marginal at the early evaluation. Wild mustard was not controlled by BAS-514.

Broadleaf weed control with 2,4-D and adjuvants, Hettinger 1990. 'Len' hard red spring wheat was seeded on May 11. Treatments were applied to 5.5-leaf wheat and 0.5 to 6 inch tall kochia on June 9 with 75 F and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 17.

Treatment	Rate	KOCZ
	oz/A	%
2,4-Ddma	4	6
2,4-Ddma (dw)	4	13
2,4-Dbee	4	20
2,4-Ddma + AMSU	4+0.25G	9
2,4-Ddma + 28%	4+0.25G	14
2,4-Ddma + Cayuse	4+0.25%	34
2,4-Ddma + X-77	4+0.25%	9
2,4-Ddma + LI-700	4+0.25%	10
2,4-Ddma + PO	4+0.18G	1
2,4-Ddma + MS	4+0.18G	29
2,4-Ddma + Exp5	4+0.25G	20
2,4-Ddma + Exp6	4+0.25G	18
2,4-Ddma + Exp7	4+0.25G	23
2,4-Ddma + Exp8	4+0.25G	2
Untreated	0	0
C.V. %		137
LSD 5%		NS
# OF REPS		4

Summary

None of the 2,4-D treatment gave adequate kochia control, regardless of adjuvant. The drought apparently cause the kochia to be extremely tolerant to 2,4-D.

Broadleaf weed control in wheat with 2,4-D plus adjuvants, Williston 1990. 'Stoa' hard red spring wheat was seeded on April 24. Treatments were applied to 5.5-leaf wheat, 4 to 8 inch tall tansymustard, 2 to 4 inch tall kochia, 2 to 3 inch tall Russian thistle, and 3 to 4 inch tall common lambsquarters on June 4 with 51 F, 65% RH, 7 mph wind and partly cloudy sky. Soil temperature at a depth of 4 inches was 58 F and surface was damp. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Evaluation was on July 12. Harvest for grain yield was on July 31.

		7-12-90						7-31-90
Treatment[a]	Rate	Wheat inj	Ruth	KOCZ	Colq	Tymu	Test weight	Wheat yield
	oz/A	%					lb/bu	bu/A
2,4-Ddma	4	0	80	46	98	98	55.7	11.78
2,4-Ddma(dw)	4	0	89	75	98	72	57.8	12.65
2,4-Dbee	4	0	95	55	98	99	57.5	11.54
2,4-Ddma+AMSU	4+0.25G	0	84	23	98	97	57.4	13.38
2,4-Ddma+28%	4+0.25G	0	81	43	98	99	56.8	12.83
2,4-Ddma+Cayuse	4+0.25%	0	91	69	98	99	58.1	12.83
2,4-Ddma+X-77	4+0.25%	0	88	70	98	99	57.1	13.32
2,4-Ddma+LI-700	4+0.25%	0	83	56	98	99	56.6	12.09
2,4-Ddma+PO	4+0.18G	0	88	73	98	99	57.5	13.19
2,4-Ddma+MS	4+0.18G	0	91	68	97	99	57.7	12.46
2,4-Ddma+Exp5	4+0.25G	0	93	67	98	99	58.3	13.54
2,4-Ddma+Exp6	4+0.25G	0	93	83	97	99	59.0	12.79
2,4-Ddma+Exp7	4+0.25G	1	93	74	97	74	58.8	13.14
2,4-Ddma+Exp8	4+0.25G	0	91	69	98	99	57.9	12.50
Untreated	0	0	0	0	0	0	54.0	10.38
C.V.%		775	5	34	1	19		12.32
LSD 5%		NS	6	28	1	25		NS
# OF REPS		4	4	4	1	4	1	4

[a] dma = dimethylamine; dw = distilled water; bee = butoxyethyl ester; 28% = 28%N fertilizer; AMSU = diammonium sulfate; cayuse = product from Wilber Ellis; Li-700 = product from Loveland Industries; PO = petroleum oil with 17% emulsifier; MS = methylated seed oil (Scoil from Agsco); and Exp's = products from NDSU.

Summary

All herbicide treatments similarly tended to increase wheat grain yield. None of the treatments were injurious to wheat. Kochia control with 2,4-D varied dependent upon the adjuvant. Kochia control with 2,4-D generally was greatest when applied the experimentals, oils, cayuse, and X-77 adjuvants, equal to when applied in distilled water.

Foxtail control in wheat, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded May 19. Treatments were applied to 4-leaf wheat, 1 to 3 inch tall kochia, and 1 to 2 inch tall foxtail on June 18 with 75 F, 70% RH, no wind, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on June 26 and August 7. Harvest for yield was on August 24.

		6-26-90				8-7-90			8-24-90
Treatment	Rate	Wheat inj	Grft	KOCZ	Rrpw	Fxtl	KOCZ	Inj	Wheat yield
	oz/A	------------------			%	------------			bu/A
HOE-6001(PS)	0.4	0	99	0	0	99	0	0	22.5
HOE-6001(PS)	0.56	3	99	0	0	99	0	2	22.5
HOE-6001(PS)	0.72	0	99	0	0	99	0	1	18.6
HOE-6001(PS)	0.88	0	99	0	0	99	0	0	22.4
HOE-6001(PS)	1.04	0	99	0	0	99	0	0	22.1
HOE-6001(PS)	1.2	0	99	3	0	99	0	1	18.8
Diclofop+PO	16+0.12G	0	99	0	0	99	0	1	23.5
HOE-7125	7.5	6	99	79	34	99	71	2	29.0
HOE-7125+Bromoxynil	7.5+2	7	99	95	46	99	96	4	28.2
HOE-7125+Bromoxynil	7.5+3	3	99	99	99	99	98	2	28.8
HOE-7125+Bromoxynil	7.5+4	6	99	99	88	99	99	4	28.7
HOE-7125	9.4	0	99	89	38	99	78	4	27.1
HOE-7125+Bromoxynil	9.4+2	6	99	96	90	99	97	7	26.8
HOE-7125+Bromoxynil	9.4+3	10	99	98	96	99	99	9	30.5
HOE-7125+Bromoxynil	9.5+4	3	98	99	99	97	99	8	29.4
HOE-7125+Dicamba-Na	9.4+1	21	99	95	98	99	99	11	29.9
BAS-514+MS	3.2+0.25G	4	91	41	0	99	98	0	31.5
BAS-514+DPX-R9674+MS	3.2+0.2+0.25G	9	99	99	99	98	99	1	31.3
Propanil&MCPA	19	23	93	95	99	74	92	9	23.0
Imazamethabenz+HOE-7125	4+7.5	4	98	89	53	99	83	3	27.1
Imazamethabenz+HOE-6001	4+0.72	1	98	18	0	99	24	1	25.6
Imazamethabenz+DPX-R9674	4+0.37	1	73	10	56	0	24	0	23.2
Untreated	0	0	0	0	0	0	0	0	15.6
C.V. %		70	11	14	42	3	18	96	15.7
LSD 5%		5	14	11	26	3	14	4	5.6
# OF REPS		4	4	4	4	4	4	4	4

Summary

Green and Yellow foxtail were effectively controlled by all herbicide treatments at the late season evaluation, except for propanil&MCPA and imazamethabenz+DPX-R9674. Propanil&MCPA and HOE-7125+dicamba caused moderate injury to wheat at the early evaluation. However, wheat generally recovered and yields appeared independent of injury. Yield tended to be increased by foxtail control and further increased by kochia control.

Propanil in wheat, Prosper 1990. 'Renville' durum wheat was seeded on April 19. Treatments were applied to 2.5- to 4-leaf wheat, 4-leaf wild mustard, 1 to 1.5 inch tall common lambsquarters, and 1 to 2 inch tall kochia on May 24 with 65 F, 60% RH, 10 to 15 mph southeast wind, and partly cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Experiment was a randomized complete block design with four replicates. Evaluations were May 31 and August 1. Harvest for yield was on August 3.

Treatment	Rate	5-31-90 Wheat inj	5-31-90 KOCZ	8-1-90 Wheat inj	8-1-90 KOCZ	8-3-90 Wheat yield
	oz/A	%	%	%	%	bu/A
Propanil&MCPA	22	18	98	0	93	57.1
Propanil&MCPA	26.4	24	99	5	96	45.2
Propanil&MCPA	35.2	32	99	2	93	59.3
Propanil-DF+PO	20+.12G	13	88	0	92	63.9
Propanil-DF+PO	20+.25G	19	97	0	86	50.7
Propanil-DF+PO	24+.25G	18	97	0	75	55.3
Propanil-DF+PO	32+.25G	21	97	0	87	50.1
Propanil-DF+MCPA-ioe+PO	20+4+.12G	15	96	1	91	62.0
Propanil-DF+MCPA-ioe+PO	20+4+.25G	23	99	1	84	55.2
Propanil-DF+MCPA-ioe+PO	24+4+.25G	7	97	0	84	48.9
Propanil-DF+MCPA-ioe+PO	32+4+.25G	23	99	2	82	57.6
Diclofop+PO	2+.25G	0	0	0	0	55.6
HOE-7125[a]	12.48	46	97	28	0	9.2
HOE-6001	1.28	3	8	0	13	51.7
Untreated	0	0	0	0	0	48.6
C.V. %		28	9	66	27	13.3
LSD 5%		7	10	2	25	9.7
# OF REPS		4	4	4	4	4

[a]The low yield represents injury from the treatment, but yields would have been higher except combine plugged with the green crop at harvest.

Summary

Durum wheat was moderately injured by propanil and severely by HOE-7125 at the May 31 evaluation. Wheat recovered from the propanil injury by the August 1 evaluation. Injury from HOE-7125 was still evident as a retardation in maturity on August 8. Propanil&MCPA was generally more effective than propanil-DF + PO (petroleum oil adjuvant) at the August 8 evaluation. The MCPA ioe appeared to disrupt normal emulsion stability. The MCPA ioe was later found to form an unstable emulsion above in water.

Propanil in wheat, Fargo 1990. 'Wheaton' hard red spring wheat was seed on May 19. Treatments were applied to 4-leaf wheat, 1 to 3 inch tall kochia, and 1 to 2 inch tall foxtail on June 18 with 75 F, 70% RH, clear sky, and no wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on June 26 and August 7.

		6-26-90			8-7-90		
Treatment	Rate	Wheat inj	Grft	KOCZ	Wheat inj	Fxtl	KOCZ
	oz/A	%					
Propanil&MCPA	22	5	85	93	1	46	85
Propanil&MCPA	26.4	6	95	98	4	77	89
Propanil&MCPA	35.2	10	97	99	5	89	95
Propanil-DF+PO	20+.12G	3	65	88	2	35	61
Propanil-DF+PO	20+.25G	9	84	93	4	62	77
Propanil-DF+PO	24+.25G	4	88	96	4	68	83
Propanil-DF+PO	32+.25G	19	88	96	6	72	86
Propanil-DF+MCPA-ioe+PO	20+4+.12G	10	86	97	3	52	60
Propanil-DF+MCPA-ioe+PO	20+4+.25G	18	96	98	8	81	86
Propanil-DF+MCPA-ioe+PO	24+4+.25G	16	90	98	6	65	84
Propanil-DF+MCPA-ioe+PO	32+4+.25G	25	92	99	9	64	95
Diclofop+PO	12+.25G	0	97	5	0	89	0
HOE-7125	12.48	6	98	95	3	97	45
HOE-6001	1.28	0	98	40	1	98	8
Untreated	0	0	0	0	0	0	0
C.V. %		61	11	12	80	21	24
LSD 5%		8	14	14	4	20	22
# OF REPS		4	4	4	4	4	4

Summary

The higher rates of propanil alone and especially propanil-DF with MCPA-ioe caused moderate injury to wheat. However, the wheat recovered from injury by the August 7 evaluation. Differences between the propanil formulation were not obvious because of variability in weed stand and general drought conditions.

2,4-D and Adjuvants with various waters, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded May 8. Treatments were applied to 6-leaf wheat, 2 to 3 inch tall kochia, and 1.5 to 3 inch tall redroot pigweed on June 14 with 70 F, 85% RH, 5 mph wind, and cloudy sky. Treatments were applied in a spray carrier water containing 2000 ppm (500 ppm sodium) calcium chloride in one experiment and Fargo water in the other except for the treatment with distilled water (dw). Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on June 22 for replicates 1 & 2 of the Fargo water experiment and June 29 for replicates 3 & 4 and calcium chloride experiment.

		6-22,29-90			6-29-90	
Treatment[a]	Rate	Wheat inj	KOCZ	Wimu	Wheat inj	KOCZ
	oz/A	--------------		%	-------------	
2,4-D dma	4	0	63	99	0	17
2,4-D dma(dw)	4	0	76	99	0	43
2,4-D bee	4	6	77	99	0	70
2,4-D dma + AMSU	4+0.25G	2	70	99	0	30
2,4-D dma + 28%	4+0.25G	0	15[b]	99	0	48
2,4-D dma + Cayuse	4+0.25%	5	76	99	0	28
2,4-D dma + X-77	4+0.25%	2	83	99	0	35
2,4-D dma + LI-700	4+0.25%	5	77	99	0	39
2,4-D dma + PO	4+0.18G	6	74	99	0	48
2,4-D dma + MS	4+0.18G	5	86	99	0	76
2,4-D dma + Exp 5	4+0.25G	4	81	99	0	69
2,4-D dma + Exp 6	4+0.25G	6	88	99	0	70
2,4-D dma + Exp 7	4+0.25G	5	80	99	0	47
2,4-D dma + Exp 8	4+0.25G	4	84	99	0	79
Untreated	0	0	0	0	0	0
C.V. %		193	25	0	0	37
LSD 5%		NS	24	NS	NS	25
# OF REPS		4	4	2	4	4

[a]AMSU = ammonium sulfate (20 g/100 ml), 28% = 28% liquid nitrate fertilizer, Cayuse = product from Wilber Ellis, Li-700 = product from Loveland Industries, PO = petroleum oil adjuvant (Mor-act), and MS = methylated seed oil, Scoil.

[b]The low control indicates a possible misapplication.

Summary

2,4-D did not injure wheat regardless of adjuvants. Calcium chloride in the spray water reduced kochia control with 2,4-D from 43% when with distilled water to 17% when with calcium chloride. 2,4-D butoxyethyl ester (bee) tended to be more effective than 2,4-D dimethylamine (dma) regardless of the spray water carrier. 2,4-D dma with methylated seed (MS) or Experimental adjuvant 5, 6, and 8 was equally as effective as 2,4-D bee for kochia control. 2,4-D dma with all other other adjuvants gave kochia control similar to 2,4-D dma in distilled water. The lower kochia control in the calcium chloride experiment than the Fargo water experiment may reflect the greater density of kochia that was in that area.

2,4-D and adjuvants with NaHCO3 water Exp 2, Fargo 1990. 'Wheaton' Hard Red Spring wheat was seeded on May 8. Treatments were applied to 6-leaf wheat, 3 to 5 inch tall kochia, and 1.5 to 3 inch tall redroot pigweed on June 14 with 70 F, 85% RH, 5 mph wind, and cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on June 29.

Treatment[a]	Rate	Wheat inj	KOCZ
	oz/A	------- %	------
2,4-Ddma	4	0	17
2,4-Ddma(dw)	4	0	43
2,4-Dbee	4	0	70
2,4-Ddma + AMSU	4+0.25G	0	30
2,4-Ddma + 28%	4+0.25G	0	48
2,4-Ddma + Cayuse	4+0.25%	0	28
2,4-Ddma + X-77	4+0.25%	0	35
2,4-Ddma + LI-700	4+0.25%	0	39
2,4-Ddma + PO	4+0.18G	0	48
2,4-Ddma + MS	4+0.18G	0	76
2,4-Ddma + Exp5	4+0.25G	0	69
2,4-Ddma + Exp6	4+0.25G	0	70
2,4-Ddma + Exp7	4+0.25G	0	47
2,4-Ddma + Exp8	4+0.25G	0	79
Untreated	0	0	0
C.V. %		0	37
LSD 5%		NS	25
# OF REPS		4	4

[a]The water carrier was sodium chloride at 1000 ppm except for dw which was distilled water; dma = dimethyl amine, bee = butoxyethyl ester, AMSU = ammonium sulfate, Cayuse = adjuvant from Wilbur Ellis, Li 700 = adjuvant from Loveland Industries, PO = petroleum oil with 17% Atplus 300F, MS = methylated seed oil (Scoil from Agsco), and Exp 5-8 or experimental adjuvants from NDSU.

Summary

2,4-D, regardless of adjuvant, did not injure wheat. Kochia control only exceeded 65 when treated with 2,4-D bee, 2,4-D dma + MS, and experimentals 5, 6, & 8. The other adjuvants did not enhance kochia control beyond that with 2,4-D in distilled water. Calcium chloride in the spray carrier reduced kochia control with 2,4-D dma from 43 to 17%.

Weed control in Flax, Fargo 1990. Experiments were conducted to evaluate various herbicide combination for broadspectrum weed control in flax. Present herbicides for postemergence weed control in flax is limited are MCPA, bromoxynil, and sethoxydim. 'Neche' flax was seeded on May 5, 1990 at Fargo, North Dakota. Treatments including broadleaf control herbicides were applied to 3 inch tall flax, and weed 1 to 3 inches tall on June 7 with 60 F and 70% relative humidity. Conditions were excellent for plant growth and the first rain after treatment was 0.31 inch on June 11. The separate sethoxydim treatments were applied to 7 inch flax and weeds 3 to 5 inches tall on June 12 with 65 F and 75% relative humidity. The first rain after treatment was 0.04 inch on June 14. Treatments were applied with a bicycle wheel type plot sprayer at 8.5 gpa, 35 psi, and 8001 flat fan nozzle. Treatments were to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were visual percent control on the dates indicated in the Table and harvest was on September 10. Kochia, common lambsquarters, and green foxtail each was more then 1 plant/ft2 and other weeds less than 2/yd2 and variable.

		6-25								8-07					9-10
		Flax								Flax					
Treatment[a]	Rate	Inj	Sdr	KOCZ	Colq	Wimu	Rrpw	Vowh	Yeft	inj	KOCZ	Colq	Wibu	Rrpw	Yield
	oz/A	%													bu/A
Bromoxynil+Sethoxydim+MS	4+3+0.25G	1	0	94	99	99	8	98	94	0	77	98	94	0	25.3
Bromoxynil&MCPA+Seth+MS	6+3+0.25G	3	3	87	99	99	55	96	97	0	87	99	99	0	27.1
MCPA-ioe+Sethoxydim+MS	4+3+0.25G	0	0	43	97	99	51	98	99	0	0	99	0	0	.0
Mets+MCPA-ioe+Seth+MS	0.02+4+3+0.25G	45	2	99	99	99	99	99	96	0	99	99	84	99	26.2
Mets+MCPA-ioe/Seth+MS	0.02+4/3+0.25G	28	0	99	99	99	99	67	95	3	97	98	76	99	26.5
Metsulfuron+Brox+Seth+MS	0.02+4+3+0.25G	44	3	99	98	99	99	99	96	9	94	97	99	98	22.1
Metsulfuron+Brox/Seth+MS	0.02+4/3+0.25G	44	1	98	99	99	99	82	99	6	92	99	99	99	25.2
Metsulfuron+Picl+Seth+MS	0.02+0.25+3+0.25G	41	2	89	92	99	99	70	89	5	71	99	97	99	20.0
DPX-R96+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	93	19	99	99	99	99	97	97	30	96	99	99	99	18.7
DPX-R9674+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	90	4	99	99	99	99	83	97	25	98	99	70	99	21.7
DPX-M6316+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	29	0	98	99	99	99	97	98	3	98	99	99	99	25.2
DPX-M6316+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	19	0	98	96	99	99	82	95	1	97	99	99	99	27.6
Imep+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	3	0	90	94	99	91	99	99	0	90	99	11	99	21.7
Imep+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	2	0	91	93	99	74	78	93	5	80	99	45	84	23.7
Imep+MCPA-ioe+MS	0.1+4+0.25G	7	0	96	93	99	89	48	76	0	97	99	71	99	23.2
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
C.V. %		29	264	4	2	0	13	15	5	89	13	1	18	10	10.6
LSD 5%		12	8	4	3	NS	14	21	7	7	14	1	19	10	3.2
# OF REPS		4	4	4	4	4	4	3	4	4	4	4	4	4	4

[a] MS = methylated seed oil with emulsifier (Sun-it), ioe = isooctyl ester, and Imep = Imazethapyr.

Summary

Flax yield related to the degree of weed control. The zero yield given for flax resulted from certain treatments that were impossible to harvest because the weeds would not pass through the combine. DPX-R9674+MCPA caused severe injury to flax, flax recovery was excellent as yield were only slightly reduced. Metsulfuron+bromoxynil+sethoxydim gave nearly complete control of all weeds and combinations with MCPA did not adequately control wild buckwheat. Also, DPX-M6316 (DPX-M6)+MCPA controlled all weed and the treated flax yield 25 to 27 bu/A. Imazethapyr appeared promising for weed control in flax.

Weed control in Flax, Fargo 1990. Experiments were conducted to evaluate various herbicide combination for broadspectrum weed control in flax. Present herbicides for postemergence weed control in flax is limited are MCPA, bromoxynil, and sethoxydim. 'Neche' flax was seeded on May 5, 1990 at Fargo, North Dakota. Treatments including broadleaf control herbicides were applied to 3 inch tall flax, and weed 1 to 3 inches tall on June 7 with 60 F and 70% relative humidity. Conditions were excellent for plant growth and the first rain after treatment was 0.31 inch on June 11. The separate sethoxydim treatments were applied to 7 inch flax and weeds 3 to 5 inches tall on June 12 with 65 F and 75% relative humidity. The first rain after treatment was 0.04 inch on June 14. Treatments were applied with a bicycle wheel type plot sprayer at 8.5 gpa, 35 psi, and 8001 flat fan nozzle. Treatments were to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were visual percent control on the dates indicated in the Table and harvest was on September 10. Kochia, common lambsquarters, and green foxtail each was more then 1 plant/ft2 and other weeds less than 2/yd2 and variable.

		6-25								8-07					9-10
		Flax								Flax					
Treatment[a]	Rate	Inj	Sdr	KOCZ	Colq	Wimu	Rrpw	Vowh	Yeft	inj	KOCZ	Colq	Wibu	Rrpw	Yield
	oz/A	%													bu/A
Bromoxynil+Sethoxydim+MS	4+3+0.25G	1	0	94	99	99	8	98	94	0	77	98	94	0	25.3
Bromoxynil&MCPA+Seth+MS	6+3+0.25G	3	3	87	99	99	55	96	97	0	87	99	99	0	27.1
MCPA-ioe+Sethoxydim+MS	4+3+0.25G	0	0	43	97	99	51	98	99	0	0	99	0	0	.0
Mets+MCPA-ioe+Seth+MS	0.02+4+3+0.25G	45	2	99	99	99	99	99	96	0	99	99	84	99	26.2
Mets+MCPA-ioe/Seth+MS	0.02+4/3+0.25G	28	0	99	99	99	99	67	95	3	97	98	76	99	26.5
Metsulfuron+Brox+Seth+MS	0.02+4+3+0.25G	44	3	99	98	99	99	99	96	9	94	97	99	98	22.1
Metsulfuron+Brox/Seth+MS	0.02+4/3+0.25G	44	1	98	99	99	99	82	99	6	92	99	99	99	25.2
Metsulfuron+Picl+Seth+MS	0.02+0.25+3+0.25G	41	2	89	92	99	99	70	89	5	71	99	97	99	20.0
DPX-R96+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	93	19	99	99	99	99	97	97	30	96	99	99	99	18.7
DPX-R9674+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	90	4	99	99	99	99	83	97	25	98	99	70	99	21.7
DPX-M6316+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	29	0	98	99	99	99	97	98	3	98	99	99	99	25.2
DPX-M6316+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	19	0	98	96	99	99	82	95	1	97	99	99	99	27.6
Imep+MCPA-ioe+Seth+MS	0.1+4+3+0.25G	3	0	90	94	99	91	99	99	0	90	99	11	99	21.7
Imep+MCPA-ioe/Seth+MS	0.1+4/3+0.25G	2	0	91	93	99	74	78	93	5	80	99	45	84	23.7
Imep+MCPA-ioe+MS	0.1+4+0.25G	7	0	96	93	99	89	48	76	0	97	99	71	99	23.2
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
C.V. %		29	264	4	2	0	13	15	5	89	13	1	18	10	10.6
LSD 5%		12	8	4	3	NS	14	21	7	7	14	1	19	10	3.2
# OF REPS		4	4	4	4	4	4	3	4	4	4	4	4	4	4

[a] MS = methylated seed oil with emulsifier (Sun-it), ioe = isooctyl ester, and Imep = Imazethapyr.

Summary

Flax yield related to the degree of weed control. The zero yield given for flax resulted from certain treatments that were impossible to harvest because the weeds would not pass through the combine. DPX-R9674+MCPA caused severe injury to flax, flax recovery was excellent as yield were only slightly reduced. Metsulfuron+bromoxynil+sethoxydim gave nearly complete control of all weeds and combinations with MCPA did not adequately control wild buckwheat. Also, DPX-M6316 (DPX-M6)+MCPA controlled all weed and the treated flax yield 25 to 27 bu/A. Imazethapyr appeared promising for weed control in flax.

Metsulfuron and Picloram for weed control in Flax, Langdon 1990. 'Neche' flax was seeded on May 5. Treatments were applied to 7 inch tall Flax, 3 to 4 inch tall common lambsquarters, 4 to 6 inch tall mustard, 3- to 4-leaf yellow foxtail, 2 to 6 inch tall wild buckwheat, and 4 to 5 inch tall kochia on June 12 with 65 F, 75% RH, 1 to 3 mph wind and partly cloudy sky. The (/)sethoxydim treatment was applied June 15. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on August 7.

Treatment	Rate	Flax inj	KOCZ	Colq	Yeft
	oz/A	-----------	%	-----------	
Metsulfuron+Picloram+Seth+MS	.02+.25+3+.25G	84	98	99	98
Metsulfuron+Picloram/Seth+MS	.02+.25/3+.25G	28	95	98	95
Metsulfuron+MCPA+Seth+MS	.02+4+3+.25G	65	99	99	99
Untreated	0	0	0	0	0
C.V. %		18	3	1	3
LSD 5%		13	3	1	3
# OF REPS		4	4	4	4

Summary

All treatments caused severe injury to flax and complete control of weeds present. The severe injury may have been because of the advanced flax growth or the moist conditions at treatment.

Adjuvants with postemergence herbicides in corn, Hettinger 1990. Hybrids 'Gerda' and 'Anna' corn were each alternately seeded in six rows throughout the field on May 15 1990. Treatments were applied to 8+-leaf corn, 3- to 4-leaf foxtail, 2 to 4 inch tall kochia, 2 to 3 inch tall Russian thistle, and 5- leaf wild buckwheat on June 20 and 21. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. X-77 was at 0.25% (v/v) and the oil adjuvants were at 1 qt/A. The experiment was a factorial arranged in a lattice design with three added treatments. Data was analyzed as a randomized complete block design with four replicates. Evaluation was on July 16.

Table located on page 35.

Summary

DPX-V9360 and DPX-E9636 control of foxtail was similar regardless of adjuvants, but kochia control was generally greater when either herbicide was with MS or MS2 than with X-77 or PO adjuvants. Russian thistle control was inadequate with all of the sulfonylureas (DPX compounds) regardless of adjuvant. DPX-79406 applied with MS generally gave greater foxtail control and when with MS or MS2 greater kochia control, than when applied with any of the other adjuvants.

Adjuvants with postemergence herbicides in corn, Williston 1990. Northrup King 'Px 9055' was seeded on May 23. Treatments were applied to 3- to 4-leaf corn, 2 to 6 inch tall redroot pigweed, 3 to 10 inch tall green and yellow foxtail, 6 to 14 inch tall wild oats, and 4 to 6 inch tall kochia on June 28 with 80 F, 65% RH, 5 to 15 mph wind, and partly cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through an 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. One week after the first evaluation the entire plot area was treated with bromoxynil at 4 oz/A to control broadleaf weeds and allow for later season foxtail evaluations. The experiment was analyzed as a randomized complete block design with four replicates. Evaluations were on July 12 and October 9. Corn yields were not taken because the extreme drought prevented corn growth.

Table located on page 36.

Summary

DPX-V9360 control of green foxtail, Russian thistle, and redroot pigweed generally was greater when applied with methylated seed oil (MS, Scoil) or MS2 (Sun-it II) adjuvants than with petroleum oil (Mor-act) or nonionic surfactant X-77. Green foxtail control remained similar for the first to final evaluation. The various adjuvants had a similar relative effectiveness for enhancement of weed control with DPX-E9636 and DPX-79406 as with DPX-V9360. However, the differences among the adjuvants were less than when with DPX-V9360. Green foxtail control with DPX-E9636 was generally greater than with DPX-79406 or DPX-V9360 when applied with X-77 or petroleum oil adjuvants, but the three compounds gave similar foxtail control when applied with MS or MS2.

Table - Adjuvants with postemergence herbicides in corn, Hettinger 1990.

Treatment[a]	Rate	Grft	KOCZ	Ruth	Corn inj
	oz/A	-------------		%	-------------
DPX-V9360+X-77	0.12	35	23	31	15
DPX-V9360+X-77	0.25	66	14	34	19
DPX-V9360+X-77	0.50	78	35	44	10
DPX-E9636+X-77	0.12	45	38	30	18
DPX-E9636+X-77	0.25	51	45	36	11
DPX-E9636+X-77	0.50	56	72	48	16
DPX-79406+X-77	0.12	41	15	23	24
DPX-79406+X-77	0.25	50	24	25	8
DPX-79406+X-77	0.50	64	64	41	11
DPX-V9360+MS	0.12	51	33	30	9
DPX-V9360+MS	0.25	56	58	31	12
DPX-V9360+MS	0.50	83	68	51	5
DPX-E9636+MS	0.12	58	85	40	10
DPX-E9636+MS	0.25	49	83	28	6
DPX-E9636+MS	0.50	70	98	48	7
DPX-79406+MS	0.12	60	65	33	12
DPX-79406+MS	0.25	79	97	40	10
DPX-79406+MS	0.50	80	87	45	5
DPX-V9360+MS2	0.12	52	69	25	9
DPX-V9360+MS2	0.25	72	54	35	10
DPX-V9360+MS2	0.50	81	88	34	5
DPX-E9636+MS2	0.12	36	50	18	6
DPX-E9636+MS2	0.25	64	91	41	13
DPX-E9636+MS2	0.50	64	92	51	6
DPX-79406+MS2	0.12	49	75	20	11
DPX-79406+MS2	0.25	62	92	27	8
DPX-79406+MS2	0.50	80	98	44	7
DPX-V9360+PO	0.12	45	18	23	15
DPX-V9360+PO	0.25	76	45	35	18
DPX-V9360+PO	0.50	86	47	50	9
DPX-E9636+PO	0.12	55	69	47	18
DPX-E9636+PO	0.25	59	76	35	9
DPX-E9636+PO	0.50	51	74	36	6
DPX-79406+PO	0.12	64	58	46	20
DPX-79406+PO	0.25	54		38	10
DPX-79406+PO	0.50	82	96	53	13
CYANIZINE+SO		6	99	99	9
C.V. %		26	22	39	73
LSD 5%		22	20	21	NS
# OF REPS		4	4	4	4

[a] MS = methylated seed oil, Scoil; MS2 = Sun-it II; PO = petroleum oil, Mor-act; and SO = seed oil adjuvants.

Table - Adjuvants with postemergence herbicides in corn, Williston 1990.

Treatment	Rate	7-12-90				10-9-90
		Fxtl	Ruth	Rrpw	Corn inj	Fxtl
	oz/A	%				
DPX-V9360+X-77	0.12	50	13	24	11	54
DPX-V9360+X-77	0.25	63	21	21	3	46
DPX-V9360+X-77	0.50	70	34	36	3	65
DPX-E9636+X-77	0.12	69	13	41	6	69
DPX-E9636+X-77	0.25	62	30	70	4	63
DPX-E9636+X-77	0.50	67	33	46	3	81
DPX-79406+X-77	0.12	66	11	46	8	54
DPX-79406+X-77	0.25	74	25	39	6	83
DPX-79406+X-77	0.50	78	28	55	4	86
DPX-V9360+MS	0.12	76	40	50	4	85
DPX-V9360+MS	0.25	77	67	30	1	90
DPX-V9360+MS	0.50	90	60	50	1	83
DPX-E9636+MS	0.12	87	36	60	2	86
DPX-E9636+MS	0.25	86	68	41	0	88
DPX-E9636+MS	0.50	79	93	61	0	93
DPX-79406+MS	0.12	81	32	46	2	90
DPX-79406+MS	0.25	91	49	60	2	92
DPX-79406+MS	0.50	95	76	75	1	97
DPX-V9360+MS2	0.12	84	54	46	3	80
DPX-V9360+MS2	0.25	89	59	44	6	84
DPX-V9360+MS2	0.50	84	68	55	0	91
DPX-E9636+MS2	0.12	73	36	41	3	83
DPX-E9636+MS2	0.25	79	40	50	2	89
DPX-E9636+MS2	0.50	78	79	50	0	89
DPX-79406+MS2	0.12	85	32	35	4	91
DPX-79406+MS2	0.25	85	62	31	1	92
DPX-79406+MS2	0.50	94	85	63	0	92
DPX-V9360+PO	0.12	76	19	16	5	66
DPX-V9360+PO	0.25	72	44	23	2	76
DPX-V9360+PO	0.50	74	61	45	7	80
DPX-E9636+PO	0.12	71	19	36	3	78
DPX-E9636+PO	0.25	79	53	59	2	83
DPX-E9636+PO	0.50	73	54	64	1	83
DPX-79406+PO	0.12	61	17	36	4	81
DPX-79406+PO	0.25	70	38	39	3	79
DPX-79406+PO	0.50	85	44	58	3	90
CYANIZINE+SO		6	97	0	1	15
C.V. %		15	26	56	9	13.3
LSD 5%		16	16	34	5	14.7
# OF REPS		4	4	4	4	4

Adjuvants with postemergence herbicides in corn, Minot 1990. 'Cenex hybrid 4038' corn was seeded on May 14. Treatments were applied to 4+-leaf corn, 6 inch tall Russian thistle, early budding wild mustard, 3 inch tall kochia, 3 to 4 inch tall foxtail, and 4 to 5 inch tall redroot pigweed on June 14 with 60 F, 80% RH, 5 to 10 mph north wind, and overcast sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gap at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was analyzed as a randomized complete block design with four replicates. Evaluations were on July 12, August 7, and October 9. Harvest for yield was on October 9.

Table located on page 38.

Summary

Adjuvant effectiveness with DPX-V9360 was generally methylated seed oil (MS, Scoil) $\geq$ MS2 (Sun-it II) > petroleum oil (Mor-act) > nonionic surfactant X-77. Adjuvants followed a similar order of effectiveness when with DPX-E9636 or DPX-79406 as with DPX-V9360 , except differences among adjuvants were less when with DPX-E9636 or DPX-79406. None of the herbicides caused important injury to corn. The degree of weed control did not always relate to corn yield. Weed populations were only moderate so small differences in control probably only caused small yield differences which were not detectable. However, corn yield was drastically reduced when weeds were not controlled or only partly controlled as with cyanazine.

Adjuvants with postemergence herbicides in corn, Fargo 1990. 'Interstate 343A' corn was seeded on May 8. Treatments were applied to 4.5 to 5-leaf corn, 3.5 to 4-leaf wild oats, .5 to 1.5 inch tall wild buckwheat, 1 to 4 inch tall common lambsquarters, and 1 to 3 inch tall foxtail on June 11 with 80 F, and 80% RH. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a factorial done in a lattice design with three treatments added and analyzed randomized complete block design with four replicates. Evaluations were on July 1 and 2, August 8, and September 25. Harvest for yield was on September 28.

Table located on page 39.

Summary

Wild oats was completely controlled at the July 1 evaluation by the sulfonylurea herbicides regardless of rate or adjuvant. Wild mustard occurred in the plot area and was controlled by all herbicides so the data is not presented. Oil type adjuvants (PO = petroleum oil, Mor-act; MS= methylated seed oil, Scoil; MS2, Sun-it II) were more effective than X-77 as adjuvants with DPX- V9360. DPX-E9636 and DPX-V9360. Corn was not injured by any of the treatments. Wild oats control increased as evaluation was delayed, but foxtail control decreased as evaluation was delayed for the less effective treatments. Common lambsquarters, Venice mallow, and wild buckwheat were not adequately controlled by the sulfonylureas regardless of adjuvants or rate of application.

Table - Adjuvants with postemergence herbicides in corn, Minot 1990.

		7-12-90						8-7-90						10-9-90			
							Corn						Corn				
Treatment	Rate	Fxtl	Rrpw	Ruth	Colq	Wibu	inj	Fxtl	Rrpw	Ruth	Colq	Wibu	inj	Fxtl	Pl/Rw	Yield	H2O
	oz/A	-------	-------	-------	-------	-------	-------	%	-------	-------	-------	-------	-------	-------	-------	bu/A	%
DPX-V9360+X-77	0.12	56	74	58	59	41	0	28	72	23	14	40	0	53	23	38.3	24
DPX-V9360+X-77	0.25	72	91	59	29	51	1	55	99	51	38	34	0	82	24	36.1	20
DPX-V9360+X-77	0.50	83	90	74	73	46	1	79	98	67	60	49	0	92	25	49.8	18
DPX-E9636+X-77	0.12	68	89	43	22	69	1	46	84	41	68	36	0	77	26	48.8	19
DPX-E9636+X-77	0.25	77	96	79	69	73	1	71	98	53	54	73	0	90	28	53.0	22
DPX-E9636+X-77	0.50	84	97	75	64	72	4	90	98	74	69	87	0	96	23	47.2	20
DPX-79406+X-77	0.12	67	80	34	55	53	1	60	95	41	49	61	0	80	26	37.8	19
DPX-79406+X-77	0.25	79	95	56	75	59	0	82	99	53	66	78	0	91	27	41.7	17
DPX-79406+X-77	0.50	91	98	62	71	66	1	96	98	68	60	67	0	98	26	42.7	18
DPX-V9360+MS	0.12	80	90	48	72	66	1	74	99	49	58	76	0	87	26	40.0	18
DPX-V9360+MS	0.25	85	93	72	43	61	1	93	97	69	81	57	0	94	28	43.2	16
DPX-V9360+MS	0.50	95	96	90	75	82	1	97	99	82	96	86	0	99	25	37.8	17
DPX-E9636+MS	0.12	85	94	77	83	85	1	84	92	65	66	85	0	95	24	44.5	19
DPX-E9636+MS	0.25	89	95	65	66	82	2	94	98	86	76	82	0	98	26	41.3	15
DPX-E9636+MS	0.50	91	99	93	56	79	1	92	99	87	92	86	0	99	24	43.6	19
DPX-79406+MS	0.12	75	89	79	37	68	0	70	99	70	87	55	0	91	28	47.9	20
DPX-79406+MS	0.25	92	96	90	56	81	1	94	95	91	75	71	0	99	23	49.0	20
DPX-79406+MS	0.50	94	98	99	85	90	2	99	99	95	96	85	0	99	25	45.8	17
DPX-V9360+MS2	0.12	83	71	55	26	51	0	74	97	57	55	46	0	85	24	39.5	22
DPX-V9360+MS2	0.25	83	83	61	49	62	0	81	98	51	56	46	0	89	27	48.4	20
DPX-V9360+MS2	0.50	86	92	84	65	65	0	93	97	88	66	58	0	97	25	49.7	18
DPX-E9636+MS2	0.12	82	97	74	74	76	1	72	94	68	67	86	0	89	27	51.6	20
DPX-E9636+MS2	0.25	80	85	68	28	74	2	84	99	86	72	61	0	98	28	41.4	22
DPX-E9636+MS2	0.50	88	98	85	59	87	2	92	96	74	84	83	0	99	23	43.2	18
DPX-79406+MS2	0.12	83	96	61	60	79	2	77	95	50	64	64	0	89	25	44.5	18
DPX-79406+MS2	0.25	92	97	78	72	81	1	94	99	90	72	77	0	99	26	46.0	17
DPX-79406+MS2	0.50	89	92	87	39	74	2	98	97	99	64	63	0	99	24	46.3	21
DPX-V9360+PO	0.12	67	83	48	56	59	2	40	86	46	43	62	0	72	28	40.3	20
DPX-V9360+PO	0.25	76	89	55	44	56	0	54	98	55	54	49	0	79	24	37.2	19
DPX-V9360+PO	0.50	87	92	66	73	69	2	85	99	69	71	54	0	94	25	42.4	16
DPX-E9636+PO	0.12	74	93	62	40	69	1	56	96	45	48	59	0	82	22	34.7	18
DPX-E9636+PO	0.25	77	97	87	73	80	3	67	89	71	64	78	0	85	25	52.1	24
DPX-E9636+PO	0.50	91	98	92	85	85	4	95	94	91	86	86	0	99	25	49.4	20
DPX-79406+PO	0.12	79	98	76	50	66	1	79	99	39	41	70	0	96	24	41.0	18
DPX-79406+PO	0.25	77	95	64	73	80	1	76	99	65	82	75	0	92	21	38.2	20
DPX-79406+PO	0.50	90	97	85	51	84	1	91	99	75	82	74	0	97	24	44.4	20
CULTIVATE														24	22	23.6	22
CYANIZINE+SO		41	50	98	84	99	6	15	26	99	99	99	0	39	21	37.1	27
WEED FREE														99	26	56.3	22
WEEDY														0	20	3.6	36
C.V. %		10	10	26	33	18	112	16	9	24	33	34	0	8	15	9.8	9.5
LSD 5%		11	12	26	27	18	2	17	11	23	31	32	NS	10	NS	NS	
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Table - Adjuvants with postemergence herbicides in corn, Fargo 1990.

Treatment	Rate	7-1&2						8-01					9-24		9-28	Seed
		Wioa	Fxtl	Wibu	Vema	Colq	Inj	Fxtl	Wibu	Vema	Colq	Wioa	Fxtl	Pl/rw	Yield	H2O
	oz/A	%													bu/A	%
DPX-V9360+X-77	0.12	81	70	47	40	31	0	40	0	10	0	99	67	19	6.8	29
DPX-V9360+X-77	0.25	89	73	57	52	43	0	70	16	1	19	99	79	21	11.5	27
DPX-V9360+X-77	0.50	88	81	55	50	35	0	87	1	20	20	99	81	22	12.4	29
DPX-E9636+X-77	0.12	89	79	52	50	54	0	81	1	16	23	99	85	20	17.8	27
DPX-E9636+X-77	0.25	91	85	59	58	55	0	97	0	40	34	99	98	19	14.0	27
DPX-E9636+X-77	0.50	92	88	64	64	58	0	99	20	45	43	99	96	21	17.3	27
DPX-79406+X-77	0.12	88	78	52	45	40	0	74	0	13	8	99	79	19	16.6	27
DPX-79406+X-77	0.25	90	84	57	55	50	0	99	3	14	29	99	89	23	16.4	28
DPX-79406+X-77	0.50	92	90	60	58	56	0	99	20	28	36	99	99	23	22.3	24
DPX-V9360+MS	0.12	89	81	56	47	45	0	93	8	20	16	99	87	14	7.0	29
DPX-V9360+MS	0.25	89	84	56	42	55	0	97	0	20	41	99	92	20	8.3	28
DPX-V9360+MS	0.50	91	88	58	48	62	0	86	0	20	28	99	93	23	15.7	27
DPX-E9636+MS	0.12	89	83	55	53	53	0	99	13	29	50	99	97	22	25.3	25
DPX-E9636+MS	0.25	92	93	61	61	62	0	94	0	30	45	99	92	22	22.9	28
DPX-E9636+MS	0.50	91	93	66	64	69	0	99	10	54	48	99	99	22	20.0	25
DPX-79406+MS	0.12	91	87	55	55	48	0	98	4	29	27	99	94	19	10.9	27
DPX-79406+MS	0.25	92	90	60	63	63	0	91	0	38	41	99	92	23	23.5	24
DPX-79406+MS	0.50	92	93	65	61	68	0	97	8	44	40	99	97	23	23.9	25
DPX-V9360+MS2	0.12	90	78	48	40	55	0	76	0	0	23	99	81	18	7.9	28
DPX-V9360+MS2	0.25	91	85	54	41	38	0	91	6	28	26	99	93	21	9.7	22
DPX-V9360+MS2	0.50	90	85	61	45	53	0	84	6	5	30	99	85	21	14.1	29
DPX-E9636+MS2	0.12	90	85	56	61	62	0	92	0	33	36	99	92	21	20.6	27
DPX-E9636+MS2	0.25	92	91	66	59	65	0	95	6	39	44	99	99	24	24.5	26
DPX-E9636+MS2	0.50	92	94	67	66	62	0	99	30	46	53	99	98	22	21.8	27
DPX-79406+MS2	0.12	88	85	55	55	58	0	89	4	16	51	99	92	21	13.8	28
DPX-79406+MS2	0.25	91	90	59	60	61	0	99	11	45	53	99	98	22	23.0	25
DPX-79406+MS2	0.50	92	93	66	65	74	0	99	10	41	45	99	96	24	24.2	26
DPX-V9360+PO	0.12	86	78	42	38	26	0	84	0	15	2	99	82	17	3.8	30
DPX-V9360+PO	0.25	90	82	54	41	43	0	86	1	9	34	99	93	23	14.1	28
DPX-V9360+PO	0.50	91	85	57	52	60	0	85	3	23	9	99	93	20	13.1	25
DPX-E9636+PO	0.12	88	84	60	51	56	0	91	9	30	18	99	91	23	20.4	26
DPX-E9636+PO	0.25	91	87	60	56	55	0	99	4	18	33	99	98	22	21.1	26
DPX-E9636+PO	0.50	91	88	59	61	62	0	99	0	46	40	99	96	21	19.7	26
DPX-79406+PO	0.12	88	83	53	54	48	0	92	0	30	25	99	85	23	17.2	27
DPX-79406+PO	0.25	91	86	62	57	60	0	85	1	38	26	99	90	23	19.7	25
DPX-79406+PO	0.50	93	90	61	59	69	0	91	8	26	35	99	96	22	23.0	26
CULTIVATE													40	22	6.2	30
CYANIZINE+SO		17	8	99	97	99	0	14	93	99	99	9	20	21	10.3	30
WEED FREE													97	22	29.1	21
WEEDY													0	13	2.6	32
C.V. %		3	5	8	10	12	0	17	147	67	58	2	9	15	41.0	14
LSD 5%		3	5	7	7	10	NS	21	16	27	27	2	11	4	9.4	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Adjuvants with postemergence herbicides in corn, Casselton 1990. 'Interstate 343A' corn was seeded on May 22. Treatments were applied to 6-leaf corn, 3-leaf foxtail, budding wild mustard, 6-leaf redroot pigweed, and 4-leaf barnyard grass on June 25 with 90 F, 75% RH, no wind, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Oil type adjuvants were applied at 1 qt/A and X-77 at 0.25% of the spray volume. The experiment was a factorial in a lattice design with three added treatments and the analysis presented is for a randomized complete block design with four replicates. Evaluations were on July 9 (broadleaves), July 16 (foxtail), August 1, and Sept 25. Harvest for yield was on Oct 12.

Table located on page 41.

Summary

Corn injury was more from DPX-E9636 than DPX-79406 and did not occur with DPX-V9360. Injury to corn was most severe when the herbicides were applied with MS (methylated seed oil, Scoil). Corn injury generally related to weed control. Corn yields generally increased directly with weed control except when corn injury occurred. Adjuvants enhancement of foxtail control with the sulfonylureas was MS more than MS2 (Sun-it II), more than PO (petroleum oil, Mor-act), more than X-77. However, the differences among adjuvants was the greatest for DPX-V9360. Foxtail control with DPX-V9360 at 0.25 oz/A was 94% with MS, 79% with PO, 86% with MS2, and 63% with X-77, at the September 25 the evaluation. Common lambsquarters control generally was enhanced more by MS and MS2 than PO or X-77 with all the sulfonylurea herbicides, but especially with DPX-V9360.

Adjuvants with postemergence herbicides, Grand Forks 1990. 'Siberian' foxtail millet, 'Steele' oats, and 'Sexauer 353' hybrid corn were seeded on May 14. Treatments were applied to 5- to 6-leaf corn and foxtail millet, 6 to 7 inch tall oats and 1.5 to 3 inch tall kochia on June 14 with 49 F, 65% RH, 2 to 8 mph wind, and partly sunny sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a factorial in a lattice design and the analysis presented is a randomized complete block design with four replicates. Evaluations were on June 28 and July 12.

Table located on page 42.

Summary

Injury to corn was not determined because of high variability because of drought and stand. Foxtail millet control with all three herbicides generally was greatest when with MSF or MS1 adjuvants, especially for DPX-V9360. Generally, phytotoxicity was DPX-79406 > DPX-E9636 > DPX-V9360.

Table - Adjuvants with postemergence herbicides in corn, Casselton 1990.

Treatment	Rate	7-09 Colq	7-09 Rrpw	7-16 Inj	7-16 Fxtl	8-01 Fxtl	8-01 Colq	8-01 Rrpw	8-01 Inj	9-25 Fxtl	9-25 Pl/Rw	10-12 Yield	Seed H2O
		---	---	---	---	---	---	---	---	---	---	bu/A	%
DPX-V9360+X-77	0.12	47	92	0	31	9	13	80	0	42	27	33.8	19
DPX-V9360+X-77	0.25	53	90	0	48	25	30	94	0	63	27	34.5	19
DPX-V9360+X-77	0.50	63	92	0	70	36	36	93	1	67	27	41.8	18
DPX-E9636+X-77	0.12	64	84	6	65	41	45	82	2	60	31	33.6	18
DPX-E9636+X-77	0.25	68	97	15	78	55	60	82	6	73	29	34.3	20
DPX-E9636+X-77	0.50	69	94	24	87	84	63	99	10	89	33	36.1	20
DPX-79406+X-77	0.12	61	96	2	65	44	31	86	1	73	30	36.3	19
DPX-79406+X-77	0.25	64	99	2	79	60	41	98	1	78	28	45.7	18
DPX-79406+X-77	0.50	68	94	18	89	89	64	99	4	94	29	46.7	18
DPX-V9360+MS	0.12	61	89	0	73	69	41	97	1	78	30	46.1	18
DPX-V9360+MS	0.25	65	91	0	90	90	70	99	1	94	29	45.9	19
DPX-V9360+MS	0.50	67	97	0	90	98	86	99	1	97	32	58.0	18
DPX-E9636+MS	0.12	69	93	20	85	79	48	99	5	89	28	39.5	19
DPX-E9636+MS	0.25	69	96	40	91	92	60	98	20	96	32	45.6	17
DPX-E9636+MS	0.50	75	95	61	94	92	58	99	18	94	41	36.9	21
DPX-79406+MS	0.12	68	92	10	89	87	58	99	3	88	31	48.2	19
DPX-79406+MS	0.25	72	94	16	92	97	79	98	2	95	30	56.0	18
DPX-79406+MS	0.50	78	93	37	95	98	87	98	10	97	35	50.1	18
DPX-V9360+MS2	0.12	53	84	0	72	59	38	99	1	77	30	52.1	18
DPX-V9360+MS2	0.25	65	92	0	85	87	74	99	0	86	29	46.8	20
DPX-V9360+MS2	0.50	72	93	0	88	93	86	99	1	92	31	53.4	18
DPX-E9636+MS2	0.12	66	97	13	82	78	61	99	2	85	30	40.6	19
DPX-E9636+MS2	0.25	67	92	34	91	91	59	98	14	92	34	50.8	19
DPX-E9636+MS2	0.50	68	97	52	95	93	54	98	16	94	33	43.2	20
DPX-79406+MS2	0.12	62	95	9	86	81	46	99	4	83	27	46.8	18
DPX-79406+MS2	0.25	72	92	24	91	93	70	99	9	94	30	48.0	18
DPX-79406+MS2	0.50	74	97	22	96	98	83	98	7	98	31	50.4	18
DPX-V9360+PO	0.12	56	84	0	59	48	30	74	0	69	30	37.3	21
DPX-V9360+PO	0.25	62	99	0	79	71	59	99	0	79	29	51.9	18
DPX-V9360+PO	0.50	63	91	0	80	75	66	93	1	80	29	38.9	18
DPX-E9636+PO	0.12	67	91	11	80	60	58	99	4	81	31	50.8	17
DPX-E9636+PO	0.25	69	96	31	87	85	54	87	9	89	33	39.5	19
DPX-E9636+PO	0.05	72	93	49	89	86	48	99	18	91	34	36.8	20
DPX-79406+PO	0.12	65	83	8	86	78	44	99	3	86	30	51.9	19
DPX-79406+PO	0.25	67	91	18	87	87	50	97	6	95	26	37.7	20
DPX-79406+PO	0.50	73	95	25	92	92	68	99	7	96	31	42.1	19
CULTIVATE										45	27	27.9	20
CYANIZINE+SO		99	45	11	11	8	97	28	0	21	28	22.6	23
WEED FREE										99	28	58.6	19
WEEDY										0	24	3.3	21
C.V. %		7	7	40	7	14	19	10	109	10	12	26.3	9.9
LSD 5%		7	9	9	8	15	15	12	8	11	5	15.6	.26
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4

Table - Adjuvants with postemergence herbicides, Grand Forks 1990.

Treatment	Rate	14 Day Fxmi	14 Day Oats	14 Day KOCZ	28 Day Fxmi	28 Day Oats	28 Day KOCZ
	oz/A	%					
35 DPX-V9360 + X-77	0.12 + 0.25%	74	72	63	63	79	45
26 DPX-V9360 + X-77	0.25 + 0.25%	76	76	79	69	83	61
17 DPX-V9360 + X-77	0.5 + 0.25%	78	85	81	80	93	69
20 DPX-E9636 + X-77	0.12 + 0.25%	75	76	95	78	92	80
15 DPX-E9636 + X-77	0.25 + 0.25%	82	83	99	88	96	93
07 DPX-E9636 + X-77	0.5 + 0.25%	89	85	98	95	98	96
22 DPX-79406 + X-77	0.12 + 0.25%	80	74	93	69	89	82
29 DPX-79406 + X-77	0.25 + 0.25%	84	86	92	83	96	81
33 DPX-79406 + X-77	0.5 + 0.25%	86	93	99	94	99	88
01 DPX-V9360 + MSF	0.12 + 0.25G	84	82	92	86	92	75
13 DPX-V9360 + MSF	0.25 + 0.25G	83	87	97	92	96	86
04 DPX-V9360 + MSF	0.5 + 0.25G	91	91	98	98	99	89
21 DPX-E9636 + MSF	0.12 + 0.25G	75	77	90	82	90	85
28 DPX-E9636 + MSF	0.25 + 0.25G	90	82	99	94	95	95
36 DPX-E9636 + MSF	0.5 + 0.25G	92	85	99	98	99	96
14 DPX-79406 + MSF	0.12 + 0.25G	84	87	98	94	95	82
11 DPX-79406 + MSF	0.25 + 0.25G	95	94	98	100	98	96
05 DPX-79406 + MSF	0.5 + 0.25G	98	96	99	100	100	96
32 DPX-V9360 + MS1	0.12 + 0.25G	76	77	92	77	89	78
18 DPX-V9360 + MS1	0.25 + 0.25G	85	84	93	91	96	85
23 DPX-V9360 + MS1	0.5 + 0.25G	95	95	96	98	99	89
30 DPX-E9636 + MS1	0.12 + 0.25G	82	74	99	88	92	89
10 DPX-E9636 + MS1	0.25 + 0.25G	90	82	99	94	97	95
31 DPX-E9636 + MS1	0.5 + 0.25G	91	88	99	99	99	98
25 DPX-79406 + MS1	0.12 + 0.25G	84	83	93	89	92	89
27 DPX-79406 + MS1	0.25 + 0.25G	91	91	98	96	97	91
34 DPX-79406 + MS1	0.5 + 0.25G	94	91	99	100	100	96
16 DPX-V9360 + PO	0.12 + 0.25G	66	65	75	60	69	69
08 DPX-V9360 + PO	0.25 + 0.25G	71	71	85	63	81	77
06 DPX-V9360 + PO	0.5 + 0.25G	75	77	92	75	88	80
12 DPX-E9636 + PO	0.12 + 0.25G	72	72	97	61	85	90
19 DPX-E9636 + PO	0.25 + 0.25G	79	82	96	80	94	86
02 DPX-E9636 + PO	0.5 + 0.25G	82	82	99	91	95	96
09 DPX-79406 + PO	0.12 + 0.25G	70	73	99	64	86	88
03 DPX-79406 + PO	0.25 + 0.25G	84	85	98	81	93	88
24 DPX-79406 + PO	0.5 + 0.25G	88	91	99	99	99	91
37 Cyanazine	0.5 + 0.25G	48	11	81	32	08	62
C.V. %		7	5	7	8	4	11
LSD 5%		8	6	9	9	5	13
# Of Reps		4	4	4	4	4	4

Adjuvants with postemergence herbicides in corn, Kindred 1990. 'Garst' and 'Pioneer' cornwas seeded on April 25. Treatments were applied to 4- to 5-leaf corn, 3.5- to 5-leaf wild proso millet, 1 to 4 inch tall common lambsquarters, 2.5 inch tall Russian thistle, and 4.5-leaf sandbur on June 16 with 65 F, 80% RH, 0 to 5 mph wind, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. All adjuvants were applied at 1 qt/A except for X-77 which was at 0.25% of the spray volume. The experiment was a factorial in a lattice design with three treatments added and analyzed as a randomized complete block design with four replicates. Evaluations were on July 10, August 15, and October 12. Harvest for yield was on October 25.

Table located on page 44.

Summary

Corn was not injured by any of the herbicides regardless of adjuvants so the data is not presented. Treatments which controlled weeds gave corn yield equal to those of weed-free corn. Yields are quite variable as the field was seeded to two varieties. However, average yield over herbicides and herbicide rates was 3923 with X-77, 4828 with PO (petroleum oil, Mor-act), 5139 with MS (methylated seed oil, Scoil), and 4894 with MS2 (Sun-it II). Wild proso millet control on July 10 exceeded 90% for Scoil, DPX-V9360 applied with Scoil or Sun-it II, DPX-79406 applied with Scoil, Sun-it II or Mor-act, and DPX-E9636 with Scoil and Mor-act. Differences among treatments increased with the later evaluations as weeds recovered for the less effective treatments. Sandbur appeared controlled by the herbicides which controlled wild proso millet, but results were confounded as sandbur was not evident in plots having dense wild proso millet. Sandbur occurred regularly in the mowed alleys. In general the oil adjuvants (Scoil, Mor-act, Sun-it II) were more effective than nonionic surfactant X-77 in enhancing the herbicides.

Table - Adjuvants with postemergence in corn, Kindred 1990.

Treatment	Rate	7-03	7-10	8-15	10-12		10-25	Seed
		Wipm	Wipm	Wipm	Wipm	Fxtl	Yield	H2O
	oz/A	---	---	%	---	---	bu/A	%
DPX-V9360+X-77	0.12	66	53	11	30	32	46.4	20
DPX-V9360+X-77	0.25	77	73	35	51	52	61.1	19
DPX-V9360+X-77	0.50	82	79	64	71	73	79.6	18
DPX-E9636+X-77	0.12	71	70	59	55	57	60.3	19
DPX-E9636+X-77	0.25	79	79	73	64	73	64.2	19
DPX-E9636+X-77	0.50	79	81	80	79	76	65.4	19
DPX-79406+X-77	0.12	78	77	52	61	72	77.8	17
DPX-79406+X-77	0.25	79	77	74	80	76	73.5	17
DPX-79406+X-77	0.50	83	84	84	83	84	88.1	17
DPX-V9360+MS	0.12	85	85	78	74	78	78.1	18
DPX-V9360+MS	0.25	88	86	84	88	85	83.8	17
DPX-V9360+MS	0.50	90	90	94	93	88	83.3	17
DPX-E9636+MS	0.12	82	80	72	76	69	74.3	18
DPX-E9636+MS	0.25	83	81	74	82	79	82.2	18
DPX-E9636+MS	0.50	88	90	87	89	86	78.3	17
DPX-79406+MS	0.12	83	83	83	85	82	65.7	18
DPX-79406+MS	0.25	89	89	86	90	88	75.6	18
DPX-79406+MS	0.50	94	93	94	93	94	88.8	16
DPX-V9360+MS2	0.12	85	82	74	83	85	81.1	18
DPX-V9360+MS2	0.25	87	86	83	86	86	68.6	18
DPX-V9360+MS2	0.50	89	93	92	91	93	83.8	18
DPX-E9636+MS2	0.12	78	78	64	75	78	87.6	17
DPX-E9636+MS2	0.25	82	85	84	86	79	80.1	17
DPX-E9636+MS2	0.50	90	89	86	83	87	81.6	18
DPX-79406+MS2	0.12	83	83	82	81	73	83.3	17
DPX-79406+MS2	0.25	88	87	91	89	86	78.3	18
DPX-79406+MS2	0.50	92	92	94	96	95	76.5	19
DPX-V9360+PO	0.12	79	77	68	71	70	68.1	18
DPX-V9360+PO	0.25	85	84	83	85	80	70.3	19
DPX-V9360+PO	0.50	87	86	86	90	86	91.9	17
DPX-E9636+PO	0.12	79	78	73	72	72	81.0	19
DPX-E9636+PO	0.25	83	84	83	89	82	77.8	18
DPX-E9636+PO	0.50	90	91	96	93	92	87.8	17
DPX-79406+PO	0.12	82	81	73	74	73	71.8	18
DPX-79406+PO	0.25	85	85	90	88	84	79.6	18
DPX-79406+PO	0.50	88	90	95	95	92	88.4	16
CYANIZINE+SO		59	59	24	28	31	44.4	19
WEED FREE					99	99	89.4	16
WEEDY					0	0	12.9	19
CULTIVATE					40	44	48.8	18
C.V. %		3	4	14	15	9	26.8	9.9
LSD 5%		4	4	15	16	10	27.8	NS
# OF REPS		4	4	4	4	4	4	4

DPX Compounds with broadleaf herbicides, Casselton 1990. 'Interstate 343A' corn was seeded on the Dalrymple Experimental Plots, May 22. Treatments were applied to 4.5-leaf corn, 0.5- to 4-inch tall kochia 2- to 8-inch tall wild mustard, 3-inch tall redroot pigweed, 3- to 5-leaf green and yellow foxtail, 3- to 4-inch tall wild buckwheat, 1.5- to 3-leaf common lambsquarters, and 3-inch tall common cocklebur on June 21 with 68 F, 40% RH, partly cloudy sky, and 10 mph northwest wind. Conditions were excellent for plant growth at treatment and rainfall for 10 day after treatment was: a trace within 1.5 h, 0.31 in 1 day, 0.86 in 6 days, and 0.09 in 7 days. Evaluations were on July 4 and Aug 1. Foxtail consisted of about 50:50 green:yellow at > 5 plants/sq ft and other weeds were at < 5/sq yd.

		7-04						8-01
Treatment[a]	Rate	Corn inj	Fxtl	Coco	Wibu	Wimu	Colq	Fxtl
	oz/A	%						
DPX-V9360+MS	0.25+0.25G	0	93	10	26	99	95	97
DPX-V9360+MS	0.5+0.25G	2	94	63	68	99	95	98
DPX-V9360+X-77	0.5+0.25%	1	40	0	15	99	47	24
DPX-V9360+Dica-dma+X-77	.5+8+.25%	0	67	99	92	99	97	44
DPX-V9360+Brox+X-77	.5+6+.25%	3	57	99	99	99	99	38
DPX-V9360+DPX-M6+X-77	0.5+.063+0.25%	2	58	20	89	99	97	19
DPX-V9360+24-Ddma+X-77	0.5+6+0.25%	2	65	88	51	99	99	31
DPX-V9360+24-Ddma+MS	0.5+6+0.25G	4	94	96	86	99	99	98
DPX-V9360+24-Ddma+MS	0.25+3+0.25G	2	93	95	67	99	99	98
DPX-79406+X-77	0.37+0.25%	1	78	64	15	99	68	35
DPX-79406+Dica-dma+X-77	.37+8+.25%	8	83	99	96	99	99	68
DPX-79406+Brox+X-77	.37+6+.25%	3	85	99	99	99	99	63
DPX-79406+DPX-M6+X-77	.37+.063+0.25%	0	78	25	81	99	96	34
DPX-79406+24-Ddma+X-77	0.37+6+0.25%	2	82	96	53	99	99	58
Dicamba-dma	8	1	10	97	90	93	99	0
Bromoxynil	6	2	5	99	99	99	99	0
DPX-M6316+X-77	0.063+0.25%	5	16	38	78	99	95	3
24-Ddma	6	1	0	89	16	99	99	0
C.V. %		131	17	25	21	2	10	30
LSD 5%		4	15	37	20	2	13	18
# OF REPS		4	4	2	4	4	4	4

[a] MS=SUN-IT; X-77=nonionic surfactant; Dica=dicamba dimethyl amine (dma); Brox=bromoxynil; DPX-M6=DPX-M6316 or thifensulfuron.

Summary

Foxtail control was adequate (> 90%) only with DPX-V9360 applied with methylated seed oil (MS). Wild mustard was controlled by all treatments and common cocklebur by all treatments except DPX-V9360 + X-77 and DPX-79406 + X-77 applied without broadleaf herbicides. DPX-V9360 + MS controlled common lambsquarters, with or without broadleaf herbicides. DPX-V9360 + 2,4-D + MS gave > 90 % control of all broadleaf weeds, except wild buckwheat. Wild buckwheat control required the inclusion of bromoxynil, dicamba, or DPX-M6316 with DPX-V9360 or DPX-79406. Corn was not injured by any treatment. The large increase in weed control from the MS adjuvant compared to X-77 may impart reflect resistance to removal by the rain which occurred shortly after treatment.

DPX compounds applied at various stages, Fargo 1990. 'Interstate 343A' was seeded on May 22. S1 treatments were applied to 3-leaf corn, 3- to 4-leaf wild oats, 4- to 6-leaf wild mustard, 3 inch tall kochia, and 3- to 4-leaf wild buckwheat on June 7 with 75 F, 75 to 80% RH, and an overcast sky. S2 treatments were applied to 5-leaf corn on June 18 with 65 F and 70% RH. The experiment was a randomized complete block design with four replicates. Evaluations were on July 3 and August 8. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an area the length of 10 by 30 ft plots. Wild oats uniform at 3 plants per square ft, wild buckwheat at 1 plant per square ft, and kochia and common lambsquarters present at 3 per sq. m.

Treatment[a]	Rate	7-3-90						8-8-90	
		Inj	Wioa	Wibu	Kocz	Colq	Grft	Fxtl	Kocz
	oz/A	%							
DPX-79406+X-77(S1)	0.25+0.25%	0	99	13	76	0	43	48	62
DPX-79406+PO(S1)	0.25+1%	13	99	35	83	40	59	74	90
DPX-79406+MSF(S1)	0.25+1%	3	99	41	99	99	80	89	98
DPX-79406+MSF(S1)	0.25+0.25G	0	99	71	99	98	73	92	96
DPX-79406+X-77(S1)	0.37+0.25%	0	99	54	78	65	73	82	88
DPX-79406+PO(S1)	0.37+1%	0	98	36	84	50	72	80	85
DPX-79406+X-77(S1)	0.5+0.25%	1	99	30	84	50	77	80	63
DPX-79406+PO(S1)	0.5+1%	1	99	62	90	90	86	91	86
DPX-V9360+X-77(S1)	0.5+0.25%	1	99	18	43	50	38	52	35
DPX-V9360+PO(S1)	0.5+1%	0	77	44	71	60	43	70	68
DPX-V9360+MSF(S1)	0.5+1%	1	99	70	97	99	84	82	89
DPX-V9360+MSF(S1)	0.5+0.25G	1	99	84	99	98	94	82	95
DPX-79406+X-77(S2)	0.25+0.25%	3	99	11	89	70	69	73	91
DPX-79406+PO(S2)	0.25+1%	0	98	15	97	87	89	83	97
DPX-79406+MSF(S2)	0.25+1%	1	99	50	99	99	98	96	99
DPX-79406+MSF(S2)	0.25+0.25G	2	99	59	98	95	98	95	99
DPX-79406+X-77(S2)	0.37+0.25%	0	99	46	93	25	88	88	93
DPX-79406+PO(S2)	0.37+1%	2	98	69	98	79	93	93	99
DPX-79406+X-77(S2)	0.5+0.25%	1	98	39	95	82	95	92	95
DPX-79406+PO(S2)	0.5+1%	0	99	58	97	84	97	95	96
DPX-V9360+X-77(S2)	0.5+0.25%	1	97	10	64	30	59	55	60
DPX-V9360+PO(S2)	0.5+1%	1	96	52	91	83	76	81	95
DPX-V9360+MSF(S2)	0.5+1%	0	99	63	99	99	98	93	99
DPX-V9360+MSF(S2)	0.5+0.25G	0	99	71	99	99	95	96	99
C.V. %		446	10	54	11	45	22	11	13
LSD 5%		NS	13	35	13	NS	24	15	18
# OF REPS		4	4	4	4	2	4	3	3

[a] PO = petroleum oil adjuvant with emulsifier (Mor-act), X-77 = nonionic surfactant.

Summary

Wild mustard was completely controlled by all treatments so data are not presented and wild oats data also are not rated for the August 8 evaluation because all treatments gave complete control. Foxtail ratings maybe slightly confounded by broadleaf weeds which were not controlled, i.e., foxtail was not easily visible when in competition with broadleaf weeds. In general weed control with both herbicides were enhanced more by methylated seed oil (MSF, Sun-it) than other adjuvants.

DPX compounds applied at various stages, Casselton 1990. 'Interstate 343A' corn was seeded May 22. S1 treatments were applied to 5-leaf corn, 3- to 5-leaf yellow foxtail, 6-leaf redroot pigweed, 4-leaf common lambsquarters, and 6 inch tall wild mustard on June 18 with 75 F, 70% RH, no wind, and clear sky. S2 treatments were applied to 6-leaf corn, 5-leaf green foxtail, 6 to 8 inch tall budding wild mustard, 2 to 4 inch tall redroot pigweed, and 1 to 3 inch tall common lambsquarters on June 25, with 89 F, 75% RH, no wind, and cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 17 and August 1. Harvest for yield was on October 12. The rows/cob and kernels/row values were determined on five cobs randomly selected in each plot.

		7-17			8-1	10-01		10-12
		Corn				Rows/	Kernels/	
Treatment	Rate	inj	Fxtl	Colq	Fxtl	cob	row	Yield
	oz/A	----------	%	---------		----	No.---	bu/A
DPX-79406+X-77(S1)	0.25+0.25%	0	79	53	74	-	-	-
DPX-79406+PO(S1)	0.25+1%	0	88	45	90	-	-	-
DPX-79406+MSF(S1)	0.25+1%	0	97	92	98	-	-	-
DPX-79406+MSF(S1)	0.25+0.25G	1	99	95	98	-	-	-
DPX-79406+X-77(S1)	0.37+0.25%	0	88	60	89	-	-	-
DPX-79406+PO(S1)	0.37+1%	0	90	82	92	-	-	-
DPX-79406+X-77(S1)	0.5+0.25%	0	95	49	94	-	-	-
DPX-79406+PO(S1)	0.5+1%	0	94	80	93	-	-	-
DPX-V9360+X-77(S1)	0.5+0.25%	0	61	15	56	18	31	50.9
DPX-V9360+PO(S1)	0.5+1%	0	94	91	92	18	31	63.3
DPX-V9360+MSF(S1)	0.5+1%	0	97	97	98	18	32	70.0
DPX-V9360+MSF(S1)	0.5+0.25G	0	97	99	97	-	-	-
DPX-79406+X-77(S2)	0.25+0.25%	3	76	68	74	-	-	-
DPX-79406+PO(S2)	0.25+1%	5	82	71	83	-	-	-
DPX-79406+MSF(S2)	0.25+1%	5	89	90	90	-	-	-
DPX-79406+MSF(S2)	0.25+0.25G	5	96	91	96	-	-	-
DPX-79406+X-77(S2)	0.37+0.25%	3	81	58	83	-	-	-
DPX-79406+PO(S2)	0.37+1%	5	85	89	88	-	-	-
DPX-79406+X-77(S2)	0.5+0.25%	3	88	87	89	-	-	-
DPX-79406+PO(S2)	0.5+1%	3	89	83	92	-	-	-
DPX-V9360+X-77(S2)	0.5+0.25%	0	63	57	62	17	29	44.1
DPX-V9360+PO(S2)	0.5+1%	4	82	77	83	16	29	54.3
DPX-V9360+MSF(S2)	0.5+1%	0	92	88	98	18	32	66.2
DPX-V9360+MSF(S2)	0.5+0.25G	0	96	95	98	-	-	-
Untreated	0	0	0	0	0	-	-	14.7
C.V. %		364	6	16	5	8	8	17.8
LSD 5%		NS	8	17	6	2	3	13.7
# OF REPS		4	4	4	4	4	4	4

Summary

None of the herbicide treatments caused any important injury to corn. Yields were taken only for DPX-V9360 treatments. Yield tended to be higher with early treatment and within a treatment date yields related to degree of weed control. The methylated seed oil adjuvant (MSF, Sun-it) was more effective than either X-77 or petroleum oil adjuvants in enhancement of DPX-V9360 or DPX-79406 for foxtail weed control in corn. Methylated seed oil adjuvant was similarly effective at 1% or at 1 qt/A. Yields were rather low because of the late season drought and weed competition from border weeds in all plots.

Weed control in corn, Casselton 1990. Preplant incorporated (ppi) herbicides were applied and twice field cultivator plus harrow incorporated, 'Interstate 343A' corn was seeded, and preemergence (PE) herbicides on May 22 with 65 F, 50% RH, partly cloudy sky, and dry soil conditions. Postemergence treatments were applied to 5-leaf corn and green foxtail, budding wild mustard, 1 to 3 inch tall common lambsquarters, and 1 to 2 inch tall redroot pigweed on June 25 with 89 F, 75% RH, cloudy sky and no wind. All 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 35 psi through 8002 flat fan nozzles for all preemergence treatments and 8.5 gpa at 35 psi through 8001 flat fan nozzles for postemergence treatments. The experiment was a randomized complete block design with four replicates. Evaluation was on July 13.

Treatments	Rate	Grass	KOCZ	Rrpw	Colq
	oz/A		%		
EPTC&S&E+Cyanazine-DF(ppi)	64+32	91	92	92	93
Alachlor+Cyanazine-DF(ppi)	64+32	92	94	89	86
Metolachlor+Cyan-DF(PE)	40+32	90	90	70	43
Pendimethalin+Cyananine-DF(PE)	16+32	83	80	85	35
Alachlor(PE)/Bromoxynil	40/6	78	49	56	0
Alac(PE)/Bromoxynil+Atra-DF	40/4+8	83	66	66	18
Bromoxynil+Atrazine-DF	4+8	91	97	97	97
Cyanazine-DF+PO	20+0.25G	92	94	94	94
DPX-V9360+X-77	0.5+0.25%	83	94	93	78
DPX-V9360+Dicamba+X-77	0.5+4+0.12%	95	97	97	95
DPX-V9360+Bromoxynil+X-77	0.5+4+0.12%	89	83	97	95
DPX-79406+X-77	0.5+0.25%	96	97	98	97
DPX-79406+Dicamba+X-77	0.5+4+0.12%	96	96	96	96
DPX-79406+Bromoxynil+X-77	0.5+4+0.12%	77	94	94	93
CGA-136872+X-77	0.5+0.25%	71	92	95	70
CGA-136872+Dicamba+X-77	0.5+4+0.12%	43	93	92	92
CGA-136872+Bromoxynil+X-77	0.5+4+0.12%	60	96	97	97
Dica-NA+Atra-DF(*Early Post)	6.6+12.6	48	97	97	95
Linuron+X-77(PD)	1.5+0.5%	58	92	91	92
Amitryne+X-77(PD)	1.6+0.5%	66	71	76	69
Paraquat(gram/super)+X-77(PD)	0.28+0.25%	74	94	88	38
Untreated	0	0	0	0	0
C.V. %		7	4	4	16
LSD 5%		7	5	5	16
# OF REPS		4	4	4	4

[a]s=dichlormid safener; E=dietholate extender; PO=Petroleum oil with 17% emulsifier; X-77=nonionic surfactant; G in rate column represents gallons per acre; PD=postemergence directed.

Summary

Cyanazine applied alone or with other grass herbicides was above 86% when soil incorporated or applied postemergence. Common lambsquarters control decreased substantially when cyanazine was applied preemergence. Bromoxynil did not provide adequate control because of large weed size. DPX-V9360 provided good weed control applied alone or with broadleaf herbicides. DPX-79406 also provided good weed control, however, grass control was reduced with the addition of bromoxynil. CGA-1368k72 did not cadequately control annual grass species but did provide 92% control of broadleaf species except common lambsquarters. No crop injury was observed with DPX-V9360(data not included), however some crop injury was observed with DPX-79406 and CGA-136872. Post-directed treatments (linuron, amitryne, and paraquat) would have provided greater weed control if applied at higher gpa and to smaller weed.

Weed control in corn, Carrington 1990. 'Pioneer 3969' corn was seeded and preplant incorporated (ppi) treatments were applied May 25. Conditions were cloudy, 65 F, 68% RH, and a moist soil. Ppi herbicides were incorporated with a single pass by a rototiller set at a 2 inch depth. Preemergence treatments were applied May 29 with clear sky, 70 F, 47% RH, and moist soil. Early postemergence treatment was applied June 29 with 75 F, 82% RH, and wet soil conditions. All treatments were applied to plots 7.5 by 25 ft with a bicycle wheel type plot sprayer delivering 17 gpa for all soil applied treatments and 8.5 gpa for postemergence treatments. Post directed (PD) treatments were applied July 6. The experiment was a complete randomized block design with 4 replicates. Evaluation was on July 13.

Treatment	Rate	Grft	Rrpw	KOCZ	Colq	Corn inj
	oz/A	%				
EPTC&S&E+Cyanazine-DF(ppi)	64+32	97	60	87	90	0
Alachlor+Cyanazine-DF(ppi)	64+32	92	83	90	90	0
Metolachlor+Cyanazine-DF(PE)	40+32	89	69	96	96	0
Pendimethalin+Cyan-DF(PE)	16+32	91	65	86	94	0
Alachlor(PE)/Bromoxynil	40/6	74	93	86	97	0
Alac(PE)/Bromoxynil+Atra-DF	40/4+8	84	92	94	97	0
Bromoxynil+Atrazine-DF	4+8	25	64	68	74	4
Cyanazine-DF+PO	20+0.25G	67	86	78	94	10
DPX-V9360+X-77	0.5+0.25%	68	81	40	28	0
DPX-V9360+Dicamba+X-77	0.5+4+0.12%	61	64	70	65	6
DPX-V9360+Bromoxynil+X-77	0.5+4+0.12%	69	84	80	89	3
DPX-79406+X-77	0.5+0.25%	70	81	75	56	28
DPX-79406+Dicamba+X-77	0.5+4+0.12%	82	85	83	81	21
DPX-79406+Bromoxynil+X-77	0.5+4+0.12%	85	92	93	97	43
CGA-136872+X-77	0.5+0.25%	49	64	68	59	16
CGA-136872+Dicamba+X-77	0.5+4+0.12%	55	75	88	89	14
CGA-136872+Bromoxynil+X-77	0.5+4+0.12%	41	88	85	95	19
Dica-NA+Atra-DF(*Early Post)	6.6+12.6	33	90	91	96	10
Linuron+X-77(PD)	1.5+0.5%	16	20	19	14	3
Amitryne+X-77(PD)	1.6+0.5%	25	19	21	24	6
Paraquat(gram/super)+X-77(PD)	0.28+0.25%	49	43	40	44	11
Untreated	0	0	0	0	0	0
C.V. %		20	24	24	21	55
LSD 5%		17	23	24	21	7
# OF REPS		4	4	4	4	4

[a]s=dichlormid safener; E=dietholate extender; PO=Petroleum oil with 17% emulsifier; X-77=nonionic surfactant; G in rate column represents gallons per acre; PD=postemergence directed.

Summary

Generally, weed control from postemergence herbicides was not as great as Casselton corn experiment. This may have been due to pre-mixing herbicide solutions 2 days prior to application. Treatments soil applied or in combination with postemergence applied herbicides generally gave adequate weed control. Addition of dicamba or bromoxynil increased broadleaf weed control over numbered compounds applied alone. Activity of bromoxynil (with alachlor or atrazine) and post directed treatments may have been greater if spray volume was increased and application was made earlier. Greatest crop injury rating were noted from DPX-79406 and CGA-136872. DPX-V9360 gave less than 6% crop injury.

DPX compounds with adjuvants, Fargo 1990. 'Interstate 343A' corn was seeded to an area with wild oats on May 4. Treatments at were to 5-leaf corn, 3- to 4-leaf wild oats 1- to 3- inch tall green and yellow foxtail (mostly green), and 1- to 6-inch tall broadleaf weeds on June 11 with 80 F and 80% relative humidity. All treatments were applied at 8.5 gpa with a bicycle wheel type plot sprayer with flat fan nozzles at 35 psi. The experiment had a randomized complete block design with four replicates. Plot consisted of four 30-inch spaced corn rows 30 ft long and treatment were applied to the two center rows. Wild oats at Fargo exceeded 20/yd^2. Other weeds were at less than 10 plants/yd^2 and were variable. Evaluations were June 26 and July 19.

		6-26-90						7-19-90				
Treatment	Rate	Corn inj	WO	Grft	KOCZ	Wibu	Wimu	Corn inj	WO	Fxtl	Vema	Wibu
	oz/A	%										
DPX-V9360+28N	0.5+4%	0	88	76	55	65	99	0	99	13	0	10
DPX-V9360+AMSU	0.5+20	0	84	73	54	66	99	0	99	0	0	10
DPX-V9360+X-77	0.5+.25%	0	88	82	63	68	99	0	99	30	25	0
DPX-V9360+X-77+28N	0.5+.25%+4%	0	92	86	69	70	99	0	99	64	40	41
DPX-V9360+X-77+AMSU	0.5+.25%+20	0	86	82	61	65	99	0	99	33	10	0
DPX-V9360+PO	0.5+1%	1	86	78	58	71	99	0	99	71	13	15
DPX-V9360+PO+28N	0.5+1%+4%	1	89	89	69	75	99	0	99	69	0	16
DPX-V9360+PO+AMSU	0.5+1%+20	2	87	83	59	69	99	0	99	56	25	25
DPX-V9360+MS	0.5+1%	0	89	91	73	75	99	0	99	92	21	36
DPX-V9360+MS+28N	0.5+1%+4%	1	92	90	77	78	99	0	99	88	40	39
DPX-V9360+MS+AMSU	0.5+1%+20	1	87	88	67	71	99	0	99	79	24	46
DPX-V9360+X-77	0.75+0.25%	1	89	85	62	70	99	0	99	67	22	42
DPX-V9360+X-77+28N	0.75+0.25%+4%	0	90	90	70	76	99	0	99	75	46	48
DPX-V9360+PO	0.75+1%	0	87	85	65	71	99	0	99	43	10	10
DPX-V9360+PO+28N	0.75+1%+4%	0	84	80	65	72	99	0	99	35	0	13
DPX-79406+X-77	0.25+0.25%	0	88	84	69	67	99	0	99	68	63	10
DPX-79406+X-77+28N	0.25+0.25%+4%	2	88	90	73	66	99	0	99	67	76	0
DPX-79406+PO	0.25+1%	0	90	84	66	65	99	0	99	64	48	0
DPX-79406+PO+28N	0.25+1%+4%	0	88	88	67	67	99	0	99	79	74	11
DPX-79406+X-77	0.37+0.25%	1	89	90	70	70	99	0	99	75	70	24
DPX-79406+X-77+28N	0.37+.25%+4%	1	90	93	78	70	99	0	99	88	85	35
DPX-79406+PO	0.37+1%	0	88	90	70	71	99	0	99	82	69	30
DPX-79406+PO+28N	0.37+1%+4%	1	89	92	76	73	99	0	99	86	39	28
C.V. %		281	4	6	11	6	15	964	0	24	74	123
LSD 5%		NS	5	8	15	6	20	NS	0	21	36	NS
# OF REPS		4	4	4	2	4	4	4	4	4	4	4

Summary

None of the herbicides injured corn. Wild buckwheat and Venice mallow were not adequately controlled by any of the herbicide treatments. Wild oats was completely controlled by both herbicides regardless of rate or adjuvant, at the August evaluation. Foxtail (green and yellow) ratings were confounded by control of other weeds, i.e., foxtail was most evident when broadleaf weeds were controlled. DPX-V9360 was most effective when applied with methylated seed oil (MS, Sun-it). 28% N or ammonium sulfate (AMSU) were less effective adjuvants than X-77 or oils with DPX-V9360 and generally when added to X-77 or oils did not enhance weed control with either herbicide.

Adjuvants with DPX-V9360 and DPX-79406, Casselton 1990. 'Interstate 343A' corn was seeded to to an area with green and yellow foxtail on May 11. Treatments were to 5-leaf corn, 5-leaf green and yellow foxtail and 1- to 3-inch tall broadleaf weeds on June 25 with 89 F and 75% relative humidity. All treatments were applied at 8.5 gpa with a bicycle wheel type plot sprayer with flat fan nozzles at 35 psi. The experiment had a randomized complete block design with four replicates. Plot consisted of four 30-inch spaced corn rows 30 ft long and treatment were applied to the two center rows. Green and yellow foxtail exceeded 50/yd^2. Other weeds were at less than 10 plants/yd^2 and were variable. Evaluations were on July 9 and August 1.

		7-09-90				8-01-90		
Treatment	Rate	Corn inj	Fxtl	Rrpw	Colq	Corn	Yeft	Colq
	oz/A	%						
DPX-V9360+28N	0.5+4%	0	68	99	41	0	23	6
DPX-V9360+AMSU	0.5+20	0	18	99	8	0	14	0
DPX-V9360+X-77	0.5+.25%	0	82	99	79	0	67	44
DPX-V9360+X-77+28N	0.5+.25%+4%	1	90	99	87	0	82	58
DPX-V9360+X-77+AMSU	0.5+.25%+20	0	90	99	89	0	87	60
DPX-V9360+PO	0.5+1%	0	86	99	84	0	75	55
DPX-V9360+PO+28N	0.5+1%+4%	0	89	99	80	1	88	49
DPX-V9360+PO+AMSU	0.5+1%+20	0	79	98	82	0	68	44
DPX-V9360+MS	0.5+1%	0	93	99	92	0	98	89
DPX-V9360+MS+28N	0.5+1%+4%	1	94	99	91	0	96	90
DPX-V9360+MS+AMSU	0.5+1%+20	0	89	99	89	0	87	79
DPX-V9360+X-77	0.75+0.25%	0	78	99	76	0	49	46
DPX-V9360+X-77+28N	0.75+0.25%+4%	1	88	99	89	0	84	77
DPX-V9360+PO	0.75+1%	0	86	99	86	0	73	56
DPX-V9360+PO+28N	0.75+1%+4%	0	91	99	80	0	86	64
DPX-79406+X-77	0.25+0.25%	11	92	99	89	3	84	69
DPX-79406+X-77+28N	0.25+0.25%+4%	14	96	99	93	4	92	74
DPX-79406+PO	0.25+1%	11	93	99	90	4	84	65
DPX-79406+PO+28N	0.25+1%+4%	11	94	99	89	3	87	76
DPX-79406+X-77	0.37+0.25%	15	96	99	90	5	89	70
DPX-79406+X-77+28N	0.37+.25%+4%	20	97	99	95	6	96	82
DPX-79406+PO	0.37+1%	20	94	99	91	7	90	71
DPX-79406+PO+28N	0.37+1%+4%	18	97	99	92	2	91	79
Untreated	0	0	0	0	0	0	0	0
C.V. %		57	7	0	11	273	11	29
LSD 5%		4	8	1	13	NS	12	24
# OF REPS		4	4	2	4	4	4	4

Summary

DPX-79406 caused injury to corn which was visibly important at the July 9 evaluation, but not on August 1. Thus, the corn apparently recovered from injury. The injury may have occurred because of the hot, humid conditions at treatment and the trace of rain which occurred within 3 h after treatment. DPX-V9360 control of foxtail and other weeds was enhanced the most by the methylated seed oil (Sun-it) adjuvant. X-77 adjuvant effectiveness was increased when applied with 28 N or ammonium sulfate. However, ammonium sulfate tended to reduce the effectiveness of petroleum oil and methylated seed oil adjuvants and 28% N increased effectiveness of petroleum oil adjuvant but not methylated seed oil. DPX-79406 control of weeds was enhanced similarly by X-77 and petroleum oil adjuvants. 28% N adjuvant in addition to X-77 or petroleum oil adjuvants tended to further enhance weed control with DPX-79406, especially with X-77.

General weed control in soybeans, Fargo 1990. Preplant incorporated (ppi) treatments were applied May 23 with 70 F, 50% RH, 0 to 5 mph south wind, partly cloudy sky and dry soil. 'McCall' soybeans were seeded on May 23. Preemergence incorporated (PE) treatments were applied May 24 with 70 F, 50% RH, 10 to 15 mph southwest wind, partly cloudy sky, and dry soil. Postemergence treatments were applied to second trifoliolate beans, 6-leaf green foxtail, 3 to 5 inch tall wild mustard, 1 to 3 inch tall common lambsquarters, and 1 to 2 inch tall redroot pigweed on June 25 with 89 F, 70% RH, no wind, and cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa through 8002 nozzles for the preemergence treatments and 8.5 gpa at 35 psi through 8001 nozzles for the post emergence treatments to an 8 ft wide area the length of 10 by 30 ft plots. The preemergence treatments were soil incorporated with a S-tine field cultivator. The experiment was a randomized complete block design with four replicates. Evaluation were on July 9 and August 1.

		2-09-90					8-01-90		
Treatment	Rate	Soybean inj	Fxtl	Wimu	Rrpw	Colq	Fxtl	Colq	KOCZ
	oz/A	%							
Trifluralin+Metr-DF(ppi)	12+3	0	89	90	99	95	74	84	72
Trifluralin&Imazethapyr(ppi)	14	2	99	99	99	99	98	98	99
Pendimethalin&Imazethapyr(ppi)	14	1	98	99	99	99	97	97	99
Pendimethalin&Imep+Metr-DF(ppi)	14+3	2	98	99	98	99	97	98	99
Pend&Imep+Metribuzin-DF(ppi)	14+4	3	99	99	99	99	98	99	99
Pendimethalin+Metribuzin-DF(ppi)	16+3	1	91	90	99	96	81	80	84
Alachlor+Metribuzin-DF(PE)	40+3	1	87	70	99	83	80	70	57
Metolachlor+Metribuzin-DF(PE)	40+3	1	82	55	75	82	59	35	28
Bentazon+PO	12+0.25G	0	90	99	82	86	99	85	84
Bent+Acif+X-77/Seth+MS	8+4+0.25%/3+0.25G	9	96	99	73	89	99	43	51
Bent+Acif+MS/Seth+MS	8+2+0.25G/3+0.25G	14	97	99	99	89	99	46	78
Bent+Acif+MS1/Seth+MS	8+2+0.25G/3+0.25G	14	98	99	98	91	99	58	82
Bent+Acif+X-77/Seth+MS	8+2+0.25%/3+0.25G	7	95	99	99	89	99	59	66
Acifluorfen+X-77	6+0.25%	8	96	99	98	77	99	31	46
Lactofen+PO/Seth+MS	3+0.12G/3+0.25G	13	96	99	99	75	99	8	99
DPX-M6316+X-77/Seth+MS	0.063+0.125%/3+0.25G	5	89	99	99	99	98	98	93
DPX-M6316+X-77/Seth+MS	0.125+.125%/3+0.25G	5	91	99	99	99	99	96	89
DPX-M6316+MS/Seth+MS	0.063+.125G/3+0.25G	3	92	99	99	99	99	96	92
DPX-M6+Clim+X-77/Seth+MS	0.063+.063+.125%/3+.25G	6	84	99	99	99	96	94	92
Imazethapyr+MS	0.6+0.25G	4	96	99	99	93	94	72	99
Imazethapyr+Sethoxydim+MS	0.5+3+0.25G	2	93	99	99	82	81	41	99
Imazethapyr+Seth+28N+MS	0.5+3+0.25G+0.25G	8	92	99	99	82	80	61	97
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		69	4	6	12	7	11	23	24
LSD 5%		5	5	8	24	9	13	22	26
# OF REPS		4	4	4	2	4	4	4	4

Summary

None of the herbicide treatments caused important injury to soybeans. The slight injury symptoms observed on July 9 were no longer evident on August 1. Surface applied alachlor or metolachlor with metribuzin gave inadequate weed control even though rainfall was adequate soon after application. Preplant herbicide treatments containing imazethapyr gave nearly complete control of all weeds present. DPX-M6316 postemergence treatments gave control of common lambsquarters which was not adequately controlled by the other postemergence treatments.

Broadspectrum weed control in soybean, Carrington 1990. Preplant herbicides were applied and rototiller incorporated, 'Maple Ridge' soybeans seeded, and preemergence treatment applied on June 1. Postemergence treatments were applied to second trifoliolate soybeans on July 2. The split (/) sethoxydim treatments were applied on July 5. Rainfall for 7 day after preemergence treatments was 2.5 inch on June 1 and 1.2 inch from June 3 through 8 and after postemergence treatments the first rain was 0.13 inch on July 7 and 0.75 inch in three subsequent rains from July 8 through 11. All treatments were applied with a bicycle wheel type plot sprayer with 8002 nozzles at 17 gpa for the preemergence treatments and 8001 nozzles at 8.5 gpa for the postemergence treatments, all at 35 psi. Treatment was to an 8 ft wide area the length of 8 by 25 ft plots. The experiment had a randomized complete block design with four replicates. Evaluation was on July 11.

Treatment	Rate	Soybean inj	Grft	Rrpw	KOCZ	Colq
	oz/A	-----------	%	----------		
Trifluralin+Metribuzin-DF(ppi)	12+3	0	93	87	96	21
Trifluralin&Imazethapyr(ppi)	14	0	97	99	99	25
Pendimethalin&Imazethapyr(ppi)	14	0	95	97	99	24
Pend&Imep+Metribuzin-DF(ppi)	14+3	0	94	99	98	25
Pend&Imep+Metribuzin-DF(ppi)	14+4	0	98	99	99	25
Pendimethalin+Metribuzin-DF(ppi)	16+3	0	88	79	95	19
Alachlor+Metribuzin-DF(PE)	40+3	0	60	45	38	6
Metolachlor+Metribuzin5DF(PE)	40+3	0	40	25	37	19
Bentazon+PO	12+0.25G	4	5	55	57	19
Bent+Acifluorfen+X-77/Seth+MS	8+4+0.25%/3+0.25G	12	87	85	55	18
Bent+Acifluorfen+MS/Seth+MS	8+2+0.25G/3+0.25G	21	94	98	82	23
Bent+Acifluorfen+MS1/Seth+MS	8+2+0.25G/3+0.25G	18	86	93	63	25
Bent+Acifluorfen+X-77/Seth+MS	8+2+0.25%/3+0.25G	12	90	94	69	20
Acifluorfen+X-77	6+0.25%	14	71	98	45	25
Lactofen+PO/Sethoxydim+MS	3+0.12G/3+0.25G	28	87	96	91	19
DPX-M6316+X-77/Sethoxydim+MS	.063+0.125%/3+0.25G	0	48	10	14	5
DPX-M6316+X-77/Sethoxydim+MS	.125+.125%/3+0.25G	6	71	96	45	8
DPX-M6316+MS/Sethoxydim+MS	.063+.125G/3+0.25G	2	77	93	54	15
DPX-M6316+Clim+X-77/Seth+MS	0.063+.063+.125%/3+.25G	3	77	92	55	19
Imazethapyr+MS	.6+0.25G	4	85	91	88	19
Imazethapyr+Sethoxydim+MS	0.5+3+0.25G	3	55	68	64	19
Imazethapyr+Sethoxydim+28N+MS	0.5+3+0.25G+0.25G	2	84	93	73	15
Untreated	0	0	0	0	0	0
C.V. %		76	17	22	33	78
LSD 5%		6	17	24	30	NS
# OF REPS		4	4	4	4	4

Summary

Treatments containing acifluorfen caused moderate injury to soybeans. Surface applied alachlor and metolachlor did not give adequate weed control. MS1 (Sun-it II) tended to be less effective than MS (methylated seed oil, Scoil) as an adjuvant with bentazon + acifluorfen. Green foxtail control was not completely expressed at evaluation, and ratings reflect early response, but maybe not final control. Treatments applied preplant incorporated which contained imazethapyr generally gave the greatest weed control.

Weed control in soybeans, Casselton 1990. 'McCall' soybeans were seeded May 24. Treatments were applied to second trifoliolate soybeans, 5-leaf green and yellow foxtail, 3 to 6 inch tall budding wild mustard, 1 to 3 inch tall common lambsquarters, and 1 to 2 inch tall redroot pigweed on June 25 with 87 F, 70% RH, no wind, and cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 9 and August 1. Weed density were foxtail at 5/ft^2 and wild mustard and common lambsquarters at 5/yd^2. Foxtail and common lambsquarters were uniform in all replicates.

		7-09-90				8-01-90	
Treatment[a]	Rate	Soybean inj	Fxtl	Wimu	Colq	Fxtl	Colq
	oz/A	-------------		%		------------	
DPX-M6316+X-77/Seth+MS	0.063+.12%/3+.25G	1	86	99	98	97	90
DPX-M6316+X-77/Seth+MS	0.063+.5%/3+.25G	1	87	99	97	97	96
DPX-M6316+X-77/Seth+MS	0.125+.12%/3+.25G	1	83	99	97	94	95
DPX-M6316+X-77/Seth+MS	0.125+.5%/3+.25G	4	82	99	98	97	97
DPX-M6316+PO/Seth+MS	0.063+.5%/3+.25G	3	85	99	98	98	92
DPX-M6+Clim+X-77/Seth+MS	0.063+.063+.12%/3+.25G	2	81	99	99	97	94
DPX-M6+Clim+PO/Seth+MS	0.063+.063+.5%/3+.25G	3	84	99	98	96	98
Imazethapyr+28N	0.5+.25G	0	68	99	30	45	18
Imazethapyr+X-77	0.5+.25%	0	78	98	53	56	53
Imazethapyr+MS	0.5+.25G	1	90	99	89	76	61
Imazethapyr+MS1	0.5+.25G	2	91	99	88	87	63
Imazethapyr+BCH	0.5+.25G	3	88	99	90	68	61
Imazethapyr+MS+X-77	0.5+.25G+.25%	2	92	99	87	90	73
Imazethapyr+MS+28N	0.5+.25G+.25G	3	90	99	85	81	45
Imazethapyr+MS+28N+X-77	0.5+.25G+.25G+.25%	2	89	99	92	73	48
Imazethapyr+BCH+28N	0.5+.25G+.25G	4	89	99	88	83	59
Imazethapyr+X-77+28N	0.5+.25%+.25G	3	88	99	88	76	72
Acif+Bent+X-77+Seth+MS	4+8+.25%+3+.25G	8	98	99	86	83	44
C.V. %		77	8	1	9	11	27
LSD 5%		3	9	1	10	13	26
# OF REPS		4	4	4	4	4	4

[a]MS = methylated seed oil with emulsifier (Sun-it), MS1 = Sun-it II, X-77 = nonionic surfactant, BCH = adjuvant from BASF, and 28N = 28% liquid nitrogen.

Summary

None of the treatments caused any important injury to soybeans. Foxtail control on August 1 exceeded 90% for all treatments containing sethoxydim and wild mustard control exceeded 97% regardless of treatment. Weed control with imazethapyr was generally enhanced more by methylated seed oil (MS=Sun-it, MS1=Sun-it II) than 28% N, X-77, or BCH (DASH) when included as the only adjuvants. Enhancement of imazethapyr from combinations of adjuvants was variable.

Imazethapyr with PO for broadleaf control in soybeans, Fargo 1990. 'McCall' soybeans were seeded on May 30. Treatment were applied to 2- to 3-leaf soybeans, 6- to 10-leaf redroot pigweed July 7 with 80 F, 55% RH, sunny sky, and 0 to 5 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 17.

Treatment	Rate	Rrpw
	oz/A	- % -
Imazethaypyr + PO1	0.25+0.25G	75
Imazethaypyr + PO2	0.25+0.25G	75
Imazethaypyr + PO3	0.25+0.25G	75
Imazethaypyr + PO4	0.25+0.25G	76
Imazethaypyr + PO5	0.25+0.25G	73
Imazethaypyr + PO6	0.25+0.25G	73
Imazethaypyr + PO7	0.25+0.25G	77
Imazethaypyr + PO8	0.25+0.25G	75
Imazethaypyr + PO9	0.25+0.25G	75
C.V. %		2
LSD 5%		NS
# OF REPS		4

Summary

Redroot pigweed control by imazethapyr was similar regardless of adjuvant.

Imazethapyr with PO for broadleaf control in soybeans, Prosper 1990. 'McCall' soybeans were seeded on May 23. Treatments were applied to second trifoliolate soybeans, 4 to 5 inch tall kochia, and 3- to 5-leaf green foxtail on June 18 with 75 F, 70% RH, clear sky and no wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 4 and July 19.

		7-04-90				7-19-90
Treatment	Rate	Soybean inj	KOCZ	Grft	Colq	KOCZ
	oz/A	%				
Imazethapyr+PO1	0.25+0.25G	0	92	80	48	93
Imazethapyr+PO2	0.25+0.25G	0	92	86	38	98
Imazethapyr+PO3	0.25+0.25G	0	93	92	43	97
Imazethapyr+PO4	0.25+0.25G	0	90	83	82	97
Imazethapyr+PO5	0.25+0.25G	1	91	78	50	97
Imazethapyr+PO6	0.25+0.25G	0	90	85	80	98
Imazethapyr+PO7	0.25+0.25G	0	97	71	70	98
Imazethapyr+PO8	0.25+0.25G	0	92	92	54	99
Imazethapyr+PO9	0.25+0.25G	0	96	91	70	99
C.V. %		427	7	21	45	2
LSD 5%		NS	NS	NS	NS	3
# OF REPS		4	4	4	2	4

Summary

Several commercial and other oil adjuvants were compared with imazethapyr. Imazethapyr's control of weeds did not significantly differ with the various adjuvants. However, the oil adjuvants tended to differ in their enhancement of specific weeds. PO 4, 6 and 9 tended to be generally more effective than the other adjuvants.

Imazethapyr with PO for broadleaf weed control in soybeans, Prosper 1990. 'McCall' soybeans were seeded on May 23. Treatments were applied to third trifoliolate soybeans, 6 to 8 inch tall kochia, and 6 inch tall foxtail on June 25 with 89 F, 70% RH, no wind, and cloudy sky with a drizzle occurring within 30 minutes. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 4 and 19.

		7-04-90			7-19-90	
Treatment	Rate	Soybean inj	KOCZ	Fxtl	Fxtl	Rrpw
		%				
Imazethapyr+PO1	0.25+0.25G	2	85	51	72	76
Imazethapyr+PO2	0.25+0.25G	1	98	64	74	75
Imazethapyr+PO3	0.25+0.25G	1	92	63	73	76
Imazethapyr+PO4	0.25+0.25G	0	96	59	74	72
Imazethapyr+PO5	0.25+0.25G	0	98	76	77	79
Imazethapyr+PO6	0.25+0.25G	1	97	70	72	72
Imazethapyr+PO7	0.25+0.25G	3	98	66	78	78
Imazethapyr+PO8	0.25+0.25G	0	98	64	78	78
Imazethapyr+PO9	0.25+0.25G	3	99	61	77	79
C.V. %		251	5	25	6	6
LSD 5%		NS	NS	NS	NS	NS
# OF REPS		4	3	4	4	4

Summary

The various oil adjuvants did not differ significantly when with imazethapyr. However, certain oils (PO5) generally tended to be more effective than others (PO1), especially at the early evaluation.

Weed control in soybeans. Mooreton and Cavalier. 1990. Field studies were conducted at at two locations to determine efficacy and crop injury from herbicides used in soybeans and to investigate soybean herbicide/insecticide interactions on herbicide performance and crop safety. Soybeans variety 'Evans' was planted on May 25 at Mooreton and 'McCall' variety was planted on June 1 at Cavalier. Treatments at Mooreton were applied on June 18 with 86 F, 37% RH, 3-5 mph wind and good soil moisture. Treatments at Cavalier were applied on June 22 with 69 F, 72% RH, 8-12 mph wind and good soil moisture. At application, soybeans at both locations were in V1 to V2 stage and weeds were 1 to 3.5 inches tall. Visual evaluations were made 28 days after application. All treatments were applied to an 8 ft wide area in plots 10 by 30 ft with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles. The experiment was a complete randomized block design with four replications.

	Treatments	Rate	Rrpw	Colq	Wibw	Inj
		lb/A	-------	(%)	------	
1	Thifensulfuron + X-77	0.004 + 0.12%	96	94	~~97~~ 78	2
2	Thifen + X-77	0.008 + 0.12%	96	95	95	11
3	Thifen + Malathion + X-77	0.008 + 1 + 0.12%	95	93	~~94~~ 80	63
4	Thifen+Chlorpyrifos+X-77	0.008 + 1 + 0.12%	97	95	~~91~~ 97	86
5	Bentazon + Dash	0.75 + 0.25 G	71	90	~~90~~ 91	2
6	Acifluorfen + X-77	0.38 + 0.25%	97	78	~~89~~ 94	10
7	Bent + Acifluor + X-77	0.75 + 0.25 + 0.25%	82	90	~~86~~ 90	9
8	Bent + Aciflour + Dash	0.75 + 0.25 + 0.25G	90	84	~~84~~ 83	27
9	Lactofen + PO	0.19 + 0.25 G	95	70	~~83~~ 51	32
10	Bent + Mal + Dash	0.75 + 1 + 0.25 G	81	88	81	43
11	Bent + Chlorpyr + Dash	0.75 + 1 + 0.25 G	39	86	~~80~~ 69	16
12	Acifluor + Mal + X-77	0.38 + 1 + 0.25%	91	81	~~78~~ 84	17
13	Acifluor + Chlorpyr + X-77	0.38 + 1 + 0.25%	93	80	~~69~~ 86	20
14	Lact + Mal + PO	0.19 + 1 + 0.25 G	96	85	~~57~~ 40	35
15	Lact + Chlorpyr + PO	0.19 + 1 + 0.25 G	93	73	~~51~~ 57	35
16	Thifen+Chlorimuron+X-77	0.004 + 0.004 + 0.12%	97	80	~~40~~ 89	2
17	Untreated		0	0	0	0
	C.V. %		7	6	9	3
	LSD 5%		8	7	10	4
	# of reps		4	4	4	4
	# of locations		2	2	2	2

X-77=nonionic surfactant, PO=petroleum oil.

Summary

Redroot pigweed and wild buckwheat control was reduced when bentazon was combined with chlorpyrifos. Lactofen plus malathion gave greater common lambsquarters control than lactofen applied alone or with chlorpyrifos. Wild buckwheat control was reduced when thifensulfuron, bentazon or lactofen was combined with malathion. Thifensulfuron, bentazon, and acifluorfen applied with malathion or chlorpyrifos gave greater crop injury than each herbicide applied alone.

<u>Lanceleaf sage control in soybeans. Christine. 1990.</u> A study was conducted to evaluate lanceleaf sage control in soybeans from currently available herbicides. Soybean variety 'McCall' was drilled in narroe row spacing in May, 1990. Treatments were applied postemergence at two weed stages. First application was made May 18 when lanceleaf sage (LLS) was 1 to 3 inches tall, soybeans at first trifoliate fully expanded, 74 F, 75% RH, wind 3 to 5 mph, good soil moisture. Second application was made May 26 when LLS was 4 to 6 inches tall , crop with 3 trifoliates fully expanded, 84 F, 60% RH, wind 1 to 3 mph, no clouds, and subsoil moisture at 0.75 inches deep. LLS stand count was 7.8 plants/square ft in untreated plots. Visual evaluations were made July 20 and September 5. All treatments were applied to an 8 ft wide area in plots 10 by 30 ft with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles. The experiment was a complete randomized block design with four replications.

Treatments	Rate	July 20		Sept 5	
		1-3"	4-6"	1-3"	4-6"
	lb/A	-------	(%)	-------	
Bentazon + COC	0.75 + 1.25%	14	15	9	11
Acifluorfen + X-77	0.25 + 0.125%	45	36	28	13
Bent + Acifluor + COC	0.75 + 0.25 + 1.25%	30	34	19	13
Thifensulfuron + X-77	0.004 + 0.125%	72	55	60	28
Thifen + X-77 + 28%N	0.004 + 0.125% + 4%	81	60	70	36
Thifen+Bent+X-77+28%N	0.004+0.75+0.125%+4%	25	15	15	11
Thifen + Bent + COC	0.004 + 0.75 + 1.25%	31	11	20	9
Thifen+Chlor+X-77+28%N	0.004+0.004+0.125%+4%	84	49	79	36
Imazethapyr+X-77+28%N	0.063 + 0.25% + 1.25%	99	90	98	94
Lactofen + COC	0.2 + 0.625%	97	99	95	96
Untreated		0	0	0	0
C.V. %		8	8	7	7
LSD 5%		9	9	8	8
# of reps		4	4	4	4

X-77=nonionic surfactant, COC=Crop oil concentrate, 28%N=Liquid nitrogen fertilizer, Chlor=Chlorimuron.

Summary

Imazethapyr and lactofen, both with adjuvants, effectively controlled lanceleaf sage applied at either growth stage. Thifensulfuron plus nonionic surfactant applied alone or with 28% nitrogen or did not effectively provide adaquate control. Thifensulfuron with chlorimuron plus nonionic surfactant and 28% nitrogen gave satisfactory control when applied at the earlier growth stage. Bentazon or acifluorfen applied alone or in combination did not provide adaquate control. Adding bentazon to thifensulfuron with adjuvants was antagonistic and greatly reduced control

Acifluorfen for drybean with PPI treatments, 1990. A preplant incorporated treatment of ethalfluralin was applied at 12 oz/A before seeding. 'C-20' dry beans, on May 23. Treatments were applied to 2nd trifoliolate beans and 3 to 6 inch tall wild mustard June 26 with 80 F, 70% RH, clear sky, and no wind. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 5 by 25 ft plots. The experiments was a randomized complete block design with four replicates. Asona was applied August 10 for a leaf hopper infestation. Evaluation was on July 4 and a harvest for yield was taken on September 12.

Treatment	Rate	Wild Mustard control	Yield
	oz/A	%	lb/A
Acifluorfen+Ag-98	2+0.25%	92	593.1
Acifluorfen+Ag-98	2.5+0.25%	89	488.4
Acifluorfen+Ag-98	3+0.25%	92	463.6
Acifluorfen+Ag-98	4+0.25%	93	573.2
Acifluorfen+Bentazon+MS	2+8+0.25G	98	656.1
Acifluorfen+Bentazon+MS1	2+8+0.25G	94	784.3
Acifluorfen+Bentazon+Ag-98	2+8+0.25%	92	443.7
Acifluorfen+Bentazon+Ag-98	3+8+0.25%	93	730.4
Acifluorfen+Bentazon+Ag-98	3+12+0.25%	95	619.2
Acifluorfen+Bentazon+Ag-98	4+12+0.25%	94	569.9
Bentazon+PO	16+0.25G	98	511.4
Bentazon&Acifluorfen(Galaxy)+Ag-98	15+0.25%	94	501.4
Untreated	0	0	356.0
C.V. %		3	43.0
LSD 5%		5	NS
# OF REPS		3	4

Summary

None of the treatments caused any visible injury to dry beans. Dry bean yield were highly variable because of variable infestation of wild mustard and common cockelbur which survived the ethalfluralin preplant incorporated treatment. The wild mustard was mainly in replicates1 and 2, but the common cockelbur was in various patches. Wild mustard was removed immediately after evaluation, but the common cockelbur was only removed in July when it became evident and plants were about 1 ft tall. The trend for higher yield with herbicide treatment probably reflect competition prior to weed removal. Yields also were low because of a leafhopper infestation. Acifluorfen at all rates effectively controlled wild mustard without any injury to dry bean.

<u>Postemergence grass control in drybeans, Fargo 1990</u>. 'C-20' drybeans were seeded May 30. Treatments were applied to 3-to 4-trifoliolate drybeans and 4 to 5.5 inch tall yellow foxtail July 5 with 64 F, 40 to 50% RH, 10 mph north wind, and partly cloudy sky. The postemergence bentazon was not applied because broadleaf weeds were too sparse to be of importance. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 25.

Treatment	Rate	7-25-90 Foxtail
	oz/A	-- % --
DPX-79376+PO/Bentazon (7day)	1+.1%/12	98
DPX-79376+PO/Bentazon (7day)	2+.1%/12	99
Fluazifop+PO/Bentazon (7day)	2+.1%/12	92
Fluazifop+PO/Bentazon (7day)	3+.1%/12	92
Quizalofop(UBI)+PO/Bentazon (7day)	1+0.25G/12	99
Quizalofop(UBI)+PO/Bentazon (7day)	2+0.25G/12	99
Sethoxydim+MS/Bentazon (7day)	3+0.25G/12	97
Untreated	0	0
C.V. %		2
LSD 5%		3
# OF REPS		4

Summary

Weeds other than foxtail were too sparse to evaluate. DPX-79376, fluazifop, and quizalofop (UBI) all gave 90% or more yellow foxtail control without any injury to drybean. Injury data is not presented as none occurred in any plots.

Postemergence grass control in drybeans, Casselton 1990. 'C-20' drybeans were seeded on May 24. Treatments were applied to second trifoliolate drybeans, 5-leaf green foxtail, and 3 to 6 inch tall wild mustard on June 26 with 80 F, 70% RH, no wind, and clear sky. Bentazon was applied on July 2. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replicates. Evaluations were on July 4 and 9.

		7-04-90		7-09-90			
Treatment	Rate	Drybean injury	Wimu	Drybean injury	Fxtl	Wimu	Colq
	oz/A	%					
DPX-79376+PO/Bent(7d)	1+.1%/12	5	30	6	99	98	65
DPX-79376+PO/Bent(7d)	2+.1%/12	17	37	5	99	99	60
Fluazifop+PO/Bent(7d)	2+.1%/12	1	34	4	82	99	61
Fluazifop+PO/Bent(7d)	3+.1%/12	1	32	7	93	97	43
Qufp(UBI)+PO/Bent(7d)	1+0.25G/12	7	39	4	99	99	74
Qufp(UBI)+PO/Bent(7d)	2+0.25G/12	10	36	5	99	99	70
Sethoxydim+MS/Bent(7d)	3+0.25G/12	0	38	2	99	99	48
C.V. %		169	35	67	2	2	24
LSD 5%		NS	16	4	3	3	18
# OF REPS		4	4	4	4	4	4

Summary

The herbicide treatments did not cause important injury to drybeans. DPX-79376 and quizalofop (UBI) gave complete control of foxtail. However, fluazifop at 2 oz/A only gave 82% foxtail control. The bentazon treatment gave complete control of wild mustard, at the July 9 evaluation.

Preplant control in drybeans, Casselton 1990. Preplant (ppi) treatments were applied and field cultivator plus harrow incorporated twice on May 23 with 70 F, 50% RH, 0 to 5 mph south wind, partly cloudy sky and dry soil. 'C-20' drybeans were seeded on May 24. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi through 8002 nozzles to an 8 ft wide area the length of 10 by 30 ft plots. Experiment was a randomized complete block design with four replicates. Evaluation was on July 9. Green and yellow foxtail density was 5/sq ft, wild mustard and redroot pigweed 1/sq yd, common lambsquarter 3 to 5/sq yd, and kochia was variable and occurred only in two replicates. Drybeans were not harvested for yield because of excessive flea beetle damage.

Treatment	Rate	Drybean inj	Fxtl	Wimu	Rrpw	Colq	KOCZ
	oz/A	%					
EPTC(ppi)	48	2	96	24	88	96	75
EPTC(ppi)	64	2	98	54	91	94	76
EPTC+Trifluralin(ppi)	48+8	3	97	70	96	99	98
Trifluralin(ppi)	16	3	97	0	99	99	99
Ethalfluralin(ppi)	16	6	98	8	98	98	99
EPTC+Ethalfluralin(ppi)	48+8	3	97	26	99	98	99
EPTC+Ethalfluralin(ppi)	48+12	3	98	59	99	98	99
Imazethapyr+Ethalfluralin(ppi)	0.5+8	6	98	99	99	99	99
Trifluralin+Clomazone(ppi)	12+8	5	97	0	92	97	97
Trifluralin+Clomazone(ppi)	12+6	4	96	21	98	97	99
C.V. %		87	2	49	7	2	5
LSD 5%		NS	2	23	9	3	10
# OF REPS		4	4	4	4	4	2

Summary

None of the herbicide treatments caused any important injury to drybeans. Wild mustard was adequately controlled only when imazethaypr was a treatment component. Redroot pigweed, common lambsquarters and kochia were controlled by all herbicide treatments, except redroot pigweed control was only 88% and kochia 75% with EPTC at 48 oz/A, and kochia 76% with EPTC at 64 oz/A.

Weed control in Canola, Langdon 1990. The preplant herbicides were applied field cultivator incorporated twice each time at a right angle to the other, soil packed by seeding 'Cando' durum at 26 lb/A with a press drill to the area, and 'Westor' canola was seeded on May 23. Postemergence treatments were to 2 inch tall canola and smartweed and 4-leaf durum on June 21 with 70 F. The second postemergence treatments (fluazifop) was to 3 inch tall canola, less than 4-leaf smartweed, 1- to 2-leaf wild buckwheat and 4.5-leaf durum. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi through 8002 flat fan nozzles for the preemergence treatments and 8.5 gpa at 35 psi through 8001 flat fan nozzles for all postemergence treatments to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 13.

Treatment	Rate	Canola inj	Durum	Smwd	Wibu	Rrpw
	oz/A	%				
Ethalfluralin(ppi)	12	8	59	59	64	99
Trifluralin(ppi)	12	0	40	36	47	99
Pendimethalin(ppi)	16	0	26	40	50	99
Pendimethalin(PE)	16	85	0	36	61	99
Pendimethalin(PE)	24	95	3	51	57	90
Dicamba-Na/Fluazifop+PO	1.5/3+0.25G	23	99	81	93	90
Clopyralid/Fluazifop+PO	2/3+0.25G	8	99	76	61	50
DPX-A7881+X-77/Flua+PO	0.25+0.25%/3+0.25G	4	96	93	63	99
DPX-A7881+X-77/Flua+PO	0.5+0.25%/3+0.25G	5	96	97	59	99
DPX-A7881+Flua+PO	0.25+3+0.25G	6	98	82	55	99
DPX-A7881+Sethoxydim+PO	0.5+3+0.25G	1	83	94	65	93
DPX-A7881+Flua+PO	0.5+3+0.25G	7	96	94	30	90
Untreated	0	0	0	0	0	0
C.V. %		30	25	29	50	
LSD 5%		8	22	27	39	
# OF REPS		4	4	4	4	1

Summary

Surface applied pendimethalin severely injured canola but not when preplant soil incorporated. Smartweed control exceeded 82% with all DPX-A7881 treatment. Fluazifop tank mixed with DPX-A7881 at 0.25 oz/A reduced smartweed control for 93% when applied separately from fluazifop to 83 in mixture. DPX-A7881 at 0.5 oz/A overcame the antagonism of smartweed control from fluazifop. All treatments effectively controlled adequately by dicamba. However, dicamba caused 23% injury to canola. Postemergence fluazifop gave 93% or more durum control and sethoxydim gave 83% durum control.

<u>Acifluorfen in sunflowers, 1990</u>. Interstate '3001' sunflower was seeded in 30 inch spaced rows to an area treated the previous day with ethafluralin at 0.75 lb/A on May 24. Treatments were applied June 25 to 6-leaf sunflowers and 2 to 3 inch tall common lambsquarters with 89 F, 70% RH, cloudy sky, and no wind with a drizzle occurring 30 minutes after treatment. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were taken on July 9 and August 1. A harvest for yield was taken on October 1.

Treatment	Rate	Wimu	Sunflower 7-9-90 inj	Burn	8-1-90 inj	10-1-90 Yield
	oz/A	------------	%	------------		lb/A
Acifluorfen+Ag-98	2+0.25%	89	29	16	15	1158.8
Acifluorfen+Ag-98	3+0.25%	98	41	23	23	764.9
Acifluorfen+Ag-98	4+0.25%	99	48	30	29	511.2
Untreated	0	0	0	0	3	1247.6
C.V. %		2	8	32	28	22.7
LSD 5%		2	4	9	8	334.5
# OF REPS		4	4	4	4	4

Summary

Acifluorfen of 3 or more oz/A cause severe injury to sunflower. Injury was more severe than ever observed from acifluorfen at even higher rates in past research. The injury may relate to the high temperature and humidity at treatment or the trace of rain which occurred within 1 h after treatment. The plots were kept weed free so the yield represents a response to injury. Acifluorfen at 2 oz/A has controlled wild mustard in previous experiments. Thus, acifluorfen at 2 oz/A has potential for use in sunflower since this rate did not reduce yields.

Fluazifop with adjuvants, Fargo 1990. 'Wheaton' Hard Red Spring wheat and 'ND 810104' oats were seeded May 8. Treatments were applied to 4-leaf wheat and oats on June 7 with 75 F, 60% RH, and an overcast sky. Treatments were applied with a bicycle wheel type-plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 3.

Treatment[a]	Rate[a]	Wheat	Oats
	oz/A		
Fluazifop-P+MSF	0.5+0.18G	58	54
Fluazifop-P+MSF	1+0.18G	98	98
Fluazifop-P+MSF	2+0.18G	99	99
Fluazifop-P+MS1	0.5+0.18G	92	92
Fluazifop-P+MS1	1+0.18G	99	99
Fluazifop-P+MS1	2+0.18G	99	99
Fluazifop-P+PO	0.5+0.25G	93	89
Fluazifop-P+PO	1+0.25G	99	98
Fluazifop-P+PO	2+0.25G	99	99
Fluazifop-P+X-77	0.5+0.25%	91	88
Fluazifop-P+X-77	1+0.25%	98	95
Fluazifop-P+X-77	2+0.25%	99	99
C.V. %		3	4
LSD 5%		3	5
# OF REPS		4	4

[a] MSF=Sun-it, MS1=Sun-it 11, PO=petroleum oil(Mor-act), G in rate column=gallons/A, and X-77=nonionic surfactant at 0.25% in the total spray volume.

Summary

Fluazifop-P similarly controlled wheat and oats regardless of adjuvants, except for MSF adjuvant with fluazifop at 0.5 oz/A. The low grass species control with fluazifop-P at 0.5 oz/A applied with MSF indicates a improper application as previously MSF has been equal or more effective than X-77 or petroleum oil. The adjuvants may have been omitted from the spray mixture.

Quizalofop with adjuvants, Fargo 1990. 'Wheaton' Hard Red Spring wheat and 'ND 810104' oats were seeded on May 8. Treatments were applied to 4- leaf wheat and oats on June 7 with 75 F, 60% RH, and an overcast sky. Treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 3 and July 18.

Treatment[a]	Rate	7-3-90 Wheat	7-3-90 Oats	7-18-90 Wheat	7-18-90 Oats
	oz/A	% control			
Quizalofop+MSF	0.125+0.12G	97	58	98	72
Quizalofop+MSF	0.25+0.12G	98	72	83	67
Quizalofop+MSF	0.5+0.12G	98	80	99	98
Quizalofop+MS1	0.125+0.12G	97	67	98	78
Quizalofop+MS1	0.25+0.12G	97	79	97	85
Quizalofop+MS1	0.5+0.12G	97	98	98	98
Quizalofop+VO	0.125+0.12G	98	72	78	62
Quizalofop+VO	0.25+0.12G	97	77	98	94
Quizalofop+VO	0.5+0.12G	98	83	97	91
Quizalofop+PO	0.125+0.12G	98	84	99	88
Quizalofop+PO	0.25+0.12G	99	96	99	98
Quizalofop+PO	0.5+0.12G	99	93	99	95
Quizalofop+X-77	0.125+0.25%	89	40	90	34
Quizalofop+X-77	0.25+0.25%	85	51	97	95
Quizalofop+X-77	0.5+0.25%	97	69	98	78
Quizalofop	0.125	81	46	80	53
Quizalofop	0.25	94	35	95	41
Quizalofop	0.5	98	81	99	85
C.V. %		11	34	16	25
LSD 5%		NS	34	NS	28
# OF REPS		4	4	4	4

[a]Quizalofop was the Assure formulation, VO=seed oil with 15% emulsifier, MSF=Sun-it, MS1=Sun-it II, PO=petroleum oil (Mor-act), G in rate column =gallons/A, and X-77=nonionic surfactant at 0.25% in total spray volume.

Summary

Wheat was more susceptible than oats to quizalofop and was controlled similarly by quizalofop regardless of adjuvants. However, seed oil (VO) tended to be less effective than the other adjuvants. Oats control with quizalofop tended to be greater for quizalofop applied with petroleum oil than the other adjuvants.

Quizalofop with adjuvants (UBI), Fargo 1990. 'Wheaton' Hard Red Spring wheat and 'ND 810104' oats were seeded on May 8. Treatments were applied to 4-leaf wheat and oats on June 7 with 75 F, 60% RH, and an overcast sky. The treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area across the species the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 3 and 18.

		7-3-90		7-18-90	
Treatment[a]	Rate[a]	Oats	Wht	Oats	Wht
	oz/A	---------	%	---------	
Quizalofop(UBI)+MSF	0.125+0.12G	98	73	85	99
Quizalofop(UBI)+MSF	0.25+0.12G	99	88	97	99
Quizalofop(UBI)+MSF	0.5+0.12G	99	99	98	99
Quizalofop(UBI)+MS1	0.125+0.12G	97	65	78	99
Quizalofop(UBI)+MS1	0.25+0.12G	99	91	94	99
Quizalofop(UBI)+MS1	0.5+0.12G	99	98	93	98
Quizalofop(UBI)+VO	0.125+0.12G	96	46	52	94
Quizalofop(UBI)+VO	0.25+0.12G	98	81	87	99
Quizalofop(UBI)+VO	0.5+0.12G	99	92	93	99
Quizalofop(UBI)+PO	0.125+0.12G	98	70	91	99
Quizalofop(UBI)+PO	0.25+0.12G	99	89	96	99
Quizalofop(UBI)+PO	0.5+0.12G	99	98	92	99
Quizalofop(UBI)+X-77	0.125+0.25%	99	67	85	99
Quizalofop(UBI)+X-77	0.25+0.25%	99	92	97	99
Quizalofop(UBI)+X-77	0.5+0.25%	99	99	98	99
Quizalofop(UBI)	0.125	88	6	21	92
Quizalofop(UBI)	0.25	99	57	80	99
Quizalofop(UBI)	0.5	99	88	96	99
C.V. %		1	9	15	2
LSD 5%		2	10	18	2
# OF REPS			4	4	4

[a]Quizalofop(UBI) was Pantera formulation, VO= seed oil with 15% emulsifier, MSF=Sun-it, MS1=Sun-it II, PO=petroleum oil (Mor-act), G in rate column=gallons/A, VO=seed oil with 15% emulsifier, and X-77=nonionic surfactant at 0.25% in the total spray volume.

Summary

Quizalofop(UBI) was more effective in controlling wheat than oats: Seed oil (VO) was less effective than the other adjuvants with quizalofop(UBI).

Sethoxydim with adjuvant volumes, Fargo 1990. 'ND 810104'oat, Siberian foxtail millet, and 'McCall' soybeans were seeded on May 30. Treatments were applied to 5- to 6-leaf wheat and S. millet, 3- to 4-trifoliolate soybeans, 5- to 6-leaf yellow foxtail, 1- to 1.5-ft redroot pigweed, and 10 inch kochia on July 5 with 70 F, 40 to 45% RH, partly cloudy sky, and 10 to 15 mph north wind. The treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area across the species the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 16.

Treatment[a]	Rate[a]	Oats	Siberian millet	Soybean
	oz/A	---------	%	----------
Sethoxydim+MSF	1+0.125G	65	75	0
Sethoxydim+MSF	1+0.18G	61	79	1
Sethoxydim+MSF	1+0.25G	65	77	0
Sethoxydim+MS1	1+0.125G	58	73	0
Sethoxydim+MS1	1+0.18G	62	74	0
Sethoxydim+MS1	1+0.25G	66	83	1
Sethoxydim+PO	1+0.125G	43	76	0
Sethoxydim+PO	1+0.18G	55	80	0
Sethoxydim+PO	1+0.25G	52	73	0
Sethoxydim+BCH	1+0.125G	65	75	2
Sethoxydim+BCH	1+0.18G	61	73	0
Sethoxydim+BCH	1+0.25G	70	79	1
C.V. %		13	12	304
LSD 5%		12	NS	NS
# OF REPS		4	4	4

[a]MSF=Sun-it, MS1=Sun-it 11, PO=petroleum oil (Mor-act), BCH= DASH, and G in the rate column represents gallon/A.

Summary

Sethoxydim control of Siberian millet was similar regardless of adjuvant or volume of adjuvant. Oats control with sethoxydim tended to increase as volume of adjuvant increased, except sethoxydim for MSF. Adjuvant effectiveness with sethoxydim for oats was BCH ≥ MSF ≥ MS1 > PO.

Sethoxydim with adjuvants, Fargo 1990. 'Wheaton' Hard Red Spring wheat and 'ND 810104' oat was seeded on May 8. Treatments were applied to 4-leaf wheat and oats on June 7 with 75 F, 60% RH, and an overcast sky. The treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 3.

Treatment[a]	Rate[a]	Wheat	Oat
	oz/A	----- %	------
Sethoxydim+MSF	0.5+0.18G	53	61
Sethoxydim+MSF	1+0.18G	78	94
Sethoxydim+MSF	2+0.18G	97	98
Sethoxydim+MS1	0.5+0.18G	45	53
Sethoxydim+MS1	1+0.18G	73	90
Sethoxydim+MS1	2+0.18G	97	98
Sethoxydim+PO	0.5+0.25G	47	49
Sethoxydim+PO	1+0.25G	70	85
Sethoxydim+PO	2+0.25G	97	98
Sethoxydim+BCH	0.5+0.25G	60	74
Sethoxydim+BCH	1+0.25G	88	94
Sethoxydim+BCH	2+0.25G	98	99
C.V. %		7	7
LSD 5%		7	8
# OF REPS		4	4

[a]MSF=Sun-it, MS1=Sun-it II, PO=petroleum oil (Mor-act), BCH= DASH, and G in the rate column represents gallon/A.

Summary

Adjuvant effectiveness with sethoxydim for wheat and oats control generally was BCH ≥ MSF > MS1 = PO, disregarding spray volume. PO and BCH were applied at 0.25 gallon/A while MSF and MS1 were at 0.18 gallon per acre.

Imazethapyr with adjuvants, Prosper 1990. 'McCall' soybean was seeded on May 30. Treatments were applied to 2-trifoliolate soybean, 5-inch tall kochia and 5-leaf foxtail on June 22 with 85 F, 65% RH, and mostly clear sky. The treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 4 and July 19. Weed density was kochia several per plot and foxtail was green and yellow with less than 4 per sq. ft. Soybean injury was general chlorosis.

		7-4-90			7-19-90
Treatment[a]	Rate	Soybean inj	KOCZ	Fxtl	Grft
	oz/A	-------	-------	% -------	-------
Imazethapyr+MSF(W)	0.25+0.18G	1	97	75	81
Imazethapyr+MSF(W)	0.5+0.18G	2	98	82	94
Imazethapyr+MSF(UW)	0.25+0.18G	1	99	79	82
Imazethapyr+MSF(UW)	0.5+0.18G	3	99	80	88
Imazethapyr+MS1(W)	0.25+0.18G	2	99	72	80
Imazethapyr+MS1(W)	0.5+0.18G	6	99	86	88
Imazethapyr+MS1(UW)	0.25+0.18G	2	99	77	84
Imazethapyr+MS1(UW)	0.5+0.18G	2	99	87	93
Imazethapyr+PO	.25+0.25G	2	98	71	78
Imazethapyr+PO	.5+0.25G	3	99	81	91
Imazethapyr+X-77	0.25+0.25%	1	95	75	77
Imazethapyr+X-77	0.5+0.25%	0	99	78	92
Untreated	0	0	0	0	0
C.V. %		126	2	10	6
LSD 5%		NS	3	10	6
OF REPS		4	4	4	4

[a]MSF=Sun-it, MS1 Sun-it II, PO=Mor-act petroleum oil, X-77=nonionic surfactant, W=washed methylated oil, and UW=unwashed methylated oil. G in the rate column represent gallons/A.

Summary

Imazethapyr did not cause important injury to soybean regardless of adjuvant or imazethapyr rate. Kochia control was complete with all treatments. Adjuvant effectiveness with imazethapyr for foxtail control did not vary greatly with adjuvants. Washing of the methyl ester of seed oil did not influence adjuvant efficacy.

Imazethapyr with adjuvant volumes, Prosper 1990. 'McCall' soybean was seeded on May 30. Treatments were applied to 2-trifoliolate soybeans, 5-inch kochia and 5-leaf foxtail on June 25 with 85 F, 65% RH, 5 to 10 mph wind, and mostly clear sky. Treatments were applied with a bicycle wheel-type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 4 and July 19. Green and yellow foxtail density was greater than 5 per sq. ft.

Treatment[a]	Rate	7-4-90 Soybean inj	7-4-90 KOCZ	7-4-90 Fxtl	7-19-90 Fxtl
	oz/A	%	%	%	%
Imazethapyr+MSF	0.25+0.125G	3	98	77	78
Imazethapyr+MSF	0.25+0.18G	4	99	81	79
Imazethapyr+MSF	0.25+0.25G	4	99	82	86
Imazethapyr+MS1	0.25+0.125G	4	98	81	83
Imazethapyr+MS1	0.25+0.18G	3	98	80	85
Imazethapyr+MS1	0.25+0.25G	1	99	82	88
Imazethapyr+PO	.25+0.25G	4	99	77	83
Imazethapyr+X-77	0.25+0.25%	3	93	68	65
Imazethapyr+MSF+28N	0.25+0.125G+0.25G	3	99	76	84
Imazethapyr+MSF+28N	0.25+0.18G+0.25G	6	99	80	86
Imazethapyr+MSF+28N	0.25+0.25G+0.25G	6	98	75	86
Imazethapyr+MS1+28N	0.25+0.125G+0.25G	5	98	76	86
Imazethapyr+MS1+28N	0.25+0.18G+0.25G	3	99	79	83
Imazethapyr+MS1+28N	0.25+0.25G+0.25G	4	98	77	85
Imazethapyr+PO+28N	0.25+0.25G+0.25G	4	99	69	82
Imazethapyr+X-77+28N	0.25+0.25%+0.25G	6	98	79	86
C.V. %		84	2	11	8
LSD 5%		NS	2	11	9
# OF REPS		4	4	4	4

[a]MSF=Sun-it, MS1=Sun-it II, PO=Mor-act petroleum oil, X-77=nonionic surfactant, and 28N=liquid fertilizer with 28% nitrogen (50% urea:50% ammonium nitrate).

Summary

MSF and MS1 enhancement of foxtail control with imazethapyr tended to increase as volume of these adjuvants increased. However, the inclusion of 28% N overcame any response to volume. 28% N was important to the enhancement of imazethaypr when applied with X-77, but of minor benefit when with the oil adjuvant.

Glyphosate with calcium chloride, Fargo 1990. 'Wheaton' hard red spring wheat and 'ND 810104' oats were seeded on April 24. Treatments were applied to late tillering wheat and oats and 4 to 8 inch tall kochia on June 26 with 80 F, 70% RH, clear sky, and no wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 2. The calcium chloride was at 2000 ppm for a calcium concentration of 1000 ppm for all treatments except (DW) which was applied in distilled water.

Treatment	Rate	Oats	Wht	KOCZ
	oz/A	---------	%	----------
Glyphosate(DW)	2	92	88	94
Glyphosate+AMSU	2+.25G	91	88	81
Glyphosate+AMSU	2+2%	93	94	95
Glyphosate+X-77	2+.25%	90	79	70
Glyphosate+AMSU+X-77	2+2%+.25%	96	93	96
Glyphosate+cayuse	2+.25G	93	87	90
Glyphosate+Li700	2+.25G	88	82	73
Glyphosate+DC5309	2+.09G	93	85	75
Glyphosate+Exp 5	2+.25G	96	89	90
Glyphosate+Exp 6	2+.25G	92	86	89
Glyphosate+Exp 9	2+.25G	99	97	99
Glyphosate+Exp 10	2+.25G	97	99	96
Glyphosate alone	2	82	65	55
C.V. %		4	8	12
LSD 5%		5	10	17
# OF REPS		4	4	3

Summary

Calcium chloride in the spray carrier antagonized glyphosate toxicity to all species. All adjuvants overcame the calcium chloride antagonism. However, glyphosate toxicity was greatest when applied with experimentals 9 and 10. The ratings were taken early after treatment because control was great and later evaluations would not have shown differences among treatments because of complete control.

Glyphosate with sodium bicarbonate, Fargo 1990. 'Wheaton' hard red spring wheat and 'ND 810104' oats were seeded on April 24. Treatments were applied to late tillering wheat and oats and 4 to 8 inch tall kochia on June 26 with 80 F, 70% RH, clear sky, and no wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 2. The sodium bicarbonate was at 3650 ppm for a sodium bicarbonate concentration of 1000 ppm sodium for all treatments except (DW) which was applied in distilled water.

Treatment	Rate	Oat	Wht	KOCZ
	oz/A	----	%	----
Glyphosate(DW)	2	88	86	81
Glyphosate+AMSU	2+.25G	90	84	75
Glyphosate+AMSU	2+2%	93	93	95
Glyphosate+X-77	2+.25%	88	79	80
Glyphosate+AMSU+X-77	2+2%+.25%	94	91	96
Glyphosate+Cayuse	2+.25G	94	86	94
Glyphosate+Li700	2+.25G	83	77	90
Glyphosate+DC5309	2+.09G	94	89	97
Glyphosate+Exp 5	2+.25G	91	85	93
Glyphosate+Exp 6	2+.25G	94	95	98
Glyphosate+Exp 9	2+.25G	94	86	96
Glyphosate+Exp 10	2+.25G	95	93	96
Glyphosate alone	2	85	72	67
C.V. %		4	7	8
LSD 5%		5	9	11
# OF REPS		4	4	3

Summary

The treatments were applied during very moist conditions and control was very effective. The ratings were taken soon after treatment to indicate differences among treatments. A later observation indicated nearly complete control with all treatments. Wheat and kochia control was antagonized by sodium bicarbonate in the spray carrier. Sodium bicarbonate antagonism of wheat control with glyphosate was overcome by all adjuvants except, Li-700 and X-77 alone. Experimentals 6 and 10 tended to be more effective than experimentals 5 and 9.

Sethoxydim antagonism by NaHCO3 at 1000 PPM sodium, Fargo 1990. 'ND 810104' oats, Foxtail millet, and 'McCall' soybeans were seeded on May 24. Treatments were applied to 6- to 7-leaf oats, 6-leaf foxtail millet, and 3rd trifoliolate soybeans July 3 with 90 F, 75% RH, 15 to 20 mph wind and a partly cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 16. The spray carrier was water with sodium bicarbonate at 3650 ppm, except for treatments with (DW) distilled water.

Treatment	Rate	Oats	Fxmi	Soyb
	oz/A	-------	%	-------
Sethoxydim+PO(distilled water)	.75+.25G	66	83	0
Sethoxydim+PO+NH4OH(DW)	.75+.25G+0.11G	79	77	0
Sethoxydim+PO+AMSU(DW)	.75+.25G+2%	77	82	0
Sethoxydim+PO+AMSU(DW)	.75+.25G+.0.85%	74	82	0
Sethoxydim+PO+Exp 6(DW)	.75+.25G+.25G	82	83	0
Sethoxydim+PO+Exp 9(DW)	.75+.25G+.25G	75	81	0
Sethoxydim+PO+Exp 10(DW)	.75+.25G+.25G	81	86	0
Sethoxydim+PO(3650 NaHCO3)	.75+.25G	34	70	0
Sethoxydim+PO+NH4OH(3650 NaHCO3)	.75+.25G+0.11G	41	72	1
Sethoxydim+PO+AMSU(3650 NaHCO3)	.75+.25G+2%	78	85	1
Sethoxydim+PO+AMSU(3650 NaHCO3)	.75+.25G+0.85%	79	79	0
Sethoxydim+PO+Exp6(3650 NaHCO3)	.75+.25G+.25G	79	83	0
Sethoxydim+PO+Exp9(3650 NaHCO3)	.75+.25G+.25G	82	83	0
Sethoxydim+PO+Exp10(3650 NaHCO3)	.75+.25G+.25G	74	80	0
C.V. %		9	10	581
LSD 5%		9	NS	NS
# OF REPS		4	4	4

Summary

Sethoxydim did not injure soybean regardless of adjuvant. Sodium bicarbonate was antagonistic to oats and foxtail millet control from sethoxydim, ammonium hydroxide adjuvant enhanced oats control with sethoxydim in distilled water, but did not overcome antagonism from sodium bicarbonate. However, diammonium sulfate (AMSU) toxicity to oats from sethoxydim in distilled water and overcome antagonism from sodium bicarbonate in the spray carrier.

Glyphosate with NaHCO3 at 3650 ppm(1000 ppm sodium), Fargo 1990. 'ND 810104' oats, 'McCall' soybeans, and 'Siberian' proso millet was seeded on May 24. Treatments were applied to 6- to 7-leaf oats, 3rd trifoliolate soybeans, and 6-leaf foxtail millet on July 3 with 90 F, 75%RH, partly cloudy sky, and 15 mph wind. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8002 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluation was on July 16.

Treatment	Rate oz/A	Oats	Soyb	Proso
		------------	%	------------
Glyphosate(DW)	1.5	75	71	92
Glyphosate(DW)+X-77	1.5+25%	76	80	95
Glyphosate(DW)+AMS	1.5+2%	85	78	95
Glyphosate	1.5	43	23	76
Glyphosate+AMSU	1.5+.25G	73	69	93
Glyphosate+AMSU	1.5+2%	84	74	95
Glyphosate+X-77	1.5+.25%	44	42	81
Glyphosate+AMSU+X-77	1.5+2%+.25%	80	81	92
Glyphosate+Cayuse	1.5+.25G	48	39	84
Glyphosate+Li-700	1.5+.25G	33	40	78
Glyphosate+Surtac	1.5+.25G	39	29	80
Glyphosate+DC5309	1.5+.09G	80	83	93
Glyphosate+Exp5	1.5+.25G	76	80	91
Glyphosate+Exp6	1.5+.25G	82	75	95
Glyphosate+Exp9	1.5+.25G	88	73	97
Glyphosate+Exp10	1.5+.25G	89	78	95
C.V. %		11	9	4
LSD 5%		10	8	5
# OF REPS		4	4	4

Summary

Sodium bicarbonate was antagonistic to glyphosate toxicity for all species. Diammonium sulfate (AMSU), DC 5309, and the experimental were the only adjuvants to overcome sodium bicarbonate antagonism of glyphosate toxicity to oats and soybeans.

The influence of Exp10 on Glyphosate phytotoxicity with NaHCO3, Fargo 1990. 'ND 810104' oats, 'McCall' soybeans, and 'Siberian' foxtail millet was seeded on May 8. Treatments were applied to late tillering oats and foxtail millet and 3rd trifoliolate soybeans on July 12 with 75 F and partly cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were on July 23 and 29.

Treatment	Rate	7-23-90			9-29-90	
		Oats	Soyb	Fxmi	Oats	Soyb
	oz/A			%		
Glyphosate(Oppm)	1.5	64	62	92	71	54
Glyphosate(Oppm)+Exp10	1.5+.05%	80	71	94	87	69
Glyphosate(Oppm)+Exp10	1.5+1.5%	87	72	96	91	68
Glyphosate(Oppm)+Exp10	1.5+3.0%	85	75	95	90	75
Glyphosate(500ppm)	1.5	48	23	86	62	34
Glyphosate(500ppm)+Exp10	1.5+0.5%	83	70	96	81	67
Glyphosate(500ppm)+Exp10	1.5+1.5%	88	68	96	90	61
Glyphosate(500ppm)+Exp10	1.5+3.0%	95	80	96	94	74
Glyphosate(1000ppm)	1.5	43	26	84	59	28
Glyphosate(1000ppm)+Exp10	1.5+0.5%	69	46	91	78	50
Glyphosate(1000ppm)+Exp10	1.5+1.5%	86	60	93	87	65
Glyphosate(1000ppm)+Exp10	1.5+3.0%	88	71	93	91	68
Glyphosate(2000ppm)	1.5	43	15	75	59	29
Glyphosate(2000ppm)+Exp10	1.5+0.5%	59	42	83	67	56
Glyphosate(2000ppm)+Exp10	1.5+1.5%	72	60	92	79	50
Glyphosate(2000ppm)+Exp10	1.5+3.0%	90	73	95	91	72
Glyphosate+AMS	1.5+2%	86	76	95	89	68
Glyphosate(2000ppm)+AMS	1.5+2%	76	59	92	79	61
Glyphosate(1000ppm)+AMS	1.5+2%	87	68	96	91	68
Glyphosate(500ppm)+AMS	1.5+2%	94	77	97	94	73
C.V. %		10	17	4	8	15
LSD 5%		11	14	5	9	12
# OF REPS		4	4	4	4	4

Summary

Glyphosate toxicity to the various species was enhanced by Exp10 and diammonium sulfate (AMS). Sodium bicarbonate antagonized glyphosate phytotoxicity, but the antagonism did not increase with sodium bicarbonate concentration. Antagonism was similar from 500 and 2000 ppm sodium bicarbonate. However, greater percentages of Exp10 were needed to overcome the antagonism from the higher sodium bicarbonate concentration.

Herbicide-insecticide interaction in wheat, Fargo 1990. 'Wheaton' hard red spring wheat was seeded April 23, 1990 at Fargo, North Dakota in a silty clay soil having 4% organic matter and pH 7.8. Treatments were applied June 7 when wheat was 6-leaf, 7-inches-tall, and had two tillers. Environmental conditions at time of treatment were as follows: cloudy skies, 67 F air temperature, 50% relative humidity, plentiful soil moisture. Treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi using 8001 flat fan nozzles. Plots were maintained weed free by handweeding. Visual estimates of percentage wheat injury were made on June 21. Plots were machine-harvested on August 7 and grain yields adjusted to 12% moisture. Plot size was 10 by 26 ft and the experiment was designed as a randomized complete block with four replications.

Treatment[a]	Rate	Wheat injury	Grain yield
	(oz/A)	(%)	(Bu/A)
Thif&Trib+Surf	0.25&0.125+0.5%	6	72
Thif&Trib+Chlorpyrifos+Surf	0.25&0.125+8+0.5%	12	66
Thif&Trib+Disulfoton+Surf	0.25&0.125+8+0.5%	9	72
Thif&Trib+Carbofuran+Surf	0.25&0.125+8+0.5%	4	72
Thif&Trif+Carbaryl+Surf	0.25&0.125+8+0.5%	5	72
Tribenuron+Surf	0.25+0.5%	8	68
Tribenuron+Chlorpyrifos+Surf	0.25+8+0.5%	6	70
Tribenuron+Disulfoton+Surf	0.25+8+0.5%	8	64
Tribenuron+Carbofuran+Surf	0.25+8+0.5%	4	73
Tribenuron+Carbaryl+Surf	0.25+8+0.5%	3	68
2,4-D-dma	8	4	74
2,4-D-dma+Chlorpyrifos	8+8	7	75
2,4-D-dma+Disulfoton	8+8	8	70
2,4-D-dma+Carbofuran	8+8	4	70
2,4-D-dma+Carbaryl	8+8	4	71
2,4-D-bee+Chlorpyrifos	8+8	8	76
Clopyralid&2,4-D	1.5&8	4	73
Clopyralid&2,4-D+Chlorpyrifos	1.5&8+8	3	76
Clopyralid&2,4-D+Disulfoton	1.5&8+8	5	71
Clopyralid&2,4-D+Carbofuran	1.5&8+8	4	73
Clopyralid&2,4-D+Carbaryl	1.5&8+8	1	76
Imazamethabenz	7.5	1	72
Imazamethabenz+Chlorpyrifos	7.5+8	1	77
Imazamethabenz+Disulfoton	7.5+8	2	75
Imazamethabenz+Carbofuran	7.5+8	1	74
Imazamethabenz+Carbaryl	7.5+8	2	74
Control	0	0	71
C.V. %		68	9
LSD 5%		4	NS

[a] Thif&Trib = Harmony Extra (2:1 mixture of thifensulfuron and tribenuron); Surf = R-11 surfactant; Chlorpyrifos = Lorsban 4E; Disulfoton = Di-Syston 6E; Carbofuran = Furadan 4L; Carbaryl = Seven 4L; 2,4-D-dma = 2,4-D dimethylamine salt; 2,4-D-bee = 2,4-D butoxyethyl ester; Clopyralid&2,4-D = Curtail.

Summary. Thifensulfuron, tribenuron, 2,4-D, 2,4-D&clopyralid, and imazamethabenz caused low levels of wheat injury (expressed as stunting) when applied without insecticide. Chlorpyrifos increased injury by thifensulfuron&tribenuron, and disulfoton increased injury by 2,4-D. Carbofuran and carbaryl did not effect visually observable wheat injury. None of the treatments reduced grain yield.

Preplant and preemergence weed control in wheat, Minot 1990. Untilled durum stubble was worked twice with a field cultivator on April 30, 1990, leaving 15 to 30% residue cover over most of the field. Preplant (PP) treatments applied May 2, prior to seeding. 'Stoa' HRS wheat seeded 0.5 to 1 inch deep at 65 lb/A into good soil moisture on May 2. Preemergence (PRE) treatments applied May 2, following seeding. Postemergence (PO) treatments applied June 13 when air temperature was 65 F, relative humidity was 40%, wind was 10 to 15 mph (shield used), kochia was 1 to 4 inches tall, common lambsquarters was 4 to 6 inches tall, and Russian thistle was 1 to 3 inches tall. Growing conditions were considered good during postemergence application. Visual estimates of percentage weed control were made June 26 and August 9. Plot size was 10 by 25 ft and the experiment was a completely randomized design with four replications.

		Evaluated 6/26				Eval. 8/9	
Treatment[a]	Rate	KOCZ	Ruth	Colq	Wimu	KOCZ	Colq
	(oz/A)	(% control)					
Triasulfuron(PP)	0.21	100	80	73	100	99	79
Triasulfuron(PRE)	0.21	96	70	74	97	91	76
Triasulfuron+X77(PO)	0.21+0.25%	-	-	-	-	99	81
Triasulfuron(PP)	0.43	100	82	98	100	99	96
Triasulfuron(PRE)	0.43	99	83	99	100	100	100
Triasulfuron+X77(PO)	0.43+0.25%	-	-	-	-	100	71
Chlorsulfuron(PP)	0.25	97	79	100	100	100	100
Chlorsulfuron(PRE)	0.25	100	63	100	100	100	99
Chlorsulfuron+X77(PO)	0.25+0.25%	-	-	-	-	82	100
C4243(PRE)	1	56	46	58	68	62	89
C4243(PRE)	1.5	67	73	96	95	67	93
C4243(PRE)	2	94	75	100	92	73	94
Tribenuron+X77(PO)	0.375+0.25%	-	-	-	-	100	100
Thif&Trib+X77(PO)	0.25&0.125+0.25%	-	-	-	-	100	99
Bromoxynil&MCPA(PO)	8	-	-	-	-	97	100
2,4-D(PO)	8	-	-	-	-	69	100
2,4-D+X77(PO)	8+0.5%	-	-	-	-	64	99
Control	0	0	0	0	0	0	0
C.V. %		21	29	27	18	21	18
LSD 5%		24	28	31	22	25	23

[a]Dimethyl amine salt of 2,4-D used; Tribenuron = DPX-L5300 (Express); Triasulfuron = CGA 131036 (Amber); Thif&Trib = thifensulfuron plus tribenuron package mix, 2:1 (Harmony Extra).

Summary. Soil-applied triasulfuron and chlorsulfuron may have performed better when applied preplant compared to preemergence, although differences were small. Soil-applied triasulfuron and chlorsulfuron controlled Russian thistle only 60 to 80%. Common lambsquarters was controlled completely by soil-applied triasulfuron at 0.43 oz/A but 0.21 oz/A provided only about 75% control. C4243 applied preemergence at 2 oz/A controlled kochia, common lambsquarters, and wild mustard 90 to 100%, but only provided 75% Russian thistle control. Postemergence triasulfuron controlled kochia but control of common lambsquarters was 70 to 80%.

<u>Herbicide treatments for sulfonylurea resistant kochia in wheat, Sarles 1990.</u> 'Sceptre' durum was seeded May 11, 1990 into a loam soil with a known infestation of sulfonylurea resistant kochia. Treatments were applied June 23 using an ATV-mounted sprayer delivering 8.5 gal/A at 30 psi with 80015 nozzles. Conditions at time of application were as follows: sunny skies, 80 F, wind 0 to 2 mph, 30% relative humidity, good growing conditions, wheat 5 to 5.5-leaf and 12 inches tall with 3 to 4 tillers, and kochia 2 to 8 inches tall. Visual estimates of percentage kochia control were made on July 11 and August 8. Plot size was 10 by 25 feet and the experiment was designed as a randomized complete block with four replications.

Treatment[a]	Rate	Evaluation date	
		July 11	Aug. 8
	(oz/A)	(% kochia control)	
Metsulfuron+X77	0.0625+0.5%	39	30
Metsulfuron+Brox&MCPA+X77	0.0625+4&4+0.5%	80	62
Metsulfuron+2,4-D+X77	0.0625+8+0.5%	63	41
Tribenuron+X77	0.125+0.5%	41	43
Tribenuron+Brox&MCPA+X77	0.125+4&4+0.5%	68	60
Tribenuron+2,4-D+X77	0.125+8+0.5%	49	51
Thifensulfuron&Tribenuron+X77	0.25&0.125+0.5%	31	22
Thif&Trib+Brox&MCPA+X77	0.25&0.125+4&4+0.5%	64	64
Thif&Trib+2,4-D+X77	0.25&0.125+8+0.5%	49	39
Chlorsulfuron+X77	0.188+0.5%	20	17
Chlorsulfuron+Brox&MCPA+X77	0.188+4&4+0.5%	76	72
Chlorsulfuron+2,4-D+X77	0.1875+8+0.5%	44	30
Bromoxynil&MCPA+X77	4&4+0.5%	60	52
Bromoxynil&MCPA+Dash	4&4+0.125G	-	24
Brox&MCPA+Pendimethalin+X77	4&4+12+0.5%	73	69
Brox&MCPA+Pendimethalin+X77	4&4+20+0.5%	78	68
2,4-D+X77	8+0.5%	36	28
C.V. %		34	40
LSD 5%		26	26

[a] 2,4-D = butoxyethyl ester of 2,4-D.

<u>Summary</u>. None of the sulfonylurea herbicides, metsulfuron, tribenuron, thifensulfuron, and chlorsulfuron, controlled kochia. The kochia control achieved with sulfonylureas applied alone (20 to 50%) may have reflected the presence of sulfonylurea susceptible plants. Adding either bromoxynil plus MCPA or 2,4-D to the sulfonylurea herbicide treatments improved control but only to between 50 to 80% due to the large size of kochia at time of treatment.

Early preplant cyanazine and oryzalin in no-till sunflowers, Minot 1990. The experiment was established in standing durum stubble (4950 lb/A surface residues) on a loam soil with pH 6.6 and 3.2% organic matter. Four week preplant (4WPP), 3 week preplant (3WPP), 2 week preplant (2WPP), and preemergence (PRE) treatments were applied April 25, May 3, May 10, and May 22, respectively, using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. On May 22, Cargill 207 sunflowers were seeded 1.5 inches deep at 21,000 seeds per acre using a Buffalo Till no-till planter set on 30-inch rows. Glyphosate at 0.75 lb ae/A was applied May 24 over the entire experiment for control of all weeds present at planting. On June 5, 11 lbs N/A as ammonium nitrate was applied to supplement the 85 lbs N/A detected by soil test to a 2-ft depth. Visual estimates of percentage weed control and sunflower plant counts were made on June 26. On October 9, sunflower plant counts were again taken and plots were hand-harvested and combine-threshed. Grain yields were corrected to 10% moisture. Plot size was 10 by 27 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate	Weed control			Plts/plot		Grain yield	
		Grft	KOCZ	Ruth	6/26	10/9	kg/ha	lb/A
	lb/A	(%)			(No.)			
Cyanazine+Pendimethalin(PRE)	2.5+2	99	95	97	6.0	1.5	221	197
Cyanazine+Pendimethalin(PRE)	3+2	99	100	99	4.8	3.0	210	187
Cyanazine(PRE)	3	98	100	98	1.3	1.5	55	49
Cyanazine(2WPP)/Pendimethalin(PRE)	2.5/2	100	100	99	7.0	3.8	353	315
Cyanazine(2WPP)/Pendimethalin(PRE)	3/2	100	100	99	2.3	0.5	43	38
Cyanazine(2WPP)/Pendimethalin(PRE)	3.5/2	100	100	100	2.0	1.5	78	70
Cyanazine(2WPP)	3	99	100	99	2.8	1.8	155	138
Cyanazine(3WPP)/Pendimethalin(PRE)	2.5/2	100	100	99	14.5	6.5	441	394
Cyanazine(3WPP)/Pendimethalin(PRE)	3/2	100	100	100	8.5	2.5	234	209
Cyanazine(3WPP)/Pendimethalin(PRE)	3.5/2	100	100	100	5.0	3.0	223	199
Cyanazine(3WPP)	3	98	100	99	13.3	9.3	453	404
Cyanazine(4WPP)/Pendimethalin(PRE)	2.5/2	99	100	98	12.0	8.0	568	507
Cyanazine(4WPP)/Pendimethalin(PRE)	3/2	100	100	98	7.5	3.0	273	244
Cyanazine(4WPP)/Pendimethalin(PRE)	3.5/2	100	100	99	5.0	3.0	181	161
Cyanazine(4WPP)	3	99	100	98	21.8	8.5	584	520
Oryzalin+Fluorochloridone(PRE)	1.25+0.5	89	93	74	81.0	44.8	1632	1456
Oryzalin+Fluorochloridone(PRE)	1.5+0.5	95	100	88	71.5	35.0	1548	1380
Oryzalin(PRE)	1.5	92	91	43	76.0	30.0	1206	1076
Oryzalin(2WPP)/Fluorochloridone(PRE)	1.25/0.5	99	100	94	80.3	55.0	1794	1600
Oryzalin(2WPP)/Fluorochloridone(PRE)	1.5/0.5	99	100	93	78.5	57.3	1824	1626
Oryzalin(2WPP)	1.5	98	92	68	66.0	46.0	1794	1600
Oryzalin(3WPP)/Fluorochloridone(PRE)	1.25/0.5	98	100	94	83.5	56.5	1871	1669
Oryzalin(3WPP)/Fluorochloridone(PRE)	1.5/0.5	97	100	97	83.0	51.0	1636	1458
Oryzalin(3WPP)	1.5	97	84	70	81.0	53.8	1647	1468
Oryzalin(4WPP)/Fluorochloridone(PRE)	1.25/0.5	100	100	94	80.8	55.3	1772	1581
Oryzalin(4WPP)/Fluorochloridone(PRE)	1.5/0.5	99	100	83	80.5	57.3	1848	1648
Oryzalin(4WPP)	1.5	96	74	67	74.0	50.3	1795	1601
Cyanazine+Oryzalin(4WPP)	3+1.5	99	100	99	15.8	10.0	1118	998
Untreated	0	0	0	0	80.8	54.3	1476	1316
Handweeded check [Pend+Fluo]	[1.5+0.5]	100	100	100	76.5	54.3	2030	1811
C.V. %		3	6	11	18.0	23.2	39	39
LSD 5%		4	8	14	10.3	8.4	514	460

[a]X-77 surfactant at 0.5% v/v was added to all treatments; handweeded check received pendimethalin plus fluorochloridone at 1.5 + 0.5 lb/A, 4 weeks before planting, supplemented by handweeding to maintain a weed-free condition.

- See next page for summary -

- See previous page for experiment description and data -

Summary. Abundant rainfall in June promoted excellent green foxtail control by oryzalin and excellent control of all weeds by cyanazine. Cyanazine reduced sunflower stands and grain yields dramatically, presumably because of movement to the root zone during June rains. Oryzalin also caused swollen and brittle stems at ground level, making sunflower plants more susceptible to lodging during windy conditions.

Early preplant cyanazine and oryzalin in no-till sunflowers, Carrington 1990. The experiment was established in standing barley stubble (3340 lb/A surface residues) on a loam soil with pH 6.3 and 3% organic matter. Four week preplant (4WPP), 3 week preplant (3WPP), 2 week preplant (2WPP), and preemergence (PRE) treatments were applied April 25, May 2, May 10, and May 23, respectively, using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. On May 23, Cargill 207 sunflowers were seeded 1.5 inches deep at 20,000 seeds per acre using a John Deer Max-Emerge no-till planter set on 30-inch rows. Glyphosate at 0.75 lb ae/A was applied May 23 over the entire experiment for control of all weeds present at planting. On June 22, 75 lbs N/A as ammonium nitrate was applied to supplement the 35 lbs N/A detected by soil test to a 2-ft depth. Visual estimates of percentage weed control and sunflower plant counts were made on June 27. On October 16, sunflower plant counts were again taken and plots were hand-harvested and combine-threshed. Grain yields were corrected to 10% moisture. Plot size was 10 by 27 ft and the experiment was a completely randomized design with four replications.

- See next page for data and summary -

- See previous page for experiment description -

Treatment[a]	Rate	Weed control					Plts/plot		Grn
		Fxtl	Wibw	Ruth	Rrpw	KOCZ	6/27	10/16	yld
	(lb/A)	(%)					(No.)		#/A
Cyanazine+Pendimethalin(PRE)	2.5+2	97	100	100	100	100	18	11	561
Cyanazine+Pendimethalin(PRE)	3+2	98	100	99	99	100	18	13	639
Cyanazine(PRE)	3	90	98	99	85	100	15	13	478
Cyanazine(2WPP)/Pendimethalin(PRE)	2.5/2	96	100	99	98	100	6	6	299
Cyanazine(2WPP)/Pendimethalin(PRE)	3/2	99	100	100	100	95	12	4	332
Cyanazine(2WPP)/Pendimethalin(PRE)	3.5/2	98	100	100	100	100	3	3	136
Cyanazine(2WPP)	3	92	100	100	97	100	3	3	94
Cyanazine(3WPP)/Pendimethalin(PRE)	2.5/2	99	100	100	100	100	7	7	284
Cyanazine(3WPP)/Pendimethalin(PRE)	3/2	99	100	100	100	100	6	5	320
Cyanazine(3WPP)/Pendimethalin(PRE)	3.5/2	99	100	100	99	100	2	1	49
Cyanazine(3WPP)	3	91	100	100	72	100	6	6	251
Cyanazine(4WPP)/Pendimethalin(PRE)	2.5/2	99	100	100	99	100	9	8	440
Cyanazine(4WPP)/Pendimethalin(PRE)	3/2	98	100	99	100	100	8	7	412
Cyanazine(4WPP)/Pendimethalin(PRE)	3.5/2	99	100	100	100	100	4	4	157
Cyanazine(4WPP)	3	89	100	100	88	100	6	5	198
Oryzalin+Fluorochloridone(PRE)	1.25+0.5	46	95	95	98	100	40	37	1112
Oryzalin+Fluorochloridone(PRE)	1.5+0.5	62	97	91	98	99	45	42	1259
Oryzalin(PRE)	1.5	27	54	56	88	74	48	44	1154
Oryzalin(2WPP)/Fluorochloridone(PRE)	1.25/0.5	36	86	78	96	100	44	42	1148
Oryzalin(2WPP)/Fluorochloridone(PRE)	1.5/0.5	75	96	94	100	100	35	33	1226
Oryzalin(2WPP)	1.5	56	77	67	93	88	44	40	1293
Oryzalin(3WPP)/Fluorochloridone(PRE)	1.25/0.5	60	80	88	99	100	43	39	1247
Oryzalin(3WPP)/Fluorochloridone(PRE)	1.5/0.5	66	85	95	99	100	46	44	1355
Oryzalin(3WPP)	1.5	54	34	57	97	95	46	44	1186
Oryzalin(4WPP)/Fluorochloridone(PRE)	1.25/0.5	58	89	96	99	100	48	45	1254
Oryzalin(4WPP)/Fluorochloridone(PRE)	1.5/0.5	60	97	98	100	100	43	41	1292
Oryzalin(4WPP)	1.5	45	43	47	76	89	42	40	1230
Cyanazine+Oryzalin(4WPP)	3+1.5	92	100	100	100	100	10	10	491
Untreated	0	0	0	0	0	0	47	43	802
Handweeded check [Pend+Fluo]	[1.5+0.5]	100	100	100	100	100	45	37	1304
C.V. %		14	14	14	10	7	33	28	32
LSD 5%		15	18	18	13	9	11	9	326

[a]X-77 surfactant at 0.5% v/v was added to all treatments; handweeded check received pendimethalin plus fluorochloridone at 1.5 + 0.5 lb/A, 4 weeks before planting, supplemented by handweeding to maintain a weed-free condition.

Summary. Abundant rainfall in June promoted excellent control of all weeds by cyanazine. Oryzalin, however, provided fair to poor control. Cyanazine reduced sunflower stands and grain yields dramatically, presumably because of movement to the root zone during June rains. Oryzalin also caused swollen and brittle stems at ground level, making sunflower plants more susceptible to lodging during windy conditions.

Postemergence treatments in fallow, Carrington 1990. Experiment was established June 12 in 6 to 10-inch-tall barley stubble. Treatments were applied to 2- to 4-leaf foxtail (60% green and 40% yellow foxtail), 10-inch-tall kochia, 1- to 1.5-ft-long wild buckwheat, and 4- to 5-inch-tall Russian thistle using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Environmental conditions at application were: air temperature 75 to 80 F, 55% relative humidity, sunny skies, good soil moisture. Estimates of percentage foxtail control were made July 2 and control of kochia, wild buckwheat, and Russian thistle was evaluated July 12. Plot size was 11 by 27 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Weed control			
		Fxtl	KOCZ	Wibw	Ruth
	(lb/A)	(%)			
Sulfosate+X77	0.25+0.5%	5	0	12	3
Glyphosate+X77	0.25+0.5%	28	43	0	14
Sulfosate+X77	0.375+0.5%	20	41	0	8
Sulfosate+X77	0.5+0.5%	46	1	5	3
Sulfosate+2,4-D-dma+X77	0.188+0.17+0.5%	4	9	4	29
Sulfosate+2,4-D-dma+X77	0.25+0.22+0.5%	6	11	5	13
Sulfosate+2,4-D-dma+X77	0.375+0.33+0.5%	34	57	5	77
Glyphosate+2,4-D-dma+X77	0.188+0.17+0.5%	19	41	10	26
Glyphosate+2,4-D-dma+X77	0.25+0.22+0.5%	29	91	7	46
Glyphosate+2,4-D-dma+X77	0.375+0.33+0.5%	50	92	3	76
Glyphosate&2,4-DII	0.188&0.17	28	85	8	69
Glyphosate&2,4-DII	0.25&0.22	51	96	2	55
Glyphosate&2,4-DII	0.375&0.33	59	97	8	96
Glyphosate&Dicamba	0.35&0.16	73	99	65	95
Glyphosate&Dicamba	0.375&0.17	63	100	79	94
Sulfosate+Dicamba+X77	0.375+0.17+0.5%	33	97	84	91
Haloxyfop+POC	0.125+0.25G	90	0	3	0
Haloxyfop+POC	0.25+0.25G	89	3	4	0
Halx+Picloram+Fluroxypyr+POC	0.125+0.125+0.0625+0.25G	90	85	100	87
Halx+Picloram+Fluroxypyr+POC	0.125+0.125+0.125+0.25G	93	98	100	95
Halx+Picloram+Fluroxypyr+POC	0.25+0.125+0.125+0.25G	95	99	100	97
Halx+Picl+2,4-D-dma+POC	0.125+0.125+0.5+0.25G	93	23	99	95
Halx+Picl+2,4-D-bee+POC	0.125+0.125+0.5+0.25G	86	37	100	97
C.V. %		26	36	24	38
LSD 5%		19	29	12	29

[a]Glyphosate&2,4-DII = Landmaster II; Glyphosate&dicamba = Fallowmaster; 2,4-D-dma = dimethylamine salt of 2,4-D; 2,4-D-bee = butoxyethyl ester of 2,4-D; POC = petroleum oil adjuvant containing 17% emulsifier.

Summary. Glyphosate and glyphosate mixtures performed poorly on all species, except that kochia and Russian thistle control was nearly complete with the high rate of glyphosate&2,4-DII or with glyphosate&dicamba treatments. Haloxyfop controlled foxtail 90 to 95% and mixtures of picloram plus fluroxypyr controlled kochia, wild buckwheat, and Russian thistle.

C4243 for weed control in fallow, Minot 1990. Preemergence (PRE) treatments were applied April 25, 1990 with few weeds emerged. On May 25, the entire area was sprayed with 2,4-D at 0.5 lb/A to control a dense stand of the winter annual green-flower pepperweed that was showing no response to the PRE treatments. Failure of the 2,4-D necessitated treatment with glyphosate at 0.75 lb ae/A on June 6. Post-emergence (PO) treatments were applied July 12 when green foxtail was tillered and 7 to 10 inches tall, redroot pigweed was 3 to 5 inches tall, kochia was 2 to 3 inches tall, and Russian thistle was 1 to 3 inches tall. Postemergence spray conditions were: sunny skies, 35% relative humidity, 78 F, no wind, good growing conditions. All treatments were applied with a bicycle wheel plot sprayer delivering 17 gpa with 8002 nozzles for PRE treatments and 8.5 gpa with 8001 nozzles for PO treatments. Spray pressure was 40 psi. Treatments were applied in 5- to 12-inch-tall standing durum stubble. Soil type was a loam with 2.6% organic matter and pH 6.2. Plot size was 10 by 30 ft and the experiment was a randomized complete block design having four replications.

		Weed control			
Treatment[a]	Rate[b]	Grft	Rrpw	Ruth	KOCZ
	(oz/A)	(%)			
C4243(PRE)	1	40	46	74	94
C4243(PRE)	2	52	58	63	81
C4243+Atrazine(PRE)	1+8	27	60	82	100
C4243+Clomazone(PRE)	1+8	69	25	39	100
Clomazone+Atrazine(PRE)	8+8	84	88	76	100
C4243+Quizalofop-P-T+POC(PO)	1+1+0.25G	98	99	85	70
C4243+Quizalofop-P-T+POC(PO)	2+1+0.25G	99	100	96	94
Untreated	0	0	0	0	0
C.V. %		39	27	27	21
LSD 5%		32	25	26	24

[a]Atrazine dry flowable was used; Quizalofop-P-T = Pantera; POC = petroleum oil adjuvant containing 17% emulsifier.
[b]0.25G = 0.25 gal/A.

Summary. C4243 applied preemergence and mixed with atrazine or clomazone controlled kochia 100% but control of green foxtail, redroot pigweed, and Russian thistle was inadequate. Postemergence C4243 at 2 oz/A mixed with Quizalofop-P-T completely controlled green foxtail and redroot pigweed and provided 96 and 94% control, respectively, of Russian thistle and kochia.

Postharvest treatments with paraquat and glyphosate, Pillsbury 1990. The experiment was established August 30 in 10-inch-tall wheat stubble about 12 days after harvest. Treatments were applied to 10- to 12-inch-tall (headed out) green foxtail using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Environmental conditions at application were: 85 F air temperature, 35% relative humidity, sunny skies, good soil moisture. Estimates of percentage green foxtail control were made on September 13. Plot size was 11 by 27 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate	Green foxtail control
	(lb/A)	
Paraquat+X77	0.375+0.5%	92
Paraquat+X77	0.5+0.5%	92
Paraquat+X77	0.75+0.5%	96
Paraquat+X77	1+0.5%	98
Paraquat+2,4-D-bee+X77	0.375+0.25+0.5%	92
Paraquat+2,4-D-bee+X77	0.5+0.25+0.5%	91
Paraquat+2,4-D-bee+X77	1+0.25+0.5%	98
Paraquat+Dicamba+R11	0.375+0.125+0.5%	87
Paraquat+Dicamba+R11	0.5+0.125+0.5%	94
Paraquat+Dicamba+R11	1+0.125+0.5%	97
Paraquat+Atrazine+X77	0.5+0.25+0.5%	93
Paraquat+Atrazine+X77	1+0.25+0.5%	99
Glyphosate+X77+AS	0.188+0.5%+1.5	99
Glyphosate+X77+AS	0.28+0.5%+1.5	100
Glyphosate+X77+AS	0.375+0.5%+1.5	100
Glyphosate+X77+AS	0.5+0.5%+1.5	100
Glyphosate&2,4-D+AS	0.188&0.17+1.5	99
Glyphosate&2,4-D+AS	0.28&0.25+1.5	100
Glyphosate&2,4-D+AS	0.375&0.33+1.5	100
Glyphosate&Dicamba+AS	0.188&0.085+1.5	100
Glyphosate&Dicamba+AS	0.28&0.13+1.5	100
Glyphosate&Dicamba+AS	0.375&0.17+1.5	100
C.V. %		4
LSD 5%		5

[a]Paraquat = Cyclone, 2 lb/gal; 2,4-D-bee = butoxyethyl ester of 2,4-D; 2,4-D-dma = dimethylamine salt of 2,4-D; X-77 = surfactant by Valent; R11 = surfactant by Wilbur-Ellis; dry flowable formulation of atrazine was used; AS = ammonium sulfate; Glyphosate&2,4-D = Landmaster II; Glyphosate&Dicamba = Fallowmaster.

Summary. All glyphosate treatments provided complete control of green foxtail. Paraquat and 1 lb/A controlled foxtail 97 to 98% but 0.375 and 0.5 lb/A provided about 92 to 93% control. Atrazine, 2,4-D ester, or dicamba did not appear to affect paraquat efficacy on green foxtail.

<u>Postharvest treatments with paraquat and glyphosate, Carrington 1990</u>. The experiment was established August 22 in 5-inch-tall millet stubble. Treatments were applied to 4- to 8-inch-tall (mostly headed out) foxtail (60% green and 40% yellow foxtail), 2- to 10-inch-tall kochia, 2- to 8-inch-tall Russian thistle, and 2-inch-tall (4- to 12-inch-diameter) prostrate pigweed using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Environmental conditions at application were: 84 F air temperature, 25% relative humidity, sunny skies, somewhat dry soil moisture conditions. Estimates of percentage green foxtail control were made on September 13. Plot size was 11 by 27 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate	Weed control			
		Fxtl	KOCZ	Ruth	Prpw
	(lb/A)	(%)			
Paraquat+X77	0.375+0.5%	98	100	100	98
Paraquat+X77	0.5+0.5%	98	100	100	100
Paraquat+X77	0.75+0.5%	99	100	100	100
Paraquat+X77	1+0.5%	99	100	100	100
Paraquat+2,4-D-bee+X77	0.375+0.25+0.5%	98	100	100	100
Paraquat+2,4-D-bee+X77	0.5+0.25+0.5%	99	100	100	100
Paraquat+2,4-D-bee+X77	1+0.25+0.5%	100	100	100	100
Paraquat+Dicamba+R11	0.375+0.125+0.5%	97	100	100	100
Paraquat+Dicamba+R11	0.5+0.125+0.5%	99	100	100	99
Paraquat+Dicamba+R11	1+0.125+0.5%	100	100	100	100
Paraquat+Atrazine+X77	0.5+0.25+0.5%	98	100	100	100
Paraquat+Atrazine+X77	1+0.25+0.5%	99	100	100	100
Glyphosate+X77+AS	0.188+0.5%+1.5	46	28	37	29
Glyphosate+X77+AS	0.28+0.5%+1.5	66	71	77	77
Glyphosate+X77+AS	0.375+0.5%+1.5	86	91	92	99
Glyphosate+X77+AS	0.5+0.5%+1.5	99	100	100	100
Glyphosate&2,4-D+AS	0.188&0.17+1.5	51	41	59	69
Glyphosate&2,4-D+AS	0.28&0.25+1.5	88	83	90	75
Glyphosate&2,4-D+AS	0.375&0.33+1.5	95	90	99	97
Glyphosate&Dicamba+AS	0.188&0.085+1.5	67	67	74	65
Glyphosate&Dicamba+AS	0.28&0.13+1.5	75	94	91	83
Glyphosate&Dicamba+AS	0.375&0.17+1.5	93	98	99	97
C.V. %		13	15	11	14
LSD 5%		16	18	14	17

[a]Paraquat = Cyclone, 2 lb/gal; 2,4-D-bee = butoxyethyl ester of 2,4-D; 2,4-D-dma = dimethylamine salt of 2,4-D; X-77 = surfactant by Valent; R11 = surfactant by Wilbur-Ellis; dry flowable formulation of atrazine was used; AS = ammonium sulfate; Glyphosate&2,4-D = Landmaster II; Glyphosate&Dicamba = Fallowmaster.

<u>Summary</u>. Complete or nearly complete foxtail control was achieved with all paraquat treatments, while glyphosate at 0.5 lb/A plus ammonium sulfate was required to control foxtail 100%. Generally, foxtail control by glyphosate&2,4-DII or glyphosate&dicamba was slightly better than with glyphosate alone. Kochia, Russian thistle, and prostrate pigweed also were controlled 100% by all paraquat treatments. Broadleaf control by glyphosate and glyphosate mixtures required 0.5 and 0.375 lb/A glyphosate, respectively.

Incorporated clomazone in fallow, Carrington 1990. The experiment was established October 16, 1989 on a loam soil with pH 6.0 and 2.5% organic matter. Non-incorporated treatments were applied to standing barley stubble while incorporated treatments were applied after 2 5-inch-deep passes with a field cultivator equipped with a tine harrow. All treatments were applied with a bicycle wheel sprayer delivering 17 gpa using 8002 nozzles at 40 psi to a 13.3-ft wide by 25-ft long area. Within 1.5 hours after herbicide application, incorporated plots were tilled again at 2 inches deep with the field cultivator/harrow operated at 5 to 7 mph. Air temperature was 50 F and soil was dry, not cloddy. Visual estimates of percentage weed control were made on June 6 after which the incorporated plots were tilled at 2 to 3 inches with the field cultivator/harrow (twice, opposite directions) and the non-incorporated plots were sprayed with glyphosate at 1 lb ae/A to control emerged vegetation. Estimates of percentage foxtail control were made on July 12. The experiment was a randomized block design with four replications, anda split plot arrangement of treatments.

Treatment[a]	Rate	Incor-porated	Evaluated 6/6[b] Fxtl	Wibw	Ruth	KOCZ	Colq	Eval 7/12[b] Fxtl
	(lb/A)		(% control)					
Clomazone	0.75	No	97	89	82	99	100	54
Clomazone+Atrazine	0.5+0.5	No	98	96	99	100	100	73
Clomazone+Atrazine	0.75+0.5	No	99	97	100	100	100	85
Clomazone+Atrazine	1+0.5	No	99	98	100	100	100	92
Untreated	0	No	0	0	0	0	0	0
LSD 5%			NS	NS	NS	NS	NS	14
Clomazone	0.75	Yes	67	79	59	84	77	76
Clomazone+Atrazine	0.5+0.5	Yes	74	75	84	100	73	76
Clomazone+Atrazine	0.75+0.5	Yes	80	76	59	99	77	85
Trifluralin	1	Yes	83	77	76	98	93	86
Untreated	0	Yes	0	0	0	0	0	0
LSD 5%			NS	NS	NS	NS	NS	14
TILLAGE (INCORPORATION) EFFECT			**	**	*	NS	**	NS

[a]Dry flowable formulation of atrazine was used.
[b]Foxtail was a mixture of yellow foxtail (60%) and green foxtail (40%).

Summary. Non-incorporated clomazone treatments performed better than incorporated treatments at the June 6 evaluation. On July 12, incorporated treatments were as effective or more effective than incorporated treatments.

Longevity of soil-applied treatments in fallow, Minot 1990. The experiment was established in 5 to 12-inch tall durum stubble (3800 lb/A residue) on a loam soil with pH 6.7 and 2.4% organic matter. Fall (F) treatments were applied October 17, 1989 when air temperature was 36 F and soil surface was dry. Spring (S) treatments were applied April 25, 1990 and application was followed immediately by rain. Almost no annual weeds were emerged on April 25. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 5 when green foxtail was 2-leaf and densely populated, kochia was 0.5 to 2-inch tall with 5 to 200 per sq yd, and Russian thistle was 0.5 to 3-inch tall with 3 to 75 per sq yd. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 5 to control emerged vegetation. Green foxtail control (dense population) was estimated again on July 11, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 11. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate	Evaluated 6/5			Eval 7/11
		Grft	KOCZ	Ruth	Grft
	(lb/A)	(%)			
BAS-514(F)	0.75	97	96	98	30
BAS-514(F)	1	99	98	98	44
BAS-514(F)	1.5	99	98	100	48
BAS-514(F)	2	99	98	98	44
BAS-514(S)	0.5	99	96	98	27
BAS-514(S)	0.75	100	93	97	64
BAS-514(S)	1	100	98	99	64
BAS-514(S)	1.25	100	99	100	70
BAS-514(S)	1.5	100	98	99	63
BAS-514+Atrazine(S)	0.5+0.5	98	100	100	33
BAS-514+Atrazine(S)	0.75+0.5	99	100	100	69
BAS-514+Atrazine(S)	1+0.5	100	100	100	65
BAS-514+Atrazine(S)	1.25+0.5	100	100	100	85
BAS-514+Atrazine+Clomazone(S)	0.5+0.5+0.5	100	100	100	85
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	100	100	100	87
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	100	100	100	84
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	100	100	100	89
Clomazone+Atrazine(S)	0.5+0.5	99	100	100	77
C.V. %		1	2	1	27
LSD 5%		NS	3	2	24

[a]Dry flowable formulation of atrazine was used; R-11 surfactant at 0.5% was added to all spring-applied treatments.

Summary. All treatments provided greater than 95% control of green foxtail, kochia, and Russian thistle when evaluated on June 5. Extremely abundant rainfall in June probably contributed to poor foxtail control by BAS-514 treatments at the July 11 evaluation. Best control at the latter evaluation date was 85 to 90% and was achieved with BAS-514-atrazine-clomazone combinations.

Longevity of soil-applied treatments in fallow, Carrington 1990. The experiment was established in barley stubble (2280 lb/A residue) on a loam soil with pH 6.9 and 2.4% organic matter. Fall (F) treatments were applied October 16, 1989 when air temperature was 57 F and soil surface was dry. Spring (S) treatments were applied April 26, 1990 when air temperature was 47 F with drizzling rain. Almost no annual weeds were emerged on April 26. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 6 when foxtail (60% green and 40% yellow foxtail) was 2- to 4-leaf and 10 to 150 per sq yd, kochia was 2 to 4 inches tall with 0.5 to 50 per sq yd, Russian thistle was 2 to 4 inches tall with 0.5 to 25 per sq yd, wild buckwheat was 4 inches tall with 2 to 30 per sq yd, and common lambsquarters was 2 to 4 inches tall with 0.5 to 10 per sq yd. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 6 to control emerged vegetation. Foxtail, redroot pigweed, and kochia control was estimated again on July 12, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 12. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate	Evaluated 6/6 Fxtl	KOCZ	Wibw	Ruth	Colq	Evaluated 7/12 Fxtl	Rrpw	KOCZ
	(lb/A)	(% weed control)							
BAS-514(F)	0.75	100	99	25	100	98	65	39	90
BAS-514(F)	1	100	100	44	99	99	77	54	99
BAS-514(F)	1.5	100	100	47	99	100	73	62	100
BAS-514(F)	2	100	100	32	100	100	90	89	100
BAS-514(S)	0.5	99	94	30	99	97	53	39	99
BAS-514(S)	0.75	100	97	56	100	98	71	37	100
BAS-514(S)	1	100	95	30	99	97	90	59	99
BAS-514(S)	1.25	100	97	55	100	99	94	76	99
BAS-514(S)	1.5	100	100	62	100	100	95	87	99
BAS-514+Atrazine(S)	0.5+0.5	100	100	86	100	99	83	86	100
BAS-514+Atrazine(S)	0.75+0.5	100	100	95	100	100	93	93	100
BAS-514+Atrazine(S)	1+0.5	100	100	85	100	100	91	90	100
BAS-514+Atrazine(S)	1.25+0.5	100	100	89	100	100	95	98	100
BAS-514+Atrazine+Clomazone(S)	0.5+0.5+0.5	100	100	98	100	100	97	94	100
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	100	100	99	100	100	99	97	100
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	100	100	99	100	100	100	99	100
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	100	100	97	100	100	99	97	99
Clomazone+Atrazine(S)	0.5+0.5	99	100	98	100	100	90	83	99
C.V. %		0	3	30	1	2	11	21	5
LSD 5%		1	4	29	NS	2	14	23	NS

[a]Dry flowable formulation of atrazine was used; R-11 surfactant at 0.5% was added to all spring-applied treatments.

Summary. All treatments gave complete or nearly complete control of foxtail, kochia, Russian thistle, and common lambsquarters at the June 6 evaluation. Clomazone treatments were the only treatments controlling wild buckwheat nearly 100% at the June 6 evaluation. At the July 12 evaluation, all treatments controlled kochia but nearly complete control of foxtail and redroot pigweed was achieved only by BAS-514-atrazine-clomazone mixtures.

Longevity of soil-applied treatments in fallow, Leonard 1990. The experiment was established in wheat stubble (2350 lb/A residue) on a loamy sand soil with pH 7.2 and 1.3% organic matter. Fall (F) treatments were applied October 23, 1989 when air temperature was 60 F and soil surface was dry. Spring (S) treatments were applied April 20, 1990 when air temperature was 76 F and soil surface dry. No weeds were emerged on April 20. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 13 when foxtail (80% green and 20% yellow foxtail) was 3- to 4-leaf and 5 to 200 per sq yd, Russian thistle was 2 to 6 inches tall with 10 to 30 per sq yd, and wild buckwheat was 2 to 8 inches tall with 2 to 10 per sq yd. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 13 to control emerged vegetation. Foxtail control (sparse population) was estimated again on July 13, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 13. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

Treatment[a]	Rate	Evaluated 6/13 Fxtl	Ruth	Wibw	Eval 7/13 Fxtl
	(lb/A)	(% control)			
BAS-514(F)	0.75	95	100	32	0
BAS-514(F)	1	95	100	7	4
BAS-514(F)	1.5	99	100	37	5
BAS-514(S)	0.5	98	100	12	10
BAS-514(S)	0.75	99	100	22	35
BAS-514(S)	1	100	100	21	29
BAS-514(S)	1.25	100	100	45	30
BAS-514(S)	1.5	100	100	44	33
BAS-514+Atrazine(S)	0.75+0.5	100	100	98	35
BAS-514+Atrazine(S)	1+0.5	100	100	98	47
BAS-514+Atrazine(S)	1.25+0.5	100	100	98	41
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	100	100	100	87
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	100	100	100	90
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	100	100	100	93
Clomazone+Atrazine(S)	0.5+0.5	91	95	100	51
Untreated	0	0	0	0	0
C.V. %		3	1	29	52
LSD 5%		4	1	25	29

[a]Dry flowable formulation of atrazine was used.

Summary. All treatments controlled Russian thistle at the June 13 evaluation, although control was incomplete (95%) with clomazone plus atrazine. Poor wild buckwheat control was achieved with BAS-514 alone at the June 13 evaluation, but treatments involving atrazine or atrazine plus clomazone provided essentially complete control. Foxtail control on June 13 was excellent by BAS-514 treatments although fall treatments were not as effective. Clomazone plus atrazine controlled foxtail 91% at the June 13 evaluation. Foxtail control evaluated in July was fair to poor for most treatments and only reached 90% for BAS-514-atrazine-clomazone mixtures.

Longevity of soil-applied treatments in fallow, Fargo 1990. The experiment was established in wheat stubble (3190 lb/A residue) on a silty clay soil with pH 7.8 and 3.9% organic matter. Fall (F) treatments were applied October 20, 1989 when air temperature was 31 F and soil surface was dry. Spring (S) treatments were applied April 19, 1990 when air temperature was 70 F with a dry soil surface. No weeds were emerged on April 19. All treatments were applied using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Visual estimates of percentage weed control were made June 12 when yellow foxtail was 3- to 4-leaf and 1 to 2 inches tall, kochia was 2 to 6 inches tall, and common lambsquarters was 2 to 5 inches tall. The entire experimental area was treated with glyphosate at 1 lb ae/A on June 12 to control emerged vegetation. Yellow foxtail and redroot pigweed control was estimated again on July 14, followed by treatment with glyphosate (1 lb/A) over the entire experiment. A dry July and August stimulated little additional weed growth, so weed control was not evaluated after July 14. Plot size was 20 by 30 ft and the experiment was a randomized complete block with four replications.

		Evaluated 6/12			Eval. 7/14	
Treatment[a]	Rate	Yeft	KOCZ	Colq	Yeft	Rrpw
	(lb/A)	(% control)				
BAS-514(F)	1	100	65	65	39	5
BAS-514(F)	1.5	100	79	84	61	23
BAS-514(F)	2	100	83	90	77	29
BAS-514(S)	0.75	99	61	58	38	4
BAS-514(S)	1	100	64	75	85	26
BAS-514(S)	1.25	100	79	88	68	16
BAS-514(S)	1.5	100	75	89	83	14
BAS-514(S)	2	100	86	90	92	50
BAS-514+Atrazine(S)	0.75+0.5	98	94	95	86	88
BAS-514+Atrazine(S)	1+0.5	98	98	99	78	70
BAS-514+Atrazine(S)	1.25+0.5	100	98	100	91	81
BAS-514+Atrazine(S)	2+0.5	100	98	100	79	66
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	99	100	99	84	80
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	99	100	100	93	83
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	100	100	100	94	81
BAS-514+Atrazine+Clomazone(S)	1.5+0.5+0.5	100	100	100	93	78
Clomazone+Atrazine(S)	0.5+0.5	96	95	89	84	76
Untreated	0	0	0	0	0	0
C.V. %		1	11	12	26	27
LSD 5%		2	13	14	27	19

[a]Dry flowable formulation of atrazine was used.

Summary. Clomazone plus atrazine controlled yellow foxtail 96% at the June 12 evaluation, but all other treatments provided 98 to 100% control. Foxtail control on July 14 was lower, with best control from BAS-514 at 2 lb/A or BAS-514-atrazine-clomazone mixtures. Near-complete kochia and common lambsquarter control on June 12 required BAS-514 plus atrazine or BAS-514-atrazine-clomazone combinations. None of the treatments provided more than about 80% control of redroot pigweed on July 14.

Wheat plantback after BAS-514 treatments in fallow, Minot 1990. Experiment was established in standing triticale stubble (1560 lb/A surface residue) on a loam soil with pH 7.7 and 1.8% organic matter. Fall (F) treatments were applied October 18, 1988 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Spring (S) treatments were applied April 25, 1989. Estimates of percentage weed control were taken on May 23, June 26, and July 26 when weeds in the check strips between plots were 2 to 6 inches tall. Immediately following each evaluation, the entire experimental area was treated with glyphosate plus 2,4-D (Landmaster II herbicide) to completely control all vegetation. Each evaluation thus represents weeds that emerged after the previous evaluation. 'Stoa' hard red spring wheat was seeded 1 inch deep at 65 lbs/A on May 3, 1990 after one 2-inch-deep pass with a field cultivator. Plots were combine-harvested August 16 and yields adjusted to 12% moisture. Plot size was 20 by 27 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Grain yield	
	(lb/A)	(kg/ha)	(Bu/A)
BAS-514(F)	1	4428	63
BAS-514(F)	1.5	4756	68
BAS-514(F)	2	4573	65
BAS-514(S)	0.75	4855	70
BAS-514(S)	1	4072	58
BAS-514(S)	1.25	4223	61
BAS-514(S)	1.5	3698	53
BAS-514+Atrazine(S)	0.75+0.5	4728	68
BAS-514+Atrazine(S)	1+0.5	4480	64
BAS-514+Atrazine(S)	1.25+0.5	4539	65
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	4775	68
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	4236	61
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	4290	62
Clomazone+Atrazine(S)	0.5+0.5	4799	69
Control	0	4860	70
C.V. %		7	7
LSD 5%		477	7

[a]Atrazine dry flowable formulation was used.

Summary. BAS-514 at rates of 1 lb/A and higher reduced grain yield of wheat planted 12 months after application. Plots were inspected for injury on May 22, 1990. From 5 to 25% chlorosis ("bleaching") was observed on plots previously treated with clomazone, but this injury did not appear to reduce yields. No injury attributable to BAS-514 was observed on May 22.

<u>Wheat plantback after BAS-514 treatments in fallow, Carrington 1990</u>. Experiment was established in standing wheat stubble that had been tilled once in the fall of 1988 with a Noble undercutter plow. Soil was a loam with pH 8.1 and 2.1% organic matter. Fall (F) treatments were applied October 18, 1988 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Spring (S) treatments were applied May 2, 1989. Estimates of percentage weed control were taken on June 1, June 27, and August 22 when weeds in the check strips between plots were 2 to 6 inches tall. Immediately following each evaluation, the entire experimental area was treated with glyphosate plus 2,4-D (Landmaster II herbicide) to control emerged vegetation. The entire experimental area was tilled 3 to 4 inches deep on April 22, 1990. 'Grandin' hard red spring wheat was seeded 1.5 inches deep at 60 lbs seed/A on April 23. Diclofop at 0.75 lb/A plus thifensulfuron&tribenuron (Harmony Extra) at 0.33 oz ai/A was applied May 23 for general weed control when wheat was 2.5-leaf. Grain yield was machine-harvested at maturity and adjusted to 12% moisture. Plot size was 20 by 30 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Grain yield
	(lb/A)	(Bu/A)
BAS-514(F)	1	43.7
BAS-514(F)	1.5	43.3
BAS-514(F)	2	41.2
BAS-514(S)	0.75	43.2
BAS-514(S)	1	45.1
BAS-514(S)	1.25	42.0
BAS-514(S)	1.5	40.5
BAS-514+Atrazine(S)	0.75+0.5	45.3
BAS-514+Atrazine(S)	1+0.5	44.6
BAS-514+Atrazine(S)	1.25+0.5	44.9
BAS-514+Atrazine+Clomazone(S)	0.75+0.5+0.5	44.4
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	44.7
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	39.4
Clomazone+Atrazine(S)	0.5+0.5	39.4
Control	0	42.9
C.V. %		9.6
LSD 5%		NS

[a]Dry flowable formulation of atrazine was used.

<u>Summary</u>. No wheat injured was observed on May 23 when wheat was 2.5-leaf. Grain yields did not differ between treatments.

Wheat plantback after BAS-514 treatments in fallow, Fargo 1990. Experiment was established in 1989 on a silty clay soil with pH 7.9 and 4.5% organic matter. Fall (F) treatments were applied in October 1988 and spring (S) treatments were applied May 1, 1989. During 1989 the entire experimental area was treated with glyphosate at 1 lb ae/A whenever the untreated check strips between plots produced 4 to 6-inch weeds. On April 27, 1990 the experimental area was tilled 2 to 3 inches deep with a field cultivator and seeded with 'Wheaton' hard red spring wheat. The experimental area was treated with thifensulfuron&tribenuron (Harmony Extra) at 0.25 oz ai/A plus 2,4-D amine at 0.25 lb ae/A for broadleaf weed control. Visual estimates of wheat chlorosis ("bleaching") and necrosis were made on May 31. Wheat was machine-harvested and yields adjusted to 12% moisture. Plot size was 20 by 26 ft and the experiment was designed as a randomized complete block with four replications.

Treatment[a]	Rate	Chlorosis[b]	Burn[b]	Grain yield	
	(lb/A)	(%)		(Bu/A)	(Kg/ha)
BAS-514(F)	1	0	1	66	4380
BAS-514(F)	1.5	0	0	68	4485
BAS-514(F)	2	0	1	66	4372
BAS-514(S)	1	0	1	72	4759
BAS-514(S)	1.25	0	2	60	4008
BAS-514(S)	1.5	0	1	66	4360
BAS-514(S)	2	0	2	68	4498
BAS-514+Atrazine(S)	1+0.5	0	2	64	4243
BAS-514+Atrazine(S)	1.25+0.5	0	2	64	4274
BAS-514+Atrazine(S)	1.5+0.5	0	2	57	3764
BAS-514+Atrazine+Clomazone(S)	1+0.5+0.5	1	2	69	4555
BAS-514+Atrazine+Clomazone(S)	1.25+0.5+0.5	3	2	72	4801
BAS-514+Atrazine+Clomazone(S)	1.5+0.5:0.5	1	2	68	4483
Clomazone+Atrazine(S)	0.5+0.5	4	1	69	4606
Control	0	0	2	66	4376
C.V. %		234	86	9	9
LSD 5%		2	NS	NS	NS

[a]Dry flowable formulation of atrazine was used.
[b]Chlorosis refers to bleaching symptoms typical of clomazone injury; burn refers to necrotic symptoms typical of triazine injury.

Summary. None of the treatments caused grain yield reductions. Low levels of chlorosis attributable to clomazone residues were evident.

ICIA5676 for weed control in corn, Fargo 1990. Experiment was established on a conventionally tilled silty clay with pH 7.8 and 4.0% organic matter. Interstate 343A was seeded 1.5 inches deep at 22,000 seeds per acre in 30-inch rows on May 9. Treatments were applied preemergence on May 10 using a bicycle wheel sprayer delivering 17 gpa with 8002 nozzles and 40 psi. Air temperature was 56 F, relative humidity was 35%, and the soil surface was dry on May 10. Estimates of percentage weed control and corn injury were made on June 19. Corn plants in the two center rows of each plot (54 total ft) were counted on July 16. Plot size was 10 by 27 ft and the experiment was a completely randomized design with four replications.

Treatment[a]	Rate	Corn injury	Plants per plot	Weed control KOCZ	Weed control Colq	Weed control Rrpw	Weed control Yeft
	(lb/A)	(%)	(No.)	(%)	(%)	(%)	(%)
ICIA5676	1.75	0	57.0	54	55	94	96
ICIA5676	2	0	53.5	72	72	98	96
ICIA5676	2.25	0	50.5	73	56	96	89
ICIA5676	2.5	0	55.5	77	84	91	95
ICIA5676+Cyanazine	1.75+2	0	55.0	80	86	87	87
ICIA5676+Cyanazine	2+2	0	49.8	86	92	98	93
ICIA5676+Cyanazine	2.25+2	0	52.8	74	92	98	98
ICIA5676+Cyanazine	2.5+2	0	51.0	86	85	98	96
Alachlor	3.5	0	46.8	67	68	93	94
Alachlor+Cyanazine	3.5+2	0	54.5	87	84	97	90
Alachlor+Cyanazine+Atrazine	3+1.63+0.38	0	50.8	88	72	92	94
Metolachlor	3	0	55.0	9	10	11	47
Metolachlor+Cyanazine	2.5+2	0	54.0	60	51	39	88
Metolachlor+Cyanazine	3+2	0	51.0	80	41	51	95
Metolachlor+Cyanazine+Atrazine	2.5+1.63+0.38	0	46.3	74	71	52	92
Pendimethalin+Cyanazine	2+2	0	43.8	95	97	31	79
Untreated	0	0	52.8	0	0	0	0
C.V. %		0	15.5	20	21	18	16
LSD 5%		NS	NS	19	19	18	19

[a]Dry flowable formulations of cyanazine and atrazine were used.

Summary. No corn injury nor effect on corn population was caused by any of the treatments. Pendimethalin plus cyanazine was the most effective treatment against kochia and common lambsquarters, although 80 to 85% control was achieved with ICIA5676 plus cyanazine or with alachlor plus cyanazine. Excellent redroot pigweed control was provided by treatments involving ICIA5676 or alachlor. Treatments involving ICIA5676 or alachlor provided excellent control of yellow foxtail, as did metolachlor in combination with cyanazine.

Effect of 2,4-D on terbufos-CGA-136872 synergism in corn, Fargo 1990. Pioneer 3949 (CGA-136872 susceptible) and Pioneer 3902 (CGA-136872 tolerant) corn was planted in 30-inch rows on May 25 in a conventionally tilled silty clay soil with pH 7.8 and 3.8% organic matter. Seeding depth was 1.5 to 2 inches and seeding rate was 21,000 seeds per acre. Terbufos (Counter 15G) insecticide at 8 oz product per 1000 ft of row was applied with the planter in a T-band over the row. Four-day-early (4DE) 2,4-D treatments were applied June 18 when corn had 5 leaves and was 6 inches tall, air temperature was 68 F, and relative humidity was 70%. All other treatments were applied June 22 when corn was 6 to 7 inches tall with 5 leaves, air temperature was 69 F, and relative humidity was 65%. Treatments were applied with a bicycle wheel sprayer (4DE treatments) or a backpack sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Visual estimates of corn injury were made July 9. Plot size was 10 by 27 ft and the experiment was a completely randomized design with four replications. All four rows of each plot were treated with insecticide (where applicable) but only three were treated with herbicide, leaving one row as an untreated check.

Corn hybrid	Insecticide	Herbicide treatment[a]		Corn injury
		Herbicides	Rate	
			(oz/A)	(%)
Pioneer 3949	No	Untreated	0	0
		CGA-136872	0.57	0
		2,4-D(4DE)/CGA-136872	8/0.57	0
		CGA-136872+2,4-D	0.57+8	0
		CGA-136872+Dicamba	0.57+8	0
Pioneer 3949	Yes	Untreated	0	0
		CGA-136872	0.57	0
		2,4-D(4DE)/CGA-136872	8/0.57	0
		CGA-136872+2,4-D	0.57+8	0
		CGA-136872+Dicamba	0.57+8	0
Pioneer 3902	Yes	Untreated	0	0
		CGA-136872	0.57	0
		2,4-D(4DE)/CGA-136872	8/0.57	0
		CGA-136872+2,4-D	0.57+8	0
		CGA-136872+Dicamba	0.57+8	0

[a]All treatments applied with X77 surfactant at 0.5% v/v; 2,4-D dimethylamine salt was used.

Summary. None of the treatments caused visually detectable corn injury.

<u>Corn variety response to DPX-V9360 and CGA-136872 with soil-applied insecticides, Fargo 1990</u>. Experiment was established on a conventionally tilled silty clay with pH 7.8 and 4% organic matter. Eleven corn hybrids were seeded 1.5 inches deep at 21,000 seeds/acre on May 21 and 22 using a Hiniker planter set on 30-inch rows. The insecticides carbofuran (Furadan 15G) at 16 oz product/1000 sq ft and terbufos (Counter 15G) at 8 oz product/1000 sq ft were applied with the planter in a T-band over the row. The entire area was treated on May 25 with atrazine at 0.38 lb/A plus cyanazine at 2 lb/A plus dicamba at 0.38 lb/A plus metolachlor at 2 lb/A for general weed control. DPX-V9360 at 1 oz ai/A and CGA-136872 at 0.57 oz ai/A were applied June 14 to the two center rows of each four-row plot using an ATV-mounted sprayer delivering 8 gpa with 80015 nozzles and 40 psi. Surfactant X-77 at 0.25% v/v was added to both herbicides. At time of treatment, air temperature was 60 F and corn was 4 to 6-leaf (5 to 8 inches tall) and probably under physiological stress due to cool, wet conditions following planting. The entire area was treated June 28 with bentazon plus Dash at 0.75 lb/A + 1 qt/A for Canada thistle control. Hand-weeding controlled later-emerging Canada thistle and ensured that plots were maintained free of weeds. Visual estimates of percentage corn injury were made June 28 and August 17. Grain was machine-harvested from the herbicide-treated rows in late October. Plot size was 10 by 22 ft and the experimental design was a randomized complete block design with a split split plot arrangement of treatments. The research was funded, in part, by a grant from Pioneer Hi-Bred International, Inc.

<u>Table 1</u>. Corn injury and grain yield as affected by DPX-V9360 and CGA-136872 in combination with carbofuran and terbufos. Data were averaged across corn varieties.

Herbicide	Insecticide[a]	Corn injury 6/28	Corn injury 8/17	Corn grain yield (Bu/A)	Corn grain yield (Kg/ha)
		(%)	(%)	(Bu/A)	(Kg/ha)
None	None	0	0	64	4025
DPX-V9360	None	1	0	63	3944
DPX-V9360	Carbofuran	0	0	75	4694
DPX-V9360	Terbufos	0	0	65	4110
CGA-136872	None	15	6	51	3193
CGA-136872	Carbofuran	13	5	61	3854
CGA-136872	Terbufos	33	12	43	2684
LSD 5%		3	2	5	293

[a]Carbofuran = Furadan 15G; terbufos = Counter 15G.

<u>Summary</u>. DPX-V9360 did not injure corn or reduce corn yield in the presence or absence of soil-applied insecticides. CGA-136872 applied without insecticide injured corn 15% and reduced grain yield 20% when averaged across corn varieties. CGA-136872 applied to corn previously treated with terbufos injured corn 33% and decreased grain yield 33% when averaged across varieties. No such injury and grain yield reductions were observed when CGA-136872 was applied to carbofuran-treated corn. The varieties most susceptible to CGA-136872 were Pioneer 3953, Pioneer 3995, Pioneer 3902, and Cargill 3477, while the most tolerant varieties were Cargill 2927, Dekalb DK397, Pioneer 3949, and Pioneer 2927.

- See next two pages for additional data -

- See previous page for experiment description and summary -

Table 2. Corn injury and grain yield as affected by DPX-V9360 and CGA-136872 in combination with carbofuran and terbufos.

Herbicide	Insecticide	Cultivar	CGA-136872 tolerance[b]	Corn injury 6/28	Corn injury 8/17	Corn grain yield (Bu/A)	Corn grain yield (Kg/ha)
				(%)	(%)	(Bu/A)	(Kg/ha)
None	None	Pioneer 3995	Sensitive	0	0	41	2587
		Pioneer 3949	Sensitive	0	0	57	3554
		Pioneer 3953	Sensitive	0	0	76	4788
		Pioneer 3902	Mod. tol.	0	0	73	4572
		Pioneer 3925	Mod. tol.	0	0	69	4314
		Pioneer 3779	Tolerant	0	0	64	4018
		Pioneer 3963	Tolerant	0	0	68	4252
		Pioneer 3921	-	0	0	74	4644
		Cargill 2927	-	0	0	55	3460
		Cargill 3477	-	0	0	66	4122
		Dekalb DK397	Tolerant	0	0	63	3963
DPX-V9360	None	Pioneer 3995	Sensitive	0	0	45	2798
		Pioneer 3949	Sensitive	0	0	56	3532
		Pioneer 3953	Sensitive	0	0	69	4341
		Pioneer 3902	Mod. tol.	0	0	71	4454
		Pioneer 3925	Mod. tol.	0	0	74	4633
		Pioneer 3779	Tolerant	0	0	55	3437
		Pioneer 3963	Tolerant	0	0	66	4121
		Pioneer 3921	-	0	0	75	4699
		Cargill 2927	-	1	0	55	3478
		Cargill 3477	-	5	0	65	4063
		Dekalb DK397	Tolerant	1	0	61	3824
DPX-V9360	Carbofuran	Pioneer 3995	Sensitive	0	0	46	2893
		Pioneer 3949	Sensitive	2	0	70	4414
		Pioneer 3953	Sensitive	0	0	87	5454
		Pioneer 3902	Mod. tol.	0	0	82	5133
		Pioneer 3925	Mod. tol.	0	0	78	4911
		Pioneer 3779	Tolerant	1	0	80	5045
		Pioneer 3963	Tolerant	0	0	74	4651
		Pioneer 3921	-	0	0	75	4740
		Cargill 2927	-	0	0	65	4056
		Cargill 3477	-	1	0	89	5566
		Dekalb DK397	Tolerant	0	0	76	4771
DPX-V9360	Terbufos	Pioneer 3995	Sensitive	0	0	46	2868
		Pioneer 3949	Sensitive	0	0	70	4414
		Pioneer 3953	Sensitive	0	0	73	4575
		Pioneer 3902	Mod. tol.	0	0	85	5368
		Pioneer 3925	Mod. tol.	0	0	67	4187
		Pioneer 3779	Tolerant	1	0	62	3911
		Pioneer 3963	Tolerant	0	0	68	4301
		Pioneer 3921	-	1	0	77	4862
		Cargill 2927	-	0	1	47	2933
		Cargill 3477	-	0	0	69	4350
		Dekalb DK397	Tolerant	0	0	55	3442
LSD 5%				11	6	15	973

Table 2 (cont.).

Herbicide	Insecticide	Cultivar	CGA-136872 tolerance[b]	Corn injury 6/28	Corn injury 8/17	Corn grain yield (Bu/A)	Corn grain yield (Kg/ha)
				(%)	(%)	(Bu/A)	(Kg/ha)
CGA-136872	None	Pioneer 3995	Sensitive	29	12	32	1984
		Pioneer 3949	Sensitive	15	6	56	3505
		Pioneer 3953	Sensitive	25	13	46	2862
		Pioneer 3902	Mod. tol.	17	3	50	3148
		Pioneer 3925	Mod. tol.	10	4	57	3561
		Pioneer 3779	Tolerant	8	1	55	3435
		Pioneer 3963	Tolerant	13	10	52	3237
		Pioneer 3921	-	12	1	61	3810
		Cargill 2927	-	12	1	53	3345
		Cargill 3477	-	17	9	40	2481
		Dekalb DK397	Tolerant	10	2	60	3759
CGA-136872	Carbofuran	Pioneer 3995	Sensitive	18	11	39	2436
		Pioneer 3949	Sensitive	11	0	61	3810
		Pioneer 3953	Sensitive	24	12	51	3176
		Pioneer 3902	Mod. tol.	7	1	70	4418
		Pioneer 3925	Mod. tol.	13	4	62	3862
		Pioneer 3779	Tolerant	10	0	77	4844
		Pioneer 3963	Tolerant	22	18	49	3082
		Pioneer 3921	-	14	4	69	4314
		Cargill 2927	-	6	1	65	4100
		Cargill 3477	-	12	3	64	4013
		Dekalb DK397	Tolerant	8	0	69	4343
CGA-136872	Terbufos	Pioneer 3995	Sensitive	39	13	32	2004
		Pioneer 3949	Sensitive	27	7	43	2684
		Pioneer 3953	Sensitive	46	27	22	1404
		Pioneer 3902	Mod. tol.	30	9	46	2908
		Pioneer 3925	Mod. tol.	27	7	51	3222
		Pioneer 3779	Tolerant	22	6	41	2591
		Pioneer 3963	Tolerant	47	27	33	2065
		Pioneer 3921	-	37	12	46	2920
		Cargill 2927	-	15	2	59	3734
		Cargill 3477	-	52	17	44	2750
		Dekalb DK397	Tolerant	28	9	52	3245
LSD 5%				11	6	15	973

[a] Carbofuran = Furadan 15G; terbufos = Counter 15G.
[b] Information on CGA-136872 tolerance derived from greenhouse and/or field screening conducted by herbicide manufacturers in conjunction with seed corn companies.

Corn growth stage and thifensulfuron-insecticide interaction, Fargo 1990. Interstate 343A corn was seeded May 7 in 30-inch rows in a conventionally tilled silty clay soil having 4% organic matter. The entire experimental area was treated on May 11 with metolachlor at 2 lb/A + cyanazine at 1.5 lb/A + atrazine at 0.375 lb/A and on May 30 with atrazine at 0.25 lb/A + cyanazine at 0.75 lb/A for weed control. Treatments were applied to 2-leaf (2 to 3 inches tall) corn on May 29 when air temperature was 69 F and relative humidity was 46%, 4-leaf (4.5 to 5 inches tall) corn on June 12 when temperature was 77 F and relative humidity 58%, 7-leaf (12 to 15 inches tall) corn on June 26 when temperature was 85 F, and relative humidity was 46%, 10-leaf (16 to 18 inches tall) corn on July 1 when temperature was 84 F, and relative humidity was 61%. Treatments were applied with a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Soil moisture was high during the treatment period, especially for 2-, 4-, and 7-leaf corn. Visual estimates of percentage crop injury were made 12 days after application: June 10, June 24, July 8, and July 13 for the 2-leaf, 4-leaf, 7-leaf, and 10-leaf stages, respectively. Visual estimates of control were again made on August 2. Plots were machine-harvested on October 16 and grain yields adjusted to 15.5% moisture. Plot size was 10 by 27 ft and the experiment was a randomized complete block design with four replications.

Summary. Thifensulfuron alone injured corn only when applied at the 10-leaf stage. Thifensulfuron-chlorpyrifos tank mixtures caused 15 to 85% corn injury and reduced grain yield. Injury by thifensulfuron plus chlorpyrifos appeared least when applied at the 2-leaf stage, although evaluations were complicated by simultaneous injury from a postemergence cyanazine application. Carbaryl-thifensulfuron mixtures did not injure corn more than thifensulfuron applied alone.

- See next page for data -

- See previous page for experiment description and summary -

Treatment[a]	Rate	Corn injury Early	Corn injury Late	Grain yield	
	(oz/A)	(%)		(kg/ha)	(Bu/A)
Thifensulfuron(2-leaf)	0.0625	0	0	4060	62
Thifensulfuron(2-leaf)	0.125	0	0	3586	54
Thifensulfuron(2-leaf)	0.25	0	0	3710	57
Thifensulfuron+Chlorpyrifos(2-leaf)	0.0625+8	16	4	3456	53
Thifensulfuron+Chlorpyrifos(2-leaf)	0.125+8	10	1	3767	58
Thifensulfuron+Chlorpyrifos(2-leaf)	0.25+8	39	6	2864	44
Thifensulfuron+Carbaryl(2-leaf)	0.0625+8	0	0	3500	53
Thifensulfuron+Carbaryl(2-leaf)	0.125+8	0	0	3252	50
Thifensulfuron+Carbaryl(2-leaf)	0.25+8	0	0	3076	47
Chlorpyrifos(2-leaf)	8	0	0	3840	59
Carbaryl(2-leaf)	8	0	0	4069	62
Thifensulfuron(4-leaf)	0.0625	0	0	2926	45
Thifensulfuron(4-leaf)	0.125	0	0	4084	62
Thifensulfuron(4-leaf)	0.25	0	0	3226	49
Thifensulfuron+Chlorpyrifos(4-leaf)	0.0625+8	38	6	2963	45
Thifensulfuron+Chlorpyrifos(4-leaf)	0.125+8	56	6	2951	45
Thifensulfuron+Chlorpyrifos(4-leaf)	0.25+8	82	18	2874	44
Thifensulfuron+Carbaryl(4-leaf)	0.0625+8	0	0	3003	46
Thifensulfuron+Carbaryl(4-leaf)	0.125+8	0	0	3925	60
Thifensulfuron+Carbaryl(4-leaf)	0.25+8	0	0	3812	58
Chlorpyrifos(4-leaf)	8	0	0	3352	51
Carbaryl(4-leaf)	8	0	0	3614	55
Thifensulfuron(7-leaf)	0.0625	0	0	2913	44
Thifensulfuron(7-leaf)	0.125	0	0	3344	51
Thifensulfuron(7-leaf)	0.25	0	0	3345	51
Thifensulfuron+Chlorpyrifos(7-leaf)	0.0625+8	57	11	2886	44
Thifensulfuron+Chlorpyrifos(7-leaf)	0.125+8	75	27	2556	39
Thifensulfuron+Chlorpyrifos(7-leaf)	0.25+8	84	53	1814	29
Thifensulfuron+Carbaryl(7-leaf)	0.0625+8	0	0	3599	55
Thifensulfuron+Carbaryl(7-leaf)	0.125+8	0	0	3615	55
Thifensulfuron+Carbaryl(7-leaf)	0.25+8	0	0	3267	50
Chlorpyrifos(7-leaf)	8	0	0	3755	57
Carbaryl(7-leaf)	8	0	0	3928	60
Thifensulfuron(10-leaf)	0.0625	12	7	2633	40
Thifensulfuron(10-leaf)	0.125	19	9	2991	46
Thifensulfuron(10-leaf)	0.25	35	9	3131	48
Thifensulfuron+Chlorpyrifos(10-leaf)	0.0625+8	62	44	2241	34
Thifensulfuron+Chlorpyrifos(10-leaf)	0.125+8	74	71	743	12
Thifensulfuron+Chlorpyrifos(10-leaf)	0.25+8	69	73	848	13
Thifensulfuron+Carbaryl(10-leaf)	0.0625+8	6	4	3314	51
Thifensulfuron+Carbaryl(10-leaf)	0.125+8	21	8	3240	49
Thifensulfuron+Carbaryl(10-leaf)	0.25+8	19	12	3188	49
Chlorpyrifos(10-leaf)	8	1	0	3150	48
Carbaryl(10-leaf)	8	0	0	3656	56
Untreated	0	0	0	3912	60
C.V. %		26	38	20	20
LSD 5%		6	4	875	13

[a]All treatments were applied with X-77 surfactant at 0.125% v/v plus 28% urea ammonium nitrate at 1 gal/acre.

Wild oat control with tridiphane-triazine tank mixtures, Fargo 1990. The experiment was established on a conventionally-tilled silty clay with pH 7.8 and 3.6% organic matter. Interstate 343A corn was seeded at 22,000 seeds per acre and at 1.5 inches deep on May 4. Treatments were applied June 4 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi and with sunny skies, air temperature of 58 F, relative humidity of 45%, 3- to 4-leaf (5 to 6 inches tall) wild oats, and 5-leaf (3 to 6 inches across) wild mustard. Estimates of percentage corn injury and weed control were made June 14. Plot size was 10 by 27 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Corn injury	Weed control Wioa	Weed control Wimu
	(lb/A)	(%)		
Cyanazine	1.5	12	37	100
Atrazine+Cyanazine	0.125+1.375	13	37	100
Atrazine+Cyanazine	0.25+1.25	15	38	100
Atrazine+Cyanazine	0.375+1.125	14	38	100
Atrazine+Cyanazine	0.5+1	13	42	100
Atrazine+Cyanazine	0.75+0.75	13	33	100
Tridiphane+Cyanazine	0.5+1.5	16	75	100
Tridiphane+Atrazine+Cyanazine	0.5+0.125+1.375	13	70	100
Tridiphane+Atrazine+Cyanazine	0.5+0.25+1.25	16	79	100
Tridiphane+Atrazine+Cyanazine	0.5+0.375+1.125	16	80	100
Tridiphane+Atrazine+Cyanazine	0.5+0.5+1	15	83	100
Tridiphane+Atrazine+Cyanazine	0.5+0.75+0.75	16	84	100
Tridiphane+Cyanazine	0.75+1.5	17	77	100
Tridiphane+Atrazine+Cyanazine	0.75+0.125+1.375	17	86	100
Tridiphane+Atrazine+Cyanazine	0.75+0.25+1.25	16	80	100
Tridiphane+Atrazine+Cyanazine	0.75+0.375+1.125	16	83	100
Tridiphane+Atrazine+Cyanazine	0.75+0.5+1	17	81	100
Tridiphane+Atrazine+Cyanazine	0.75+0.75+0.75	15	89	100
Control		0	0	0
C.V. %		19	14	0
LSD 5%		4	12	NS

[a]All treatments applied with vegetable oil adjuvant (containing 15% emulsifier) at 1 quart per acre.

Summary. Cyanazine or cyanazine-atrazine tank mixtures without tridiphane controlled wild oats 35 to 40%, with no response to increasing levels of atrazine. Adding tridiphane to atrazine-cyanazine mixtures dramatically increased wild oat control and 0.75 lb/A tridiphane provided slightly better control than did 0.5 lb/A tridiphane. With tridiphane at 0.5 lb/A, increasing levels of atrazine in the cyanazine-atrazine mixtures provided increased control but this effect was less evident with tridiphane at 0.75 lb/A. All treatments controlled wild mustard 100%. Corn injury ranged from 12 to 17% and generally paralleled wild oat control.

Split application of tridiphane and triazines for wild oat control, Fargo 1990. The experiment was established on a conventionally-tilled silty clay with pH 7.8 and 3.6% organic matter. Interstate 343A corn was seeded at 22,000 seeds per acre and at 1.5 inches deep on May 4. Four-day-early (4DE) treatments were applied on May 31, two-day-early (2DE) treatments on June 2 with 65 F (rain about 12 hours later), 1-day-early treatments on June 3 with 55 F, and other treatments on June 4 with sunny skies, air temperature of 58 F, relative humidity of 45%, 3- to 4-leaf (5 to 6 inches tall) wild oats, and 5-leaf (3 to 6 inches across) wild mustard. All treatments were applied using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Estimates of percentage corn injury and weed control were made June 14. Plot size was 10 by 27 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Corn injury	Weed control Wioa	Weed control Wimu
	(lb/A)	(%)		
Atrazine+Cyanazine	0.5+1	12	50	100
Tridiphane+Atrazine+Cyanazine	0.5+0.5+1	16	88	100
Tridiphane(1DE)/Atrazine+Cyanazine	0.5/0.5+1	17	91	100
Tridiphane(1DE)/Tridiphane+Atrazine+Cyanazine	0.25/0.25+0.5+1	19	93	100
Tridiphane(2DE)/Atrazine+Cyanazine	0.5/0.5+1	11	85	100
Tridiphane(2DE)/Tridiphane+Atrazine+Cyanazine	0.25/0.25+0.5+1	15	88	100
Tridiphane(4DE)/Atrazine+Cyanazine	0.5/0.5+1	12	68	100
Tridiphane(4DE)/Tridiphane+Atrazine+Cyanazine	0.25/0.25+0.5+1	17	93	100
Untreated	0	0	0	0
C.V. %		22	10	0
LSD 5%		5	12	NS

[a]All treatments applied with vegetable oil adjuvant (containing 15% emulsifier) at 1 quart per acre.

Summary. Wild oat control increased from 50 to 88% when tridiphane was added to an atrazine-cyanazine mixture. Applying tridiphane 1 or 2 days earlier than the triazines did not increase control compared to the tridiphane-triazine tank mix. Similarly, a split application with half the tridiphane applied 1 or 2 days early and half applied as a tank mix with the triazines did not increase control. Wild oat control was reduced to 68% when tridiphane was applied 4 days early, but the 4-day-early split application restored control to 93%. Corn injury ranged between 11 and 17% and generally correlated with wild oat control. All treatments controlled wild mustard 100%.

Soybean growth stage and thifensulfuron-insecticide interaction, Fargo 1990. McCall soybeans were seeded May 24 in 30-inch-rows in a conventionally tilled silty clay soil having 4% organic matter. The entire experimental area was treated on May 25 with metolachlor at 2 lb/A and on June 6 with bentazon at 0.75 lb/A plus Dash at 1 qt/A for weed control. Treatments were applied as follows: unifoliolate (UF) soybeans on June 13 when crop was 2 inches tall, air temperature was 70 F and relative humidity was 65%; first trifoliolate (1TF) soybeans on June 24 when soybeans were 6 inches tall and late in the first trifoliolate, temperature was 68 F and relative humidity 65%; second trifoliolate (2TF) soybeans on June 28 when soybeans were 8 inches tall and late in the second trifoliolate, temperature was 75 F, and relative humidity was 52%; third trifoliolate (3TF) soybeans on June 30 when soybeans were 8.5 to 9.5 inches tall and late in the third trifoliolate, temperature was 65 F, and relative humidity was 70%. Treatments were applied with a bicycle wheel or backpack sprayer delivering 8.5 gal/A with 8001 nozzles and 40 psi. Soil moisture was high during the treatment period. Visual estimates of percentage crop injury were made 12 days after application: June 25, July 6, July 10, and July 12 for the UF, 1TF, 2TF, and 3TF stages, respectively. On August 17, plant height was measured and crop injury was estimated. Plots were machine-harvested on September 24 and grain yields adjusted to 12% moisture. Plot size was 10 by 27 ft and the experiment was a randomized complete block design with four replications.

Summary. Thifensulfuron alone injured soybeans most when applied at the 2nd and 3rd trifoliolate leaf stages, although injury was consistently low at the labeled rate of thifensulfuron (0.0625 oz/A). Injury by thifensulfuron alone did not result in grain yield reductions. Soybeans were injured severely when chlorpyrifos was tank mixed with thifensulfuron, with least injury occurring when applications were made at the 1st trifoliolate leaf stage. Grain yields were reduced by thifensulfuron-chlorpyrifos combinations except where thifensulfuron was applied at 0.0625 and 0.125 oz/A to 1st trifoliolate soybeans. Carbaryl-thifensulfuron tank mixes injured 2nd and 3rd trifoliolate soybeans but grain yields did not appear to be affected.

- See next page for data -

- See previous page for experiment description and summary -

Treatment[a]	Rate	Soybean injury Early	Late	Plant height	Grain yield	
	(oz/A)	(%)		(cm)	(Bu/A)	(Kg/ha)
Thifensulfuron(UF)	0.0625	1	0	64.8	23	1557
Thifensulfuron(UF)	0.125	4	0	68.8	23	1524
Thifensulfuron(UF)	0.25	9	0	67.4	21	1413
Thifensulfuron+Chlorpyrifos(UF)	0.0625+8	68	29	54.8	16	1087
Thifensulfuron+Chlorpyrifos(UF)	0.125+8	79	55	47.8	13	893
Thifensulfuron+Chlorpyrifos(UF)	0.25+8	90	72	42.8	7	497
Thifensulfuron+Carbaryl(UF)	0.0625+8	4	0	69.3	23	1532
Thifensulfuron+Carbaryl(UF)	0.125+8	4	0	68.5	23	1527
Thifensulfuron+Carbaryl(UF)	0.25+8	9	0	69.3	22	1477
Chlorpyrifos(UF)	8	1	0	69.4	25	1672
Carbaryl(UF)	8	1	0	65.5	21	1445
Thifensulfuron(1TF)	0.0625	1	0	-	24	1605
Thifensulfuron(1TF)	0.125	1	0	67.5	22	1503
Thifensulfuron(1TF)	0.25	2	0	67.9	22	1488
Thifensulfuron+Chlorpyrifos(1TF)	0.0625+8	46	2	67.0	22	1513
Thifensulfuron+Chlorpyrifos(1TF)	0.125+8	58	18	61.9	21	1429
Thifensulfuron+Chlorpyrifos(1TF)	0.25+8	77	42	51.1	16	1103
Thifensulfuron+Carbaryl(1TF)	0.0625+8	0	0	66.3	20	1346
Thifensulfuron+Carbaryl(1TF)	0.125+8	0	0	67.3	20	1350
Thifensulfuron+Carbaryl(1TF)	0.25+8	5	0	66.5	22	1447
Chlorpyrifos(1TF)	8	1	0	64.6	20	1362
Carbaryl(1TF)	8	0	0	69.7	25	1665
Thifensulfuron(2TF)	0.0625	4	0	66.4	22	1470
Thifensulfuron(2TF)	0.125	22	2	62.3	22	1469
Thifensulfuron(2TF)	0.25	34	10	61.5	23	1552
Thifensulfuron+Chlorpyrifos(2TF)	0.0625+8	75	44	49.7	16	1060
Thifensulfuron+Chlorpyrifos(2TF)	0.125+8	76	45	51.2	16	1051
Thifensulfuron+Chlorpyrifos(2TF)	0.25+8	88	69	39.9	10	683
Thifensulfuron+Carbaryl(2TF)	0.0625+8	27	3	63.4	23	1557
Thifensulfuron+Carbaryl(2TF)	0.125+8	36	4	64.3	23	1571
Thifensulfuron+Carbaryl(2TF)	0.25+8	58	23	55.5	21	1396
Chlorpyrifos(2TF)	8	19	8	67.9	22	1496
Carbaryl(2TF)	8	2	0	65.1	22	1453
Thifensulfuron(3TF)	0.0625	5	1	67.8	24	1610
Thifensulfuron(3TF)	0.125	31	3	64.0	23	1576
Thifensulfuron(3TF)	0.25	49	16	61.3	23	1577
Thifensulfuron+Chlorpyrifos(3TF)	0.0625+8	66	15	58.5	19	1269
Thifensulfuron+Chlorpyrifos(3TF)	0.125+8	83	52	49.2	15	990
Thifensulfuron+Chlorpyrifos(3TF)	0.25+8	87	68	40.0	9	572
Thifensulfuron+Carbaryl(3TF)	0.0625+8	11	0	64.1	20	1360
Thifensulfuron+Carbaryl(3TF)	0.125+8	30	6	64.2	24	1582
Thifensulfuron+Carbaryl(3TF)	0.25+8	54	23	57.6	20	1357
Chlorpyrifos(3TF)	8	0	0	64.4	21	1386
Carbaryl(3TF)	8	0	0	70.6	24	1584
Untreated	0	0	0	68.6	23	1525
C.V. %		28	56	6.9	13	13
LSD 5%		11	11	2.4	4	239

[a]All treatments were applied with X-77 surfactant at 0.125% v/v plus 28% urea ammonium nitrate at 1 gal/acre.

Relative timing of thifensulfuron and insecticides in soybeans, Fargo 1990. 'McCall' soybeans were seeded in 30-inch rows on May 24 in a silty clay soil with 4% organic matter. Metolachlor at 2 lb/A was applied on June 5, bentazon at 1 lb/A plus Sun-It adjuvant at 1 qt/A on June 8, and sethoxydim at 0.2 lb/A plus Dash at 1 qt/A on June 29 over the entire experimental area for weed control. Weed escapes were controlled by hand-weeding. All thifensuluron was applied June 25 when soybeans were in the late 1st trifoliolate stage (5 to 5.5 inches tall) and environmental conditions were: 70 F, 46% relative humidity (RH), sunny. Chlorpyrifos and carbaryl alone also were applied on June 25. Insecticides applied 5 days earlier than thifensulfuron (5DE) were applied with 71 F, 84% RH, and extremely wet soil. Treatments applied 2 days early (2DE), 1 day early (1DE), 1 day later (1DL), 3 days later (3DL), and 5 days later (5DL) were applied with 60 F and 63% RH, 64 F and 70% RH, 70 F and 68% RH, 65 F and 80% RH, and 70 F and 54% RH, respectively. Visual estimates of percentage soybean injury were taken on July 7. Plant heights and percentage injury were taken on August 20. The three treated rows of each plot were machine-harvested at maturity and grain yields were adjusted to 12% moisture. Plot size was 10 by 27 ft and the experiment was designed as a randomized complete block with four replications.

Summary. Chlorpyrifos applied 5, 2, or 1 day before or 1 day after thifensulfuron application dramatically increased soybean injury compared to thifensulfuron applied alone. Carbaryl applied 1 or 2 days before thifensulfuron also caused soybean injury but only about 15%. None of the treatments reduced soybean height on August 20 or grain yield taken at maturity. Failure of thifensulfuron-chlorpyrifos tank mixtures to cause substantial soybean injury was probably due to a lengthy time interval (4.5 to 5 hours) between mixing and application. Chlorpyrifos breaks down rapidly in high pH water such as the Fargo municipal water (pH 8.2) used to mix these treatments. Soybean injury symptoms included plant stunting, reduced leaf size, and chlorosis. Little necrosis was observed (even with high % visual injury ratings) in contrast with the growth stage experiment (pages 26 and 27 of this volume) where thifensulfuron was applied as a tank mix with chlorpyrifos.

- See next page for data -

- See previous page for experiment description and summary -

Treatment[a]	Rate	Injury 7/7	Injury 8/20	Plant height	Grain yield
	(oz/A)	(%)	(%)	(cm)	(kg/ha)
Thifensulfuron	0.0625	0	0	60.6	1299
Thifensulfuron	0.125	2	0	57.6	1221
Thifensulfuron	0.25	17	4	56.8	1212
Chlorpyrifos	8	1	0	61.5	1479
Carbaryl	8	0	0	59.6	1317
Thifensulfuron+Chlorpyrifos	0.0625+8	7	0	59.5	1231
Thifensulfuron+Chlorpyrifos	0.125+8	6	0	62.0	1356
Thifensulfuron+Chlorpyrifos	0.25+8	34	2	54.5	1152
Chlorpyrifos(5DE) / Thifensulfuron	8 / 0.0625	55	6	59.1	1207
Chlorpyrifos(5DE) / Thifensulfuron	8 / 0.125	66	17	52.6	1019
Chlorpyrifos(2DE) / Thifensulfuron	8 / 0.0625	55	8	60.3	1405
Chlorpyrifos(2DE) / Thifensulfuron	8 / 0.125	69	8	55.7	1237
Chlorpyrifos(1DE) / Thifensulfuron	8 / 0.0625	53	7	58.7	1219
Chlorpyrifos(1DE) / Thifensulfuron	8 / 0.125	75	17	55.8	1226
Thifensulfuron / Chlorpyrifos(1DL)	0.0625 / 8	50	1	60.4	1356
Thifensulfuron / Chlorpyrifos(1DL)	0.125 / 8	55	3	55.4	1206
Thifensulfuron / Chlorpyrifos(3DL)	0.0625 / 8	10	0	60.0	1154
Thifensulfuron / Chlorpyrifos(3DL)	0.125 / 8	11	0	60.4	1357
Thifensulfuron / Chlorpyrifos(5DL)	0.0625 / 8	4	0	61.4	1327
Thifensulfuron / Chlorpyrifos(5DL)	0.125 / 8	13	3	57.3	1288
Thifensulfuron+Carbaryl	0.0625+8	5	0	61.5	1325
Thifensulfuron+Carbaryl	0.125+8	5	0	62.3	1318
Thifensulfuron+Carbaryl	0.25+8	12	3	54.1	1117
Carbaryl(5DE) / Thifensulfuron	8 / 0.0625	3	1	62.8	1349
Carbaryl(5DE) / Thifensulfuron	8 / 0.125	5	2	57.9	1366
Carbaryl(2DE) / Thifensulfuron	8 / 0.0625	3	1	59.4	1209
Carbaryl(2DE) / Thifensulfuron	8 / 0.125	17	4	58.3	1164
Carbaryl(1DE) / Thifensulfuron	8 / 0.0625	4	1	63.4	1409
Carbaryl(1DE) / Thifensulfuron	8 / 0.125	13	2	62.7	1393
Thifensulfuron / Carbaryl(1DL)	0.0625 / 8	1	0	64.6	1536
Thifensulfuron / Carbaryl(1DL)	0.125 / 8	4	2	60.5	1322
Thifensulfuron / Carbaryl(3DL)	0.0625 / 8	2	2	59.8	1338
Thifensulfuron / Carbaryl(3DL)	0.125 / 8	10	2	63.8	1447
Thifensulfuron / Carbaryl(5DL)	0.0625 / 8	4	1	62.3	1340
Thifensulfuron / Carbaryl(5DL)	0.125 / 8	0	0	61.4	1237
Untreated	0	0	0	55.9	1309
C.V. %		30	146	7.7	16
LSD 5%		8	5	NS	291

[a]All thifensulfuron was applied with 0.125% surfactant plus 1 gal/A 28% urea ammonium nitrate.

<u>Bivert and 2,4-D antagonism against glyphosate and sethoxydim, Fargo 1990</u>. ND810104 oats, McCall soybeans, and Siberian foxtail millet were seeded May 30 in a tilled silty clay soil using a 6-ft-wide drill. Treatments were applied July 5 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Plant stages at application were: 5.5- to 6-leaf oats (10 to 16 inches tall), 2.5- to 3-trifoliolate soybeans (6 to 8 inches tall), and 4.5- to 5.5-leaf millet (8 to 12 inches tall). Environmental conditions at application were: air temperature 71 F, relative humidity 40%, partly cloudy sky, good soil moisture. Plot size was 10 by 18 ft and treatments were applied across 6-ft-wide strips of the three bioassay species. The experiment was a completely randomized block design with four replications.

Treatment[a]	Rate[a,b]	Oats	Soybean	Foxtail millet
	(lb/A)	(% control)		
Glyphosate+R11	0.19+0.5%	85	87	99
Glyphosate+R11	0.38+0.5%	97	95	100
Glyphosate+2,4-D-dma+R11	0.19+0.5+0.5%	76	93	98
Glyphosate+2,4-D-dma+R11	0.38+0.5+0.5%	92	97	100
(Glyt+Bivert)+2,4-D-dma+R11	(0.19+0.016G)+0.5+0.5%	70	90	98
(Glyt+Bivert)+2,4-D-dma+R11	(0.38+0.031G)+0.5+0.5%	98	98	100
(2,4-D-dma+Bivert)+Glyt+R11	(0.5+0.031G)+0.19+0.5%	74	91	98
(2,4-D-dma+Bivert)+Glyt+R11	(0.5+0.031G)+0.38+0.5%	99	98	100
(Glyt+Bivert)+2,4-D-bee+R11	(0.19+0.016G)+0.5+0.5%	77	93	96
(Glyt+Bivert)+2,4-D-bee+R11	(0.38+0.031G)+0.5+0.5%	95	99	100
(Glyt+2,4-D-dma+Bivert)+R11	(0.19+0.5+0.047G)+0.5%	73	91	97
Sethoxydim+Sun-It	0.1+0.25G	41	0	56
Seth+2,4-D-bee+Sun-It	0.1+0.5+0.25G	44	78	69
(Seth+Bivert)+2,4-D-bee+Sun-It	(0.1+0.016G)+0.5+0.25G	36	75	66
(2,4-D-bee+Bivert)+Seth+Sun-It	(0.5+0.031G)+0.1+0.25G	37	76	70
Seth+2,4-D-dma+Sun-It	0.1+0.5+0.25G	38	77	65
(Seth+Bivert)+2,4-D-dma+Sun-It	(0.1+0.016G)+0.5+0.25G	45	76	59
(2,4-D-dma+Bivert)+Seth+Sun-It	(0.5+0.031G)+0.1+0.25G	31	74	66
(Seth+2,4-D-dma+Bivert)+Sun-It	(0.1+0.5+0.048G)+0.25G	43	0	69
C.V. %		13	4	7
LSD 5%		13	4	9

[a]Chemicals in parentheses were mixed first and then mixed with water before adding other ingredients to the tank; Glyt = glyphosate; Seth = sethoxydim; 2,4-D-dma = dimethylamine salt of 2,4-D; 2,4-D-bee = butoxyethyl ester of 2,4-D.
[b]G = gallons per acre.

<u>Summary</u>. 2,4-D amine appeared to slightly antagonize oat control by glyphosate. Mixing either 2,4-D or glyphosate with Bivert before adding other components to the spray mixture seemed to overcome this antagonism, but only at the 0.38 lb/A rate of glyphosate. Glyphosate plus 2,4-D on foxtail millet and sethoxydim plus 2,4-D on oats and foxtail millet failed to show antagonism compared to glyphosate or sethoxydim applied alone. Therefore, a beneficial effect of Bivert in overcoming antagonism was not evident.

Cayuse and ammonium sulfate for glyphosate, Fargo 1990. ND810104 oats, McCall soybeans, and Siberian foxtail millet were seeded May 30 in a conventionally-tilled silty clay soil using a 6-ft-wide drill. Treatments were applied July 5 using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Plant stages at application were: 5.5- to 6-leaf oats (10 to 16 inches tall), 2.5- to 3-trifoliolate soybeans (6 to 8 inches tall), and 4.5- to 5.5-leaf millet (8 to 12 inches tall). Environmental conditions at application were: air temperature 71 F, relative humidity 40%, partly cloudy sky, good soil moisture. Plot size was 10 by 18 ft and treatments were applied across 6-ft-wide strips of the three bioassay species. The experiment was a completely randomized block design with four replications.

Treatment[a]	Rate	Eval. July 17			Eval. July 30		
		Oats	Sobe	Ftmi	Oats	Sobe	Ftmi
	(lb/A)	(% control)					
Glyphosate	0.28	96	86	100	100	87	100
Glyphosate	0.14	86	71	99	98	70	100
Glyphosate+R11	0.28+0.5%	99	94	100	100	95	100
Glyphosate+R11	0.14+0.5%	85	74	99	98	75	100
Glyphosate+R11	0.094+0.5%	75	67	97	93	67	99
Glyphosate+AS	0.28+0.72	99	82	100	100	85	100
Glyphosate+AS	0.14+0.72	92	70	100	100	72	100
Glyphosate+Cayuse	0.28+0.75%	99	89	100	100	91	100
Glyphosate+Cayuse	0.14+0.75%	90	74	99	99	73	100
Glyphosate+R11+AS	0.28+0.5%+0.72	99	96	100	100	96	100
Glyphosate+R11+AS	0.14+0.5%+0.72	92	75	99	99	77	100
Glyphosate+R11+AS	0.094+0.5%+0.72	85	72	98	98	78	100
Glyphosate+R11+Cayuse	0.28+0.5%+0.75%	97	95	100	100	95	100
Glyphosate+R11+Cayuse	0.14+0.5%+0.75%	92	77	99	99	79	100
Glyphosate+R11+Cayuse	0.094+0.5%+0.75%	77	61	98	95	68	100
C.V. %		4	4	1	1	5	0
LSD 5%		5	5	1	2	6	0

[a] R11 = surfactant by Wilbur-Ellis; AS = ammonium sulfate; Cayuse = adjuvant by Wilbur-Ellis designed as a substitute for ammonium sulfate.

Summary. Adding additional surfactant (R11) or ammonium sulfate slightly improved glyphosate efficacy. Glyphosate plus R11 plus ammonium sulfate generally provided maximum control and was slightly better than glyphosate plus R11 plus Cayuse at the 0.094 lb/A rate of glyphosate.

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

The experiment was established at three locations in North Dakota and began on 25 August 1981 at Dickinson, 1 September 1982 at Sheldon, and on 11 June 1982 at Valley City. Dickinson had a loamy fine sand soil with pH 6.6 and 3.6% organic matter, Sheldon had a fine sandy loam with pH 7.7 and 2.1% organic matter, and Valley City had a loam with pH 6.7 and 9.4% organic matter. Dickinson, located in western North Dakota, generally receives much less precipitation than the other two sites located in eastern North Dakota. All treatments were applied annually except 2,4-D alone which was applied biannually (both spring and fall). Picloram and picloram plus 2,4-D were applied in late August 1981 and in June of 1982 through 1986. The Sheldon and Dickinson locations were discontinued following the fall evaluations in 1985 and spring evaluations in 1989, respectively. The Valley City site has received eight picloram and picloram plus 2,4-D treatments and 14 2,4-D treatments. The plots were 10 by 30 ft and each treatment was replicated four times in a randomized complete block design. Evaluations were based on percent stand reduction as compared to the control.

Leafy spurge control averaged 79% across all treatments 48 months after the first treatment and declined slightly to 71% following the 1988 drought [60 and 72 months after treatment (MAT)] before increasing to 87% in 1990 (84 MAT) (Table). Leafy spurge control 84 MAT increased by an average of 26, 14, and 13% when 2,4-D at 1 to 2 lb/A was applied with picloram at 0.25, 0.38 or 0.5 lb/A, respectively, as compared to picloram alone. The greatest enhancement of leafy spurge control with 2,4-D plus picloram was with 2,4-D at 1.5 lb/A and picloram at 0.375 lb/A or less.

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

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

Herbicide	Rate	1990 Valley City June	1990 Valley City Aug	Months after first treatment 12[a]	24	36	48	60	72
	— lb/A —	% control							
Picloram	0.25	64	68	39	48	48	58	49	38
Picloram	0.38	96	83	65	62	52	77	69	67
Picloram	0.5	92	84	65	71	81	86	77	71
2,4-D bian	1	77	83	22	30	38	50	39	55
2,4-D bian	1.5	62	89	22	24	26	45	49	49
2,4-D bian	2	75	87	19	30	26	54	54	62
Picloram + 2,4-D	0.25 + 1	92	93	52	66	63	85	73	76
Picloram + 2,4-D	0.25 + 1.5	88	95	58	66	70	85	77	62
Picloram + 2,4-D	0.25 + 2	91	95	57	62	66	83	76	77
Picloram + 2,4-D	0.38 + 1	96	97	69	72	70	90	84	76
Picloram + 2,4-D	0.38 + 1.5	88	96	68	74	76	93	84	79
Picloram + 2,4-D	0.38 + 2	96	97	68	59	76	91	86	82
Picloram + 2,4-D	0.5 + 1	96	96	71	75	84	94	87	82
Picloram + 2,4-D	0.5 + 1.5	99	99	64	73	80	97	91	88
Picloram + 2,4-D	0.5 + 2	99	97	76	75	81	95	91	88
LSD (0.05)		19	5	18	14	19	14	14	15

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

Picloram applied with various spray additives and 2,4-D for leafy spurge control. Lym, Rodney G., and Frank A. Manthey. Previous research at North Dakota State University has shown that less than 30% of the picloram applied to leafy spurge is absorbed and approximately 5% reaches the roots. Picloram still remains the most effective herbicide for leafy spurge control and when applied with 2,4-D provides better control than picloram applied alone. The increase in control is due to decreased picloram metabolism not increased absorption or translocation. Thus, a likely approach for increased picloram efficiency for leafy spurge control is by increasing absorption and thereby increasing the amount of picloram translocated to the roots. The purpose of this experiment 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.

The first experiment was established on June 5 and 13, 1989 at Chaffee and Dickinson, ND, respectively. The second experiment was established only at Chaffee on the same date. There was a dense stand of leafy spurge in the full flower to early seed-set growth stages at both locations. The weather was overcast with 70 F and 56% relative humidity at Chaffee and clear, 61 F and 65% relative humidity at Dickinson. 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 fertilizer solutions ammonium sulfate, urea, and a commercial formulation of fertilizer plus surfactant equivalent to 15-3-3-2 (N-P-K-S) by weight plus 17% nonionic surfactant (Inhance); a sulfuric acid buffer (SCI-40); a soybean oil formulated with Atplus 300F emulsifier 90:10 (v/v); the commercial surfactants, X-77, LI-700, Silwett L-77, and Triton CS7; and the industrial surfactants, Emulphor ON877 (polyoxyethylated fatty alcohol), Gafac RA-600 and Gafac RS-710 (both are free acids of a complex organic phosphate ester), Igepal CO530 (ethoxylated nonylphenol), Mapeg 200 MOT (PEG 200 monotallate), Mapeg 400 MOT (PEG 400 monotallate), Mapeg 400 DO (PEG 400 dioleate) and Mapeg 400 MO (PEG 400 monooleate).

Leafy spurge control increased or tended to increase when picloram at 0.25 but not 0.5 lb/A was applied with an additive compared to picloram alone at both locations (Table 1). Leafy spurge control with picloram at 0.25 lb/A alone was 37% averaged over both locations 3 months after treatment (MAT) compared to 60% when applied with a spray additive. All spray additives except Silwett L-77 decreased or tended to decrease leafy spurge control when applied with picloram at 0.5 lb/A compared to the herbicide applied alone. No treatment provided satisfactory leafy spurge control 12 MAT.

In the second experiment, leafy spurge control tended to increase when picloram at 0.25 lb/A was applied with Mapeg 400 MOT, Gafac RA-600 and LI-700 3 MAT (Table 2). Control averaged over all picloram plus additive treatments was 57% compared to 41% when the herbicide was applied alone. Control was similar regardless of treatment 12 MAT. In general leafy spurge control tended to decrease when picloram plus 2,4-D was applied with an additive compared to the herbicides alone except when picloram plus 2,4-D at 0.25 plus 1 lb/A was applied with Triton CS7 which averaged 71% 3 MAT compared to 52% when the herbicides were applied alone. Picloram plus 2,4-D plus Mapeg 400 MO averaged

68% leafy spurge control and was the only treatment that provided increased control compared to the herbicides applied alone (41%) 12 MAT.

The third experiment evaluated selected additives applied with picloram or picloram plus 2,4-D for leafy spurge control in the fall. The experiment was established near Hunter, ND on September 13, 1989 in a dense leafy spurge stand when the plants were in the fall regrowth stage. Plot design and size and application procedure were similar to previous experiments. The weather was clear, 70 F with 33% relative humidity. Leafy spurge control was similar regardless of treatment when additives were applied with picloram or picloram plus 2,4-D in the fall (Table 3). Control averaged 96 and 25% 9 and 12 MAT, respectively.

In general, leafy spurge control was occasionally increased when a spray additive was applied with picloram at 0.25, but not at 0.5 lb/A compared to the herbicide alone. All additives, except Triton CS7 and Mapeg 400 MO decreased leafy spurge control when applied with picloram plus 2,4-D in the spring. Control with picloram or picloram plus 2,4-D applied in the fall was not influenced by any additive evaluated. The additives that did increase short-term leafy spurge 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. (Published with approval of the Agric. Exp. Stn. North Dakota State Univ., Fargo).

Table 1. Picloram applied with various additives for leafy spurge control in June 1989 at two locations in North Dakota (Lym and Manthey).

		Location/evaluation date				
		Chaffee		Dickinson		Mean
Treatment	Rate	Sept 89	June 90	Sept 89	June 90	3 MAT[a]
	— lb/A —	% control				
Picloram + Mapeg 200 MOT	0.25+1 qt	57	30	74	3	66
Picloram + Gafac RA-600	0.25+0.5%	64	37	65	3	65
Picloram + Emulphur ON 877	0.25+0.5%	53	43	47	0	50
Picloram + X-77 + AMSU[b]	0.25+0.25%+2.5	52	33	58	3	55
Picloram + Silwett L-77	0.25+0.5%	55	31	75	8	65
Picloram + Mapeg 200 MOT	0.5+0.5%	49	19	72	0	61
Picloram + Gafac RA-600	0.5+0.5%	49	41	65	3	57
Picloram + Emulphur ON 877	0.5+0.5%	50	25	56	0	53
Picloram + X-77 + AMSU[b]	0.5+0.25%+2.5	53	36	65	4	59
Picloram + Silwett L-77	0.5+0.5%	58	41	89	14	74
Picloram	0.25	44	32	29	3	37
Picloram	0.5	67	54	74	18	71
LSD (0.05)		16	NS	16	8	12

[a]Months after treatment
[b]Ammonium sulfate 2.5 lb N/A.

Table 2. Picloram and picloram plus 2,4-D applied with various additives for leafy spurge control in June 1989 near Chaffee, North Dakota (Lym and Manthey).

Additive	Rate/A	Herbicide/rate (lb/A)/evaluation date			
		Picloram 0.25		Picloram + 2,4-D 0.25+1	
		Sept 89	June 90	Sept 89	June 90
		% control			
Mapeg 200 MOT	1 qt	46	41	36	53
Mapeg 400 MOT	1 qt	55	51	37	60
Mapeg 400 DO	1 qt	51	53	40	50
Mapeg 400 MO	0.5%	47	52	40	68
Soybean oil+Atplus 300 F	1 qt + 1%	47	48	42	50
SCI-40	1%	28	32	23	40
Gafac RS-710	0.5%	37	48	27	41
Gafac RA-600	0.5%	57	95	15	33
Emulphor ON 877	0.5%	47	63	33	49
Igepal CO-530	0.5%	37	49	43	55
X-77 + urea	0.25% + 2.5 lb	45	42	28	33
LI-700	1 qt	60	81	56	61
Triton CS7	0.5%	43	65	71	55
Silwett L-77	0.25%	39	41	63	53
Inhance	1 qt	47	59	51	44
None	..	41	34	52	41
Picloram (alone)	0.5 lb	57	59	40	71
LSD (0.05)		23	NS	29	25

Table 3. Picloram and picloram plus 2,4-D applied with various additives in September 1989 near Hunter, North Dakota (Lym and Manthey).

Additive	Rate/A	Herbicide/rate (lb/A)/evaluation date			
		Picloram 0.5		Picloram + 2,4-D 0.5+1	
		June 90	Aug 90	June 90	Aug 90
		% control			
Mapeg 400 MOT	1 qt	92	10	..	..
Mapeg 400 DO	1 qt	..	..	99	41
Gafac RA-600	0.5%	92	13	..	..
Emulphor ON 877	0.5%	96	19	..	..
Igepal CO-530	0.5%	..	..	96	29
LI-700	1 qt	97	32	97	24
Triton CS7	0.5%	..	..	97	22
Silwett L-77	0.25%	92	15	98	38
Inhance	1 qt	94	22	96	26
None	..	96	25	97	34
LSD (0.05)		NS	NS	NS	NS

Leafy spurge control with combinations of auxin herbicides applied for 3 years. Lym, Rodney G., and Calvin G. Messersmith. Picloram remains the most effective herbicide for leafy spurge control. However, due to cost or environmental concerns it is often advantageous to tank-mix picloram with other herbicides, as single or annual treatments for leafy spurge control. The purpose of these experiments was to evaluate annual applications of picloram applied with dicamba and various 2,4-D formulations for leafy spurge control.

The experiments were established in 1986 on June 11 or Sept 15 near Dickinson, on June 18 or Sept 3 near Valley City, and on August 28 on the Sheyenne National Grasslands. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. Retreatments were applied annually in the spring or fall through 1988. All plots were 10 by 30 ft in a randomized complete block design with four replicates. Evaluations were based on visible percent stand reduction as compared to the control.

Leafy spurge control was similar regardless of the 2,4-D formulation applied with picloram plus dicamba in the spring (Table). Control averaged across all treatments and both locations was 70% in the fall of 1988 (data not shown) but declined to 53% 1 yr after the third application [36 months after the first treatment (MAT)]. This is similar to the commonly used treatment picloram plus 2,4-D at 0.25 plus 1 lb/A which averaged 60% or more based on long-term observations, 12 months after the last retreatment was applied in a 3 yr annual application program.

Fall application of picloram applied with dicamba and 2,4-D provided much better long-term control than the same treatments applied in the spring (Table). Control averaged across all treatments and location was 66 and 43% 12 and 24 months after the third treatment. Leafy spurge control with picloram at 0.5 lb/A averaged 59% 1 yr following the third fall application, but improved to 81% when picloram at 0.5 lb/A was applied with dicamba at 2 lb/A. The 80% or better leafy spurge control is similar to a 3 yr annual application of dicamba at 2 lb/A alone or picloram plus 2,4-D at 0.5 plus 1 lb/A based on previous research conducted at North Dakota State University. Leafy spurge control with picloram plus dicamba was not improved by adding 2,4-D regardless of the 2,4-D formulation.

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

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

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

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

Fluroxypyr formulations for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Fluroxypyr is a pyridine carboxylic acid herbicide similar to picloram but with less soil residual. Previous research conducted at North Dakota State University has shown fluroxypyr provides short-term leafy spurge control. The methyl heptyl ester evaluated in that study may have caused a rapid kill of the leafy spurge topgrowth resulting in poor herbicide translocation to the roots. The purpose of this study was to evaluate the triisopropyl and diisopropyl amine formulations of fluroxypyr for leafy spurge control.

The experiment was established on June 13 near Dickinson and June 15, 1989 near Hunter, ND. Leafy spurge was dense at both locations and in the late-flower to seed set growth stages at treatment. 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 at both locations. The sky was clear at Dickinson with 62 F air temperature and 50% relative humidity while it was partly cloudy at Hunter, 80 F and 28% relative humidity. Evaluations were based on visible percent stand reduction as compared to the control.

		Location/evaluation date			
		Hunter		Dickinson	
Treatment	Rate	29 Aug 89	29 May 90	20 Sept 89	16 June 90
	lb/A	% control			
Fluroxypyr triisopropyl amine	0.25	9	0	13	3
Fluroxypyr triisopropyl amine	0.5	15	4	32	4
Fluroxypyr triisopropyl amine	1	20	3	52	0
Fluroxypyr diisopropyl amine	0.25	6	0	9	1
Fluroxypyr diisopropyl amine	0.5	19	0	21	1
Fluroxypyr diisopropyl amine	1	17	0	61	0
Fluroxypyr methyl heptyl ester	0.5	59	3	70	7
Fluroxypyr methyl heptyl ester	1	59	8	64	3
Fluroxypyr triisopropyl amine + picloram	0.25 + 0.25	57	18	73	8
Fluroxypyr triisopropyl amine + picloram	0.5 + 0.25	53	3	69	21
Fluroxypyr methyl heptyl ester + picloram	0.5 + 0.25	64	23	88	12
Picloram	0.25	42	2	59	14
Picloram	0.5	53	13	72	45
Picloram + 2,4-D	0.25 + 1	51	13	71	3
LSD (0.05)		20	11	23	16

The fluroxypyr ester formulation provided better leafy spurge control than either amine formulation (Table). Fluroxypyr ester provided an average of 63% leafy spurge control 2 to 3 months after application compared to only 22% when fluroxypyr amine was applied, averaged over all application rates and both locations. Leafy spurge control was similar when picloram was applied alone or with fluroxypyr amine or ester. The commonly used annual treatment picloram plus 2,4-D at 0.25 plus 1 lb/A provided similar control to the best fluroxypyr and fluroxypyr plus picloram treatments at both locations. No treatment provided satisfactory control 12 months after treatment. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105)

Leafy spurge control with BAS-51400 or sulfometuron and chlorflurenol applied with various formulations of 2,4-D. Lym, Rodney G., and Calvin G. Messersmith. BAS-51400 is an auxin type herbicide with moderate soil residual. Sulfometuron is a sulfonylurea herbicide that provides leafy spurge control especially when applied with picloram. Previous research has shown chlorfluernol applied with an auxin herbicide sometimes provides increased leafy spurge control compared to the auxin herbicide applied alone. The purpose of this research was to evaluate BAS-51400 and sulfometuron applied alone and in combination with picloram, various formulations of 2,4-D, or chlorflurenol for leafy spurge control.

The BAS-51400 experiment (Table 1) was established in June and July 1989 when leafy spurge was in the true flower and late seed-set growth stages, respectively. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 25 ft in a randomized complete block design with four replications. Evaluations were based on visible percent stand reduction as compared to the control. BAS-51400 was applied with soybean oil plus Atplus 300F (emulsifier) rather than the recommended oil additive BAS-009 because that additive caused rapid injury to leafy spurge leaves in greenhouse trials.

BAS-51400 provided better leafy spurge control the following growing season when applied during the true-flower compared to the seed-set growth stage (Table 1). BAS-51400 applied at 1 lb/A alone or with Silwett L-77 gave an average of 40% control 12 months after treatment (MAT) when applied in June, while BAS-51400 with soybean oil additive or picloram tended to give less leafy spurge control.

Two experiments to evaluate sulfometuron or chlorflurenol applied alone or with various formulations of 2,4-D were established near Valley City, ND on June 6, 1989 (Table 2). The experimental procedures were similar to the previous experiment except the plots were 10 by 30 ft. Leafy spurge was in the true flower growth stage, 20 to 24 inches tall with vigorous growth at treatment.

Sulfometuron plus 2,4-D gave leafy spurge control superior to either herbicide applied alone (Table 2). Control averaged 31% when the herbicides were applied alone compared to 62% when applied together 12 MAT. Grass injury averaged 15% regardless of treatment. Leafy spurge control was similar regardless of the 2,4-D formulation applied with sulfometuron.

Leafy spurge control was similar when picloram was applied with 2,4-D at equal application rates regardless of the 2,4-D formulation used (Table 2). Also, chlorflurenol did not improve leafy spurge control when added to picloram or picloram plus 2,4-D. 2,4-D applied with the spray additive SCI-40 provided control similar to 2,4-D applied alone. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105).

Table 1. BAS-51400 applied alone, with various additives, or with picloram for leafy spurge control (Lym and Messersmith).

Application date/ treatment	Rate	Evaluation date Aug 89	June 90	Aug 90
	lb/A	% control		
June 89				
BAS-51400 + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	60	4	0
BAS-51400 + soybean oil + Atplus 300F	1 + 1 qt + 1%	26	1	1
BAS-51400 + Silwett L-77	1 + 0.25%	55	38	16
BAS-51400	1	55	41	31
Picloram + BAS-51400	0.25 + 0.5	72	26	10
Picloram + 2,4-D	0.25 + 0.5	80	14	4
July 89				
BAS-51400 + soybean oil + Atplus 300F	0.5 + 1 qt + 1%	34	3	0
BAS-51400 + soybean oil + Atplus 300F	1 + 1 qt + 1%	53	6	1
BAS-51400 + Silwett L-77	1 + 0.25%	28	22	2
BAS-51400	1	28	17	3
Picloram + BAS-51400	0.25 + 0.5	66	9	0
Picloram + 2,4-D	0.25 + 0.5	80	0	0
LSD (0.05)		24	NS	17

Table 2. Various formulations of 2,4-D applied alone or with sulfometuron, chlorflurenol, or picloram for leafy spurge control (Lym and Messersmith).

Treatment	Rate	September 89 Control	September 89 Grass Injury	June 90 Control	August 90 Control	August 90 Grass injury
	— oz/A —	%				
2,4-D plus sulfometuron experiment						
2,4-D mixed amine[a]	16	50	23	26	13	0
2,4-D mixed amine[a]	32	50	11	48	9	0
Sulfometuron	0.5	47	31	25	0	10
Sulfometuron	1	4	13	23	6	10
2,4-D mixed amine[a] + sulfometuron	16 + 0.5	76	21	58	13	0
2,4-D mixed amine[a] + sulfometuron	16 + 1	70	11	58	24	0
2,4-D mixed amine[a] + sulfometuron	32 + 0.5	60	13	59	18	0
2,4-D mixed amine[a] + sulfometuron	32 + 1	73	13	74	20	0
2,4-D alkanolamine + sulfometuron	16 + 1	57	39	59	22	0
2,4-D mixed amine[a] + sulfometuron + chlorflurenol	16 + 0.5 + 2	71	21	60	23	0
2,4-D alkanolamine + sulfometuron + chlorflurenol	16 + 0.5 + 2	77	25	59	16	13
2,4-D alkanolamine + SCI-40	16 + 1%	50	16	43	16	0
LSD (0.05)		33	27	28	NS	NS
2,4-D plus chlorflurenol experiment						
2,4-D mixed amine[a]	32	16	..	7	2	..
2,4-D mixed amine[a]	64	60	..	54	8	..
2,4-D mixed amine[a] + picloram	32 + 4	73	..	81	22	..
2,4-D mixed amine[a] + picloram	32 + 8	86	..	94	34	..
2,4-D alkanolamine + picloram	32 + 8	92	..	93	29	..
2,4-D mixed amine[a] + picloram + chlorflurenol	32 + 4 + 2	64	..	79	12	..
2,4-D alkanolamine + picloram + chlorflurenol	32 + 4 + 2	71	..	82	15	..
2,4-D mixed amine[a] + chlorflurenol	32 + 2	47	..	23	1	..
2,4-D alkanolamine + chlorflurenol	32 + 2	51	..	25	8	..
Picloram + chlorflurenol	4 + 2	54	..	76	8	..
Chlorflurenol	2	9	..	5	0	..
2,4-D mixed amine[a] + SCI-40	1 + 1%	57	..	38	11	..
LSD (0.05)		4	..	19	18	..

[a]Mixed amine salts of 2,4-D (2:1 dimethylamine:diethanolamine)-EH736.

Sulfometuron applied alone or with auxin herbicides followed by picloram retreatments for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that sulfometuron provides better leafy spurge control when applied in mid-summer or fall compared to spring treatments. However, sulfometuron applied annually has caused severe grass injury and should not be used as a retreatment. The purpose of these experiments was to evaluate initial treatments of sulfometuron alone and followed by annual retreatments with picloram in the fall, and in combination with auxin herbicides applied from mid-July to mid-September for leafy spurge control.

All herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 30 ft in a randomized complete block design. The sulfometuron experiment establishment dates in 1986 and leafy spurge growth stages were: July 22 and August 27 near Chaffee, ND, at the mature seed and fall regrowth stages, respectively; September 3 near Valley City, ND, well branched and in the fall regrowth stage; and September 15 near Dickinson, ND, in the fall regrowth stage with most leaves chlorotic or bright red. As leafy spurge control declined, a retreatment of picloram at 4 oz/A was applied 12 months after the original treatment as a split-block treatment to the back one-third of each plot at Chaffee and Dickinson and at 8 oz/A at Valley City. Evaluations were based on visible percent stand reduction as compared to the control.

Sulfometuron plus auxin herbicide treatments applied in July near Chaffee provided 82 to 100% top growth control 1 month after treatment (MAT) (Table 1). Sulfometuron alone did not provide satisfactory leafy spurge control. When evaluated in May 1987, grass injury tended to increase as the sulfometuron rate increased and was higher when sulfometuron was applied with picloram or dicamba compared to sulfometuron alone. When evaluated in August 1987, control was similar whether sulfometuron was applied alone or with an auxin herbicide prior to the picloram retreatment (62%). Control decreased rapidly and no treatment provided satisfactory leafy spurge control in 1988.

Leafy spurge control tended to be better when sulfometuron plus an auxin herbicide was applied in August or September (Table 2) compared to July (Table 1). However, grass injury also was higher. Long-term leafy spurge control tended to be higher as the sulfometuron rate increased up to 2 oz/A. The dicamba and 2,4-D rate had little affect on control over the ranges evaluated, but control tended to increase as the picloram application rate increased. Long-term control was much higher at Valley City compared to the other two locations. The best treatment for long-term control at Valley City was sulfometuron plus picloram at 2 plus 16 oz/A which averaged 80% 22 MAT compared to 32% control with picloram at 16 oz/A alone. Retreatment with picloram at 4 or 8 oz/A increased leafy spurge control at Chaffee and Valley City but not at Dickinson. Leafy spurge control averaged 81% when sulfometuron had been applied at 1 or 2 oz/A, averaged over all auxin herbicide combinations, followed by two annual picloram retreatments which was 20% higher than control with picloram alone. Control declined gradually and averaged 31% in August 1990, 24 months after the last retreatment. Thus, sulfometuron may be useful as the initial treatment in a long term management program provided some grass injury is acceptable. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

Table 1. Leafy spurge control by sulfometuron plus auxin herbicides applied in July at Chaffee, ND (Lym and Messersmith).

		Evaluation date								
		Aug 86	May 87		Aug 87		May 88		Aug 88	
Treatment	Rate	Control	Control	Grass injury	Control	Retreatment[a]	Control	Retreatment[a]	Control	Retreatment[a]
	oz/A	%								
Sulfometuron+picloram	0.5 + 8	100	40	11	15	52	6	16	0	10
Sulfometuron+dicamba	0.5 + 16	83	5	0	7	54	10	16	7	6
Sulfometuron+2,4-D	1 + 8	97	18	3	8	53	10	43	1	19
Sulfometuron+picloram	1 + 8	99	60	20	16	54	10	27	6	13
Sulfometuron+dicamba	1 + 16	82	47	11	14	76	4	28	0	6
Sulfometuron+picloram	2 + 32	99	97	30	60	66	53	65	38	35
Sulfometuron+dicamba	2 + 130	100	96	49	59	69	26	37	11	15
Sulfometuron	1	31	18	10	7	66	6	41	1	9
Sulfometuron	2	13	16	15	8	72	0	33	3	19
Control	0	0	0	0	0	48	0	26	0	11
LSD(0.05)		15	32	21	22	NS	NS	NS	NS	24

[a]Picloram at 4 oz/A applied as a split-block treatment to the back one-third of each plot on June 29, 1987.

Table 2. Sulfometuron plus auxin herbicides applied in August or September followed by a picloram retreatment for leafy spurge control (Lym and Messersmith).

		Evaluation date									
		May 87		Aug 87		June 88		Sept 88	June 89	Sept 89	Aug 90
Treatment	Rate	Control	Grass injury	Control	Grass injury	Control	Retreatment	Retreatment	Retreatment		Retreatment
	oz/A	%									
Chaffee											
Sulfometuron+picloram	0.5+8	89	35	15	..	5	78	11	..	..	..
Sulfometuron+dicamba	0.5+16	68	8	16	..	13	72	10	..	..	..
Sulfometuron+2,4-D	1+8	35	83	1	..	0	44	11	..	..	..
Sulfometuron+picloram	1+8	95	46	32	..	8	67	16	..	..	..
Sulfometuron+dicamba	1+16	81	36	17	..	5	78	11	..	..	..
Sulfometuron+picloram	2+32	94	56	70	..	29	68	12	..	..	..
Sulfometuron+dicamba	2+128	95	53	56	..	8	78	16	..	..	..
Fosamine	64	43	15	9	..	3	78	16	..	..	..
Fosamine	96	56	13	20	..	6	70	12	..	..	..
Control	..	0	0	0	..	0	63	10	..	..	..
LSD (0.05)		29	19	28		NS	NS	NS			
Dickinson											
Sulfometuron+2,4-D	0.5+16	55	61	23	33	0	3	..	..	..	..
Sulfometuron+picloram	0.5+12	97	71	67	26	1	25	..	..	..	..
Sulfometuron+2,4-D	2+16	75	73	26	33	1	16	..	..	..	..
Sulfometuron+2,4-D	2+32	78	70	29	33	4	14	..	..	..	..
Sulfometuron+picloram	2+8	95	89	83	60	11	14	..	..	..	..
Sulfometuron+picloram	2+12	99	94	90	80	8	36	..	..	..	..
Sulfometuron+picloram	2+16	99	98	93	91	20	39	..	..	..	..
LSD (0.05)		20	29	22	24	NS	NS				
Valley City											
Sulfometuron+2,4-D	0.5+16	41	0	11	0	6	96	20	92	33	5
Sulfometuron+2,4-D	0.5+32	57	0	9	0	1	91	19	89	62	5
Sulfometuron+picloram	0.5+8	96	7	39	0	3	98	43	95	65	13
Sulfometuron+picloram	0.5+12	98	3	68	0	15	99	36	98	76	31
Sulfometuron+picloram	0.5+16	99	4	81	0	16	99	51	99	63	35
Sulfometuron+2,4-D	1+16	90	5	26	0	5	94	29	93	64	24
Sulfometuron+2,4-D	1+32	93	6	41	0	8	99	34	96	81	38
Sulfometuron+picloram	1+8	99	8	85	0	36	97	37	99	81	58
Sulfometuron+picloram	1+12	99	6	88	0	34	96	53	97	78	59
Sulfometuron+picloram	1+16	99	8	86	0	45	99	43	99	86	51
Sulfometuron+2,4-D	2+16	97	34	68	4	10	99	57	98	80	43
Sulfometuron+2,4-D	2+32	99	29	73	14	13	98	52	97	93	40
Sulfometuron+picloram	2+8	99	49	97	20	52	100	68	98	78	31
Sulfometuron+picloram	2+12	99	41	95	0	45	100	75	98	87	65
Sulfometuron+picloram	2+16	99	37	98	20	80	99	65	93	82	48
Picloram	16	99	0	63	0	32	97	25	98	61	12
Control		..	..	..	..	0	98	29	94	58	3
LSD (0.05)		12	22	22	20	22	7	38	6	32	35

[a] Picloram at 4 oz/A applied as a split-block treatment to the back one-third of each plot in Aug 1987 at Chaffee and Dickinson and at 8 oz/A in Aug 1987 and September 1988 at Valley City.

Leafy spurge control with sulfometuron and/or picloram plus 2,4-D in a 3 year 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 in North Dakota, Chaffee and Valley City in the east and Dickinson in the west. The soil at Dickinson was a loamy fine sand with pH 6.5 and 6% organic matter, at Valley City a loam with pH 7.1 and 9.2% organic matter, and at Chaffee a sandy loam with pH 7.4 and 6.7% organic matter. Spring treatments were applied the first week of June and fall treatments the first or second week of September in 1988 and the retreatments were applied at a similar time in 1989 and 1990. Leafy spurge received the same treatments in 1990 as in 1988 to complete the 3 yr treatment program. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The plots were 9 by 30 ft at Chaffee and Dickinson and 10 by 30 ft at Valley City and each treatment was replicated four times in a randomized complete block design at all sites. Evaluations were based on percent stand reduction as compared to the control. The initial grass stand at Dickinson was too sparse to allow evaluation of grass injury and was abandoned following the June 1990 evaluation.

Leafy spurge control, averaged across all spring treatments increased from 18 to 49% 12 and 24 months after the first treatment (MAT), respectively (Table). The best leafy spurge control (60%) was provided by the combination treatments of picloram plus 2,4-D at 4 plus 16 oz/A in 1988 followed by the same treatment in 1989 or sulfometuron plus picloram at 1.25 plus 4 oz/A in 1989; or sulfometuron plus 2,4-D at 1.25 plus 16 oz/A in 1988 followed by picloram plus 2,4-D at 4 plus 16 oz/A in 1989. Grass injury averaged only 6% when picloram plus 2,4-D was applied in 1989 compared to 14% with sulfometuron plus 2,4-D and 29% with sulfometuron plus picloram. Leafy spurge control improved to 66 and 81% in August 1990 averaged over all treatments at Valley City and Chaffee, respectively, following the third spring treatment.

Leafy spurge control with sulfometuron plus picloram at 1.25 plus 4 oz/A applied for 2 consecutive yr averaged 80% but grass injury averaged 86% (Table). Sulfometuron applied with 2,4-D at 1.25 plus 4 oz/A averaged 49 and 89% leafy spurge control and grass injury, respectively, following two consecutive annual treatments. Picloram plus 2,4-D fall applied for 2 consecutive yr averaged only 7% leafy spurge control, but control increased to 38 and 62% when sulfometuron plus 2,4-D or sulfometuron plus picloram was applied the second yr rather than picloram plus 2,4-D. However, grass injury also increased and averaged 56%.

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 combination treatments were best when fall applied. However, grass injury was severe when sulfometuron was applied in the fall. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

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

				Location and evaluation date									Mean[a]			
				Chaffee				Valley City				Dickinson				
				June 90		Aug 90		June 90		Aug 90		June 90	12 MAT		24 MAT	
1988 and 1990 Date applied and treatment	Rate	1989 Treatment	Rate	Control	Grass inj	Control	Grass inj	Control	Grass inj	Control	Grass inj	Control	Control	Grass inj	Control	Grass inj
	- oz/A -		- oz/A -	%												
Spring																
Sulfometuron+picloram	1.25+4	Sulfometuron+picloram	1.25+4	32	8	63	3	67	39	47	26	11	18	12	37	23
Sulfometuron+picloram	1.25+4	Picloram+2,4-D	4+16	56	11	80	0	70	9	34	10	12	18	11	46	10
Sulfometuron+2,4-D	1.25+16	Sulfometuron+2,4-D	1.25+16	44	19	82	3	25	10	82	38	15	21	16	28	14
Sulfometuron+2,4-D	1.25+16	Picloram+2,4-D	4+16	61	3	90	0	78	10	89	6	32	28	9	57	7
Picloram+2,4-D	4+16	Picloram+2,4-D	4+16	79	0	87	0	75	3	91	10	14	13	0	56	2
Picloram+2,4-D	4+16	Sulfometuron+picloram	1.25+4	73	14	85	0	80	14	37	20	34	17	0	67	55
Picloram+2,4-D	4+16	Sulfometuron+2,4-D	1.25+16	63	7	80	2	51	35	85	32	35	11	0	49	21
LSD (0.05)													NS	7	12	16
Fall																
Sulfometuron+picloram	1.25+4	Sulfometuron+picloram	1.25+4	99	98	80	94	100	95	80	77	98	46	70	80	86
Sulfometuron+picloram	1.25+4	Picloram+2,4-D	4+16	89	83	38	80	99	58	46	33	58	52	76	42	56
Sulfometuron+2,4-D	1.25+16	Sulfometuron+2,4-D	1.25+16	97	98	61	92	95	97	81	86	98	31	80	49	89
Sulfometuron+2,4-D	1.25+16	Picloram+2,4-D	4+16	74	91	16	58	96	92	4	44	56	25	89	10	51
Picloram+2,4-D	4+16	Picloram+2,4-D	4+16	55	12	9	4	98	4	5	1	19	10	3	7	3
Picloram+2,4-D	4+16	Sulfometuron+picloram	1.25+4	90	57	39	24	100	99	85	73	96	6	0	62	48
Picloram+2,4-D	4+16	Sulfometuron+2,4-D	1.25+16	90	71	47	45	93	99	29	83	93	2	0	38	64
LSD (0.05)				26	21	26	20	19	24	20	30	17	12	7	16	19

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

Evaluation of sulfometuron applied alone or with other herbicides in the spring or fall for leafy spurge control and grass injury. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that sulfometuron must be applied at rates of at least 1 oz/A with an auxin herbicide to control leafy spurge. Also, sulfometuron has been more effective on leafy spurge when applied in fall compared to spring but grass injury also is higher. The purpose of this research was to evaluate leafy spurge control and grass injury with sulfometuron applied alone or with dicamba, picloram, or 2,4-D in the spring or fall followed by various retreatments the next year.

The experiment was established in a dense stand of leafy spurge near Valley City, ND, on June 2 or August 31, 1988, for the spring- or fall-applied treatments, respectively. The soil at Valley City was a loam with pH 7.1 and 9.2% organic matter. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. The retreatments were applied as a split-block treatment with three replications. The original whole plots were 15 by 50 ft, and the retreatment subplots were 10 by 15 ft. The 1988 growing season was much warmer and drier than normal. The weather at application for the spring or fall applied treatments was air temperature 89 and 74 F, 42 and 68% relative humidity, and soil temperature of 79 and 70 F at 3 inches, respectively. Retreatments were applied on June 7 and September 13, 1989, for the spring and fall treatments, respectively. Evaluations were based on visible percent stand reductions as compared to the control.

Picloram at 16 oz/A gave 92% leafy spurge control and was the only spring-applied treatment to provide satisfactory control 12 months after treatment (MAT) (Table 1). Sulfometuron at 1.5 and 3 oz/A applied with 2,4-D at 16 oz/A provided 20 and 75% leafy spurge control, respectively, compared to 0 and 8%, respectively, with sulfometuron alone. Sulfometuron plus picloram at 1.5 plus 8 oz/A provided 65% leafy spurge control 12 MAT compared to only 26% with picloram at 8 oz/A applied alone. Sulfometuron applied with dicamba did not increase control compared to either herbicide applied alone. Sulfometuron gave only slight grass injury with sulfometuron.

Sulfometuron plus picloram at 1.5 plus 8 oz/A without a retreatment provided 67% leafy spurge control in June 1990, 24 MAT (Table 2). The best retreatments were picloram at 8 oz/A and sulfometuron plus picloram at 1.5 plus 8 oz/A which averaged 89% control with minimal grass injury. Grass injury averaged only 12% in June 1990 compared to 32% in September 1989 (Tables 1 and 2). Leafy spurge control had declined to an average of 35% regardless of treatment by August 1990.

All 1988 fall-applied treatments provided excellent leafy spurge control in June 1989 except 2,4-D at 16 oz/A and picloram at 8 oz/A (Table 1). However, grass injury averaged 98% with any treatment that included sulfometuron. Leafy spurge control declined rapidly by September 1989. The best treatments, averaging 76% leafy spurge control, were sulfometuron at 3 oz/A plus 2,4-D, sulfometuron at 1.5 oz/A plus dicamba or picloram, and picloram at 16 oz/A. Grass injury declined slightly to 88% 12 MAT, averaged over all fall sulfometuron treatments.

Sulfometuron plus picloram at 1.5 plus 8 oz/A averaged 90% leafy spurge control without any retreatments 21 MAT compared to 20 and 0% with sulfometuron and picloram applied alone at the same rates (Table 3). However, grass injury also was much higher, averaging 78% compared to 49 and 0% with sulfometuron and picloram applied alone. The retreatments provided similar control when averaged over the original treatments and averaged 98% except sulfometuron plus 2,4-D at 1.5 plus 16 oz/A averaged 91%. Grass injury increased when sulfometuron at 1.5 oz/A was applied as a retreatment either with 2,4-D or picloram and injury averaged 94% over all original treatments as compared to 58% when picloram or picloram plus 2,4-D was applied.

Leafy spurge control averaged over all retreatments was 84% when sulfometuron was applied with picloram, 2,4-D, or dicamba compared to 63 and 54% when sulfometuron or the auxin herbicides were applied alone, respectively, 24 months after the original treatment (Table 3). However, grass injury remained high, averaging 85% with any treatment that included sulfometuron. The best retreatment was sulfometuron plus picloram at 1.5 plus 8 oz/A which averaged 95% leafy spurge control 12 MAT compared to 75% when picloram was applied alone, but grass injury was also high and averaged 94%.

In summary, leafy spurge control was improved with minimal grass injury when sulfometuron was applied with 2,4-D or picloram in the spring compared to the herbicides applied alone. Grass injury increased when sulfometuron was applied 2 yr in a row. Sulfometuron plus picloram or 2,4-D fall-applied provided good leafy spurge control but nearly 80 to 90% grass injury. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table 1. Sulfometuron applied alone or with various auxin herbicides in the spring or fall 1988 for leafy spurge control (Lym and Messersmith).

Application date and treatment	Rate	Evaluation June 1989 Control	Evaluation June 1989 Grass inj.	Retreatment and rate (oz/A)/ evaluation Sept. 1989: Sulf.+2,4-D 1.5 + 16 Control	Sulf.+2,4-D 1.5 + 16 Grass inj.	Sulf+pic 1.5 + 8 Control	Sulf+pic 1.5 + 8 Grass inj.	Picloram 8 Control	Picloram 8 Grass inj.	Pic+2,4-D 4 + 16 Control	Pic+2,4-D 4 + 16 Grass inj.	Control Control	Control Grass inj.	Mean Control	Mean Grass inj.
	(oz/A)	(%)													
June 1988															
Sulfometuron	1.5	0	15	44	53	69	48	60	31	82	11	24	7	56	30
Sulfometuron	3	8	22	44	92	67	73	93	57	73	26	2	16	56	53
Sulfometuron+2,4-D	1.5+16	20	17	28	52	73	14	87	33	73	17	2	35	53	30
Sulfometuron+2,4-D	3+16	75	21	70	43	81	70	63	35	79	7	34	8	66	33
Sulfometuron+dicam.	1.5+32	6	7	54	37	80	28	64	25	90	17	0	5	56	22
Sulfometuron+pic.	1.5+8	65	8	52	77	81	35	71	2	67	0	52	0	65	23
2,4-D	16	0	0	9	13	38	10	86	3	77	0	0	0	42	5
Dicamba	32	0	0	61	45	62	3	86	3	72	3	25	0	61	11
Picloram	8	26	0	35	12	59	2	68	3	87	0	17	0	53	3
Picloram	16	92	0	50	0	75	0	63	0	77	3	50	3	63	1
Control	..	0	0	33	43	58	39	68	5	76	9	0	0	47	19
Mean				44	43	68	29	74	18	78	8	19	7		
LSD (0.05)		16	15	Whole plot = 17, 11; subplot = 12, 8; whole plot X subplot = 38,26											
August 1988															
Sulfometuron	1.5	97	97	..	..	..	..	..	..	..	..	31	88		
Sulfometuron	3	99	99	..	..	..	..	..	..	..	..	52	91		
Sulfometuron+2,4-D	1.5+16	96	98	..	..	..	..	..	..	..	..	31	83		
Sulfometuron+2,4-D	3+16	99	97	..	..	..	..	..	..	..	..	67	92		
Sulfometuron+dicam.	1.5+32	100	99	..	..	..	..	..	..	..	..	79	91		
Sulfometuron+pic.	1.5+8	100	98	..	..	..	..	..	..	..	..	88	80		
2,4-D	16	8	3	..	..	..	..	..	..	..	..	12	0		
Dicamba	32	97	3	..	..	..	..	..	..	..	..	20	0		
Picloram	8	78	17	..	..	..	..	..	..	..	..	37	0		
Picloram	16	99	7	..	..	..	..	..	..	..	..	70	1		
Control	..	0	0	..	..	..	..	..	..	..	..	0	0		
LSD (0.05)		6	7									21	17		

Table 2. Sulfometuron applied alone or with various auxin herbicides in June 1988 followed by various retreatments 12 months later for leafy spurge control (Lym and Messersmith).

		1989 retreatment and rate (oz/A)/ evaluation											
		Sulf.+2,4-D 1.5 + 16		Sulf+pic 1.5 + 8		Picloram 8		Pic+2,4-D 4 + 16		Control		Mean	
Evaluation date and treatment	Rate	Con trol	Grass inj.	Con trol	Grass inj.	Con trol	Grass inj.	Con trol	Grass inj.	Con trol	Grass inj.	Con trol	Grass inj.
	oz/A	%											
June 1990													
Sulfometuron	1.5	24	21	96	28	89	3	72	0	17	0	60	11
Sulfometuron	3	32	58	89	66	92	12	76	0	0	0	58	27
Sulfometuron+2,4-D	1.5+16	15	37	89	7	96	11	66	2	3	0	54	12
Sulfometuron+2,4-D	3+16	58	9	89	40	75	7	83	0	25	0	66	11
Sulfometuron+dicam.	1.5+32	29	4	94	18	77	4	82	0	3	0	57	5
Sulfometuron+pic.	1.5+8	41	20	86	7	88	1	79	0	67	0	71	6
2,4-D	16	0	3	92	8	93	0	72	18	3	0	52	6
Dicamba	32	18	35	83	5	91	0	66	0	7	0	53	8
Picloram	8	22	7	88	2	92	0	77	0	10	0	58	2
Picloram	16	65	3	92	0	89	0	70	0	46	2	72	1
Control	..	0	31	95	6	89	4	54	0	0	0	48	8
Mean		28	21	90	17	88	4	72	2	16	1		
LSD (0.05)		Whole plot = 12, 10; subplot = 8, 7; whole plot X subplot = 27,23											
August 1990													
Sulfometuron	1.5	9	13	51	0	41	0	43	0	0	0	29	3
Sulfometuron	3	18	39	40	36	46	0	35	0	0	0	28	15
Sulfometuron+2,4-D	1.5+16	0	7	52	0	63	0	44	0	2	0	32	5
Sulfometuron+2,4-D	3+16	40	0	58	20	45	0	72	0	18	0	47	4
Sulfometuron+dicam.	1.5+32	20	0	45	2	37	0	56	0	7	0	33	0
Sulfometuron+pic.	1.5+8	11	21	48	5	63	0	65	0	46	0	46	5
2,4-D	16	0	0	44	0	51	0	47	0	0	0	29	0
Dicamba	32	18	0	48	0	51	0	53	0	10	0	36	0
Picloram	8	12	3	44	0	41	0	60	0	10	0	33	1
Picloram	16	35	0	73	3	46	0	49	0	32	0	47	1
Control	..	0	27	32	0	31	0	44	0	0	0	21	5
Mean		15	10	49	6	47	0	52	0	11	0		
LSD (0.05)		Whole plot = 14, 9; subplot = 10, 6; whole plot X subplot = 31,20											

Table 3. Sulfometuron applied alone or with various auxin herbicides in September 1988 followed by various retreatments 12 months later for leafy spurge control (Lym and Messersmith).

		1989 retreatment and rate (oz/A)/evaluation											
		Sulf.+2,4-D 1.5 + 16		Sulf+pic 1.5 + 8		Picloram 8		Pic+2,4-D 4 + 16		Control		Mean	
Application date and treatment	Rate	Control	Grass inj.	Control	Grass inj.	Control	Grass inj.	Control	Grass inj.	Control	Grass inj.	Control	Grass inj.
	oz/A	%											
June 1990													
Sulfometuron	1.5	78	100	100	92	99	93	97	80	20	49	79	83
Sulfometuron	3	74	87	100	98	99	92	99	92	52	65	85	87
Sulfometuron+2,4-D	1.5+16	92	92	100	83	99	93	95	84	28	32	83	78
Sulfometuron+2,4-D	3+16	97	81	100	98	100	90	98	95	71	81	93	89
Sulfometuron+dicam.	1.5+32	97	88	100	92	99	85	99	87	69	80	93	86
Sulfometuron+pic.	1.5+8	97	93	100	89	100	92	99	93	90	78	97	89
2,4-D	16	93	99	100	100	100	18	92	22	11	0	79	48
Dicamba	32	90	86	100	95	98	18	93	9	8	0	79	42
Picloram	8	91	96	100	97	100	15	98	0	0	0	78	42
Picloram	16	98	100	100	97	99	17	93	0	80	3	95	43
Control	..	94	98	100	97	95	72	97	35	8	30	79	66
Mean		91	93	100	94	99	62	97	54	40	40		
LSD (0.05)		Whole plot = 7, 10; subplot = 5, 7; whole plot X subplot = 15,22											
August 1990													
Sulfometuron	1.5	45	100	96	96	77	84	48	71	34	51	60	80
Sulfometuron	3	60	91	75	97	62	90	59	74	79	91	67	89
Sulfometuron+2,4-D	1.5+16	56	85	95	87	77	84	42	86	31	69	60	82
Sulfometuron+2,4-D	3+16	76	82	98	94	97	88	90	92	59	79	84	87
Sulfometuron+dicam.	1.5+32	71	88	98	96	93	78	92	89	53	78	81	85
Sulfometuron+pic.	1.5+8	70	91	97	95	96	91	94	92	73	67	86	87
2,4-D	16	45	96	99	97	73	15	24	0	0	0	48	42
Dicamba	32	62	70	98	90	48	0	55	0	24	0	58	32
Picloram	8	61	82	98	94	64	10	57	0	0	0	56	37
Picloram	16	77	95	96	94	70	7	58	0	23	0	65	39
Control	..	73	94	96	94	68	22	24	8	0	0	52	43
Mean		63	88	95	94	75	52	60	48	32	38		
LSD (0.05)		Whole plot = 15, 10; subplot 10, 7; wide plot X subplot = 33,23											

Leafy spurge control in midsummer and fall with glyphosate and 2,4-D. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that glyphosate at 0.75 lb/A applied from mid-July through September will give approximately 90% leafy spurge control the following growing season. Since glyphosate is a non-selective herbicide, grass injury often is 80 to 100% which is unacceptable for pasture and rangeland weed control. Recently it has been shown that glyphosate applied at rates less than 0.75 lb/A in combination with 2,4-D can provide good leafy spurge control with only slight or no grass injury. The purpose of this research was to evaluate glyphosate applied with 2,4-D or dicamba in midsummer and fall for leafy spurge control and grass injury.

The first experiment (Table 1) was established near Hunter, ND and treatments were applied on July 18 or September 26, 1989. The leafy spurge was in the seed-set growth stage when treatments were applied in July and the temperature was 77 F and 67% relative humidity. In September, the leafy spurge was in the fall regrowth stage with green leaves on the branched regrowth and some yellow and red leaves on the stem. Air temperature was 62 F and relative humidity was 58%. The herbicides were applied using a tractor-mounted sprayer delivery 8.5 gpa at 35 psi. The plots were 10 by 30 ft in a randomized complete block design with four replications. Grass species were mostly quackgrass with some western wheatgrass. Evaluations were based on percent stand reduction as compared to the control.

Leafy spurge control 2 months after treatment (MAT) was better when glyphosate was applied with 2,4-D in July rather than alone or with dicamba (Table 1). Grass injury was variable but tended to be greater when glyphosate was applied at 0.76 lb/A compared to 0.38 lb/A. All treatments applied in September provided better leafy spurge control than the July applications when evaluated in June 1990, except glyphosate plus 2,4-D at 0.76 plus 0.68 lb/A and glyphosate plus dicamba at 0.76 plus 0.34 lb/A gave similar control at the two application dates. Treatments applied in September 1989 provided an average of 92% leafy spurge control in June 1990 but grass injury was severe and averaged 75%. Picloram plus 2,4-D at 0.5 plus 1 lb/A provided 97% leafy spurge control but grass injury averaged 31%. No treatment provided satisfactory control when evaluated 11 to 13 MAT and grass injury still averaged 50% following glyphosate application at 0.76 lb/A in September.

The second experiment (Table 2) was established near Valley City, ND and treatments were applied on August 16 or September 14, 1989. Plot design, application and leafy spurge growth stage was similar to the previous experiment. The weather was clear with 78 F and 43% relative humidity and 68 F with 51% relative humidity when treatments were applied in August and September, respectively. Grasses present included western wheatgrass and various bluegrasses.

Glyphosate plus 2,4-D provided 100% leafy spurge control 1 MAT regardless of the 2,4-D rate compared to 14 and 59% control when glyphosate was applied alone or with dicamba (Table 2). Picloram applied alone at 0.5 lb/A or with glyphosate or glyphosate plus 2,4-D averaged 93% control with only 7% grass injury. Glyphosate plus 2,4-D or dicamba applied in August or September provided similar leafy spurge control the following growing season, averaging 60%. However, grass injury was greater when treatments were applied in September compared to August and averaged 80 and 30% injury, respectively. Picloram applied alone or with glyphosate or glyphosate plus 2,4-D provided 81 and 99% control when applied in August and September, respectively. No treatment provided satisfactory control 12 MAT.

A third experiment (Table 2) to compare commercial glyphosate plus 2,4-D mixtures to tank-mixtures was established near Dickinson, ND on September 19, 1989. The weather was clear with 76 F and 17% relative humidity. All experimental conditions were as described previously except the leafy spurge had red leaves following frost. Control was similar regardless of the glyphosate plus 2,4-D mixture but much lower than in the previous two experiments. Picloram plus 2,4-D at 0.5 plus 1 lb/A provided only 53% control which is also lower than the long-term average of approximately 90% from this treatment. The poor control could be due to the generally dry conditions. Previous research has shown leafy spurge control from picloram applied following a frost is not decreased, but it may decrease control with glyphosate.

In summary, glyphosate plus 2,4-D or dicamba applied in August or September but not July will provide fair leafy spurge control through the first part of the following growing season, but grass injury may be severe, especially if the treatments are applied in September. Glyphosate plus 2,4-D or dicamba gave leafy spurge control similar to picloram plus 2,4-D, the most common treatment for leafy spurge control, at less cost per acre. However, the observed grass injury from glyphosate may be unacceptable to most land managers. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105).

Table 2. Leafy spurge control with glyphosate applied with 2,4-D dicamba or picloram near Valley City and Dickinson, ND (Lym and Messersmith).

Application date/ treatment	Rate	Valley City/evaluation date: Sept 89 Control	Sept 89 Grass inj.	June 90 Control	June 90 Grass inj.	Aug 90 Control	Aug 90 Grass inj.	Dickinson Eval. date: June 90 Control
	lb/A	%						
July								
Glyphosate	0.38	14	9	29	40	4	0	..
Glyphosate + 2,4-D	0.38 + 0.34	100	38	52	29	5	0	..
Glyphosate + 2,4-D	0.38 + 0.65	100	33	55	16	13	8	..
Glyphosate + dicamba	0.38 + 0.17	..	..	63	46	9	9	..
Glyphosate + dicamba	0.76 + 0.34	59	16	..	..	..	..	..
Picloram	0.5	..	..	85	18	9	0	..
Picloram + glyphosate	0.38 + 0.5	88	0	90	9	18	0	..
Picloram + glyphosate + 2,4-D	0.5 + 0.38 + 0.65	99	10	68	30	9	3	..
September								
Glyphosate	0.38	..	..	52	70	26	83	..
Glyphosate + 2,4-D	0.38 + 0.34	..	..	55	73	8	71	..
Glyphosate + 2,4-D	0.76 + 0.68	..	..	..	..	..	..	..
Glyphosate + 2,4-D	0.38 + 0.65	..	..	67	82	14	70	24
Glyphosate + 2,4-D	0.76 + 1.3	..	..	..	..	..	..	13
Glyphosate + dicamba	0.38 + 0.17	..	..	66	85	16	84	..
Picloram	0.5	..	..	100	18	49	3	..
Picloram + glyphosate	0.38 + 0.5	..	..	99	97	55	3	..
Picloram + glyphosate + 2,4-D	0.5 + 0.38 + 0.65	..	..	99	98	43	82	..
Glyphosate + 2,4-D (tankmix)	0.38 + 0.65	..	..	..	..	..	..	26
Glyphosate + 2,4-D (tankmix)	0.76 + 1.3	..	..	..	..	..	..	45
Picloram	2	..	..	..	..	..	..	99
Picloram + 2,4-D	0.5 + 1.0	..	..	..	..	..	..	53
LSD (0.05)		10	16	29	28	20	13	31

Table 1. Leafy spurge control with glyphosate applied with 2,4-D or dicamba at two application dates, near Hunter, ND (Lym and Messersmith).

Application date/ treatment	Rate	Evaluation date					
		Sept 89		June 90		Aug 90	
		Control	Grass inj.	Control	Grass inj.	Control	Grass inj.
	lb/A	%					
July							
Glyphosate + X-77	0.75 + 0.25%	32	15	77	19	11	8
Glyphosate + 2,4-D	0.38 + 0.34	82	10	45	3	0	0
Glyphosate + 2,4-D	0.76 + 0.68	87	50	74	13	5	1
Glyphosate + 2,4-D	0.38 + 0.65	72	20	38	0	0	0
Glyphosate + 2,4-D	0.76 + 1.3	89	61	32	33	0	6
Glyphosate + dicamba	0.38 + 0.17	49	15	63	27	4	4
Glyphosate + dicamba	0.76 + 0.34	66	30	90	9	8	0
September							
Glyphosate + X-77	0.75 + 0.25%	..	..	95	96	0	56
Glyphosate + 2,4-D	0.38 + 0.34	..	..	90	46	4	9
Glyphosate + 2,4-D	0.76 + 0.68	..	..	89	70	4	32
Glyphosate + 2,4-D	0.38 + 0.65	..	..	94	56	6	23
Glyphosate + 2,4-D	0.76 + 1.3	..	..	90	94	0	57
Glyphosate + dicamba	0.38 + 0.17	..	..	94	68	11	25
Glyphosate + dicamba	0.76 + 0.34	..	..	96	97	12	56
Picloram + 2,4-D	0.5 + 1.0	..	..	97	31	61	16
LSD (0.05)		17	31	25	36	19	23

Long-term leafy spurge control with herbicides followed by insect biocontrol agents. Lym, Rodney G., and Calvin G. Messersmith. An experiment to evaluate long-term leafy spurge control and forage production was established near Valley City, North Dakota in 1983. Herbicide treatments were applied until 1988 when the forage production part of the experiment was completed. The introduction and establishment of leafy spurge biocontrol agents in North Dakota holds promise for economical management of this weed. However, the effect of long-term herbicide application prior to insect introduction on the biocontrol agents establishment is not known. Prior herbicide treatment of a leafy spurge infestation may be detrimental to insect establishment due to less dense stands and to the insect life cycle because of chemical residue. Since much of the leafy spurge acreage has been treated with herbicides it is important to determine if biological control agents will establish and reproduce on previously treated leafy spurge. Thus, herbicide treatments were continued in 1990 on the forage production plots to establish a research area until insects are available to conduct the establishment and life-cycle experiment.

The treatments were selected based on previous research conducted at North Dakota State University and included 2,4-D at 2 lb/A, picloram plus 2,4-D at 0.25 plus 1 lb/A, picloram at 2 lb/A, and dicamba at 8 lb/A, and were applied in August 1983 or June 1984 as fall or spring treatments. The 2,4-D at 2 lb/A and picloram plus 2,4-D treatments were applied annually, while the picloram alone and dicamba treatments were reapplied when leafy spurge control declined to 70% or less. Sulfometuron plus picloram at 0.08 plus 0.5 lb/A were applied in June or August, 1988 to plots that previously were only mowed. No treatments were applied in 1989. When the experiment was reestablished in 1990, the herbicide treatments were the same except the sulfometuron plus picloram treatment was replaced by picloram plus 2,4-D at 0.5 plus 1 lb/A or glyphosate plus 2,4-D at 0.38 plus 0.62 lb/A in the spring or fall, respectively. Also, the picloram plus 2,4-D fall treatment application rate was increased from 0.25 plus 1 lb/A to 0.5 plus 1 lb/A.

The herbicides were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 15 by 50 ft in a randomized complete block design with four replications. Evaluations were based on a visual 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. The experimental site will be maintained until a sufficient number of biocontrol agents are available to continue the experiment.

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

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

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

Canada thistle control with CGA-136872 applied at two growth stages. Lym, Rodney G., C.G. Messersmith, and K.M. Christianson. Canada thistle is a perennial weed that regrows from crown and root segments each year and continues to be a problem in cultivated crops. An experiment to evaluate two rates of CGA-136872 applied with various additives at two growth stages was established near Fargo, ND. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi when the Canada thistle plants were at the 4 to 6 leaf or 10 to 12 leaf growth stage. The experiment was established in a randomized complete block design with four replications and plots were 10 by 30 ft. The treatments were evaluated visually on July 24, 1990 for percent Canada thistle suppression as compared to the control. The Canada thistle was mowed on July 26, 1990, and a second visual evaluation was taken August 28, 1990.

Treatment	Growth stage	Rate	1990 Evaluations July 12	1990 Evaluations Aug 28
	- leaf No. -	- gm/ha -	- % suppression -	
CGA-136872 + X-77	4	20 + 0.25%	19	12
CGA-136872 + Agridex	4	20 + 0.25%	33	17
CGA-136872 + X-77	4	40 + 0.25%	29	23
CGA-136872 + Agridex	4	40 + 0.25%	42	10
Dicamba + 2,4-D + X-77	4	0.0673 + 0.28 + 0.25%	18	14
Clopyralid + 2,4-D	4	0.100 + 0.56	46	20
CGA-136872 + Sunit	4	20 + 0.25%	31	20
CGA-136872 + Sunit	4	40 + 0.25%	55	20
CGA-136872 + X-77	10	20 + 0.25%	39	13
CGA-136872 + Agridex	10	20 + 0.25%	50	6
CGA-136872 + X-77	10	40 + 0.25%	38	6
CGA-136872 + Agridex	10	40 + 0.25%	52	3
Dicamba + 2,4-D + X-77	10	0.0673 + 0.28 + 0.25%	51	10
Clopyralid + 2,4-D	10	0.100 + 0.56	59	26
CGA-136872 + Sunit	10	20 + 0.25%	55	10
CGA-136872 + Sunit	10	40 + 0.25%	54	5
LSD (0.05)			19	NS

CGA-136872 provided 50% Canada thistle suppression one month after treatment when applied at the 10 leaf stage compared to 34% when applied to the 4 leaf stage plants (Table). Canada thistle suppression was similar from CGA-136872 at 20 and 40 gm/ha. Generally CGA-136872 provided better suppression (46%) when applied with Sunit or Agridex than X-77 (31%). The clopyralid plus 2,4-D treatments gave 53% Canada thistle suppression, similar to CGA-136872 applied with Sunit or Agridex. Dicamba plus 2,4-D provided an average of 35% suppression.

Suppression of Canada thistle by all treatments declined substantially by August 1990. Suppression from CGA-136872 was similar regardless of leaf stage at application, rate, or additive. Suppression with clopyralid plus 2,4-D and dicamba plus 2,4-D declined to an average of 18%. In general, no treatment reduced the Canada thistle infestation and treatments would have to be repeated to maintain suppression. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).