1989 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

NOT FOR PUBLICATION

SUMMARY OF 1989
WEED CONTROL EXPERIMENTS

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Green Section: General Weed Control in Crops.

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Blue Section: Weed Control in Reduced Tillage Systems

CLIMATIC DATA - PROSPER/AMENIA 1989

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1								57	32	77	45	93	63	98	69
2								70	37	73	51	97	64		
3								73	34	76	44	93	59	101	74
4		.12						69	34	72	38	105	75	95	61
5								40	26	74	52	86	63	74	56
6								60	24	86	47	89	53	89	53
7								77	30	73	48	95	64	82	45
8								68	46	67	42	93	71	88	45
9								78	39	74	35	87	64	92	49
10								82	39	82	42	86	65	93	57
11					.35			82	54	78	54	90	60	92	58
12			.08 .04		.55			83	49	62	46	82	60	93	60
13					.04			82	37	56	45	84	53	83	60
14								84	51	70	46	89	52	74	57
15								86	47	80	40	90	53	79	50
16								88	52	82	43	85	56	84	50
17		.35	.04	.16				69	61	77	57	84	62	89	57
18		.03		.43	.55			72	61	85	49	89	60	92	66
19		.12	.04		.08			69	45	95	55	94	54	79	60
20						66	42	75	40	92	73	93	57	72	51
21		.08	.20		.55	73	32	84	37	73	57	89	60	79	51
22		.24	.43			75	53	72	50	77	52	89	57	84	54
23						70	49	77	48	81	58	90	64	88	61
24		.75				77	50	68	48	80	52	97	66	85	67
25	.04	.04	.55			68	43	63	45	76	59	97	66	75	63
26	.04		.04		.55	57	44	62	42	77	56	77	58	79	56
27					.43	54	39	78	37	83	47	83	56	77	49
28				.16	.55	59	41	74	55	88	55	85	63	75	57
29	.04	.08				53	30	57	48	91	66				
30					.04	48	30	56	48	89	57	92	58	70	51
31		.04			1.81			68	49					68	58

CLIMATIC DATA - CARRINGTON 1989

Date	Precipitation					April		May		June		July		August	
	April	May	June	July	Aug.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.10					48	31	57	30	76	42	92	62	96	72
2						51	29	69	30	73	50	91	63	98	65
3		T			.65	48	33	67	40	74	35	89	62	97	66
4		.43				48	27	62	32	76	37	97	56	92	55
5						51	27	50	27	76	51	96	73	79	50
6						49	29	63	17	85	51	95	59	73	44
7	.05					44	27	79	37	82	50	86	51	80	44
8	T					44	14	68	45	67	42	94	61	85	48
9	T	.05				31	16	78	41	73	36	93	66	89	50
10						44	18	78	40	70	42	84	60	90	59
11			1.41	.11		41	22	77	42	76	52	85	60	89	59
12			.13			47	25	80	42	60	41	86	62	92	64
13			.19		.03	57	32	82	40	55	40	80	54	85	60
14			.03			54	30	80	48	70	38	82	54	72	53
15						73	28	84	46	73	41	85	50	78	43
16	.03					62	29	83	49	79	51	87	49	83	44
17		.70		.11		43	14	79	54	79	56	73	52	90	59
18		.01		.05	1.63	54	26	80	49	82	49	86	57	90	68
19		.19	.26		1.15	66	37	70	45	87	51	89	54	74	59
20						65	40	70	41	82	69	93	54	69	50
21			.02		.10	76	30	84	38	69	55	91	57	69	49
22						80	41	91	49	84	45	90	60	85	53
23						77	45	82	48	78	48	88	56	88	58
24		.52	.03			61	47	75	38	78	47	89	62	89	65
25						64	38	70	38	76	52	99	62	82	64
26	.37	.04			.02	55	36	64	39	78	49	90	64	81	56
27					.07	53	34	78	39	82	41	80	55	73	47
28				1.25	.46	58	34	70	41	88	52	80	55	72	45
29	.06	.64		.14		50	27	58	39	77	57	78	58	73	47
30	.07					57	26	57	47	88	51	85	58	71	52
31	.10				1.65			66	42			92	60	69	49

CLIMATIC DATA - CASSELTON 1989

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1	T					37	29	56	34	68	44	85	59	90	59
2	.08					49	31	56	34	76	53	92	65	98	71
3	.32					48	35	71	36	71	54	95	60	97	74
4	.38	.06				38	31	71	47	70	52	93	60	100	62
5		.06				44	31	67	26	76	37	97	74	94	59
6						49	29	42	23	73	41	103	68	75	43
7			T			45	29	66	33	84	59	85	55	77	49
8			T			43	17	76	49	62	44	87	64	83	48
9	T					31	17	69	38	68	36	93	69	88	51
10		.06				44	19	76	40	74	41	94	64	90	52
11	T					44	22	80	52	80	41	88	64	92	58
12			.12			46	27	81	49	76	58	86	60	91	61
13			.06		.18	45	30	83	43	62	44	91	60	92	62
14			.02		.07	61	31	84	47	62	46	82	58	87	57
15						55	27	85	47	71	40	83	55	75	49
16	T					66	37	86	42	78	45	88	52	80	48
17	.11		.40			55	15	86	62	80	51	89	62	89	48
18		.28	.07	.61	.80	40	16	66	58	85	56	81	62	91	65
19		.20		.07		57	31	74	59	72	55	86	59	78	56
20						66	37	69	39	92	72	90	57	70	51
21			1.06			71	32	75	39	92	56	94	57	70	51
22		.16	.14		.46	73	35	83	49	70	53	92	60	78	52
23		.25				76	50	74	47	77	56	87	56	91	56
24		.68				71	51	79	54	81	52	87	63	88	61
25	.11	.19	.60			76	43	71	43	79	58	91	65	85	62
26	.02	.02			.40	69	43	64	42	79	58	96	67	75	62
27	.06					69	38	63	39	76	48	97	61	79	63
28	.07				.73	53	39	77	48	82	55	80	56	81	57
29			.03	.25		59	35	62	47	87	55	85	58	76	51
30	.16	.25				52	31	61	48	89	56	84	63	74	53
31		.12			2.08			60	48			87	59	74	55

CLIMATIC DATA - CROOKSTON 1989

Date	Precipitation					April		May		June		July		August	
	April	May	June	July	Aug.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.09		.04			39	27	55	40	75	54	89	68	99	73
2	.20				.25	48	34	67	36	70	41	85	63	94	74
3		.07				39	28	70	41	75	45	87	56	100	58
4		.12	T			40	27	67	23	67	51	94	71	91	59
5				.19		38	27	37	22	72	44	98	63	66	42
6			.14			39	27	69	28	82	53	80	49	76	49
7	T	.05	.02			39	13	74	45	60	43	83	61	81	44
8				.13		24	13	67	35	65	37	91	63	80	49
9						26	18	76	40	65	42	88	59	90	60
10						41	23	81	55	77	53	82	61	91	63
11	.02		.07			33	22	82	54	74	60	80	61	91	63
12			.02		.55	42	25	83	45	61	47	84	57	92	58
13			.20			52	32	81	56	54	41	80	54	82	58
14						43	31	83	47	69	41	84	51	75	48
15						60	34	84	56	75	46	87	54	77	46
16	.02	.03				54	19	85	60	80	55	89	57	82	50
17		2.06				38	23	64	57	75	54	85	61	87	67
18		.10	.17	.04	.58	49	29	74	59	84	54	87	55	98	69
19		.56				60	36	67	43	89	69	89	54	78	51
20	.01		.22			55	31	71	42	87	59	92	58	64	54
21		T	.15		1.12	70	38	79	57	72	49	93	59	76	51
22		.11	.76			75	48	67	49	76	58	89	58	81	59
23		.64	.48			65	48	74	51	76	53	88	67	85	63
24		.33	.37			72	43	66	46	78	59	88	69	83	62
25		.26			.23	65	42	62	41	73	60	95	69	74	64
26	.05					56	35	62	42	74	52	92	57	80	47
27		T		.04	.10	54	36	74	45	76	54	71	56	77	57
28		.04	.07	.16	1.29	58	31	68	45	82	61	76	56	72	54
29	T	.13			.01	51	32	60	45	85	61	84	58	69	46
30		.06			1.04	50	25	61	49	87	60	84	56	69	52
31					.10			68	47			92	67	70	53

CLIMATIC DATA - FARGO 1989

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1	.12	T				42	32	56	34	74	45	91	67	97	71
2	.38					48	31	69	40	71	46	96	68	96	71
3	.09				T	39	35	70	38	74	39	92	59	100	76
4	T	.01				43	30	67	34	70	38	97	62	94	64
5			T		T	46	29	39	27	73	52	103	74	74	56
6						43	27	58	25	83	49	84	63	76	43
7	.11	T	T			45	24	75	38	72	48	86	53	82	49
8	T	T	T	T		29	17	63	45	65	45	92	66	87	52
9				.01		31	17	78	44	72	39	93	72	90	54
10	.02			T		44	18	80	45	79	44	85	63	92	63
11	T		T	.03	1.47	38	24	80	56	76	58	83	65	90	62
12			.10		.17	44	22	80	56	64	45	89	64	89	64
13	T		T		.02	59	34	79	45	56	45	82	58	85	61
14			T		T	51	29	80	55	70	47	83	55	74	55
15	T	.02				64	31	83	50	77	45	87	52	78	48
16	.18					56	23	86	58	79	51	90	59	81	57
17		.91	.04	.23		39	14	69	61	78	59	84	62	87	61
18		T	.04	.19	.44	54	30	73	59	85	51	88	63	89	65
19		.01	T	T	.20	64	34	71	46	93	60	89	58	81	59
20	T		T			67	40	74	42	92	71	92	57	70	51
21		.43	.43		.23	73	30	82	44	71	55	92	62	78	55
22	T	.17				72	54	74	50	77	51	89	66	84	56
23			T			70	49	76	51	81	58	88	64	86	66
24		.69	.12			77	49	69	47	80	53	90	67	82	66
25	.05	.02	.75		T	68	44	65	43	77	59	96	69	74	64
26	.02	T	.02		.77	56	45	62	43	77	55	96	71	79	58
27	.01				.22	54	39	76	40	80	49	77	60	76	52
28	T	.04		.16	.31	56	42	73	54	86	57	82	58	77	59
29	.02	.23	.01			52	34	61	48	89	65	87	62	72	53
30	.03	.07			.32	48	33	56	48	85	59	85	63	70	54
31		T			1.92			68	49			91	61	73	59

CLIMATIC DATA - LANGDON 1989

Date	Precipitation April	May	June	July	Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1	T				.02	35	9	47	31	69	44	81	62	90	65
2	.14		T			41	23	60	28	76	47	90	64	100	72
3				.18		47	23	68	38	66	36	79	53	95	65
4						39	23	64	35	75	36	81	57	98	54
5		.19	.01	T		44	24	65	21	69	51	96	69	84	56
6						36	22	36	17	71	49	87	55	68	42
7	.01		.37			37	25	58	25	84	47	77	52	74	45
8	.09	.12	.03			32	7	77	46	50	36	85	59	70	48
9	.01			.82		24	9	67	44	62	39	89	62	83	55
10						27	10	76	46	71	47	80	57	89	59
11	T			.02	T	36	20	79	52	77	49	80	56	87	57
12			.42			35	20	78	52	66	53	80	59	89	60
13			.46			40	24	79	46	55	44	79	52	93	62
14			.14		T	47	30	79	49	67	39	78	54	72	51
15						44	30	81	50	67	39	81	56	69	44
16						62	32	85	53	74	51	84	57	78	49
17	T					47	15	84	56	77	54	86	55	82	57
18		.73	.01			38	19	68	52	65	47	86	55	88	62
19					.88	49	30	77	57	81	54	86	57	79	56
20		.02				59	30	60	39	87	64	87	58	72	46
21	T		T			56	32	66	40	84	53	93	60	69	45
22			T		T	65	34	79	45	75	49	92	61	69	49
23	T	.09				68	40	69	48	74	53	91	60	82	56
24		.17				68	47	72	51	72	50	90	65	88	63
25	.37	.02			T	51	31	59	41	76	55	88	65	87	61
26		.16	.10		.11	55	35	57	35	74	52	98	58	78	55
27						51	29	60	38	65	44	86	53	73	45
28		.34		T	.01	51	28	75	44	72	51	73	53	74	52
29			1.07	.04		55	28	55	38	81	56	67	56	73	51
30	.03	T	.06		.12	47	29	57	38	81	56	67	56	73	51
31		.02						63	44			86	57	64	49

CLIMATIC DATA - MINOT 1989

	Precipitation					April		May		June		July		August	
Date	April	May	June	July	Aug.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.19					54	27	50	32	64	46	87	64	99	69
2			.01			50	32	60	36	75	52	92	59	99	72
3					.06	55	32	68	41	65	40	85	54	99	65
4	.02					45	27	63	38	73	42	85	59	91	59
5	.03	.01			.16	52	28	68	30	76	56	98	70	80	55
6	T	T				52	31	45	21	76	58	94	61	67	40
7	.07		.35			45	33	69		88	50	78	57	71	47
8	.13	.01	.01	T		36	20	83	48	54	36	89	62	81	52
9	.07			T		35	9	64	45	67	44	97	65	87	55
10						32	10	77	48	74	53	83	57	90	60
11			T	.21	T	40	28	77	59	81	58	71	58	92	63
12	T		.29	T	T	44	27	80	56	79	52	83	59	88	63
13			.27		T	56	32	78	45	59	45	83	58	89	57
14	.10		.04		T	54	33	81	50	60	38	78	61	72	54
15						51	33	80	52	70	49	82	59	66	42
16						75	37	84	55	75	56	83	55	79	46
17		.48	.21		.57	47	15	74	55	86	59	85	58	88	55
18			.05	1.45	.42	41	20	75	48	74	51	68	56	90	63
19		T			T	56	30	81	50	82	52	83	57	83	55
20	T					67	35	66	46	91	64	86	62	77	51
21						65	35	69	47	80	56	91	65	69	52
22					.12	78	36	79	50	67	46	89	65	73	56
23						83	49	73	47	73	50	91	70	88	57
24	.39	.36	.06	T		73	42	80	53	76	49	85	69	95	67
25		.04	.02		.05	50	35	61	39	73	53	87	67	95	64
26	.38	.19	.01			59	40	51	40	75	46	94	60	82	52
27	.01					50	32	64	43	72	42	83	56	73	47
28		T		.01	.74	51	31	80	47	83	55	77	56	62	49
29	T	.30	.89	.11		56	30	65	38	89	59	77	57	69	45
30	.02	.06		T	T	44	29	53	39	80	60	82	55	71	49
31								56	40			86	62	72	51

CLIMATIC DATA - RENVILLE 1989

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1								54	34	78	47	90	65	86	71
2		.10			.01			62	31	82	51	91	67	85	64
3			.01					70	38	77	46	93	70	86	71
4		.36						61	46	77	47	96	68	90	66
5		.06						42	32	83	53	96	72	78	59
6								57	29	91	64	92	74	68	60
7								73	27	85	58	87	62	75	44
8		.08		.01				69	45	56	51	94	65	82	47
9								74	36	72	41	101	69	86	52
10								80	40	80	43	92	64	84	50
79								79	51	81	57	84	66	84	62
12			.05					82	42	74	53	85	66	85	61
13			.05		.04			78	41	61	43	82	61	89	58
14			.04		.01			79	50	66	47	78	56	75	56
15								82	49	74	37	81	58	78	50
16								86	53	82	44	86	54	81	47
17		.26	.01	.80				85	61	88	57	79	54	84	52
18		.33	.01	1.61		59	35	64	60	85	63	72	61	84	55
19		.04			.28	73	28	78	54	94	55	80	55	78	60
20		.01	.36			76	40	78	43	98	75	84	57	79	53
21			.15		1.13	77	41	84	43	88	64	84	60	85	56
22	.26	.11			.01	65	51	84	56	73	55	82	55	83	60
23						73	49	84	58	82	55	82	60	81	60
24		.05	.21			74	50	79	57	81	52	83	63	76	60
25			.04		.01	75	52	76	46	82	63	88	66	69	57
26	.24		.82		.03	62	51	62	45	77	61	90	66	78	63
27	.05					64	49	78	38	83	62	86	68	77	61
28	.67					48	41	82	58	90	64	86	56	79	60
29	.06	.04		1.95		45	37	64	50	80	70	85	66	74	51
30	.03	.05	.07		.07	50	31	63	48	91	71	80	65	71	54
31								71	54			65	65	76	64

CLIMATIC DATA - WILLISTON 1989

Date	Precipitation April	Precipitation May	Precipitation June	Precipitation July	Precipitation Aug.	April Max.	April Min.	May Max.	May Min.	June Max.	June Min.	July Max.	July Min.	August Max.	August Min.
1			T			56	33	58	29	73	44	93	68	103	72
2	.02			.08	T	65	30	66	31	70	49	92	56	102	75
3	.03	T				50	34	65	41	72	43	90	53	98	60
4	T	.02			.04	52	32	56	40	75	47	104	61	88	62
5	.02					49	27	57	30	82	45	104	68	76	53
6	.20			.03	.03	47	34	74	29	89	55	94	59	77	47
7	.37	.03				48	32	77	52	88	50	91	59	83	47
8	.11					35	23	70	42	71	38	107	61	88	52
9						36	19	75	44	80	45	104	62	94	56
10			.10			46	25	76	51	80	56	78	60	96	68
11			.69	.07		50	27	86	53	83	57	86	60	95	61
12			.03		.13	62	29	85	51	64	52	90	59	92	60
13						62	39	72	48	68	44	90	60	86	59
14						55	33	70	43	72	41	82	60	77	50
15						73	34	80	53	81	47	84	52	85	49
16	T	.02				63	31	79	48	84	56	84	54	91	61
17		.04		.40	.25	42	15	75	52	85	58	85	60	93	63
18						61	27	85	43	83	48	83	58	94	66
19		.01				70	34	85	40	94	49	91	58	79	52
20			.02			71	45	68	43	94	53	96	63	80	48
21			.08		.04	83	46	75	41	71	51	98	65	82	61
22						87	51	76	52	76	45	97	67	89	55
23	.05		.12			85	46	85	46	73	48	96	68	101	61
24	.59	.56	T		.10	64	42	81	47	73	46	94	72	101	65
25		.32			.02	58	41	63	39	79	46	93	65	85	59
26	.20	.28	.08			56	44	62	39	76	44	93	56	78	49
27	.12			.03	T	46	33	76	45	90	48	93	60	74	47
28				.02	.40	57	31	71	46	90	64	88	61	64	54
29	T	.22				58	30	64	39	91	55	90	60	76	42
30		.06				50	30	51	41	94	60	93	57	80	55
31					.25			68	42	104	68	79	50		

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
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
Howe = Horseweed
KOCZ = Kochia
Latu = Ladysthumb
Lent = Lentils
Lesp = Leafy spurge
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
Wesa = Western salsify
Wht = Wheat
Wibw = Wild buckwheat
Wimu = Wild mustard
Wioa = Wild oats
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 1989

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
AC 222,293 Imazamethabenz	AC 293 Immb	American Cyanamid	2.5 lb/gal	Assert
AC 310, 448	AC 310448	American Cyanamid	3 lb/gal	None
Acetochlor	Acet	Monsanto	7.5 lb/gal	Harness
Acifluorfen	Acif	BASF Rhone Poulenc	2 lb/gal E,S 2 lb/gal S	Blazer Tackle
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+
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
Chlorsulfuron	Clsu	DuPont	75% DF	Glean
Clethodim	Clet	Valent	2 lb/gal	Select
Clomazone	Clom	FMC	4 lb/gal	Command
Clopyralid	Clpy	Dow	3 lb/gal S	Stinger
Clopyralid+2,4-D	Clpy&2,4-D	Dow	0.38 + 2 lb/gal S	Curtail
Cyanazine	Cyan	DuPont	80% WP, 90% DF 4 lb/gal F	Bladex
Cycloate	Cycl	ICI	6 lb/gal E	Ro-Neet

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
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-79376	DPX79376	DuPont	0.8 lb/gal	None
DPX-79406 (DPX-E9636, DPX-V9360)	DPX-79406	DuPont	25% WP	None
DPX-A7881	DPX-A7	DuPont	75% DF	Muster
DPX-E9636	DPX-E9	DuPont	25% DF	None
DPX-L5300	DPX-L5	DuPont	75% DF	Express
DPX-M6316	DPX-M6	DuPont	75% DF	Harmony
DPX-M6316-60	DPX-M6-60	DuPont	25%	Pinnacle
DPX-R9674 (DPX-L5300 + DPX-M6316)	DPX-R9	DuPont	75% DF	Harmony Extra
DPX-Y6202(-44) (Quizalofop)	Qufp	DuPont	0.75 lb/gal EC	Assure
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	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 option
Fluazifop-P	Flfp-P	ICI	1 lb/gal E	Fusilade 2000

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
Fluroxypyr	Flox	Dow	1.7 lb/gal	Starane
Fomesafen	Fome	ICI	2 lb/gal	Reflex
Fosamine	Fosa	DuPont	4 lb/gal S	Krenite
Glyphosate	Glyt	Monsanto	3 lb/gal S	Roundup
Haloxyfop	Halx	Dow	2 lb/gal	Verdict
HOE-7113		Hoechst-Roussel	0.5 lb/gal	Puma
HOE-7125 (fenoxaprop+MCPA + 2,4-D)		Hoechst-Roussel	0.75 lb/gal	Tiller
ICIA-5676	ICIA5676	ICI	6.4 lb/gal	None
Imazaquin	Imqn	American Cyanamid	1.5 lb/gal	Scepter
Imazethapyr	Imep	American Cyanamid	2.5 lb/gal	Pursuit
KIH-2665	KIH2665	Elanco	50% DF	
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	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	2 lb/gal S	Tordon 22K
Propachlor	Prcl	Monsanto	4 lb/gal F	Ramrod
Propanil + MCPA	Prnl + MCPA	Rohm & Haas	3.0 + 1.4 lb E	Stampede CM
Pyrazon	Pyra	BASF	4.2 lb/gal F	Pyramin
Pyridate	Pyri	Gilmore	3.75 lb/gal E	Tough

Common Name or Code Name	Abbreviation[a]	Company	Formulation	Trade Name
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
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
V-23121	None	Valent	0.83 lb/gal E	None
V-23031	None	Valent	0.83 lb/gal E	None

[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 varies with available space, but usually was the first letters and numbers.

SOIL TEST RESULTS AT VARIOUS WEED EXPERIMENT LOCATIONS

	Soil Texture	Organic matter	pH	lb/A N	P	K
Amenia, ND (New form.)	Silt loam	2.8	7.8	208	81	698
Amenia, ND (Cover crop)	Silt loam	2.8	7.6	211	86	983
Amenia, ND (Spring barley)	Silt loam	3.4	7.6	225	87	540
Amenia, ND (Soil applied)	Silt loam	3.4	7.6	225	87	540
Amenia, ND (Fall & spring)	Silt loam	2.4	7.6	210	92	1135
Amenia, ND (Wibw cntl)	Silt loam	2.8	7.8	208	81	698
Amenia, ND (Drift)	Silt loam	3.0	7.8	157	81	695
Carrington, ND	Loam	3.6	7.2	Fertilized by test		
Casselton, ND	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	7.9	105	22	260
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 (Sect. 22)	Silty clay	6.0	7.5	190	26	1095
Fargo (sugarbeets)	Silty clay	4.6	7.1	118	59	920
Hillsboro, ND	Silty clay	4.5	7.3	104	42	725
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 loam	3.5	6.8	77	38	775
New England, ND	Clay loam	5.8	6.7			
Renville, MN	-	7.0	7.5	89	20	215
St. Thomas, ND	Silt loam	4.1	7.9	78	58	770
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		

Fall and spring soil applied herbicides, Amenia, 1988-1989. Fall treatments were applied 2:00 pm October 17, 1988 when the air temperature was 50F, soil temp. at six inches was 54F, relative humidity was 62%, wind was north at 10-15 mph, and soil moisture was good. Spring treatments were applied 1:00 pm April 28, 1989 when the air temperature was 57F, soil temp. at six inches was 52F, relative humidity was 27%, wind was northeast at 20-25 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. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 28. Lorsban 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. Sugarbeet injury and green and yellow foxtail control were evaluated July 2.

Treatment	Rate	Sugarbeet injury	Gr & Ye Foxtail
	(lb/A)	(%)	(%)
Metolachlor (PPI) Fall	2	0	71
Metolachlor (PPI) Fall	3	8	76
Metolachlor (PPI) Fall	4	11	92
Metolachlor (Pre) Fall	2	3	69
Metolachlor (Pre) Fall	3	3	81
Metolachlor (Pre) Fall	4	3	93
EPTC+Cycloate (PPI) Fall	2+2	5	82
Ethofumesate (PPI) Fall	3.75	6	75
Diethatyl (PPI) Fall	6	8	71
Cycloate+Triallate (PPI) Fall	4+1.5	0	76
Metolachlor (PPI) Spring	2	5	85
Metolachlor (PPI) Spring	3	8	88
EPTC+Cycloate (PPI) Spring	1.5+2	11	96
Ethofumesate (PPI) Spring	3.75	1	60
Diethatyl (PPI) Spring	6	4	87
Cycloate+Triallate (PPI) Spring	4+1.5	4	92
HIGH MEAN		11	96
LOW MEAN		0	60
EXP MEAN		5	81
C.V. %		107	11
LSD 5%		NS	13
LSD 1%		NS	17
# OF REPS		4	4

Summary

None of the treatments caused significant sugarbeet injury. Preemergence fall-applied metolachlor gave foxtail control similar to incorporated fall-applied metolachlor. Spring-applied metolachlor at 2 lb/A gave better foxtail control than fall-applied metolachlor at 2 lb/A. Fall-applied ethofumesate at 3.75 lb/A gave better foxtail control than spring-applied ethofumesate at 3.75 lb/A. Fall-applied diethatyl at 6 lb/A gave less foxtail control than spring-applied diethatyl at 6 lb/A.

Soil applied herbicides, Amenia, 1989. Preplant incorporated herbicides were applied and rototiller incorporated 10:00 am April 28 when the air temperature was 57F, soil temperature at six inches was 54F, relative humidity was 27%, wind was northeast at 20-25 mph, and soil moisture was fair. The rototiller was set four inches deep for treatments containing EPTC or cycloate and two inches deep for all other PPI treatments. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 28. Lorsban 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. Preemergence treatments were applied April 28 following seeding. All herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and common lambsquarters control were evaluated May 23. Common lambsquarters control was evaluated again July 2.

		----- May 23 -----		July 2
Treatment	Rate	Colq control	Sgbt injury	Colq control
	(lb/A)	-------------	(%)	-------------
EPTC	2	75	15	83
EPTC+Cycloate	1.5+1.5	84	11	83
EPTC+Cycloate	1+2	93	9	86
EPTC+Cycloate	1+2.5	89	11	90
EPTC+Cycloate	2+2	95	21	92
EPTC+Cycloate	1.5+2.5	91	11	94
Cycloate	4	92	5	90
Diethatyl	5	33	10	20
Diethatyl (pre)	5	4	0	0
Ethofumesate	3.5	69	3	93
Ethofumesate (pre)	3.5	0	0	33
EPTC+Cycloate+Diethatyl	1+2+4	94	23	93
EPTC+Cycloate/Diethatyl (pre)	1+2/4	93	20	86
EPTC+Cycloate/Ethofume (pre)	1+2/3.5	96	16	98
Cycloate+Diethatyl	3+3	91	19	91
HIGH MEAN		96	23	98
LOW MEAN		0	0	0
EXP MEAN		73	12	75
C.V. %		10	45	12
LSD 5%		10	7	13
LSD 1%		13	10	17
# OF REPS		4	4	4

Summary

Common lambsquarters control from ethofumesate improved between May 23 and July 2. All other treatments gave similar control on the two evaluation dates so the July 2 evaluation will be discussed. Preplant incorporated EPTC + cycloate followed by preemergence ethofumesate gave 98% control of common lambsquarters. Only EPTC at 2 lb/A, EPTC + cycloate at 1.5+1.5 lb/A, diethatyl at 5 lb/A (pre or PPI), and preemergence ethofumesate gave significantly less control than the best treatment. The greatest sugarbeet injury was 23% from preplant incorporated EPTC + cycloate + diethatyl. Other treatments which gave a similar level of injury were EPTC + cycloate at 2+2 lb/A, preplant incorporated EPTC + cycloate followed by preemergence diethatyl, and cycloate + diethatyl.

Soil applied herbicides, Renville, 1989. Preplant incorporated herbicides were applied 3:30 pm May 12 when the air temperature was 80F, soil temp. at six inches was 66F, relative humidity was 24%, wind was east at 15 mph, and soil moisture was poor. The first five treatments were incorporated with a rototiller set four inches deep. The remainder of the PPI treatments were incorporated with 2 passes of a tandem disk set four inches deep. 'KW 1745' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12. Preemergence treatments were applied May 12 after planting. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles to the center four rows of six row plots. Sugarbeet injury and green foxtail control were evaluated July 6. No sugarbeet injury was visible July 6.

Treatment	Rate	Green Foxtail control
	(lb/A)	(%)
EPTC	2	34
EPTC+Cycloate	1.5+1.5	48
EPTC+Cycloate	1+2	54
EPTC+Cycloate	1+2.5	61
EPTC+Cycloate	2+2	53
EPTC+Cycloate	1.5+2.5	66
Cycloate	4	75
Diethatyl	5	63
Diethatyl (pre)	5	33
Ethofumesate	3.5	69
Ethofumesate (pre)	3.5	36
EPTC+Cycloate+Diethatyl	1+2+4	78
EPTC+Cycloate/Diethatyl (pre)	1+2/4	70
EPTC+Cycloate/Ethofumesate (pre)	1+2/3.5	71
Cycloate+Diethatyl	3+3	74
HIGH MEAN		78
LOW MEAN		33
EXP MEAN		59
C.V. %		17
LSD 5%		14
LSD 1%		19
# OF REPS		4

Summary

Green foxtail control generally was fair to poor with all treatments.

Postemergence herbicides applied over soil applied herbicides, Hillsboro, 1989. Soil applied herbicide treatments 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 treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles and incorporated twice with a tandem disk and harrow 2:30 pm May 4 when the wind was west at 10 mph, soil temperature at six inches was 47F, and the soil moisture was good. 'Beta 6264' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. The first postemergence herbicide application was 4:00 pm June 2 when the air temperature was 71F, soil temp. at six inches was 68F, relative humidity was 21%, wind was north at 20 mph, soil moisture was good, sugarbeets were in the cotyledon to 4 leaf stage, prostrate pigweed was in the cotyledon to 2 leaf stage, and green and yellow foxtail was emerging to 3 inches tall. The second postemergence application was 1:30 pm June 8 when the air temperature was 65F, soil temp. at six inches was 62F, relative humidity was 48%, wind was north at 18 mph, soil moisture was good, sugarbeets were in the 2 to 6 leaf stage, prostrate pigweed was in the cotyledon stage to 1.5 inches in diameter, and green and yellow foxtail was 0.5 to 4 inches tall. The third postemergence application was 3:00 pm June 19 when the air temperature was 90F, soil temp. at six inches was 80F, relative humidity was 37%, wind was south at 10 to 12 mph, soil moisture was fair, sugarbeets were in the 6-10 leaf stage, prostrate pigweed was in the 4 leaf stage to 8 inches in diameter, and green and yellow foxtail was 1.5 to 6 inches tall. All postemergence treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury, prostrate pigweed, and green and yellow foxtail control were evaluated in the untreated, EPTC + cycloate, and diethatyl strips July 3.

		Untreated			EPTC+Cycloate			Diethatyl		
Treatment	Rate	Sgbt inj	Prpw cntl	Fxtl cntl	Sgbt inj	Prpw cntl	Fxtl cntl	Sgbt inj	Prpw cntl	Fxtl cntl
	(lb/A)	(%)								
No Postemergence Application	0	0	0	0	16	53	88	8	65	[illegible]
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	0	74	99	23	93	99	10	93	[illegible]
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	9	84	99	26	97	99	15	96	99
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	8	84	99	21	97	99	9	98	99
Des/Des/Des+Seth+Dash	0.25/0.33/0.5+0.2+0.25G	9	87	99	26	98	99	18	99	99
Des+Clpy/Des/Seth+Sun-It	.25+.09/.33/.2+.25G	5	86	99	24	95	99	9	97	99
Des+Clpy/Des/Seth+Sun-It	.25+.19/.33/.2+.25G	0	80	99	25	95	99	11	97	99
De+Clpy/De+Clpy/Seth+SunIt	.25+.09/.33+.09/.2+.25G	3	83	99	24	97	99	9	98	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.09/.2+.25G	5	84	99	23	97	99	9	96	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.19/.2+.25G	0	81	99	18	95	99	8	97	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.09+0.2+0.25G	8	81	99	20	95	99	10	96	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.19+0.2+0.25G	5	79	99	24	96	99	10	95	99
De+Endo/De+Endo/Seth+Dash	.25+.25/.33+.25/.2+.25G	0	84	99	19	95	99	9	97	99
--/Clopyralid+Endothall/--	--/0.09+0.75/--	0	3	64	16	56	91	8	68	81
--/Clopyralid+Endothall/--	--/0.19+0.75/--	0	5	63	16	60	91	8	68	81
--/Clopyralid+Endothall/--	--/0.19+0.5/--	0	5	58	16	58	90	8	72	79
--/Seth+Dash/Pyrazon+BAS-09002S	--/.2+.25G/2+.25G	5	35	99	20	69	99	9	75	99
--/Seth+Dash/Pyrazon+OC	--/0.2+0.25G/2+0.25G	1	20	99	16	68	99	8	75	99
--/Seth+Dash/Pyrazon+Dash	--/0.2+0.25G/2+0.25G	0	20	99	16	64	99	8	74	99
--/Seth+Dash/Pyrazon+Sun-It	--/0.2+0.25G/2+0.25G	0	28	99	18	64	99	8	76	99
--/Sethoxydim+Dash/Pyrazon	--/0.2+0.25G/2	0	0	99	16	60	99	8	70	99
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	0	79	99	18	97	99	8	96	99
C.V. %		155	15	4	23	7	2	41	5	2
LSD 5%		6	11	5	6	8	2	5	6	3
LSD 1%		7	15	7	9	10	3	NS	8	4
# OF REPS		4	4	4	4	4	4	4	4	4

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester; BAS-09002S = BASF surfactant; OC = BASF oil concentrate (Booster Plus E); FB = 'Foam Buster' antifoaming agent

Postemergence herbicides applied over soil applied herbicides, Mooreton, 1989. Soil applied herbicide treatments 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 treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles and incorporated twice with a tandem disk and harrow 4:45 pm May 15 when the air temperature was 85F, soil temperature at six inches was 63F, relative humidity was 31%, wind was south at 10 mph, and the soil moisture was poor. 'KW 1745' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 15. The first postemergence herbicide application was 2:00 pm June 6 when the air temperature was 85F, soil temp. at six inches was 72F, relative humidity was 31%, wind was south at 17 mph, soil moisture was good, sugarbeets were in the cotyledon to 2 leaf stage, redroot pigweed were in the cotyledon to 4 leaf stage, and green and yellow foxtail was 0.5 to 1 inches tall. The second postemergence application was 12:15 pm June 16 when the air temperature was 77F, soil temp. at six inches was 66F, relative humidity was 36%, wind was southeast at 20 mph, soil moisture was good, sugarbeets were in the 4 leaf stage, redroot pigweed were in the 2 leaf stage to 2 inches tall, and green and yellow foxtail was 1 to 3 inches tall. The third postemergence application was 9:30 am June 23 when the air temperature was 74F, soil temp. at six inches was 68F, relative humidity was 58%, wind was west at 0 to 5 mph, soil moisture was good, sugarbeets were in the 6 to 8 leaf stage, redroot pigweed were in the 4 leaf stage to 5 inches tall, and green and yellow foxtail was in the 2 leaf stage (1 inch tall) to the 6 leaf stage (4 inches tall). All postemergence treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury, redroot pigweed, and green and yellow foxtail control were visually evaluated in the untreated, EPTC + cycloate, and diethatyl strips June 28.

Treatment*	Rate	Untreated			EPTC+Cycloate			Diethatyl		
		Sgbt inj	Rrpw cntl	Yeft cntl	Sgbt inj	Rrpw cntl	Yeft cntl	Sgbt inj	Rrpw cntl	Yeft cntl
	(lb/A)	(%)								
No Postemergence Application	0	0	0	0	15	79	97	0	93	83
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	10	96	99	25	99	99	6	99	99
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	13	96	99	29	99	99	16	99	99
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	11	98	99	31	99	99	16	99	99
Des/Des/Des+Seth+Dash	0.25/0.33/0.5+0.2+0.25G	19	99	99	39	99	99	25	99	99
Des+Clpy/Des/Seth+Sun-It	.25+.09/.33/.2+.25G	9	97	99	26	99	99	13	99	99
Des+Clpy/Des/Seth+Sun-It	.25+.19/.33/.2+.25G	8	94	99	34	99	99	14	99	99
De+Clpy/De+Clpy/Seth+SunIt	.25+.09/.33+.09/.2+.25G	8	98	99	29	99	99	14	99	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.09/.2+.25G	15	97	99	38	99	99	14	99	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.19/.2+.25G	10	97	99	30	99	99	10	99	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.09+0.2+0.25G	14	97	99	34	99	99	18	99	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.19+0.2+0.25G	14	95	99	30	99	99	14	99	99
De+Endo/De+Endo/Seth+Dash	.25+.25/.33+.25/.2+.25G	14	95	99	31	99	99	15	99	99
--/Clopyralid+Endothall/--	--/0.09+0.75/--	3	0	0	16	86	97	3	93	88
--/Clopyralid+Endothall/--	--/0.19+0.75/--	3	0	0	14	81	99	3	94	85
--/Clopyralid+Endothall/--	--/0.19+0.5/--	3	0	0	16	81	97	5	93	85
--/Seth+Dash/Pyrazon+BAS-09002S	--/.2+.25G/2+.25G	15	60	99	29	89	99	15	96	99
--/Seth+Dash/Pyrazon+OC	--/0.2+0.25G/2+0.25G	10	58	99	23	88	99	10	96	99
--/Seth+Dash/Pyrazon+Dash	--/0.2+0.25G/2+0.25G	11	53	99	28	86	99	15	97	99
--/Seth+Dash/Pyrazon+Sun-It	--/0.2+0.25G/2+0.25G	10	58	99	28	88	99	11	96	99
--/Sethoxydim+Dash/Pyrazon	--/0.2+0.25G/2	0	3	99	13	79	99	0	94	99
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	3	94	99	23	99	99	3	99	99
C.V. %		64	15	0	27	4	1	62	2	3
LSD 5%		8	14	0	10	5	1	9	3	4
LSD 1%		11	19	0	13	7	1	12	4	6
# OF REPS		4	4	4	4	4	4	4	4	4

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester; BAS-09002S = BASF surfactant; OC = BASF oil concentrate (Booster Plus E); FB = 'Foam Buster' antifoaming agent

Postemergence herbicides applied over soil applied herbicides, St. Thomas, 1989. Soil applied herbicide treatments 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 treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles and incorporated twice with a tandem disk and harrow 8:30 am May 9 when the wind was easterly at 5-10 mph, soil temperature at six inches was 60F, and the soil moisture was poor. 'Hilleshog Monoricca' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 9. Temik at 1.5 lb a.i./A was applied using a modified in-furrow system at planting. The first postemergence herbicide application was 7:00 pm May 26 when the air temperature was 63F, soil temp. at six inches was 64F, relative humidity was 43%, wind was north at 8 mph, soil moisture was good, sugarbeets were in the cotyledon to 2 leaf stage, redroot pigweed were in the cotyledon to 4 leaf stage, and green foxtail was 0.5 to 2 inches tall. The second postemergence application was 12:15 pm June 2 when the air temperature was 61F, soil temp. at six inches was 64F, relative humidity was 59%, wind was north at 15 mph, soil moisture was good, sugarbeets were in the 2 to 4 leaf stage, redroot pigweed were in the cotyledon stage to one inch tall, and green foxtail was emerging to 3 inches tall. The third postemergence application was 11:00 am June 15 when the air temperature was 80F, soil temp. at six inches was 68F, relative humidity was 38%, wind was south at 0 to 2 mph, soil moisture was good, sugarbeets were in the 6-10 leaf stage, redroot pigweed were 2 to 4 inches tall, and green foxtail was 2 to 6 inches tall. All postemergence treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury, redroot pigweed and green foxtail control were visually evaluated in the untreated, EPTC + cycloate, and diethatyl strips July 3.

		Untreated			EPTC+Cycloate			Diethatyl		
Treatment*	Rate	Sgbt inj	Rrpw cntl	Grft cntl	Sgbt inj	Rrpw cntl	Grft cntl	Sgbt inj	Rrpw cntl	Grft cntl
	(lb/A)	(%)								
No Postemergence Application	0	0	0	0	13	56	83	0	55	[illegible]
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	13	81	99	28	93	99	15	90	99
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	14	93	99	31	98	99	25	95	99
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	14	93	99	35	95	99	16	94	99
Des/Des/Des+Seth+Dash	0.25/0.33/0.5+0.2+0.25G	18	96	98	35	98	99	29	94	99
Des+Clpy/Des/Seth+Sun-It	.25+.09/.33/.2+.25G	9	93	99	23	97	99	18	93	99
Des+Clpy/Des/Seth+Sun-It	.25+.19/.33/.2+.25G	10	90	98	33	94	99	25	90	99
De+Clpy/De+Clpy/Seth+SunIt	.25+.09/.33+.09/.2+.25G	9	91	99	34	95	99	14	90	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.09/.2+.25G	9	91	99	22	95	99	14	89	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.19/.2+.25G	13	93	99	34	94	99	18	89	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.09+0.2+0.25G	13	85	99	34	96	99	16	92	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.19+0.2+0.25G	14	94	99	35	97	99	13	94	99
De+Endo/De+Endo/Seth+Dash	.25+.25/.33+.25/.2+.25G	11	90	99	30	95	99	19	93	99
--/Clopyralid+Endothall/--	--/0.09+0.75/--	5	0	50	16	60	89	6	56	64
--/Clopyralid+Endothall/--	--/0.19+0.75/--	0	19	61	18	65	94	5	67	75
--/Clopyralid+Endothall/--	--/0.19+0.5/--	0	5	35	15	69	90	8	53	59
--/Seth+Dash/Pyrazon+BAS-09002S	--/.2+.25G/2+.25G	4	23	99	17	60	99	13	61	97
--/Seth+Dash/Pyrazon+OC	--/0.2+0.25G/2+0.25G	0	0	99	15	77	99	0	59	98
--/Seth+Dash/Pyrazon+Dash	--/0.2+0.25G/2+0.25G	0	3	99	18	70	99	3	59	99
--/Seth+Dash/Pyrazon+Sun-It	--/0.2+0.25G/2+0.25G	0	6	98	19	65	99	5	62	98
--/Sethoxydim+Dash/Pyrazon	--/0.2+0.25G/2	0	0	99	13	62	98	0	56	99
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	0	96	99	16	96	99	3	92	99
C.V. %		88	11	7	28	9	4	67	8	8
LSD 5%		9	9	8	10	10	5	11	9	11
LSD 1%		11	12	11	13	14	7	15	12	14
# OF REPS		4	4	4	4	4	4	4	4	4

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester; BAS-09002S = BASF surfactant
OC = BASF oil concentrate (Booster Plus E); FB = 'Foam Buster' antifoaming agent

Postemergence herbicides applied over soil applied herbicides, data combined over Hillsboro, Mooreton, and St. Thomas, 1989.

Treatment*	Rate	Untreated			EPTC+Cycloate			Diethatyl		
		Sgbt inj	Prpw or Rrpw cntl	Fxtl cntl	Sgbt inj	Prpw or Rrpw cntl	Fxtl cntl	Sgbt inj	Prpw or Rrpw cntl	Fxtl cntl
	(lb/A)	(%)								
No Postemergence Application	0	0	0	0	15	63	89	3	71	66
Des/Des/Seth+Dash	0.16/0.25/0.2+0.25G	8	84	99	25	95	99	10	94	99
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	12	91	99	29	98	99	19	96	99
Des/Des/Des+Seth+Dash	0.16/0.25/0.33+0.2+0.25G	11	92	99	29	97	99	14	97	99
Des/Des/Des+Seth+Dash	0.25/0.33/0.5+0.2+0.25G	15	94	99	33	98	99	24	97	99
Des+Clpy/Des/Seth+Sun-It	.25+.09/.33/.2+.25G	8	92	99	24	97	99	13	96	99
Des+Clpy/Des/Seth+Sun-It	.25+.19/.33/.2+.25G	6	88	99	30	96	99	17	95	99
De+Clpy/De+Clpy/Seth+SunIt	.25+.09/.33+.09/.2+.25G	6	90	99	29	97	99	12	96	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.09/.2+.25G	10	91	99	27	97	99	12	95	99
Des/Des+Clpy/Seth+Sun-It	.25/.33+.19/.2+.25G	8	90	99	27	96	99	12	95	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.09+0.2+0.25G	11	88	99	29	96	99	15	96	99
Des/Des/Clpy+Seth+Dash	0.25/0.33/0.19+0.2+0.25G	11	89	99	30	97	99	12	96	99
De+Endo/De+Endo/Seth+Dash	.25+.25/.33+.25/.2+.25G	8	89	99	27	96	99	14	96	99
--/Clopyralid+Endothall/--	--/0.09+0.75/--	3	1	38	16	68	92	5	72	78
--/Clopyralid+Endothall/--	--/0.19+0.75/--	1	8	41	16	69	95	5	76	80
--/Clopyralid+Endothall/--	--/0.19+0.5/--	1	3	31	16	69	92	7	72	74
--/Seth+Dash/Pyrazon+BAS-09002S	--/.2+.25G/2+.25G	8	39	99	22	73	99	12	77	98
--/Seth+Dash/Pyrazon+OC	--/0.2+0.25G/--	4	26	99	18	78	99	6	77	99
--/Seth+Dash/Pyrazon+Dash	--/0.2+0.25G/2+0.25G	4	25	99	20	73	99	8	76	99
--/Seth+Dash/Pyrazon+Sun-It	--/0.2+0.25G/2+0.25G	3	30	99	21	72	99	8	78	99
--/Sethoxydim+Dash/Pyrazon	--/0.2+0.25G/2	0	1	99	14	67	99	3	73	99
De+FB/De+FB/Seth+Dash	.16+.0625G/.25+.0625G/.2+.25G	1	90	99	19	97	99	4	96	99
C.V. %		90	20	12	29	8	3	64	9	6
LSD 5%		4	9	8	5	6	2	5	6	5
LSD 1%		6	12	11	7	7	3	7	8	6
# OF REPS		12	12	12	12	12	12	12	12	12

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester; BAS-09002S = BASF surfactant; OC = BASF oil concentrate (Booster Plus E); FB = 'Foam Buster' antifoaming agent

Summary

Identical experiments were conducted at three locations. The combined data over locations is discussed. Sugarbeet injury and pigweed spp control was or tended to be less from postemergence herbicides alone than from postemergence herbicides over plots treated with diethatyl or EPTC+cycloate. EPTC+cycloate followed by postemergence herbicides caused greater sugarbeet injury than diethatyl followed by postemergence herbicides. Desmedipham+Foam Buster gave or tended to give less sugarbeet injury and greater pigweed spp control than desmedipham. All treatments including sethoxydim gave nearly total control of green or yellow foxtail. Clopyralid + endothall or pyrazon + additives gave poor control of pigweed spp.

New formulations of desmedipham&phenmedipham and ethofumesate, Amenia, 1989.

Triallate at 2 lb/A was applied to the entire experiment and incorporated with an Alloway 'Seed Better' April 26. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 lb/A of product was applied using a modified in-furrow system at planting. Herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots on three application dates. The first application was 3:00 pm June 7 when the air temperature was 56F, soil temperature at six inches was 64F, relative humidity was 88%, wind was northwest at 25 mph, soil moisture was good, and sugarbeets were in the 2 to 6 leaf stage. The second application was 3:30 pm June 16 when the air temperature was 82F, soil temperature at six inches was 74F, relative humidity was 26%, wind was southeast at 20-25 mph, soil moisture was fair, and sugarbeets were in the 4 to 8 leaf stage. The third application was 1:30 pm June 23 when the air temperature was 77F, soil temperature at six inches was 74F, relative humidity was 53%, wind was southeast at 2-6 mph, soil moisture was good, and sugarbeets were in the 6 to 10 leaf stage. Sugarbeet injury was evaluated June 29.

Treatment*	Rate	Sugarbeet injury
	(lb/A)	(%)
Desmedipham&Phenmedipham/--/--	0.25/--/--	0
Desmedipham&Phenmedipham/--/--	0.5/--/--	13
Desmedipham&Phenmedipham/--/--	0.75/--/--	21
Desmedipham&Phenmedipham/Desmed&Phenmed/--	0.25/0.25/--	8
Desmedipham&Phenmedipham/Desmed&Phenmed/--	0.5/0.5/--	16
CQ1174+ECD847+af/--/--	0.25+2%+0.04%/--/--	10
CQ1174+ECD847+af/--/--	0.5+2%+0.04%/--/--	15
CQ1174+ECD847+af/--/--	0.75+2%+0.04%/--/--	21
CQ1174+ECD+af/CQ1174+ECD847+af/--	0.25+2%+0.04%/0.25+2%+0.04%/--	25
CQ1174+ECD+af/CQ1174+ECD847+af/--	0.5+2%+0.04%/0.5+2%+0.04%/--	24
CQ1184+ECD847+af/--/--	0.25+2%+0.04%/--/--	8
CQ1184+ECD847+af/--/--	0.5+2%+0.04%/--/--	21
CQ1184+ECD847+af/--/--	0.75+2%+0.04%/--/--	20
CQ1184+ECD847+af/CQ1184+ECD847+af/--	0.25+2%+0.04%/0.25+2%+0.04%/--	14
CQ1184+ECD847+af/CQ1184+ECD847+af/--	0.5+2%+0.04%/0.5+2%+0.04%/--	25
CQ1191/--/--	0.25/--/--	3
CQ1191/--/--	0.5/--/--	16
CQ1191/--/--	0.75/--/--	25
CQ1191/CQ1191/--	0.25/0.25/--	13
CQ1191/CQ1191/--	0.5/0.5/--	33
CQ1183/--/--	0.25/--/--	9
CQ1183/--/--	0.5/--/--	9
CQ1183/--/--	0.75/--/--	8
CQ1183/CQ1183/--	0.25/0.25/--	8
CQ1183/CQ1183/--	0.5/0.5/--	9
Desmedipham&Phenmedipham+BAS-09002S/--/--	0.25+0.25%/--/--	18
Desmedipham&Phenmedipham+BAS-09002S/--/--	0.5+0.25%/--/--	18
Desmedipham&Phenmedipham+BAS-09002S/--/--	0.75+0.25%/--/--	20
Desmedipham&Phenmedipham+Nu-Film-P/--/--	0.25+0.05G/--/--	8
Desmedipham&Phenmedipham+Nu-Film-P/--/--	0.5+0.05G/--/--	19
Desmedipham&Phenmedipham+Nu-Film-P/--/--	0.75+0.05G/--/--	26
Desmedipham&Phenmedipham+Sun-It/--/--	0.25+0.25G/--/--	18
Desmedipham&Phenmedipham+Sun-It/--/--	0.5+0.25G/--/--	21
Desmedipham&Phenmedipham+Sun-It/--/--	0.75+0.25G/--/--	20

(continued on next page)

New formulations of desmedipham&phenmedipham and ethofumesate, Amenia, 1989. (continued)

Treatment*	Rate (lb/A)	Sugarbeet injury (%)
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.25+1.1/--	13
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.5+1.1/--	21
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.75+1.1/--	24
--/Desmedipham&Phenmedipham+Ethofumesate-SC/--	--/0.25+1.1/--	19
--/Desmedipham&Phenmedipham+Ethofumesate-SC/--	--/0.5+1.1/--	19
--/Desmedipham&Phenmedipham+Ethofumesate-SC/--	--/0.75+1.1/--	20
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.25+0.56/--	11
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.5+0.56/--	15
--/Desmedipham&Phenmedipham+Ethofumesate/--	--/0.75+0.56/--	26
--/Des&Phen+Ethofume/Des&Phen+Ethofume	--/0.25+0.56/0.25+0.56	16
--/Des&Phen+Ethofume/Des&Phen+Ethofume	--/0.5+0.56/0.5+0.56	26
--/Desmedipham&Phenmedipham/--	--/0.25/--	1
--/Desmedipham&Phenmedipham/--	--/0.5/--	14
--/Desmedipham&Phenmedipham/--	--/0.75/--	14
--/Desmedipham&Phenmedipham/Desmedipham&Phenmedipham	--/0.25/0.25	9
--/Desmedipham&Phenmedipham/Desmedipham&Phenmedipham	--/0.5/0.5	11
HIGH MEAN		33
LOW MEAN		0
EXP MEAN		16
C.V. %		47
LSD 5%		10
LSD 1%		14
# OF REPS		4

* New formulations by Nor-Am of desmedipham&phenmedipham at 1:1 ratios include CQ1174 (80% WG), CQ1184 (70% WG), CQ1191 (1.45 lb/gal), and CQ1183 (70% WP); Ethofumesate-SC (4 lb/gal) = new formulation of ethofumesate by Nor-Am; af = anti-foaming agent from Nor-Am; BAS-09002S = BASF surfactant; Sun-It = Agsco sunflower methyl ester; ECD847 = adjuvant from Nor-Am; Nu-Film-P = adjuvant from Miller Chemical and Fertilizer Corporation

Summary

Desmedipham&phenmedipham at 0.25 lb/A applied June 7 gave less sugarbeet injury than CQ1174+ECD847+antifoamer at 0.25 lb/A+2%+0.04%, desmedipham&phenmedipham+BAS-09002S at 0.25 lb/A+0.25%, and des&phen+Sun-It at 0.25 lb/A+1 qt/A. Des&phen at 0.25 lb/A applied June 7 and June 16 gave less sugarbeet injury than CQ1174+ECD847+antifoamer at 0.25 lb/A+2%+0.04% applied twice. Des&phen at 0.5 lb/A applied June 7 and June 16 gave less sugarbeet injury than CQ1191 at 0.5 lb/A applied twice. Des&phen+ethofumesate gave sugarbeet injury similar to des&phen+ethofumesate-SC.

Wild buckwheat control, Crookston, 1989. 'Hilleshog Mono 8012' sugarbeet was seeded 1.25 inches deep in rows 1, 2, and 3 of six row plots and 'Van der Have Puressa II' sugarbeet was seeded in rows 4, 5, and 6 May 10. A twelve foot strip of wild buckwheat was seeded across herbicide plots May 10 prior to seeding sugarbeets. The first herbicide application was 1:30 pm June 5 when the air temperature was 68F, soil temp. at six inches was 63F, relative humidity was 59%, wind was northwest at 0-5 mph, soil moisture was good, sugarbeets were in the cotyledon to 2 leaf stage, wild buckwheat was in the cotyledon to 1 leaf stage, and protrate pigweed was in the cotyledon to 2 leaf stage. The second application was 1:30 pm June 22 when the air temperature was 78F, soil temp. at six inches was 70F, relative humidity was 43%, wind was west at 2-4 mph, soil moisture was good, sugarbeets were in the 4-8 leaf stage, wild buckwheat was in the 2 leaf stage to 3.5 inches tall, and prostrate pigweed was in the 4 leaf stage to a 3 inch diameter. All treat-ments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim at 0.2 lb/A plus Sun-It at 1 qt/A was broadcast over entire plot area June 14. Prostrate pigweed control was evaluated July 4. Sugarbeet injury and wild buckwheat control were evaluated July 13. The mean of these two evaluations is reported here.

Treatment*	Rate	Sugarbeet injury	Prostrate Pigweed control	Wild buckwheat control
	(lb/A)	(%)		
Clopyralid/--	0.09/--	0	5	77
Clopyralid/--	0.19/--	0	24	93
Endothall/--	0.5/--	5	16	67
Endothall/--	0.75/--	5	14	71
Des&Phen/--	0.33/--	4	86	35
Clpy+Dash/--	0.09+0.25G/--	0	5	84
Clpy+Dash/--	0.19+0.25G/--	4	4	96
Clpy+Sun-It/--	0.19+0.25G/--	5	29	98
Clpy+OC/--	0.19+0.25G/--	5	8	97
Clpy+Endo/--	0.09+0.5/--	0	13	91
Clpy+Endo/--	0.09+0.75/--	3	13	90
Clpy+Endo/--	0.19+0.5/--	8	26	94
Clpy+Endo/--	0.19+0.75/--	13	45	98
Clpy+Des&Phen/--	0.09+0.33/--	0	85	77
Clpy+Des&Phen/--	0.19+0.33/--	10	88	89
--/Clopyralid	--/0.09	0	0	63
--/Clopyralid	--/0.19	4	5	76
--/Endothall	--/0.75	16	8	96
--/Endothall	--/1	16	28	99
--/Des&Phen	--/0.5	0	58	33
--/Clpy+Dash	--/0.09+0.25G	0	5	61
--/Clpy+Dash	--/0.19+0.25G	0	8	79
--/Clpy+Sun-It	--/0.19+0.25G	0	0	79
--/Clpy+OC	--/0.19+0.25G	0	3	76
--/Clpy+Endo	--/0.09+0.5	18	25	95
--/Clpy+Endo	--/0.09+0.75	16	18	98
--/Clpy+Endo	--/0.19+0.5	23	8	96
--/Clpy+Endo	--/0.19+0.75	26	29	99
--/Clpy+Des&Phen	--/0.09+0.5	3	74	70
--/Clpy+Des&Phen	--/0.19+0.5	3	68	84

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Wild buckwheat control, Crookston, 1989. (continued)

Treatment*	Rate (lb/A)	Sugarbeet injury	Prostrate Pigweed control	Wild buckwheat control
		-----------------	(%)	-----------------
HIGH MEAN		26	88	99
LOW MEAN		0	0	33
EXP MEAN		6	26	82
C.V. %		78	63	8
LSD 5%		7	23	9
LSD 1%		9	31	12
# OF REPS		4	4	4

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester; OC = BASF oil concentrate (Booster Plus E)

Summary

Clopyralid gave better control of cotyledon to one leaf wild buckwheat than of larger wild buckwheat but endothall gave better control of the larger wild buckwheat. Dash, Sun-It, or Booster Plus E as adjuvants with clopyralid did not improve wild buckwheat control. Clopyralid at 0.09 lb/A plus endothall gave better wild buckwheat control than clopyralid alone at 0.09 lb/A. Treatments that included desmedipham and phenmedipham gave the best prostrate pigweed control and cotyledon to two leaf prostrate pigweed were controlled better than larger prostrate pigweed. Endothall caused more injury when applied to 4 to 8 leaf sugarbeets than when applied to cotyledon to 2 leaf sugarbeets.

Wild buckwheat control, Crookston, 1989. 'Hilleshog Mono 8012' sugarbeet was seeded 1.25 inches deep in rows 1, 2, and 3 of six row plots and 'Van der Have Puressa II' sugarbeet was seeded in rows 4, 5, and 6 May 10. A twelve foot strip of wild buckwheat was seeded across herbicide plots May 10 prior to seeding sugarbeets. The first herbicide application was 12:30 pm June 5 when the air temperature was 68F, soil temp. at six inches was 63F, relative humidity was 59%, wind was northwest at 0-5 mph, soil moisture was good, sugarbeets were in the cotyledon to 2 leaf stage, and wild buckwheat was in the cotyledon to 1 leaf stage. The second application was 1:30 pm June 14 when the air temperature was 68F, soil temp. at six inches was 61F, relative humidity was 59%, wind was northeast at 8 mph, soil moisture was good, sugarbeets were in the 2-4 leaf stage, and wild buckwheat was in the 1-3 leaf stage and 2 inches tall. All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim at 0.2 lb/A plus Sun-It at 1 qt/A was broadcast over entire plot area June 22. Sugarbeet injury and wild buckwheat control were visually evaluated July 4 and July 13. The means of these two evaluations are presented here.

Treatment*	Rate	Sugarbeet injury	Wild Buckwheat control
	(lb/A)	---------- (%)	----------
Clopyralid/--	0.09/--	0	76
Clopyralid/--	0.19/--	2	96
--/Clopyralid	--/0.09	0	71
--/Clopyralid	--/0.19	3	95
Clpy/Clpy	0.09/0.09	0	98
Clpy+Dash/Clpy+Dash	0.09+0.25G/0.09+0.25G	0	97
Des&Phen/Des&Phen	0.25/0.33	0	51
Des&Ph+Endo/Des&Ph+Endo	0.25+0.25/0.33+0.33	0	90
Des&Ph+Clpy/Des&Ph+Clpy	0.25+0.09/0.33+0.09	4	97
Des&Ph+Clpy/Des&Ph+Clpy	0.25+0.19/0.25+0.19	5	100
Endothall/Endothall	0.5/0.5	20	99
Endothall/--	0.75/--	7	81
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.09	3	82
Des&Phen+Clpy/Des&Phen	0.25+0.09/0.33	2	90
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.19	3	93
C.V. %		91	7
LSD 5%		4	9
LSD 1%		5	13
# OF REPS		4	4

* Dash = BASF surfactant

Summary

Only split applied endothall at 0.5/0.5 lb/A caused important sugarbeet injury. Split applied clopyralid at 0.09/0.09 lb/A gave wild buckwheat control similar to one application of clopyralid at 0.19 lb/A but superior to one application at 0.09 lb/A. Split applied desmedipham & phenmedipham gave only 51% control of wild buckwheat. Adding clopyralid at 0.09 lb/A to one of the two split applications of desmedipham & phenmedipham gave wild buckwheat control superior to clopyralid alone or split applied desmedipham & phenmedipham but inferior to split applied desmedipham & phenmedipham + clopyralid at 0.25+0.09/0.33+0.09 lb/A.

Wild buckwheat control, Amenia, 1989. Triallate at 2 lb/A was broadcast over entire plot area and incorporated with an 'Alloway Seed Better' April 26. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. A twelve foot strip of wild buckwheat was seeded across herbicide plots April 26 prior to seeding sugarbeets. The first herbicide application was 1:30 pm June 1 when the air temperature was 76F, soil temp. at six inches was 68F, relative humidity was 45%, wind was south-west at 10 mph, soil moisture was good, sugarbeets were mostly in the cotyledon stage with a few early emerging sugarbeets up to the 4 leaf stage, and wild buckwheat was in the 2 leaf stage. The second appli- cation was 9:30 am June 7 when the air temperature was 56F, soil temp. at six inches was 64F, relative humidity was 88%, wind was northwest at 20 mph, soil moisture was good, sugarbeets were in the 2-4 leaf stage, and wild buckwheat was in the cotyledon to 5 leaf stage and two inches tall. All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim at 0.2 lb/A plus Sun-It at 1 qt/A was broadcast over entire plot area June 13. Sugarbeet injury and wild buckwheat control were evaluated June 26 and July 29. The means of these two evaluations are presented here.

Treatment*	Rate (lb/A)	Sugarbeet injury (%)	Wild Buckwheat control (%)
Clopyralid/--	0.09/--	1	26
Clopyralid/--	0.19/--	7	73
--/Clopyralid	--/0.09	0	50
--/Clopyralid	--/0.19	8	89
Clpy/Clpy	0.09/0.09	6	79
Clpy+Dash/Clpy+Dash	0.09+0.25G/0.09+0.25G	5	90
Des&Phen/Des&Phen	0.25/0.33	4	92
Des&Ph+Endo/Des&Ph+Endo	0.25+0.25/0.33+0.33	14	95
Des&Ph+Clpy/Des&Ph+Clpy	0.25+0.09/0.33+0.09	15	99
Des&Ph+Clpy/Des&Ph+Clpy	0.25+0.19/0.25+0.19	25	99
Endothall/Endothall	0.5/0.5	14	93
Endothall/--	0.75/--	0	58
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.09	10	95
Des&Phen+Clpy/Des&Phen	0.25+0.09/0.33	6	99
Des&Phen/Des&Phen+Clpy	0.25/0.33+0.19	16	99
C.V. %		41	6
LSD 5%		5	7
LSD 1%		7	9
# OF REPS		4	4

* Dash = BASF surfactant

Summary

Split applied desmedipham & phenmedipham gave 92% control of wild buckwheat, much better control than was observed at Crookston. Clopyralid alone gave less than 90% wild buckwheat control at this location while clopyralid at 0.19 lb/A gave 95% control at Crookston. Sugarbeet injury was greater at Amenia than Crookston. The variable results between the two locations suggests that split application of herbicide combinations may be needed for consistent wild buckwheat control.

Wild buckwheat control, Amenia, 1989. Triallate at 2 lb/A was broadcast over entire plot area and incorporated with an 'Alloway Seed Better' April 26. Mitsui Monohikari sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. A twelve foot strip of wild buckwheat was seeded across herbicide plots April 26 prior to seeding sugarbeets. The first herbicide application was 12:30 pm June 1 when the air temperature was 76F, soil temp. at six inches was 68F, relative humidity was 45%, wind was southwest at 10 mph, soil moisture was good, sugarbeets were mostly in the cotyledon stage with a few early emerging sugarbeets up to the 4 leaf stage, and wild buckwheat was in the 2 leaf stage. The second appli-cation was 1:00 pm June 13 when the air temperature was 55F, soil temp. at six inches was 59F, relative humidity was 76%, wind was north at 12 mph, soil moisture was good, sugarbeets were in the 4-8 leaf stage, and wild buckwheat was in the 3 leaf stage to three inches tall. All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sethoxydim at 0.2 lb/A plus Sun-It at 1 qt/A was broadcast over entire plot area June 7. Sugarbeet injury and wild buckwheat control were visually evaluated June 26 and July 29. The means of these two evaluations are presented here.

Treatment*	Rate	Sugarbeet injury	Wild Buckwheat control
	(lb/A)	----------- (%)	----------
Clopyralid/--	0.09/--	0	19
Clopyralid/--	0.19/--	8	61
Endothall/--	0.5/--	0	27
Endothall/--	0.75/--	2	53
Des&Phen/--	0.33/--	2	21
Clpy+Dash/--	0.09+0.25G/--	4	43
Clpy+Dash/--	0.19+0.25G/--	8	81
Clpy+Sun-It/--	0.19+0.25G/--	6	72
Clpy+OC/--	0.19+0.25G/--	6	74
Clpy+Endo/--	0.09+0.5/--	2	69
Clpy+Endo/--	0.09+0.75/--	1	80
Clpy+Endo/--	0.19+0.5/--	8	89
Clpy+Endo/--	0.19+0.75/--	11	91
Clpy+Des&Phen/--	0.09+0.33/--	1	54
Clpy+Des&Phen/--	0.19+0.33/--	13	70
--/Clopyralid	--/0.09	2	39
--/Clopyralid	--/0.19	8	78
--/Endothall	--/0.75	8	98
--/Endothall	--/1	13	98
--/Des&Phen	--/0.5	0	75
--/Clpy+Dash	--/0.09+0.25G	3	56
--/Clpy+Dash	--/0.19+0.25G	11	77
--/Clpy+Sun-It	--/0.19+0.25G	8	77
--/Clpy+OC	--/0.19+0.25G	6	74
--/Clpy+Endo	--/0.09+0.5	8	95
--/Clpy+Endo	--/0.09+0.75	13	99
--/Clpy+Endo	--/0.19+0.5	13	98
--/Clpy+Endo	--/0.19+0.75	17	99
--/Clpy+Des&Phen	--/0.09+0.5	2	82
--/Clpy+Des&Phen	--/0.19+0.5	13	84

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Wild buckwheat control, Amenia, 1989. (continued)

Treatment*	Rate (lb/A)	Sugarbeet injury	Wild Buckwheat control
		----------- (%)	----------
HIGH MEAN		17	99
LOW MEAN		0	19
EXP MEAN		6	71
C.V. %		53	10
LSD 5%		5	10
LSD 1%		6	13
# OF REPS		4	4

* Dash = BASF adjuvant; Sun-It = Agsco sunflower methyl ester; OC = BASF oil concentrate (Booster Plus E)

Summary

Both clopyralid and endothall gave better wild buckwheat control with the second time of application rather than the first. This differs from the results at Crookston. The level of wild buckwheat control from clopyralid was much lower at Amenia than at Crookston. Addition of an oil adjuvant to clopyralid at 0.19 lb/A improved wild buckwheat control with the first time of application but not the second. Oil adjuvants had no effect at Crookston. Clopyralid+endothall generally gave better wild buckwheat control than clopyralid alone or endothall alone at both locations. Endothall caused greater sugarbeet injury at the second application than at the first.

Grass control herbicides, Crookston, 1989. 'Valley' oats was seeded in a 16 foot strip across the herbicide plots May 10 prior to seeding sugarbeets. 'Hilleshog Mono 8012' was seeded 1.25 inches deep in rows 1, 2, and 3 of six row plots and 'Van der Have Puressa II' was seeded in rows 4, 5, and 6 May 10. The first herbicide application was 2:00 pm June 5 when the air temperature was 68F, soil temp. at six inches was 63F, relative humidity was 59%, wind was northwest at 0-5 mph, soil moisture was good, sugarbeets were in the cotyledon to 2 leaf stage, oats was in the 2 leaf stage (3.5 inches tall) to the 4 leaf stage (4.5 inches tall), and green foxtail was just emerging to 0.5 inches tall. The second herbicide application was 12:15 pm June 14 when the air temperature was 68F, soil temp. at six inches was 61F, relative humidity was 59%, wind was northeast at 8 mph, soil moisture was good, sugarbeets were in the 2 to 4 leaf stage, oats was 6 to 10 inches tall, and green foxtail was 0.5 to 1.5 inches tall. The third herbicide application was 12:15 pm June 22 when the air temperature was 78F, soil temp. at six inches was 70F, relative humidity was 43%, wind was west at 2 to 4 mph, soil moisture was good, sugarbeets were in the 4 to 8 leaf stage, oats was 10 to 14 inches tall, and green foxtail was 1.5 to 4 inches tall. All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Green foxtail and oats control were evaluated July 4 and July 13. The average of these two evaluations is presented here. Sugarbeet injury was evaluated July 4 and July 13. There was no visible sugarbeet injury July 4. Sugarbeet injury ratings from July 13 are presented here.

Treatment*	Rate	Sugarbeet injury	Green Foxtail control	Oats control
	(lb/A)	-----------	(%)	----------
Des/Des/Seth+Dash	0.25/0.33/0.1+0.25G	1	98	91
Des/Des/Seth+Dash	0.25/0.33/0.2+0.25G	0	96	94
Des/Des/Seth+Sun-It	0.25/0.33/0.1+0.25G	3	98	86
Des/Des/Seth+Dash+28%N	0.25/0.33/0.1+0.25G+1G	1	98	91
Des/Des/Seth+Sun-It+28%N	0.25/0.33/0.1+0.25G+1G	1	98	91
Des/Des/DPX-Y6202+OC	0.25/0.33/0.06+0.25G	0	99	94
Des/Des/DPX-Y6202+OC	0.25/0.33/0.09+0.25G	1	98	96
Des/Des/Clethodim+OC	0.25/0.33/0.078+0.25G	0	99	98
Des/Des/Clethodim+OC	0.25/0.33/0.094+0.25G	0	99	99
Des/Des/Clethodim+OC	0.25/0.33/0.125+0.25G	1	100	100
Des/Des/HOE-46360+OC	0.25/0.33/0.07+0.25G	0	98	93
Des/Des/HOE-46360+OC	0.25/0.33/0.14+0.25G	1	99	99
Des/Des/Fluazifop-P+OC	0.25/0.33/0.125+0.25G	0	89	95
Des/Des/Flfp-P+OC	0.25/0.33/0.188+0.25G	1	97	97
--/Des/Des+Seth+Dash	--/0.33/0.5+0.2+0.25G	0	91	81
--/Des/Des+Sethoxydim	--/0.33/0.5+0.2	3	71	58
--/Des/Clpy+Seth+Dash	--/0.33/0.2+0.2+0.25G	8	100	93
--/Des/Des+DPX-Y6202+OC	--/0.33/0.5+0.09+0.25G	0	96	83
--/Des/Des+DPX-Y6202	--/0.33/0.5+0.09	1	83	67
--/Des/Clpy+DPX-Y6202+OC	--/0.33/0.2+0.09+0.25G	1	100	94
--/Des/Des+Clethodim+OC	--/0.33/0.5+0.094+0.25G	0	87	89
--/Des/Des+Clethodim+OC	--/0.33/0.5+0.125+0.25G	1	91	94
--/Des/Des+Clethodim	--/0.33/0.5+0.125	0	88	92
--/Des/Clpy+Clethodim+OC	--/0.33/0.2+0.094+0.25G	9	99	98

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Grass control herbicides, Crookston, 1989. (continued)

Treatment*	Rate (lb/A)	Sugarbeet injury (%)	Green Foxtail control (%)	Oats control (%)
--/Des/Des+HOE-46360+OC	--/0.33/0.5+0.07+0.25G	0	93	60
--/Des/Des+HOE-46360	--/0.33/0.5+0.07	0	98	50
--/Des/Clpy+HOE-46360	--/0.33/0.2+0.07	3	99	92
--/Des/Des+Flfp-P+OC	--/0.33/0.5+0.188+0.25G	0	54	88
--/Des/Des+Flfp-P	--/0.33/0.5+0.188	3	54	90
--/Des/Clpy+Flfp-P+OC	--/0.33/0.2+0.188+0.25G	4	92	94
Des/Des/--	0.25/0.33/--	0	12	6
--/Des/Des+Dash	--/0.33/0.5+0.25G	0	18	14
--/Des/Des	--/0.33/0.5	0	13	8
--/Des/Clpy+Dash	--/0.33/0.2+0.25G	0	1	0
--/Des/Clpy	--/0.33/0.2	1	1	0
HIGH MEAN		9	100	100
LOW MEAN		0	1	0
EXP MEAN		1	80	76
C.V. %		188	5	5
LSD 5%		3	6	5
LSD 1%		4	8	7
# OF REPS		4	4	4

* OC = BASF Booster Plus E; Sun-It = Agsco sunflower methyl ester; 28%N = 28% N solution containing urea and NH_4NO_3; Dash = BASF surfactant

Summary

Desmedipham antagonized oats control from sethoxydim, DPX-Y6202, clethodim, HOE-46360, and fluazifop-P when applied in tank-mix combination with these herbicides. Clopyralid in tank-mix combinations did not antagonize oats control by any of the herbicides. Desmedipham+sethoxydim+Dash, desmedipham+DPX-Y6202+OC, and desmedipham+HOE-46360+OC gave better oats control than the same herbicide combinations without oil additive. Oats control was similar from desmedipham+ fluazifop-P or desmedipham+clethodim whether applied with or without oil additive.

Broadleaf plus grass herbicides on wild oats, Fargo, 1989. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. The herbicide treatments were applied 1:00 pm June 16 when the air temperature was 84F, soil temperature at six inches was 69F, relative humidity was 64%, wind was southeast at 10-20 mph, soil moisture was poor, and wild oats was in the 6 to 8 leaf stage. Treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Bromoxynil + MCPA at 0.375 + 0.375 lb/A was applied in 17 gpa water at 40 psi to the entire plot area July 10 to control broadleaf weeds. Wild oats control was evaluated July 19.

Treatment*	Rate	Wild Oats control
	(lb/A)	(%)
Sethoxydim	0.2	41
Sethoxydim+Dash	0.2+0.25G	100
Sethoxydim+Sun-It	0.2+0.25G	100
Sethoxydim+Dash+28%N	0.2+0.25G+1G	100
Sethoxydim+Sun-It+28%N	0.2+0.25G+1G	97
Sethoxydim+Desmedipham+Dash	0.2+0.5+0.25G	89
Sethoxydim+Desmedipham	0.2+0.5	59
Desmedipham+Dash	0.5+0.25G	4
Desmedipham	0.5	4
Sethoxydim+Clopyralid+Dash	0.2+0.2+0.25G	98
Sethoxydim+Clopyralid	0.2+0.2	72
Clopyralid+Dash	0.2+0.25G	0
Clopyralid	0.2	0
Sethoxydim+Endothall+Dash	0.2+0.75+0.25G	98
Sethoxydim+Endothall	0.2+0.75	81
Endothall+Dash	0.75+0.25G	5
Endothall	0.75	0
DPX-Y6202(DPX-79376)	0.09	91
DPX-Y6202(DPX-79376)+OC	0.09+0.25G	99
DPX-Y6202(DPX-79376)+Desmedipham	0.09+0.5	66
DPX-Y6202(DPX-79376)+Des+OC	0.09+0.5+0.25G	51
DPX-Y6202(DPX-79376)+Clopyralid	0.09+0.2	88
DPX-Y6202(DPX-79376)+Clpy+OC	0.09+0.2+0.25G	98
DPX-Y6202(DPX-79376)+Endothall	0.09+0.75	86
DPX-Y6202(DPX-79376)+Endo+OC	0.09+0.75+0.25G	90
Clethodim	0.094	91
Clethodim+OC	0.094+0.25G	100
Clethodim+Desmedipham	0.094+0.5	69
Clethodim+Desmedipham+OC	0.094+0.5+0.25G	96
Clethodim+Clopyralid	0.094+0.2	94
Clethodim+Clopyralid+OC	0.094+0.2+0.25G	100
Clethodim+Endothall	0.094+0.75	15
Clethodim+Endothall+OC	0.094+0.75+0.25G	74

(continued on next page)

Broadleaf plus grass herbicides on wild oats, Fargo, 1989. (continued)

Treatment*	Rate (lb/A)	Wild Oats control (%)
HOE-46360	0.07	96
HOE-46360+OC	0.07+0.25G	92
HOE-46360+Desmedipham	0.07+0.5	23
HOE-46360+Desmedipham+OC	0.07+0.5+0.25G	16
HOE-46360+Clopyralid	0.07+0.2	77
HOE-46360+Clopyralid+OC	0.07+0.2+0.25G	83
HOE-46360+Endothall	0.07+0.75	76
HOE-46360+Endothall+OC	0.07+0.75+0.25G	80
Fluazifop-P	0.188	94
Fluazifop-P+OC	0.188+0.25G	99
Fluazifop-P+Desmedipham	0.188+0.5	79
Fluazifop-P+Desmedipham+OC	0.188+0.5+0.25G	59
Fluazifop-P+Clopyralid	0.188+0.2	100
Fluazifop-P+Clopyralid+OC	0.188+0.2+0.25G	96
Fluazifop-P+Endothall	0.188+0.75	98
Fluazifop-P+Endothall+OC	0.188+0.75+0.25G	98
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		72
C.V. %		15
LSD 5%		15
LSD 1%		20
# OF REPS		4

* OC = BASF crop oil concentrate (Booster Plus E); Dash = BASF surfactant; 28%N = 28% N solution containing urea and NH_4NO_3; Sun-It = Agsco sunflower methyl ester

Summary

Fluazifop-P, HOE-46360, clethodim, and DPX-Y6202 gave similar control of wild oats when used alone or with an oil additive. Sethoxydim gave very poor wild oats control when used without an oil additive. Desmedipham antagonized or tended to antagonize wild oats control from sethoxydim, DPX-Y6202, clethodim, HOE-46360, and fluazifop-P. However, clethodim+desmedipham+OC gave wild oats control similar to clethodim+OC. Clopyralid antagonized wild oats control from HOE-46360 only. Endothall antagonized wild oats control from clethodim and HOE-46360. DPX-Y6202+desmedipham+OC and fluazifop-P + desmedipham + OC gave less wild oats control than the same herbicides without the oil concentrate.

Postemergence control of eastern black nightshade, Renville, 1989. 'Hilleshog 5135' sugarbeet was seeded April 26. The first herbicide application was 9:10 am May 31 when the air temperature was 62F, soil temp. at six inches was 57F, relative humidity was 60%, wind was northwest at 5-10 mph, soil moisture was fair, sugarbeets were in the 6 leaf stage, and black nightshade was in the 4 leaf stage. The second herbicide application was 9:15 pm June 5 when the air temperature was 69F, soil temp. at six inches was 67F, relative humidity was 40%, wind was north at 5 mph, soil moisture was poor, sugarbeets were in the 6 to 8 leaf stage, and black nightshade was in the 6 to 8 leaf stage. The third applicaton was 12:30 pm June 15 when the air temperature was 72F, soil temp. at six inches was 70F, relative humidity was 35%, wind was northwest at 5-7 mph, soil moisture was poor, sugarbeets were in the 8 to 10 leaf stage, and black nightshade was in the 8 to 10 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and eastern black nightshade control were visually evaluated June 22 and July 6.

Treatment	Rate	-- June 22 -- Sgbt inj	E. Black Night-shade control	-- July 6 -- Sgbt inj	E. Black Night-shade control
	(lb/A)	------------	(%)	------------	
Desmedipham/Desmedipham/--	0.25/0.33/--	0	81	0	86
Desmed/Desmed+Clpy/--	0.25/0.33+0.09/--	1	93	0	92
Desmed/Desmed+Clpy/--	0.25/0.33+0.19/--	1	90	0	97
Des+Clpy/Des+Clpy/--	0.25+0.09/0.33+0.09/--	0	97	0	98
Desmed+Clpy/Desmed/--	0.25+0.09/0.33/--	0	94	0	97
Desmed+Clpy/Desmed/--	0.25+0.19/0.33/--	0	92	0	99
--/--/Clopyralid	--/--/0.19	0	29	0	74
--/Clopyralid/--	--/0.09/--	0	0	0	68
--/Clopyralid/--	--/0.19/--	0	6	0	84
--/Clopyralid+Dash/--	--/0.09+0.25G/--	0	21	0	80
--/Clopyralid+Dash/--	--/0.19+0.25G/--	1	84	0	88
--/Clopyralid+Endothall/--	--/0.09+0.5/--	0	15	0	80
--/Clopyralid+Endothall/--	--/0.19+0.5/--	0	25	0	80
--/Pyrazon+BAS-09002S/--	--/2+0.25G/--	4	44	0	66
Desmed/Desmed/Desmed	0.25/0.33/0.5	5	99	0	97
Desm/Desm/Desm+Clpy	0.25/0.33/0.5+0.19	6	98	0	98
Desm/Desm/Desm+Endo	0.25/0.33/0.5+0.5	13	99	0	98
Desm/Desm/Desm+Etho	0.25/0.33/0.5+0.5	13	99	0	95
C.V. %		146	24	0	8
LSD 5%		5	22	NS	10
LSD 1%		7	29	NS	13
# OF REPS		4	4	4	4

* BAS-09002S = BASF surfactant; Dash = BASF surfactant

Summary

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative. Clopyralid applied without additive on June 5 had little visible effect on eastern black nightshade by June 22. Control was easily visible by July 6. Addition of Dash to clopyralid at 0.19 lb/A speeded the appearance of symptoms but the final evaluation on July 6 indicated that clopyralid at 0.19 lb/A gave control similar to clopyralid at 0.19 lb/A plus Dash. Two applications of desmedipham in combination with clopyralid gave eastern black nightshade control superior to two applications of desmedipham with no clopyralid and superior to clopyralid alone. Three applications of desmedipham gave excellent control with or without clopyralid, endothall, or ethofumesate.

Postemergence control of common cocklebur, Bird Island, 1989. 'Hilleshog 5135' sugarbeet was seeded May 15. The first herbicide application was 11:15 am June 1 when the air temperature was 72F, soil temp. at six inches was 57F, relative humidity was 40%, wind was northwest at 5-10 mph, soil moisture was fair, sugarbeets were in the 2 to 4 leaf stage, and common cocklebur was in the 2 leaf stage. The second herbicide application was 4:00 pm June 6 when the air temperature was 84F, soil temp. at six inches was 71F, relative humidity was 29%, wind was northeast at 5-8 mph, soil moisture was poor, sugarbeets were in the 4 leaf stage, and common cocklebur was in the 4 leaf stage. The third applicaton was 3:30 pm June 15 when the air temperature was 72F, soil temp. at six inches was 68F, relative humidity was 28%, wind was southeast at 5-7 mph, soil moisture was poor, sugarbeets were in the 6 leaf stage, and common cocklebur was in the 6 to 8 leaf stage. All herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeet injury and common cocklebur control were visually evaluated June 22 and July 6.

Treatment*	Rate	- June 22 - Sgbt inj	- June 22 - Cocb cntl	-- July 6 -- Sgbt inj	-- July 6 -- Cocb cntl
	(lb/A)	(%)			
Desmedipham/Desmedipham/--	0.25/0.33/--	4	86	0	88
Desmed/Desmed+Clpy/--	0.25/0.33+0.09/--	6	91	0	95
Desmed/Desmed+Clpy/--	0.25/0.33+0.19/--	6	96	0	94
Des+Clpy/Des+Clpy/--	0.25+0.09/0.33+0.09/--	6	99	0	97
Desmed+Clpy/Desmed/--	0.25+0.09/0.33/--	3	95	0	94
Desmed+Clpy/Desmed/--	0.25+0.19/0.33/--	3	85	0	91
--/--/Clopyralid	--/--/0.19	1	76	0	83
--/Clopyralid/--	--/0.09/--	1	51	0	81
--/Clopyralid/--	--/0.19/--	0	71	0	85
--/Clopyralid+Dash/--	--/0.09+0.25G/--	0	55	0	78
--/Clopyralid+Dash/--	--/0.19+0.25G/--	0	71	0	80
--/Clopyralid+Endothall/--	--/0.09+0.5/--	0	83	0	88
--/Clopyralid+Endothall/--	--/0.19+0.5/--	0	83	0	93
--/Pyrazon+BAS-09002S/--	--/2+0.25G/--	8	33	0	14
Desmed/Desmed/Desmed	0.25/0.33/0.5	13	96	0	97
Desm/Desm/Desm+Clpy	0.25/0.33/0.5+0.19	8	76	0	90
Desm/Desm/Desm+Endo	0.25/0.33/0.5+0.5	11	95	0	90
Desm/Desm/Desm+Etho	0.25/0.33/0.5+0.5	14	97	0	96
HIGH MEAN		14	99	0	97
LOW MEAN		0	33	0	14
EXP MEAN		5	80	0	85
C.V. %		99	13	0	11
LSD 5%		6	15	NS	13
LSD 1%		9	20	NS	18
# OF REPS		4	4	4	4

* BAS-09002S = BASF surfactant; Dash = BASF surfactant

Summary

Experiment was conducted in cooperation with Mark Law, Southern Minnesota Beet Sugar Cooperative. Common cocklebur control from clopyralid applied June 6 increased between the first evaluation on June 22 and the July 6 evaluation. Split applications of desmedipham gave common cocklebur control similar to split application of desmedipham plus clopyralid or single applications of clopyralid.

Simulated herbicide drift on sugarbeets, Amenia, 1989. Diethatyl + cycloate + triallate at 3+3+2 lbs ai/A was applied and incorporated with an Alloway 'Seed Better' April 26. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 26. Counter 15G at 12 lbs product/A was applied using a modified in-furrow system at planting. Sugarbeets were hand thinned to an eight inch spacing June 7. Plots were maintained weedfree by hand weeding thoughout the growing season and sethoxydim at 0.3 lbs/A+Dash at 1 qt/A was applied July 12 for grass control. The early treatments were applied 4:30 pm June 8 when the air temperature was 67F, soil temperature at six inches was 64F, relative humidity was 46%, wind was north at 12-15 mph, soil moisture was good, and sugarbeets were in the 2 to 6 leaf stage. The late treatments were applied 2:00 pm June 23 when the air temperature was 77F, soil temperature at six inches was 74F, relative humidity was 53%, wind was southeast at 2-6 mph, soil moisture was good, and sugarbeets were in the 4 to 10 leaf stage. Treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots. Sugarbeets were cultivated June 1 and July 12. Sugarbeets were evaluated for visible injury July 12. Sugarbeets were counted in the center two rows of each 38 foot plot August 24 and harvested October 2.

Treatment*	Rate	Sgbt inj	Sgbt popl	Sucro	Loss to Mol	Root Yield	Impur Index	Extra Sucro
	(lb/A)	(%)	(#/76')	(%)	(%)	(ton/A)		(lb/A)
Applied June 8:								
Untreated Check	0	0	95	15.5	1.7	15.1	817	4105
DPX-M6316&DPX-L5300+X-77	0.0001+0.25%	5	99	15.4	1.7	16.9	824	4541
DPX-M6316&DPX-L5300+X-77	0.00025+0.25%	6	102	15.3	1.7	14.6	819	3916
DPX-M6316&DPX-L5300+X-77	0.0005+0.25%	71	68	15.2	1.8	12.6	873	3333
DPX-M6316&DPX-L5300+X-77	0.001+0.25%	84	41	14.3	1.9	6.7	980	1681
DPX-M6316&DPX-L5300+X-77	0.002+0.25%	99	15	13.2	2.1	2.7	1177	581
DPX-M6316-60+X-77	0.0001+0.25%	6	97	15.0	1.7	11.0	838	2890
DPX-M6316-60+X-77	0.00025+0.25%	19	90	15.4	1.7	12.1	826	3258
DPX-M6316-60+X-77	0.0005+0.25%	52	90	15.1	1.7	12.1	836	3190
DPX-M6316-60+X-77	0.001+0.25%	86	53	15.2	1.8	6.7	899	1735
DPX-M6316-60+X-77	0.002+0.25%	97	23	14.0	2.0	2.8	1047	649
Imazethapyr+X-77	0.02+0.25%	100	1	----	---	----	----	----
Imazethapyr+X-77	0.01+0.25%	98	17	13.4	2.0	2.3	1063	530
Imazethapyr+X-77	0.005+0.25%	96	26	13.6	2.1	4.0	1110	936
Imazethapyr+X-77	0.001+0.25%	13	97	15.3	1.6	12.6	782	3394
AC 222,293	0.2	93	58	14.6	2.0	8.0	975	1993
AC 222,293	0.1	59	74	15.2	1.7	12.2	819	3242
AC 222,293	0.05	11	91	15.6	1.6	13.8	765	3816
AC 222,293	0.025	1	98	15.1	1.8	15.9	851	4171
2,4-D	0.06	55	88	15.4	1.8	7.5	870	2002
Bromoxynil-RP	0.06	44	39	15.4	1.8	11.1	846	2990
Bentazon	0.2	14	74	15.4	1.8	14.3	856	3835
DPX-M6316&DPX-L5300+Difp	0.001+0.03	51	79	15.0	1.9	12.4	935	3175
DPX-M6&DPX-L5+Difp+OC	0.001+0.03+0.25G	96	35	13.9	2.1	6.2	1105	1451

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Simulated herbicide drift on sugarbeets, Amenia, 1989. (continued)

Treatment*	Rate (lb/A)	Sgbt inj (%)	Sgbt popl (#/76')	Sucro (%)	Loss to Mol (%)	Root Yield (ton/A)	Impur Index	Extra Sucro (lb/A)
Applied June 23:								
Untreated Check		0	93	15.2	1.7	14.3	828	3816
DPX-M6316&DPX-L5300+X-77	0.0001+0.25%	5	89	15.0	1.8	13.2	886	3428
DPX-M6316&DPX-L5300+X-77	0.00025+0.25%	25	87	15.3	1.7	13.7	816	3683
DPX-M6316&DPX-L5300+X-77	0.0005+0.25%	79	88	14.6	1.9	7.5	937	1874
DPX-M6316&DPX-L5300+X-77	0.001+0.25%	88	69	14.4	2.0	7.1	983	1751
DPX-M6316&DPX-L5300+X-77	0.002+0.25%	97	34	13.4	2.1	3.5	1144	798
DPX-M6316-60+X-77	0.0001+0.25%	4	93	15.3	1.7	12.5	801	3358
DPX-M6316-60+X-77	0.00025+0.25%	19	103	15.4	1.7	13.2	810	3573
DPX-M6316-60+X-77	0.0005+0.25%	56	93	15.0	1.8	10.0	881	2609
DPX-M6316-60+X-77	0.001+0.25%	89	67	13.7	2.0	4.8	1068	1096
DPX-M6316-60+X-77	0.002+0.25%	97	44	13.4	2.2	3.8	1161	850
Imazethapyr+X-77	0.02+0.25%	100	2	----	---	----	----	----
Imazethapyr+X-77	0.01+0.25%	97	19	12.2	2.2	1.1	1285	221
Imazethapyr+X-77	0.005+0.25%	92	67	13.4	2.2	5.6	1193	1247
Imazethapyr+X-77	0.001+0.25%	78	80	14.7	2.0	9.0	979	2253
AC 222,293	0.2	76	76	14.5	2.0	8.0	1000	1967
AC 222,293	0.1	30	87	14.6	1.8	11.6	913	2915
AC 222,293	0.05	10	91	14.9	1.7	12.0	852	3110
AC 222,293	0.025	3	100	15.5	1.8	14.2	862	3818
2,4-D	0.06	34	100	14.9	1.9	8.0	944	2052
Bromoxynil-RP	0.06	14	97	15.2	1.8	11.8	836	3152
Bentazon	0.2	8	98	15.2	1.8	12.9	878	3417
DPX-M6316&DPX-L5300+Difp	0.001+0.03	51	86	14.9	1.8	10.0	907	2590
DPX-M6&DPX-L5+Difp+OC	0.001+0.03+0.25G	96	43	13.4	2.1	3.6	1128	818
C.V. %		15	13	3.7	6.9	18.2	10	18
LSD 5%		11	13	.7	.2	2.3	118	617
LSD 1%		14	16	.9	.2	3.1	155	811
# OF REPS		4	4	4	4	4	4	4

* X-77 = non-ionic surfactant from Chevron Chemical Co.;
OC = BASF oil concentrate (Booster Plus E)

Summary

DPX-M6316-60 at 0.0001 lb/A or higher applied June 8 reduced extractable sucrose/A. DPX-M6316&DPX-L5300 at 0.0001 or 0.00025 lb/A did not significantly reduce extractable sucrose/A. DPX-M6316-60 was more toxic to 2 to 6 leaf sugarbeets on June 8 than DPX-M6316&DPX-L5300. However, sugarbeets with 4 to 10 leaves treated on June 23 had a greater loss in extractable sucrose from DPX-M6316&DPX-L5300 at 0.0005 lb/A than from DPX-M6316-60 at 0.0005 lb/A. DPX-M6316&DPX-L5300+diclofop gave less sugarbeet injury and less yield loss than DPX-M6316&DPX-L5300+diclofop+oil concentrate. Imazethapyr reduced extractable sucrose/A at all tested rates and with both application dates. Imazethapyr at 0.001 lb/A caused losses in extractable sucrose/A similar to DPX-M6316-60 at 0.0005 lb/A. Bentazon at 0.2 lb/A caused visible leaf burn on sugarbeets but did not significantly reduce extractable sucrose/A. AC 222,293 at 0.2 lb/A caused losses in extractable sucrose/A similar to DPX-M6316-60 from 0.0005 to 0.001 lb/A.

Simulated herbicide drift on sugarbeets, Renville, 1989. 'KW 1745' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12. Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots 10:00 am June 19 when the air temperature was 79F, soil temperature at six inches was 72F, relative humidity was 60%, wind was northwest at 6-8 mph, soil moisture was poor, and sugarbeets were in the 6 leaf stage. Sugarbeet injury was evaluated June 26 and July 10.

Treatment*	Rate	-June 26- Sugarbeet injury	-July 10- Sugarbeet injury
	(lb/A)	---------- (%)	---------
DPX-M6316&DPX-L5300+X-77	0.002+0.25%	85	83
DPX-M6316&DPX-L5300+X-77	0.001+0.25%	65	61
DPX-M6316&DPX-L5300+X-77	0.0005+0.25%	45	30
DPX-M6316&DPX-L5300+X-77	0.00025+0.25%	3	0
DPX-M6316-60+X-77	0.002+0.25%	70	60
DPX-M6316-60+X-77	0.001+0.25%	10	5
DPX-M6316-60+X-77	0.0005+0.25%	11	8
DPX-M6316-60+X-77	0.00025+0.25%	21	18
Imazethapyr+X-77	0.02+0.25%	90	89
Imazethapyr+X-77	0.01+0.25%	74	58
Imazethapyr+X-77	0.005+0.25%	29	21
Imazethapyr+X-77	0.001+0.25%	3	0
2,4-D	0.125	21	4
2,4-D	0.06	8	0
Dicamba	0.125	55	33
Dicamba	0.06	20	20
HIGH MEAN		90	89
LOW MEAN		3	0
EXP MEAN		38	30
C.V. %		19	32
LSD 5%		11	14
LSD 1%		14	18
# OF REPS		4	4

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

Summary

DPX-M6316&DPX-L5300 caused greater injury to sugarbeets than DPX-M6316-60 except at the lowest rate. Imazethapyr at 0.001 lb/A caused less sugarbeet injury than DPX-M6316&DPX-L5300 at 0.001 lb/A. Sugarbeets generally were injured less by herbicide treatments at this location than at Amenia. Sugarbeets at Amenia were treated with Counter insecticide while sugarbeets at Renville were untreated. Soil moisture was better at Amenia than at Renville. These two factors may have contributed to greater sugarbeet injury at Amenia than at Renville.

Canada thistle control with clopyralid, Fargo, 1989. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 12. Treatments were applied 1:00 pm May 31 when the air temperature was 67F, soil temperature at six inches was 58F, relative humidity was 67%, wind was 5 mph, soil moisture was good, sugarbeets were in the cotyledon stage, and Canada thistle was emerging to six inches tall. The second half of split application treatments was applied 4:00 pm June 14 when the air temperature was 73F, soil temperature at six inches was 68F, relative humidity was 36%, wind was northeast at 8 mph, soil moisture was fair, sugarbeets were in the 2-6 leaf stage, and Canada thistle was 5 to 10 inches tall. Three treatments were applied when Canada thistle was in the bud stage 2:30 pm June 26 when the air temperature was 77F, soil temperature at six inches was 72F, relative humidity was 46%, wind was west at 20 mph, soil moisture was good, sugarbeets were in the 6 to 10 leaf stage, and Canada thistle were 2 to 18 inches tall and budding. All treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to eight rows of nine row plots. Sugarbeets were cultivated June 8, June 14, and June 29. Canada thistle control was evaluated September 18, 1989.

Treatment*	Rate (lb/A)	Canada Thistle control (%)
Untreated Check	0	0
Clopyralid	0.09	66
Clopyralid	0.19	84
Clopyralid	0.25	64
Clopyralid+Desmedipham	0.19+0.5	82
Clopyralid+Desmedipham	0.25+0.5	87
Clopyralid+Dash	0.09+0.25G	53
Clopyralid+Dash	0.19+0.25G	88
Clopyralid+Dash	0.25+0.25G	86
Clopyralid+Endothall	0.19+0.75	79
Clopyralid+Sun-It	0.19+0.25G	74
Clopyralid+OC	0.19+0.25G	81
Clopyralid/Clopyralid	0.095/0.095	79
Clopyralid/Clopyralid	0.125/0.125	88
Glyphosate+X-77 (bud)	1.5+0.25%	59
Glyt+Dicamba+X-77 (bud)	1+0.25+0.25%	64
Glyt+Clpy+X-77 (bud)	1+0.19+0.25%	60
Untreated Check		0
C.V. %		22
LSD 5%		20
LSD 1%		27
# OF REPS		4

* Dash = BASF surfactant; OC = BASF oil concentrate (Booster Plus E); X-77 = non-ionic surfactant from Chevron Chemical Co.; Sun-It = Agsco sunflower methyl ester

Summary

Desmedipham in combination with clopyralid did not reduce Canada thistle control compared to clopyralid alone. Clopyralid at 0.19 lb/A plus additives gave Canada thistle control similar to clopyralid alone. Split application of clopyralid did not improve control. Clopyralid gave greater control of Canada thistle than glyphosate.

Bivert and Safe 6 with Sethoxydim, Fargo, 1989. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. Treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots 10:30 am June 19 when the air temperature was 81F, the soil temperature at six inches was 69F, relative humidity was 45%, wind was south at 15-20 mph, soil moisture was fair, sugarbeets were in the 6 leaf stage, and wild oats was in the 8 leaf stage to 13 inches tall. The desired amount of water for each treatment was measured prior to adding the chemicals. Chemicals were added to the water as listed from left to right mixing each combination of chemicals to the left of the parenthesis before adding the remaining chemicals to the spray solution. Bromoxynil + MCPA at 0.38 + 0.38 lb/A was broadcast over the entire experiment July 10. Wild oats control was evaluated July 17.

Treatment (rate)*	Wild Oats control (%)
Desm+Bivert (0.5+0.75pt)+Seth+Dash (0.2+2 pt)	79
Seth+Bivert (0.2+0.25pt)+Dash (2pt)+Desm (0.5)	100
Desm+Seth+Bivert (0.5+0.2+1 pt)+Dash (2 pt)	83
Desmedipham+Sethoxydim+Dash (0.5+0.2+2 pt)	83
Sethoxydim+Dash (0.1+2 pt)	96
Sethoxydim+Dash (0.2+2 pt)	99
Seth+Bivert (0.2+0.25 pt)+Dash (2 pt)	100
Safe 6 (pH 5)+Seth+Dash (0.1+2 pt)	98
Safe 6 (pH 5)+Seth+Dash (0.2+2 pt)	98
NaHCO3(1000ppm)+Safe6(pH5)+Seth+Dash(0.1+2pt)	79
NaHCO3(1000ppm)+Safe6(pH5)+Seth+Dash(0.2+2pt)	99
HIGH MEAN	100
LOW MEAN	79
EXP MEAN	92
C.V. %	10
LSD 5%	14
LSD 1%	19
# OF REPS	4

* Safe 6 = chemical used to adjust water pH to 5; $NaHCO_3$ = baking soda; Dash = BASF surfactant; Bivert = adjuvant from Stull Chemical Co.

Summary

Desmedipham+sethoxydim+Dash gave less wild oats control than sethoxydim + Dash. Mixing sethoxydim with Bivert in water before adding Dash and desmedipham eliminated the antagonism between desmedipham and sethoxydim. Other mixing orders did not reduce antagonism. Safe 6 did not overcome the antagonism of wild oats control from sethoxydim at 0.1 lb/A caused by $NaHCO_3$ at 1000 ppm.

Wild oats control, Fargo, 1989. Triallate was applied in 17 gpa water at 40 psi through 8002 nozzles and rototiller incorporated two inches deep 4:30 pm May 3 when the air temperature was 69F, relative humidity was 33%, wind was west at 20 mph, and soil moisture was good. 'Van der Have Puressa II' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 4. The first postemergence herbicide application was 4:15 pm June 14 when the air temperature was 73F, soil temperature at six inches was 67F, relative humidity was 36%, wind was northeast at 8 mph, soil moisture was fair, sugarbeets were in the 4 leaf stage, and wild oats was 8 to 14 inches tall. The second postemergence application was 1:00 pm June 26 when the air temperature was 77F, soil temperature at six inches was 72F, relative humidity was 46%, wind was west at 20 mph, and soil moisture was good. All treatments were applied to the center four rows of six row plots. Postemergence herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles. Bromoxynil + MCPA at 0.375 + 0.375 lb/A was applied to the entire plot area July 10 to control broadleaf weeds. Wild oats control was evaluated July 17.

Treatment*	Rate (lb/A)	Wild Oats control (%)
Untreated Check	0	0
Triallate/--/--	1.5/--/--	99
Triallate/Seth+Dash/--	1.5/0.2+0.25G/--	100
--/Sethoxydim+Dash/--	--/0.2+0.25G/--	99
--/--/Sethoxydim+Dash	--/--/0.2+0.25G	100
--/Sethoxydim+Dash/Sethoxydim+Dash	--/0.2+0.25G/0.2+0.25G	100
Triallate/Sethoxy+Dash/Sethoxy+Dash	1.5/0.2+0.25G/0.2+0.25G	100
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		85
C.V. %		2
LSD 5%		2
LSD 1%		3
# OF REPS		4

* Dash = BASF surfactant

Summary

All treatments gave nearly total control of wild oats.

Sethoxydim and clopyralid on hand weeded sugarbeets, Fargo, 1989. Cycloate + diethatyl at 3+3 lb/A was broadcast over the entire experiment and incorporated with an 'Alloway Seed Better' May 5. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. Herbicide treatments were applied 5:00 pm June 22 when the air temperature was 75F, soil temp. at six inches was 71F, relative humidity was 44%, wind was easterly at 2 to 4 mph, soil moisture was good, and sugarbeets were in the 6 to 8 leaf stage. Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to four row plots. Plots were cultivated June 5 and June 29. Plots were hand weeded and hand thinned to an 8 inch spacing June 30. Plots were maintained weed free throughout the growing season. Sugarbeet injury was evaluated July 19. The injury scale was 5% for slight cupping of the leaf edges to 35% when the leaves were severely cupped with very little leaf surface still visible. Sugarbeets in the center two rows of each 30 foot plot were counted August 18 and harvested September 27.

Treatment*	Rate (lb/A)	Sgbt inj (%)	Sgbt popl (#/60')	Sucr (%)	Loss to Mol (%)	Root Yield (ton/A)	Impur Index	Extract Sucrose (lb/A)
Untreated Check	0	0	88	13.0	2.0	26.3	1138	5670
Sethoxydim+Dash	0.2+0.25G	0	98	13.6	1.9	24.5	1037	5612
Sethoxydim+Dash	0.4+0.25G	0	82	13.6	1.9	23.8	1011	5536
Sethoxydim+DashII	0.2+0.25G	0	91	13.6	1.8	24.8	951	5811
Sethoxydim+DashII	0.4+0.25G	0	91	13.8	1.9	23.8	995	5586
Sethoxydim+Sun-It	0.2+0.25G	0	95	13.8	1.7	25.7	918	6109
Sethoxydim+Sun-It	0.4+0.25G	0	86	13.6	1.8	24.1	985	5573
Seth+Dash+28%N	0.4+0.25G+1G	0	86	13.8	1.8	23.2	969	5493
Seth+Sun-It+28%N	0.4+0.25G+1G	0	89	12.4	1.8	23.1	1018	4874
Sethoxydim(II)	0.4	0	90	13.5	1.9	24.6	1007	5627
Sethoxydim(II)+Dash	0.4+0.25G	0	87	13.5	1.8	23.8	992	5468
Seth(II)+Dash(II)	0.4+0.25G	0	98	13.5	1.8	24.5	982	5692
Untreated Check	0	0	96	13.8	1.8	23.7	981	5583
Clopyralid	0.1	4	94	13.7	1.9	22.2	1019	5214
Clopyralid	0.2	8	97	13.8	1.8	22.5	945	5348
Clopyralid	0.4	19	97	13.5	2.0	23.5	1056	5347
Clopyralid+Dash	0.1+0.25G	6	87	13.6	1.8	24.3	989	5644
Clopyralid+Dash	0.2+0.25G	9	90	13.8	1.8	24.7	953	5882
Clopyralid+Dash	0.4+0.25G	23	88	13.0	2.0	20.8	1128	4528
Clopyralid+Sun-It	0.1+0.25G	5	90	14.0	1.8	23.5	924	5728
Clopyralid+Sun-It	0.2+0.25G	10	98	13.5	1.8	23.6	994	5430
Clopyralid+Sun-It	0.4+0.25G	18	94	13.5	1.9	21.8	1016	5000
Clopyralid+Dash(II)	0.4+0.25G	25	102	13.8	1.9	21.7	1006	5087
Clpy+Seth+Dash	0.2+0.2+0.25G	11	95	13.6	1.8	23.6	969	5472
Clpy+Seth+Dash	0.4+0.2+0.25G	26	103	13.2	2.0	21.8	1090	4844
Clpy+Seth+Dash	0.4+0.4+0.25G	18	97	13.7	1.8	22.6	1000	5312
Clpy+Seth+Dash+28%N	0.4+0.2+0.25G+1G	16	100	13.4	2.0	21.8	1074	4911
Clpy+Seth(II)+Dash	0.4+0.2+0.25G	15	97	13.1	2.0	23.1	1114	5127
Clpy+Seth+Sun-It	0.2+0.2+0.25G	9	91	13.2	1.9	25.8	1033	5733
Clpy+Seth+Sun-It	0.4+0.2+0.25G	15	97	13.7	1.9	24.5	994	5722
Clpy+Seth+Sun-It	0.4+0.4+0.25G	19	102	13.7	1.8	22.6	968	5265
Clpy+Seth+Sun-It+28%N	0.4+0.2+0.25G+1G	18	95	13.2	1.9	21.4	1036	4755
Clopyralid+Sethoxydim	0.4+0.4	15	90	13.6	2.0	21.6	1072	4921
C.V. %		47	11	5.6	9.3	8.7	13	12
LSD 5%		6	NS	NS	NS	2.8	NS	NS
# OF REPS		4	4	4	4	4	4	4

* Dash = BASF surfactant; Sun-It = Agsco sunflower methyl ester;
28%N = 28% N solution containing urea and NH_4NO_3

(continued on next page)

Sethoxydim and clopyralid on hand weeded sugarbeets, Fargo, 1989. (continued)

SUMMARY: None of the treatments significantly affected extractable sucrose/A. Sugarbeet yield in T/A was reduced by clopyralid at 0.4 lb/A plus Dash, Sun-It, or Dash(II) at 0.25 gal/A; clopyralid+sethoxydim+Dash at 0.4+0.2 lb/A + 0.25 gal/A; clopyralid+sethoxydim+Dash+28%N at 0.4 + 0.2 lb/A + 0.25 + 1 gal/A; and clopyralid+sethoxydim+Sun-It+28%N at 0.4+0.2 lb/A + 0.25+1 gal/A as compared to the mean of the two untreated checks.

Sethoxydim and clopyralid on herbicide treated and untreated soil, Fargo, 1989. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi to the center four rows of six row plots through 8002 nozzles and incorporated with a rototiller set four inches deep 4:30 pm May 3 when the air temperature was 69F, relative humidity was 33%, wind was west at 20 mph, and soil moisture was good. 'KW 1745' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 3. Postemergence herbicide treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots 2:00 pm June 26 when the air temperature was 77F, soil temperature at six inches was 72F, relative humidity was 46%, wind was west at 20 mph, soil moisture was good, and sugarbeets were in the 8 to 10 leaf stage. Sugarbeets were hand thinned to an eight inch spacing June 22. Sugarbeets were hand weeded June 22 and maintained weed free throughout the growing season. Sugarbeets were cultivated June 5 and June 29. The center two rows of 34 foot plots were harvested September 29.

Treatment*	Rate	Sucros	Loss to Mol	Root Yield	Impur Index	Extract Sucrose
	(lb/A)	(%)	(%)	(ton/A)		(lb/A)
Cycloate+Diet/Seth+Dash	3+3/0.4+0.25G	13.3	2.3	20.7	1251	4441
Sethoxydim+Dash	0.4+0.25G	13.3	2.3	21.0	1272	4489
Untreated	0	13.1	2.3	19.8	1292	4175
Cycloate+Diethatyl/Clopyralid	3+3/0.4	12.7	2.4	20.2	1357	4064
Clopyralid	0.4	12.7	2.4	19.9	1372	3998
Cycloate+Diethatyl/Clpy+Dash	3+3/0.4+0.25G	12.7	2.4	19.8	1364	3998
Clopyralid+Dash	0.4+0.25G	12.9	2.4	19.1	1345	3919
Cycl+Diet/Clpy+Seth+Dash	3+3/0.4+0.5+0.25G	12.6	2.3	21.2	1351	4263
Clopyralid+Sethoxydim+Dash	0.4+0.4+0.25G	12.9	2.4	19.5	1355	3995
HIGH MEAN		13.3	2.4	21.2	1372	4489
LOW MEAN		12.6	2.3	19.1	1251	3919
EXP MEAN		12.9	2.3	20.1	1329	4149
C.V. %		3.3	2.8	12.6	5	11
LSD 5%		NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4

* Dash = BASF surfactant

Summary

None of the treatments significantly affected sugarbeet yield.

Time of sethoxydim and clopyralid application on hand weeded sugarbeets, Fargo, 1989. Cycloate + diethatyl at 3+3 lb/A was broadcast over entire experiment and incorporated with an 'Alloway Seed Better' May 5. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 5. The first postemergence herbicide application was 6:30 pm June 8 when the air temperature was 68F, soil temperature at six inches was 62F, relative humidity was 43%, wind was northeast at 8-10 mph, soil moisture was good, and sugarbeets were in the 2 to 4 leaf stage. The second postemergence herbicide application was applied 6:00 pm June 22 when the air temperature was 75F, soil temp. at six inches was 71F, relative humidity was 44%, wind was east at 2 to 4 mph, soil moisture was good, and sugarbeets were in the 6 to 8 leaf stage. Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to four row plots. Plots were cultivated June 5 and June 29. Plots were hand weeded and hand thinned to an 8 inch spacing June 30. Plots were maintained weed free throughout the growing season. A visual evaluation of sugarbeet injury was taken July 19. The injury scale was 5% for slight cupping of the leaf edges to 35% when the leaves were severely cupped with very little leaf surface still visible. Sugarbeets in the center two rows of each 30 foot plot were counted August 18 and harvested September 27.

Treatment*	Rate (lb/A)	Sgbt inj (%)	Sgbt Popl (#/60ft)	Sucrose (%)	Loss to Mol (%)	Root Yield (ton/A)	Impur Index	Extract Sucrose (lb/A)
Applied June 8:								
Sethoxydim+Dash	0.4+0.25G	0	94	14.6	1.6	25.2	821	6451
Clopyralid	0.2	4	97	14.1	1.7	24.8	927	6069
Clopyralid	0.4	9	102	14.2	1.8	23.3	922	5661
Clopyralid+Dash	0.2+0.25G	4	101	14.1	1.7	23.9	889	5826
Clopyralid+Dash	0.4+0.25G	8	103	13.7	1.9	22.4	1003	5231
Clpy+Seth+Dash	0.2+0.4+0.25G	3	99	13.6	1.9	23.3	1008	5411
Clpy+Seth+Dash	0.4+0.4+0.25G	9	100	13.7	1.8	22.2	985	5200
Applied June 22:								
Sethoxydim+Dash	0.4+0.25G	0	101	14.0	1.7	23.8	930	5718
Clopyralid	0.2	14	105	14.3	1.7	23.9	862	5986
Clopyralid	0.4	24	103	14.2	1.7	23.5	880	5810
Clopyralid+Dash	0.2+0.25G	9	92	13.4	1.9	22.7	1064	5074
Clopyralid+Dash	0.4+0.25G	21	105	13.3	1.9	22.2	1072	4976
Clpy+Seth+Dash	0.2+0.4+0.25G	11	104	14.0	1.8	24.3	940	5853
Clpy+Seth+Dash	0.4+0.4+0.25G	20	98	13.4	1.9	22.9	1024	5219
C.V. %		42	5	5.1	10.5	7.1	15	10
LSD 5%		6	NS	NS	NS	NS	NS	834
LSD 1%		8	NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4

* Dash = BASF surfactant

Summary

Sugarbeets treated June 8 with clopyralid at 0.4 lb/A + Dash, clopyralid + sethoxydim at 0.2+0.4 lb/A + Dash, and clopyralid + sethoxydim at 0.4+0.4 lb/A + Dash yielded less extractable sucrose/A than those treated with sethoxydim at 0.4 lb/A + Dash. Sugarbeets treated June 22 with clopyralid at 0.2 or 0.4 lb/A + Dash yielded less extractable sucrose/A than those treated with clopyralid at 0.2 lb/A. The yield of extractable sucrose/A and percent sugarbeet injury did not appear to be closely related.

Spring barley as a cover crop for sugarbeets, Amenia, 1989. 'Azure' barley was seeded at various rates with a John Deere grain drill across the sugarbeet plots April 27. 'Mitsui Monohikari' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 27. Counter 15G at 12 lb product/A was applied using a modified in-furrow system at planting. Sethoxydim at 0.2 lb ai/A + OC (BASF oil concentrate Booster Plus E) at 1 qt/A was applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center four rows of six row plots at various dates to control the barley cover crop. The first herbicide application was 2:30 pm May 16 when the air temperature was 88F, soil temperature at six inches was 71F, relative humidity was 23%, wind was south at 15-20 mph, soil moisture was poor, sugarbeets were in the cotyledon stage, and barley was in the 2 leaf stage (3 to 4 inches tall). The second application was 11:30 am June 1 when the air temperature was 76F, soil temperature at six inches was 68F, relative humidity was 45%, wind was southwest at 10 mph, soil moisture was good, sugarbeets were in the four leaf stage, and barley was 6 to 8 inches tall. The third application was 11:00 am June 13 when the air temperature was 55F, soil temperature at six inches was 59F, relative humidity was 76%, wind was north at 12 mph, soil moisture was good, sugarbeets were in the 8 leaf stage, and barley was 8 to 12 inches tall. Sugarbeets were cultivated May 23 and June 19. Sugarbeets were maintained weed free throughout the growing season by hand weeding. Sugarbeets were hand thinned to an eight inch spacing June 7. The center two rows of 30 foot plots were harvested and counted October 3.

Barley cover crop seeding rate (bushels/A)	Herbicide Application Date	Sgbt Popl (#/60ft)	Sucrose (%)	Loss to Molas (%)	Root Yield (ton/A)	Impurity Index	Extrac Sucros (lb/A)
0.00	May 16	55	15.2	1.9	15.1	900	3948
0.33	May 16	56	15.3	1.8	13.9	854	3742
0.66	May 16	56	15.3	1.8	15.6	854	4162
1.00	May 16	54	15.6	1.8	12.4	821	3431
0.00	June 1	54	15.3	1.8	13.3	844	3577
0.33	June 1	44	14.5	1.9	10.7	956	2655
0.66	June 1	50	15.0	1.6	12.9	802	3406
1.00	June 1	56	14.9	1.8	14.7	863	3805
0.00	June 13	49	14.8	1.8	14.2	867	3655
0.33	June 13	50	15.0	1.8	11.3	900	2962
0.66	June 13	50	14.7	1.6	13.1	795	3381
1.00	June 13	46	14.8	1.8	11.2	887	2920
HIGH MEAN		56	15.6	1.9	15.6	956	4162
LOW MEAN		44	14.5	1.6	10.7	795	2655
EXP MEAN		52	15.0	1.8	13.2	862	3470
C.V. %		14	3.4	7.8	19.1	8	21
LSD 5%		NS	NS	NS	NS	NS	NS
LSD 1%		NS	NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4

Summary

Sethoxydim plus oil concentrate gave nearly total control of barley at all three dates of application and control evaluations are not reported in the table. Sugarbeet yield was not significantly affected by barley cover crop or the date of herbicide application. However, sugarbeets produced where barley was treated with sethoxydim on June 1 or June 13 tended to yield less than sugarbeets produced on barley treated May 16.

<u>Burndown of winter wheat and winter rye cover crop prior to sugarbeet emergence, Amenia, 1988-1989.</u> A 12 foot strip of 'Rough Rider' winter wheat and a 12 foot strip of 'Rymin' winter rye were seeded across herbicide plots at 30 lb/A September 8, 1988. 'Maribo 403' sugarbeet was seeded 1.25 inches deep in 22 inch rows April 28, 1989. Lorsban 15G was applied at 12 lb/A of product using a modified in-furrow system at planting. Herbicide treatments were applied after planting at 3:30 pm April 28 when the air temperature was 57F, soil temp. at six inches was 52F, relative humidity was 27%, wind was northeast at 20-25 mph, soil moisture was fair, winter wheat was 2 inches tall and tillering, and winter rye was 3 inches tall and tillering. Herbicides were applied to the center four rows of six row plots across the cover crop strips. All treatments were applied in 8.5 gpa water at 40 psi using 8001 nozzles. Winter wheat and winter rye control were evaluated May 22.

Treatment*	Rate (lb/A)	Winter Wheat (%)	Winter Rye (%)
Glyphosate+X-77	0.19+0.5%	11	8
Glyphosate+X-77	0.28+0.5%	44	29
Glyphosate+X-77	0.38+0.5%	45	50
Glyphosate+Diethatyl+X-77	0.19+5+0.5%	8	15
Glyphosate+Diethatyl+X-77	0.38+5+0.5%	43	49
Glyphosate+Ethofumesate+X-77	0.19+3+0.5%	26	18
Glyphosate+Ethofumesate+X-77	0.38+3+0.5%	48	50
Glyphosate+Metolachlor+X-77	0.19+3+0.5%	18	18
Glyphosate+Metolachlor+X-77	0.38+3+0.5%	36	49
Glyphosate+Pyrazon+X-77	0.19+4+0.5%	15	13
Glyphosate+Pyrazon+X-77	0.38+4+0.5%	25	36
Sethoxydim+Dash	0.1+0.25G	10	0
Sethoxydim+Dash	0.2+0.25G	21	10
Sethoxydim+Dash	0.3+0.25G	48	29
Sethoxydim+28%N+Dash	0.1+1.0G+0.25G	4	0
Sethoxydim+28%N+Dash	0.2+1.0G+0.25G	31	10
Sethoxydim+28%N+Dash	0.3+1.0G+0.25G	38	38
Fluazifop-P+OC	0.1+0.25G	24	9
Fluazifop-P+OC	0.2+0.25G	50	28
Fluazifop-P+OC	0.3+0.25G	68	65
HIGH MEAN		68	65
LOW MEAN		4	0
EXP MEAN		31	26
C.V. %		42	39
LSD 5%		18	15
LSD 1%		24	19
# OF REPS		4	4

* OC = BASF oil concentrate (Booster Plus E); Dash = BASF surfactant;
28%N = 28% N solution containing urea and NH_4NO_3;
X-77 = non-ionic surfactant from Chevron Chemical Co.

Summary

The greatest control of winter wheat and winter rye was from fluazifop-P at 0.3 lb/A. However, even this treatment only gave 65 to 68% control.

Time of cover crop burn-down, Amenia, 1988-1989. 'Rymin' winter rye was seeded in 18 inch rows diagonally across herbicide plots at a seeding rate of 30 pounds per acre September 8, 1988. An Alloway 'Seed Better' was used for a light tillage pass before seeding 'Maribo 403' sugarbeet 1.25 inches deep in 22 inch rows May 2, 1989. Counter 15G was applied at 12 pounds product per acre using a modified in-furrow system at planting. The "0" weeks after planting (0WAP) treatments were applied 10:30 am May 2 when the air temperature was 70F, soil temp. at six inches was 53F, relative humidity was 30%, wind was west at 15 mph, soil moisture was poor, and rye was 3 inches tall and tillering. The 2 WAP treatments were applied 12:30 pm May 16 when the air temperature was 88F, soil temp. at six inches was 71F, relative humidity was 23%, wind was south at 15-20 mph, soil moisture was poor, sugarbeets were in the cotyledon stage, and rye was 6-10 inches tall. The 0 WAP and 2 WAP treatments were applied to the center four rows of six row plots with an Alloway band sprayer using 400067E nozzles at 45 psi to deliver 13.3 gpa in a 10 inch band. The 3 WAP treatments were applied May 23 when the air temperature was 80F, soil temp. at six inches was 70F, relative humidity was 58%, wind was north at 12 mph, sugarbeets were cotyledon to 2 leaf, and rye was 8-15 inches tall. The 4 WAP treatments were applied 10:00 am June 1 when the air temperature was 76F, soil temp. at six inches was 68F, relative humidity was 45%, wind was southwest at 10 mph, soil moisture was good, sugarbeets were cotyledon to 4 leaf, and rye was 20 inches tall and heading. The 3 WAP and 4 WAP treatments were applied to the center four rows of six row plots with a broadcast sprayer using 8001 nozzles at 40 psi to deliver 8.5 gpa. All plots were cultivated June 1 (6 hours after spraying), June 8, June 19, and July 5. Hand weeding was done throughout the growing season to control broadleaf weeds. Sugarbeets were hand thinned to an 8 inch spacing June 16. The center two rows of 34 foot plots were harvested and counted October 3, 1989.

Treatment*	Rate	Harvest Sgbt Popl	Sucro	Loss to Mol	Root Yield	Impur Index	Extrac Sucros
	(lb/A)	(#/68')	(%)	(%)	(T/A)		(lb/A)
Glyphosate+X-77 (0WAP)	0.19+0.5%	36	14.3	1.9	5.7	977	1401
Glyphosate+X-77 (0WAP)	0.38+0.5%	22	13.9	1.7	3.6	907	890
Sethoxy+Dash+28%N (2WAP)	0.2+0.25G+1.0G	33	14.5	1.9	5.8	958	1437
Sethoxy+Dash+28%N (2WAP)	0.3+0.25G+1.0G	52	14.9	1.9	10.0	926	2591
Sethoxy+Dash+28%N (3WAP)	0.2+0.25G+1.0G	38	15.1	1.8	7.6	881	1992
Sethoxy+Dash+28%N (3WAP)	0.3+0.25G+1.0G	46	14.6	2.0	9.3	974	2328
Sethoxy+Dash+28%N (4WAP)	0.2+0.25G+1.0G	30	14.2	2.0	6.1	993	1460
Sethoxy+Dash+28%N (4WAP)	0.3+0.25G+1.0G	45	14.7	1.9	8.9	925	2241
Fluazifop+OC (2WAP)	0.1+0.25G	29	14.5	1.9	5.2	939	1290
Fluazifop+OC (2WAP)	0.2+0.25G	34	14.8	1.8	6.1	886	1558
Fluazifop+OC (3WAP)	0.1+0.25G	35	14.5	1.9	6.1	927	1537
Fluazifop+OC (3WAP)	0.2+0.25G	40	15.0	1.9	7.6	914	1959
Fluazifop+OC (4WAP)	0.1+0.25G	28	14.3	1.9	5.4	948	1333
Fluazifop+OC (4WAP)	0.2+0.25G	32	14.6	1.9	6.6	930	1651

(continued on next page)

Time of cover crop burn-down, Amenia, 1988-1989. (continued)

Treatment*	Rate (lb/A)	Harvest Sgbt Popl (#/68')	Sucro (%)	Loss to Mol (%)	Root Yield (T/A)	Impur Index	Extrac Sucros (lb/A)
Glyp+X-77 (0WAP)/Seth+Dash+28%N (2WAP)	0.19+0.5%/0.2+0.25G+1G	36	15.1	1.9	7.7	915	2038
Glyp+X-77 (0WAP)/Seth+Dash+28%N (3WAP)	0.19+0.5%/0.2+0.25G+1G	43	15.0	1.9	8.7	913	2237
Glyp+X-77 (0WAP)/Seth+Dash+28%N (4WAP)	0.19+0.5%/0.2+0.25G+1G	44	14.3	2.0	9.3	1011	2267
Glyp+X-77 (0WAP)/Seth+Dash+28%N (2WAP)	0.38+0.5%/0.3+0.25G+1G	48	14.9	1.9	9.2	952	2357
Glyp+X-77 (0WAP)/Seth+Dash+28%N (3WAP)	0.38+0.5%/0.3+0.25G+1G	48	15.2	1.8	9.7	873	2565
Glyp+X-77 (0WAP)/Seth+Dash+28%N (4WAP)	0.38+0.5%/0.3+0.25G+1G	46	14.7	2.0	9.7	991	2420
HIGH MEAN		52	15.2	2.0	10.0	1011	2591
LOW MEAN		22	13.9	1.7	3.6	873	890
EXP MEAN		38	14.6	1.9	7.4	937	1878
C.V. %		21	3.4	7.4	23.7	8	24
LSD 5%		11	.7	NS	2.5	NS	636
LSD 1%		15	NS	NS	3.3	NS	847
# OF REPS		4	4	4	4	4	4

* X-77 = non-ionic surfactant from Chevron Chemical Co.;
Dash = BASF surfactant; 28%N = 28% N solution containing urea and NH_4NO_3;
OC = BASF oil concentrate (Booster Plus E)

Summary

Glyphosate applied after planting gave very poor control of winter rye and extractable sucrose/A was low in plots treated only with glyphosate. Sugarbeets treated with sethoxydim+Dash+28%N at 0.3 lb/A+0.25+1 gal/A or glyphosate at planting plus postemergence sethoxydim yielded more than 2000 lb/A of extractable sucrose. Sugarbeets treated 2 weeks after planting with sethoxydim at 0.3 lb/A plus adjuvants tended to yield more extractable sucrose/A than sugarbeets treated 3 or 4 weeks after planting.

<u>Cover crops for establishment of sugarbeets, Amenia, 1988-1989.</u> Cover crop blocks 66 feet by 70 feet were established in the fall of 1988. These blocks were solid seeded in 4.5 inch rows perpendicular to sugarbeet rows, seeded in one row strips between each sugarbeet row, or seeded in 18 inch rows diagonally across sugarbeet rows. 'Linton' flax at 13 lb/A was seeded August 22, 1988. 'Steele' oats and 'Stoa' spring wheat were seeded at 30 lb/A August 25, 1988. 'Rymin' winter rye and 'Rough Rider' winter wheat were seeded at 30 lb/A September 8, 1988. One half of each cover crop block was tilled lightly with an Alloway 'Seed Better' May 2, 1989. 'Hilleshog 4046' sugarbeet was seeded 1.25 inches deep in 22 inch rows May 2, 1989. Counter 15G at 12 lb/A of product was applied using a modified in-furrow system at planting. Diethatyl + glyphosate at 5 + 0.38 lb/A plus X-77 at 0.5% v/v was applied in 13.3 gpa water at 40 psi in a 10 inch band through 4001E nozzles to all cover crop blocks 2:00 pm May 2, 1989 when the air temperature was 70F, soil temp. at six inches was 53F, relative humidity was 30%, wind was west at 15 mph, soil moisture was poor, winter wheat was 2 inches tall and tillering, and rye was 3 inches tall and tillering. Seth-oxydim at 0.3 lb/A plus Sun-It at 1 qt/A was applied in 8.5 gpa water at 40 psi through 8001 nozzles to all cover crop blocks 1:00 pm June 1 when the air temperature was 76F, soil temp. at six inches was 68F, relative humidity was 45%, wind was southwest at 10 mph, sugarbeets were in the cotyledon stage, winter wheat was 16 inches tall, and rye was 20 inches tall and heading. Sethoxydim at 0.2 lb/A plus Sun-It at 1 qt/A was applied in 8.5 gpa water at 40 psi through 8001 nozzles to all cover crop blocks June 14. Sugarbeets were cultivated May 23, June 1, June 16, and July 5. Hand weeding of broad-leaf weeds was done May 30 and plots were maintained weed free throughout the growing season. Sugarbeet stand counts were taken June 13 before thinning. Sugarbeets were hand thinned to an 8 inch spacing June 18. Sugarbeets were harvested and counted in 80 feet of row in each plot October 3, 1989.

Treatment	6-13 Sgbt Popl (#/100')	Harvest Sgbt Popl (#/80')	Sucro (%)	Loss to Mol (%)	Root Yield (T/A)	Impur Index	Extrac Sucros (lb/A)
No cover crop - till	176	79	15.4	2.2	14.1	1013	3712
No cover crop - notill	127	81	15.3	2.1	15.5	1024	4053
W. wheat - solid seeded - till	191	80	15.2	2.1	11.1	1017	2871
W. wheat - solid seeded - notill	211	72	15.0	2.2	9.8	1073	2468
W. wheat - rows - till	166	70	15.6	2.2	10.2	1028	2721
W. wheat - rows - notill	180	76	15.5	2.1	10.9	1001	2884
Rye - solid seeded - till	190	71	14.9	2.0	10.5	996	2654
Rye - solid seeded - notill	211	73	14.6	2.0	10.1	1015	2522
Rye - rows - till	183	74	15.2	2.0	11.2	955	2930
Rye - rows - notill	197	77	15.0	2.0	11.4	943	2959
S. wheat - solid seeded - till	180	71	15.1	2.2	10.6	1082	2706
S. wheat - solid seeded - notill	123	70	15.1	2.1	12.9	1048	3271
S. wheat - strips - till	155	89	15.4	1.9	17.5	915	4646
S. wheat - strips - notill	165	80	16.0	1.9	14.2	863	3929
Oats - solid seeded - till	171	81	15.3	2.0	14.2	940	3771
Oats - solid seeded - notill	158	82	15.4	1.9	13.3	910	3617
Oats - strips - till	167	84	15.6	2.0	14.6	949	3931
Oats - strips - notill	171	84	15.3	2.0	15.9	963	4177

(continued on next page)

Cover crops for establishment of sugarbeets, Amenia, 1988-1989. (continued)

Treatment	6-13 Sgbt Popl (#/100')	Harvest Sgbt Popl (#/80')	Sucro (%)	Loss to Mol (%)	Root Yield (T/A)	Impur Index	Extrac Sucros (lb/A)
Flax - solid seeded - till	147	80	15.1	2.1	12.1	1031	3094
Flax - solid seeded - notill	175	76	15.2	2.1	12.0	1005	3080
Flax - strips - till	137	76	15.6	2.0	16.1	927	4375
Flax - strips - notill	114	86	15.7	1.9	16.8	909	4586
HIGH MEAN	211	89	16.0	2.2	17.5	1082	4646
LOW MEAN	114	70	14.6	1.9	9.8	863	2468
EXP MEAN	168	78	15.3	2.0	13.0	982	3407
C.V. %	19	15	3.8	9.4	28.1	12	32
LSD 5%	46	NS	NS	NS	NS	NS	NS
LSD 1%	61	NS	NS	NS	NS	NS	NS
# OF REPS	4	4	4	4	4	4	4

Summary

Sugarbeet yield and quality were not significantly affected by treatments.

Oats cover crop plus preemergence herbicides, Amenia, 1988-1989. 'Steele' oats was seeded at 30 lb/A in 4.5 inch rows diagonally across the herbicide plots August 29, 1988. Fall herbicide treatments were applied 2:00 pm October 17, 1988 when the air temperature was 50F, soil temp. at six inches was 54F, relative humidity was 62%, wind was north at 10-15 mph and soil moisture was fair. An 'Alloway Seed Better' was used for very light tillage before seeding 'Van der Have Puressa II' sugarbeet 1.25 inches deep in 22 inch rows April 28, 1989. Lorsban 15G at 12 lb/A of product was applied using a modified in-furrow system at planting. Spring herbicide treatments were applied 4:30 pm April 28, 1989 when the air temperature was 57F, soil temp. at six inches was 52F, relative humidity was 27%, wind was northeast at 20-25 mph, soil moisture was fair and oats was 3 inches tall and tillering. All herbicides except the impregnated cycloate were applied to the center four rows of six row plots using 8002 nozzles to apply 17 gpa water at 40 psi. Cycloate was impregnated onto 200 lb/A of 46-0-0 urea fertilizer by adding the concentrated chemical to a weighed amount of fertilizer in a paper sack and shaking the sack for five minutes. One sack was mixed for each plot and spread by hand over all six rows of the plot. Sethoxydim at 0.3 lb/A plus Sun-It at 1 qt/A was broadcast over the entire experiment June 1, 1989 when sugarbeets were in the cotyledon to 4 leaf stage and oats was 20 inches tall. Sugarbeet injury and kochia control were evaluated July 2.

Treatment	Rate	Sugarbeet injury	Kochia control
	(lb/A)	(%)	(%)
Metolachlor (Pre) Fall	2	0	0
Metolachlor (Pre) Fall	3	0	0
Metolachlor (Pre) Fall	4	0	0
Ethofumesate (Pre) Fall	3.75	0	96
Diethatyl (Pre) Fall	6	0	0
Cycloate (Impregnated) Fall	4	0	0
Metolachlor (Pre) Spring	2	0	0
Metolachlor (Pre) Spring	3	0	0
Ethofumesate (Pre) Spring	3.75	0	71
Diethatyl (Pre) Spring	6	0	0
HIGH MEAN		0	96
LOW MEAN		0	0
EXP MEAN		0	17
C.V. %		0	31
LSD 5%		NS	8
LSD 1%		NS	10
# OF REPS		4	4

Summary

Fall-applied ethofumesate gave excellent kochia control, superior to control from spring-applied ethofumesate.

Winter wheat cover crop plus preemergence herbicides, Amenia, 1988-1989. 'Rough Rider' winter wheat was seeded diagonally across the herbicide plots in 18 inch rows at a rate of 30 lb/A September 8, 1988. Fall herbicide treatments were applied 2:00 pm October 17, 1988 when the air temperature was 50F, soil temp. at six inches was 54F, relative humidity was 62%, wind was north at 10-15 mph and soil moisture was fair. An 'Alloway Seed Better' was used for very light tillage before seeding 'Van der Have Puressa II' sugarbeet 1.25 inches deep in 22 inch rows April 28, 1989. Lorsban 15G at 12 lb/A of product was applied using a modified in-furrow system at planting. Spring herbicide treatments were applied 4:30 pm April 28, 1989 when the air temperature was 57F, soil temp. at six inches was 52F, relative humidity was 27%, wind was northeast at 20-25 mph, soil moisture was fair and winter wheat was 2 inches tall and tillering. All herbicides except the impregnated cycloate were applied to the center four rows of six row plots using 8002 nozzles to apply 17 gpa water at 40 psi. Cycloate was impregnated onto 200 lb/A of 46-0-0 urea fertilizer by adding the concentrated chemical to a weighed amount of fertilizer in a paper sack and shaking the sack for five minutes. One sack was mixed for each plot and spread by hand over all six rows of the plot. Sethoxydim at 0.3 lb/A plus Sun-It at 1 qt/A was broadcast over the entire experiment June 1, 1989 when sugarbeets were in the cotyledon to 4 leaf stage and winter wheat was 18 inches tall. Winter wheat control was evaluated July 2.

Treatment	Rate (lb/A)	Winter Wheat control (%)
Metolachlor (Pre) Fall	2	3
Metolachlor (Pre) Fall	3	5
Metolachlor (Pre) Fall	4	8
Ethofumesate (Pre) Fall	3.75	100
Diethatyl (Pre) Fall	6	0
Cycloate (Impregnated) Fall	4	0
Metolachlor (Pre) Spring	2	10
Metolachlor (Pre) Spring	3	5
Ethofumesate (Pre) Spring	3.75	69
Diethatyl (Pre) Spring	6	0
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		20
C.V. %		37
LSD 5%		11
LSD 1%		14
# OF REPS		4

Summary

Fall-applied ethofumesate gave total control of winter wheat.

Multispecies screening of PPI and postemergence herbicides. Fargo (NW Section 22). 1989. Preplant incorporated herbicides were applied in 17 gpa water at 40 psi through 8002 nozzles to the center seven feet of eleven foot plots June 5 when the air temperature was 65F, wind was north at 5 mph, and soil moisture was good. Incorporation was with a rototiller set four inches deep. 'Wheaton' wheat, 'Azure' barley, 'S-541' safflower, 'Valley' oats, 'KW 3265' sugarbeet, 'Linton' flax, 'Kirby' tame mustard, 'Siberian' foxtail millet, 'Interstate 201' corn, 'C-20' navy bean, 'Ozzie' soybean, and 'Interstate 3001' sunflower were seeded in strips across herbicide plots June 5. Postemergence treatments were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center seven feet of eleven foot plots 10:30 am June 30 when the air temperature was 75F, soil temperature at six inches was 72F, relative humidity was 78%, wind was northwest at 4-8 mph, soil moisture was good, wheat was 8 to 10 inches tall, barley was 10 to 12 inches tall, safflower was 2 to 5 inches tall, oats was 6 to 10 inches tall, sugarbeets were in the six leaf stage, flax was 2 to 4 inches tall, tame mustard was in the cotyledon stage to 4 inches tall, foxtail millet was 8 to 10 inches tall, corn was in the 3 to 7 leaf stage (3 to 8 inches tall), navy beans were in the second trifolialate, soybeans were in the 2 leaf stage to first trifolialate, sunflowers were in the 2 leaf stage to 3.5 inches tall, and redroot pigweed were in the cotyledon stage to 4 inches tall. Crop injury and weed control were evaluated July 20.

Preplant incorporated herbicides:

Treatment	Rate	Brly	Wht	Saff	Oats	Sgbt	Flax	Tmus	Fxtl	Navy	Soyb	Corn	Sunf	Rrpw
	(lb/A)	percent control												
Metolachlor	2	50	33	4	34	45	16	36	94	6	8	4	5	76
Metolachlor	4	71	76	11	82	53	13	74	95	11	19	0	10	93
CGA-144155	2	65	79	31	73	61	26	40	79	15	8	63	43	24
CGA-144155	4	75	83	16	91	75	21	40	93	5	15	51	48	36
Trifluralin	1	81	83	3	97	100	13	15	100	18	18	80	0	95
Trifluralin	0.3	24	9	0	58	88	0	0	90	0	5	35	0	80
Cyanazine-L	2	73	68	13	73	91	75	78	59	25	5	24	85	65
Cyanazine-L	0.7	9	10	0	11	85	21	13	10	3	0	0	66	44
EPTC&Dichlormid	3	86	96	0	98	60	33	74	93	5	15	10	33	84
EPTC&Dichlormid	1	60	59	13	84	68	40	56	90	13	26	13	23	63
Imazethapyr	0.06	71	43	80	60	100	91	97	92	9	30	80	80	96
Imazethapyr	0.02	25	14	24	34	98	87	95	86	10	13	21	60	96
Metribuzin-DF	0.5	60	75	44	80	93	85	76	45	68	9	30	93	86
Metribuzin-DF	0.19	19	33	25	21	85	44	43	20	16	6	34	57	71
Clomazone	1	93	97	25	88	90	100	96	94	29	11	83	54	38
Clomazone	0.33	43	55	5	19	41	75	46	56	6	0	25	29	6
Acetochlor	2	68	75	20	86	78	75	75	94	8	8	4	11	92
ICI-A5676	1.5	56	66	9	81	50	25	31	82	5	4	8	26	81
ICI-A5676	2	63	63	26	77	78	60	61	85	5	4	23	35	86
AC 310,448	0.15	13	14	0	0	74	0	0	0	0	0	0	43	8
AC 310,448	0.2	0	0	0	0	70	0	13	0	0	0	5	63	8
HIGH MEAN		93	97	80	98	100	100	97	100	68	30	83	93	96
LOW MEAN		0	0	0	0	41	0	0	0	0	0	0	0	6
EXP MEAN		53	54	17	59	75	43	50	69	12	10	28	41	63
C.V. %		27	28	88	20	19	30	25	16	87	114	55	53	14
LSD 5%		20	21	20	17	20	18	18	16	15	15	22	31	13
LSD 1%		27	28	27	23	27	24	24	21	20	21	29	41	17
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	4

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Multispecies screening of PPI and postemergence herbicides, Fargo (NW Section 22), 1989. (cont.)

Postemergence herbicides:

Treatment[a]	Rate (lb/A)	Brly	Wht	Saff	Oats	Sgbt	Flax	Tmus	Fxtl	Navy	Soyb	Corn	Sunf	Rrpw
		percent control												
Imazethapyr+X-77	0.06+0.25%	60	95	59	78	100	9	99	90	12	7	13	92	83
Imazethapyr+X-77	0.02+0.25%	30	75	12	15	100	0	100	63	8	5	42	67	40
DPX-M6316-60+X-77	0.016+0.25%	17	5	2	0	100	32	100	0	50	13	20	95	98
DPX-M6316-60+X-77	0.006+0.25%	10	2	7	0	100	22	99	5	35	27	37	92	96
DPX-M6316-60+X-77	0.002+0.25%	3	2	5	3	100	3	94	3	10	3	0	72	87
DPXM6316&DPXL5300+X77	.018+.25%	0	8	63	12	100	89	100	8	53	33	50	97	98
DPXM6316&DPXL5300+X77	.006+.25%	0	0	9	3	100	48	100	0	20	7	7	91	94
DPXV9360&DPXE9636+OC	.032+.25G	100*	100*	70*	100*	100*	97*	100*	99*	90*	85*	0*	90*	97*
DPXV9360&DPXE9636+OC	.016+.25G	99	100	50	97	95	96	100	98	56	58	3	80	98
CGA-136872+OC	0.03+0.25G	87	100	87	89	99	83	100	9	60	75	0	92	93
CGA-136872+OC	0.015+0.25G	83	100	87	89	100	80	100	22	55	63	12	95	88
KIH-2665+X-77	0.125+0.25%	99	100	81	93	100	97	100	72	86	91	3	73	98
KIH-2665+X-77	0.075+0.25%	97	100	78	92	100	86	96	43	82	87	17	58	99
Fluroxypyr	0.1	0	2	68	2	48	75	47	0	32	35	3	67	15
Fluroxypyr	0.05	0	0	28	0	27	33	7	7	7	3	7	27	0
V-23121	0.019	0	0	0	2	0	0	0	0	7	0	37	18	0
V-23031+OC	0.06+0.25G	7	23	8	3	57	7	10	0	12	12	37	38	93
Acifluorfen+X-77	0.5+0.25%	13	23	87	11	5	70	99	0	10	3	0	28	80
Acifluorfen+X-77	0.25+0.25%	3	7	69	7	22	67	90	2	13	0	18	53	47
Bentazon+OC	0.75+0.25G	0	0	95	2	98	0	100	0	3	0	0	87	52
Bentazon+OC	0.33+0.25G	0	0	68	0	98	0	100	0	8	0	2	78	22
Bromoxynil-RP	0.38	13	0	98	2	100	7	93	3	30	15	3	90	53
Bromoxynil-RP	0.12	0	0	93	0	93	0	87	0	12	5	0	85	33
Desmedipham	0.75	8	20	12	33	18	23	81	2	27	18	20	40	48
Desmedipham	0.33	13	15	13	20	0	13	53	0	10	15	35	33	29
Dicamba	0.5	22	17	98	7	93	52	91	3	98	97	12	93	98
Dicamba	0.12	7	3	88	0	75	7	23	0	89	97	15	88	73
Clopyralid	0.2	0	0	98	0	0	0	0	0	100	100	55	98	0
Clopyralid+Dash	0.2+0.25G	0	0	95	0	7	0	0	0	100	100	18	96	0
Glyphosate+X-77	0.25+0.25%	100	100	100	100	100	100	100	99	97	93	100	99	99
Glyphosate+X-77	0.12+0.25%	100	100	98	100	100	97	100	100	97	85	91	96	98
Paraquat-Cyclone+X-77	.5+.25%	100	100	99	100	100	99	58	32	60	94	32	77	96
Paraquat-Cyclone+X-77	.25+.25%	100	99	100	99	100	99	64	40	62	94	18	90	99
Diclofop+OC	1+0.25G	0	0	0	76	0	0	0	80	7	3	100	33	0
Diclofop+OC	0.33+0.25G	0	0	7	68	10	7	33	60	7	5	93	48	0
Fluazifop-P+OC	0.2+0.25G	100	100	0	100	3	0	0	70	0	0	100	7	0
Fluazifop-P+OC	0.07+0.25G	98	100	2	99	0	0	0	15	0	0	100	0	0
Sethoxydim+Sun-It	0.2+0.25G	100	100	0	100	0	0	0	100	2	7	100	3	0
Sethoxydim+Sun-It	0.07+0.25G	97	98	0	96	0	0	0	98	2	2	95	13	0
HIGH MEAN		100	100	100	100	100	100	100	100	100	100	100	99	99
LOW MEAN		0	0	0	0	0	0	0	0	0	0	0	0	0
EXP MEAN		39	42	52	42	62	37	64	30	37	36	34	66	55
C.V. %		28	20	18	26	19	42	17	34	36	34	57	39	25
LSD 5%		18	13	15	18	19	25	18	16	22	20	32	42	22
LSD 1%		23	18	20	24	25	33	23	22	29	26	42	55	30
# OF REPS		3	3	3	3	3	3	3	3	3	3	3	3	3

* Evaluation for one replication only. This treatment is not included in experiment analysis.
a Dash = BASF surfactant; X-77 = non-ionic surfactant from Chevron Chemical Co.; Sun-It = Agsco sunflower methyl ester; OC = BASF oil concentrate (Booster Plus E);

Soil residual from soybean herbicides, Fargo (NW section 22), 1987-1989. '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 temp. 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 cotyledon to the two trifoliolate stage (1-4 inches tall). Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 7 feet of 14 foot plots. Plots were 45 feet long. Wheat, corn, sugarbeets, and flax bioassay strips were seeded across herbicide plots in 1988. Conventional tillage was carried out in the spring and fall of each growing season. Sugarbeets were seeded 1.25 inches deep in 22 inch rows June 2, 1989. Sugarbeets were seeded parallel and perpendicular to herbicide plots to provide a dense population of sugarbeets for evaluation. Sugarbeet injury was evaluated June 30, 1989.

1987 Treatment	Rate	Sugarbeet injury in 1989
	(lb/A)	(%)
AC 263,499	0.06	93
AC 263,499	0.12	100
Fomesafen	0.25	0
Fomesafen	0.5	0
Lactofen	0.2	0
Lactofen	0.4	0
Acifluorfen	0.38	0
Acifluorfen	0.75	0
Untreated Check	0	0
HIGH MEAN		100
LOW MEAN		0
EXP MEAN		21
C.V. %		5
LSD 5%		1
LSD 1%		2
# OF REPS		4

Summary

AC 263,499 applied in 1987 caused severe injury to sugarbeets seeded in 1989. Other herbicides did not cause visible sugarbeet injury.

Soil residual from wheat herbicides, Fargo (NW section 22), 1987-1989. 'Marshall' wheat was seeded at 75 pounds per acre June 2, 1987. Herbicide treatments were applied 3:30 pm June 24, 1987 when the air temp. was 73F, soil temp. 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 wheat was six inches tall. Herbicides were applied in 8.5 gpa water at 40 psi through 8001 nozzles to the center 7 feet of 14 foot plots. Plots were 45 feet long. Soybeans, flax, sugarbeets, and oats bioassay strips were seeded across herbicide plots in 1988. Conventional tillage was carried out in the spring and fall of each growing season. Sugarbeets were seeded 1.25 inches deep in 22 inch rows June 2, 1989. Sugarbeets were seeded parallel and perpendicular to herbicide plots to provide a dense population of sugarbeets for evaluation. Sugarbeet injury was evaluated June 30, 1989.

1987 Treatment	Rate	Sugarbeet injury in 1989
	(lb/A)	(%)
DPX-M6316	0.015	0
DPX-M6316	0.03	0
DPX-L5300	0.015	0
DPX-L5300	0.03	0
AC 222,293	0.3	0
AC 222,293	0.6	0
Untreated Check	0	0
HIGH MEAN		0
LOW MEAN		0
EXP MEAN		0
C.V. %		529
LSD 5%		NS
LSD 1%		NS
# OF REPS		4

Summary

Herbicides applied in 1987 caused no visible sugarbeet injury in 1989.

<u>Wild oats control in Wheat, Fargo 1989.</u> 'Wheaton' Hard Red Spring wheat was seeded on April 26. Treatments (S1) were applied to 3-leaf wheat and wild oats and cotyledon- to 4-leaf wild mustard on May 23 with 70 F, 60% RH, 10 mph east wind, and partly cloudy sky. Treatments (S2) were applied to 4.5-leaf wheat and 2- to 4.5-leaf wild oats and 1 to 4 inch tall wild mustard on June 2 with 65 F, 60% RH, 10 mph northwest wind, and cloudy 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 with four replications. Evaluation was on July 10. Wild oats density was 3/sq yd and wild mustard was variable. Harvest for wheat yield was on July 24.

Treatment	Rate	Wheat Injury	Wild Oats	Wild Mustard	Wheat Yield
	(oz/A)	(%)	-(% control)--		(bu/A)
Diclofop(S1)	12	0	95	0	24.9
Diclofop(S1)	16	0	98	6	25.0
Diclofop+PO(S1)	12+0.125G	1	99	0	25.7
Diclofop+PO(S1)	16+0.125G	2	99	0	23.2
Diclofop+MS(S1)	12+0.125G	0	98	0	27.7
Diclofop+MS(S1)	16+0.125G	1	99	0	26.0
AC 222,293-SC(S1)	4	0	75	83	25.4
AC 222,293(S1)	4	0	64	94	26.6
AC 222,293(S1)	6	0	70	98	27.9
AC 222,293+PO(S1)	4+0.125G	1	98	99	28.7
AC 222,293+MS(S1)	4+0.125G	0	99	99	28.8
HOE-6001(S1)	1.3	0	99	0	28.4
Diclofop(S2)	16	2	98	0	28.9
Diclofop+PO(S2)	16+0.125G	6	98	5	23.5
Diclofop+MS(S2)	16+0.125G	3	98	4	22.1
AC 222,293-SC(S2)	6	0	98	99	25.3
AC 222,293(S2)	4	0	73	99	29.3
AC 222,293(S2)	6	0	84	99	27.3
AC 222,293+PO(S2)	4+0.125G	2	96	99	26.3
AC 222,293+MS(S2)	4+0.125G	2	99	99	28.3
Difenzoquat(S2)	10	6	96	5	22.2
Difenzoquat(S2)	12	0	96	32	25.0
Difenzoquat+Bromoxynil&MCPA(S2)	10+8	2	97	99	29.5
HOE-7125(S2)	12.5	1	95	99	28.0
HOE-7125+Bromoxynil(S2)	12.5+3	3	96	99	26.1
HOE-6001(S2)	1.3	3	99	5	28.9
Untreated	0	0	0	0	26.0
C.V. %		431	6	16	13.4
LSD 5%		NS	7	11	NS
# OF REPS		4	4	4	4

Summary

Wheat yield was not increased because of the sparse wild oats. None of the herbicides caused important injury to the wheat as injury values were low and treatments did not influence yield. The SC formulations of difenzoquat gave higher wild oat control then the other formulations. Petroleum oil and methylated sunflower oil enhanced wild oat control with AC 222,293. The environment at treatments were positive for crop growth which may be important to the generally greater wild oat control with diclofop than AC 222,293.

Wild oats control in wheat, Langdon 1989. 'Cando' Durum wheat was seeded at 70 lb/A on May 6. S1 treatments were applied to 3-leaf Durum and 1- to 2 -leaf wild oats on June 8 with 43 F, 15 mph wind, and a clear sky. S2 treatments were applied to 5-leaf Durum and 3.5- to 4-leaf wild oats on June 19 with 85 F, 15 mph south wind and a clear sky. All treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel type sprayer to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Broadleaf weeds were treated with 8 oz/A 2,4-D + 0.25 oz/A DPX-M6316 + 0.25% X-77 on June 23. Evaluation was on August 1 and wild oats density was 150 heads/sq yd.

Treatment	Rate	Wheat injury	Wheat yield	Wild oat control
	(oz/A)	(%)	(bu/A)	(%)
Diclofop(S1)	12	0		84
Diclofop(S1)	16	1		91
Diclofop+PO(S1)	12+0.125G	0		80
Diclofop+PO(S1)	16+0.125G	0		98
Diclofop+MS(S1)	12+0.125G	1		91
Diclofop+MS(S1)	16+0.125G	0		91
AC 222,293-SC(S1)	4	1		84
AC 222,293(S1)	4	0		39
AC 222,293(S1)	6	1		55
AC 222,293+PO(S1)	4+0.125G	0		95
AC 222,293+MS(S1)	4+0.125G	1		94
HOE-6001(S1)	1.3	2		96
Diclofop(S2)	16	0		40
Diclofop+PO(S2)	16+0.125G	0		66
Diclofop+MS(S2)	16+0.125G	2		57
AC 222,293-SC(S2)	6	0		94
AC 222,293(S2)	4	0		62
AC 222,293(S2)	6	0		87
AC 222,293+PO(S2)	4+0.125G	0		90
AC 222,293+MS(S2)	4+0.125G	1		89
Difenzoquat(S2)	10	0		90
Difenzoquat(S2)	12	3		94
Difenzoquat+Bromoxynil&MCPA(S2)	10+8	1		93
HOE-7125(S2)	12.5	30		73
HOE-7125+Bromoxynil(S2)	12.5+3	18		59
HOE-6001(S2)	1.3	3		95
Untreated	0	0		0
C.V. %		122		14
LSD 5%		4		15
# OF REPS		4		4

Summary

HOE-7125 injured Cando durum wheat and injury was reduced by the inclusion of bromoxynil. None of the other herbicide treatments caused important injury. The SC formulation of AC 222,293 was more effective than the other formulation at both application stages. The inclusion of petroleum oil (PO) or methylated seed oil (MS) with the standard formulation of AC 222,293 enforced wild oats control to equal or exceeded that with the SC formulation. Both oil adjuvants enhanced wild oats control with diclofop applied at the late stage when wild oats control was low. Wild oats control by HOE 7125 was reduced by bromoxynil in the mixture.

__Wild oats control in wheat, Minot 1989.__ 'Stoa' Hard Red Spring Wheat was seeded on May 4. Treatments (S1) were applied to 3.6- to 3.8-leaf wheat, 1- to 3.5-leaf wild oats, and emerging to 1.5 inch tall foxtail on May 31 with 55 F, 74% RH, 4 mph west wind and clear sky at application. Treatments (S2) were applied to 4.7- to 5-leaf wheat, 3- to 5-leaf wild oats and 0.5 to 3.5 inch tall foxtail on June 5 with 76 F, 38% RH, 6 mph north wind and clear sky at application. 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 20 ft plots. The experiment was a randomized complete block with 4 replications. Evaluation was on July 14. Wild oats density was _ 1/sq yd and foxtail was 10 plants/sq. ft. A 4 by 15 sq ft area of wheat was harvested for yield on August 1.

Treatment	Rate	Wheat Injury	Wild oats	Green foxtail	Test weight	Wheat Yield
	(oz/A)	(%)	(%	control)	(lb/bu)	(bu/A)
Diclofop(S1)	12	0	97	91	59.7	33.9
Diclofop(S1)	16	0	99	94	60.0	35.6
Diclofop+PO(S1)	12+0.125G	0	99	94	59.4	39.3
Diclofop+PO(S1)	16+0.125G	0	99	95	59.7	37.4
Diclofop+MS(S1)	12+0.125G	0	99	95	59.9	37.5
Diclofop+MS(S1)	16+0.125G	0	99	96	59.3	35.9
AC 222,293-SC(S1)	4	0	98	3	59.8	34.2
AC 222,293(S1)	4	0	96	3	59.4	37.1
AC 222,293(S1)	6	0	96	28	59.9	34.4
AC 222,293+PO(S1)	4+0.125G	0	99	8	59.3	36.2
AC 222,293+MS(S1)	4+0.125G	0	99	20	60.0	35.4
HOE-6001(S1)	1.3	0	99	94	59.7	37.1
Diclofop(S2)	16	0	90	93	59.6	35.5
Diclofop+PO(S2)	16+0.125G	0	94	97	59.7	36.9
Diclofop+MS(S2)	16+0.125G	1	90	70	60.2	35.1
AC 222,293-SC(S2)	6	0	98	3	59.6	35.7
AC 222,293(S2)	4	0	70	0	59.1	32.8
AC 222,293(S2)	6	0	93	8	59.5	32.5
AC 222,293+PO(S2)	4+0.125G	0	98	10	59.8	36.8
AC 222,293+MS(S2)	4+0.125G	0	99	8	59.9	36.6
Difenzoquat(S2)	10	2	84	0	59.7	33.9
Difenzoquat(S2)	12	1	80	6	59.6	33.9
Difenzoquat+Bromoxynil&MCPA(S2)	10+8	3	83	15	60.1	35.0
HOE-7125(S2)	12.5	1	93	98	59.2	33.2
HOE-7125+Bromoxynil(S2)	12.5+3	1	86	98	60.2	34.6
HOE-6001(S2)	1.3	1	98	98	60.2	36.3
Untreated	0	0	0	0	59.2	32.9
C.V. %		308	8	18	1.2	8.5
LSD 5%		NS	10	12	NS	NS
OF REPS		4	4	4	4	4

Summary

Wild oats density was sparse, and control exceeded 90% with all treatments, except AC 222,293 at 4 oz/A, difenzoquat treatments and HOE-7125 + Bromoxynil at the late application. Green foxtail control exceeded 90% with diclofop, except when applied with MS at the late stage; HOE-7125; and HOE-6001. None of the treatments injured wheat and all treatments tended to increase yield compared to the untreated wheat.

Wild oats control in wheat, Williston 1989. 'Amidon' hard red spring wheat was seeded on fallow May 3. Treatments (S1) were applied to 4-leaf wheat, 3 to 3.5-leaf wild oats, 3-to 5-leaf green foxtail, and 1-to 2-inch tall Russian thislte on May 31 with 46 F, 92% RH, 4 mph wind, and a clear sky. Treatments (S2) were applied to 5.5-leaf wheat, 4.5-leaf wild oats, 4- to 6-leaf green foxtail, and 2 to 3 inch tall Russian thistle on June 6 with 79 F, 40% RH, 10 mph wind, and a clear sky. All treatments were applied with a tractor-mounted plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 24 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 14. Infestations of wild oats and green foxtail were light and were not rated in the second replication. Russian thistle infestation was moderate to heavy. Harvest for yield was on July 26.

Treatment[a]	Rate	Wheat Injury	Wheat Test weight	Wheat Yield	Ruth	Wioa	Grft
	(oz/A)	(%)	(lb/bu)	(bu/A)	--(%	control)	---
Diclofop(S1)	12	10	55.2	11.7	0	88	95
Diclofop(S1)	16	5	54.9	12.3	0	95	95
Diclofop+PO(S1)	12	2	55.0	13.2	0	93	95
Diclofop+PO(S1)	16	4	55.1	12.0	0	96	95
Diclofop+MS(S1)	12	6	55.2	11.0	0	96	95
Diclofop+MS(S1)	16	4	55.1	11.8	0	92	95
AC 222,293-SC(S1)	4	1	54.9	13.7	35	95	20
AC 222,293(S1)	4	1	55.1	13.1	24	80	0
AC 222,293(S1)	6	4	55.5	12.6	38	95	0
AC 222,293+PO(S1)	4	1	55.9	13.9	66	96	17
AC 222,293+MS(S1)	4	4	55.3	13.4	59	96	10
HOE-6001(S1)	1.3	0	55.3	12.6	13	65	96
Diclofop(S2)	16	1	55.0	11.0	0	93	90
Diclofop+PO(S2)	16	5	55.5	11.4	0	68	90
Diclofop+MS(S2)	16	6	55.5	11.1	0	90	95
AC 222,293-SC(S2)	6	0	55.4	12.8	40	69	32
AC 222,293(S2)	4	3	55.5	10.8	8	88	0
AC 222,293(S2)	6	4	56.2	13.6	19	93	0
AC 222,293+PO(S2)	4	6	55.6	11.3	38	95	0
AC 222,293+MS(S2)	4	3	55.5	12.2	50	92	10
Difenzoquat(S2)	10	3	56.2	12.4	11	68	0
Difenzoquat(S2)	12	6	56.6	11.0	35	93	0
Difenzoquat+Bromoxynil&MCPA(S2)	10+8	8	56.3	11.8	86	73	17
HOE-7125(S2)	12.5	0	56.8	13.6	94	93	98
HOE-7125+Bromoxynil(S2)	12.5+3	0	57.1	14.6	95	95	98
HOE-6001(S2)	1.3	7	55.2	9.1	5	91	62
Untreated	0	0	55.0	11.2	0	0	0
C.V. %		140		16.9	54	13	40
LSD 5%		NS		NS	20	19	31
# OF REPS		4	1	4	4	3	3

[a]PO=petroleum oil with 17% (v/v) emulsifier from Wilbur Ellis (Moract); MS =methylated seed oil from Agsco (Sun-it); Bromoxynil&MCPA was a formulated mixture (1:1); oil adjuvant were at 1 pint/A; and HOE-7125= a 1.3:1:3 formulated mixture of fenoxaprop:2,4-D:MCPA.

Summary

None of the herbicides caused important injury to wheat. Wheat yield was not increased by treatment as weed densities were light except for Russian thistle which apparently was not highly competitive. Petroleum oil and methylated seed oil adjuvants enhanced wild oats control with AC 222,293 at both stages of application. Oil adjuvants tended to enhance wild oats control with diclofop at the first but not at the second stage. HOE-7125 alone or with bromoxynil gave greater than 90% control of all weeds.

Antagonism of wild oats control by herbicide combinations, Fargo 1989. 'Wheaton' Hard Red Spring Wheat was seeded 2.5 inches deep in 7 inch spaced rows on April 26. Treatments were applied to 4-leaf wheat and wild oats on June 1 with 70 F, 65% RH, 10 mph southwest 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 with four replications. Evaluation was on July 10 and wild oat density was 5 to 10 plants per sq yd. Harvest for wheat yield was on July 24.

Treatment	Rate	Wheat injury	Wild oats control	Wheat Yield
	(oz/A)	(%)	(%)	(bu/A)
DPX-R9674+X-77	0.45+0.25%	0	0	21.6
DPX-R9674+2,4-D dma	0.45+4+0.25%	0	3	24.2
DPX-R9674+MCPA dma+X-77	0.45+4+0.25%	0	0	20.9
DPX-R9674+MCPA ioe+X-77	0.45+4+0.25%	0	0	22.4
DPX-R9674+Bromoxynil+X-77	0.45+4+0.25%	0	6	23.6
HOE-7125	12.5	5	96	29.0
HOE-7125+DPX-R9674	12.5+0.45	0	82	28.7
HOE-6001	1.3	1	99	28.4
HOE-6001+DPX-R9674	1.3+0.45	3	99	30.7
HOE-6001+DPX-R9674+2,4-D dma	1.3+0.45+4	0	77	27.0
HOE-6001+DPX-R9674+MCPA dma	1.3+0.45+4	1	82	27.4
HOE-6001+DPX-R9674+Bromoxynil	1.3+0.45+4	1	98	29.2
Diclofop+PO	16+0.125G	0	88	25.3
Diclofop+DPX-R9674+PO	16+0.45+0.125G	0	82	27.8
Diclofop+DPX-R9674+Bromoxynil+PO	16+0.45+4+0.125G	2	84	25.4
AC 222,293	6	3	98	26.5
AC 222,293+DPX-R9674	6+0.45	6	99	24.6
AC 222,293+DPX-R9674+X-77	6+0.45+0.25%	8	99	26.5
AC 222,293+DPX-R9674+MCPA ioe	6+0.45+4	3	98	27.2
Difenzoquat	12	1	95	29.2
Difenzoquat+DPX-R9674	12+0.45	3	94	25.1
Difenzoquat+DPX-R9674+2,4-D dma	12+0.45+4	4	91	26.6
Difenzoquat+DPX-R9674+MCPA dma	12+0.45+4	6	94	29.4
Difenzoquat+DPX-R9674+Bromoxynil	12+0.45+4	5	97	27.7
Untreated	0	0	0	21.8
C.V. %		109	5	13.9
LSD 5%		3	5	5.1
# OF REPS		4	4	4

Summary

None of the herbicide treatments caused important injury to wheat. Wheat yield were or tended to be higher for treatment which gave effective wild oats control. DPX-R9674 antagonized wild oats control with HOE-7125 and diclofop, but not with HOE-6001, AC 222,293 or difenzoquat. However, wild oats control with HOE-6001 was antagonized by DPX-R9674 + 2,4-D or + MCPA.

Antagonism of wild oats control by herbicide combinations, Minot 1989. 'Stoa' Hard Red Spring wheat was seeded on May 4. Treatments were applied to 4.7- to 5-leaf wheat, 3- to 5-leaf wild oats, and 1 to 3 inch tall Russian thistle and common lambsquarters on June 6 with 76 F, 38% RH, 8 mph north wind, and a clear sky at application. All treatments were applied in 8.5 gpa at 35 psi with a bicycle wheeltype plot sprayer to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was randomized complete block with four replications. Evaluation was on July 14. Weed densities were: wild oats ≤ 5 plants/plot, foxtail ¢ 3 plants/sq. ft and common lambsquarters 1 plant/sq. yd. A 4 by 15 sq ft area of wheat was harvested for yield on August 3.

		Wheat					
Treatment	Rate	Inj	Tw	Moisture	Yield	Colq control	Grft control
	(oz/A)	(%)	(lb/bu)	(%)	(bu/A)	--(%)--	--(%)--
DPX-R9674+X-77	0.45+0.25%	0	58.5	13.2	32.2	99	0
DPX-R9674+2,4-D dma	0.45+4+0.25%	0	59.3	13.6	39.3	99	0
DPX-R9674+MCPA dma+X-77	0.45+4+0.25%	0	58.9	13.4	35.4	99	4
DPX-R9674+MCPA ioe+X-77	0.45+4+0.25%	0	58.4	13.5	42.6	99	10
DPX-R9674+Bromoxynil+X-77	0.45+4+0.25%	0	59.2	14.1	38.3	99	0
HOE-7125	12.5	1	58.5	15.4	41.2	99	99
HOE-7125+DPX-R9674	12.5+0.45	0	58.6	13.6	36.1	99	80
HOE-6001	1.3	0	58.2	14.1	35.0	8	99
HOE-6001+DPX-R9674	1.3+0.45	0	59.4	13.6	40.7	99	98
HOE-6001+DPX-R9674+2,4-D dma	1.3+0.45+4	0	58.5	13.4	39.9	99	70
HOE-6001+DPX-R9674+MCPA dma	1.3+0.45+4	0	58.9	13.6	38.1	99	62
HOE-6001+DPX-R9674+Bromoxynil	1.3+0.45+4	0	58.2	13.1	41.4	99	94
Diclofop+PO	16+0.125G	1	59.2	13.8	38.1	0	71
Diclofop+DPX-R9674+PO	16+0.45+0.125G	0	59.1	13.9	38.4	99	6
Diclofop+DPX-R9674+Bromoxynil+PO	16+0.45+4+0.125G	0	59.2	13.7	36.5	99	33
AC 222,293	6	0	57.3	13.4	31.1	25	0
AC 222,293+DPX-R9674	6+0.45	1	58.9	13.7	36.7	99	5
AC 222,293+DPX-R9674+X-77	6+0.45+0.25%	0	58.9	13.1	34.4	99	5
AC 222,293+DPX-R9674+MCPA ioe	6+0.45+4	0	58.9	13.2	36.9	99	5
Difenzoquat	12	0	59.0	14.1	39.2	0	0
Difenzoquat+DPX-R9674	12+0.45	1	59.2	13.5	33.7	99	3
Difenzoquat+DPX-R9674+2,4-D dma	12+0.45+4	0	59.0	13.5	34.4	99	0
Difenzoquat+DPX-R9674+MCPA dma	12+0.45+4	1	58.7	13.8	37.6	99	0
Difenzoquat+DPX-R9674+Bromoxynil	12+0.45+4	1	57.6	13.5	34.1	99	0
Untreated	0	0	56.1	14.8	29.6	0	0
C.V. %		405	1.8	4.6	11.0	13	30
LSD 5%		NS	1.5	.9	5.7	15	13
# OF REPS		4	4	4	4	4	4

Summary

None of the herbicide combinations injured wheat. Wild oats densities were not adequate for evaluation. However, green foxtail control with HOE-7125 and diclofop were antagonized by DPX-R9674. HOE-6001 control of green foxtail was not antagonized by DPX-R9674, but was when 2,4-D or MCPA were included in the treatment. The antagonism of green foxtail by DPX-R9674 with diclofop was reduced when bromoxynil was included in the treatments. Common lambsquarters was controlled by all treatments, except HOE-6001, diclofop, AC 222,293, and difenzoquat applied alone. Yield tended to be higher for treated than untreated wheat.

Antagonism with herbicide combinations for weed control in wheat, Williston 1989. 'Amidon' hard red spring wheat was seeded on fallow May 3. Treatments were applied to 4-leaf wheat, 3 to 3.5-leaf wild oats, 3 to 5-leaf green foxtail, and 1 to 2-inch tall Russian thistle on May 31 with 57 F, 73% RH, 4.5 mph wind, and a clear sky. Treatments were applied with a tractor-mounted plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft area the length of 10 by 24 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 17. Russian thistle infestation was moderate to heavy and wild oat and green foxtail were infested lightly. Harvest for wheat yield was on July 26.

Treatment[a]	Rate	Wheat Inj	Wheat Test weight	Wheat Yield	Ruth	Wioa	Grft
	(oz/A)	(%)	(lb/bu)	(bu/A)	-----(%)----- control		
DPX-R9674+X-77	0.45+0.25%	6	55.3	12.9	96	21	10
DPX-R9674+2,4-D dma	0.45+4+0.25%	3	55.3	14.7	99	0	0
DPX-R9674+MCPA dma+X-77	0.45+4+0.25%	4	55.0	14.1	98	0	0
DPX-R9674+MCPA ioe+X-77	0.45+4+0.25%	3	55.6	14.5	98	0	0
DPX-R9674+Bromoxynil+X-77	0.45+4+0.25%	3	56.0	14.3	98	19	28
HOE-7125	12.5	10	56.3	14.0	93	86	99
HOE-7125+DPX-R9674	12.5+0.45	3	55.6	15.2	99	79	97
HOE-6001	1.3	13	55.3	13.6	62	90	93
HOE-6001+DPX-R9674	1.3+0.45	6	56.3	15.2	96	95	99
HOE-6001+DPX-R9674+2,4-D dma	1.3+0.45+4	8	55.6	14.0	99	54	81
HOE-6001+DPX-R9674+MCPA dma	1.3+0.45+4	6	56.0	13.4	98	21	86
HOE-6001+DPX-R9674+Bromoxynil	1.3+0.45+4	11	56.0	14.3	98	90	99
Diclofop+PO	16	6	55.6	14.6	66	93	59
Diclofop+DPX-R9674+PO	16+0.45	6	55.6	14.1	98	92	38
Diclofop+DPX-R9674+Bromoxynil+PO	16+0.45+4	1	55.6	15.2	97	66	46
AC 222,293	6	0	55.6	14.2	85	94	13
AC 222,293+DPX-R9674	6+0.45	1	55.6	15.8	97	97	5
AC 222,293+DPX-R9674+X-77	6+0.45+0.25%	2	55.6	15.7	97	95	8
AC 222,293+DPX-R9674+MCPA ioe	6+0.45+4	3	55.6	15.5	98	96	0
Difenzoquat	12	2	56.3	15.0	59	61	0
Difenzoquat+DPX-R9674	12+0.45	8	56.0	14.1	99	80	0
Difenzoquat+DPX-R9674+2,4-D dma	12+0.45+4	11	56.0	13.5	99	93	19
Difenzoquat+DPX-R9674+MCPA dma	12+0.45+4	4	55.6	14.4	97	76	15
Difenzoquat+DPX-R9674+Bromoxynil	12+0.45+4	9	56.3	14.3	98	90	8
Untreated	0	0	55.3	11.3	0	0	0
C.V. %		108		8.3	17	30	49
LSD 5%		8		1.7	21	27	25
# OF REPS		4	1	4	4	4	4

[a]X-77=non-ionic surfactant from Valent with 17% (v/v) emulsifier; dma=dimethyl amine formulation; ioe=isooctyl ester; PO=petroleum oil from Wilber Ellis (Moract) applied at 1 pint/A; and DPX-R9674 is a 2:1 mixture of DPX-M6316 and DPX-L5300.

Summary

None of the herbicide treatments caused important injury to wheat. Wild oats and/or green foxtail control from HOE-6001 was antagonized by DPX-R9674 with 2,4-D or MCPA, but not by bromoxynil. Green foxtail control with diclofop was antagonized by DPX-R9674 alone or with bromoxynil.

AC 222,293 formulations for control in wild oats, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded 2.5 inch deep in 7 inch spaced rows on April 26. Treatments (S1) were applied to 4-leaf wheat and wild oats on June 1 with 70 F, 65% RH, 10 mph southwest wind and a clear sky at application. Treatments (S2) were applied to 5- to 6-leaf wheat and 4- to 5-leaf wild oats with 62 F, 60% RH, 10 to 20 mph northwest wind and an overcast sky at application. 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 randomized complete block with four replications. Evaluation was on July 21 and wild oats density was 10 to 15 plts/sq yd. Harvest for wheat yield was on July 25.

Treatment	Rate	Wheat injury	Wild oats control	Yield
	(oz/A)	(%)	(%)	(bu/A)
AC 222,293,LC(S1)	3.7	1	96	25.2
AC 222,293,LC(S1)	6.1	0	98	26.1
AC 222,293,LC(S1)	7.5	0	98	29.3
AC 222,293,LC+X-77(S1)	6.1+0.25%	0	97	29.4
AC 222,293,LC+X-77(S1)	7.5+0.25%	3	96	25.6
AC 222,293,SC(S1)	3.7	1	96	25.5
AC 222,293,SC(S1)	6.1	1	98	25.2
AC 222,293,SC(S1)	7.5	0	97	27.4
AC 222,293,SC+X-77(S1)	6.1+0.25%	0	97	26.1
AC 222,293,SC+X-77(S1)	7.5+0.25%	0	96	27.8
Diclofop(S1)	16	0	97	24.9
AC 222,293,LC(S2)	6.1	0	89	25.0
AC 222,293,LC(S2)	7.5	0	96	24.4
AC 222,293,LC+X-77(S2)	6.1+0.25%	3	87	20.2
AC 222,293,LC+X-77(S2)	7.5+0.25%	0	95	24.9
AC 222,293,SC(S2)	6.1	1	96	24.0
AC 222,293,SC(S2)	7.5	6	97	25.3
AC 222,293,SC+X-77(S2)	6.1+0.25%	0	98	28.3
AC 222,293,SC+X-77(S2)	7.5+0.25%	0	96	26.9
Difenzoquat(S2)	12	8	98	24.0
Untreated	0	0	97	23.8
C.V. %		432	4	18.0
LSD 5%		NS	5	NS
# OF REPS		4	4	4

Summary

None of the herbicide treatments cause important injury to wheat. Wheat yield was not significantly increased by the herbicide treatments because of high variability and sparse wild oats. Both AC 222,293 formulations gave 96% or more wild oats control with early treatment (S1). The LC formulation of AC 222,293 at 6.1 oz/A gave less wild oats control than the SC formulation at the late application (S2).

AC-222,293 plus broadleaf herbicides, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded 2.5 inch deep in 7 inch spaced rows on April 26. Treatments were applied to 4-leaf wheat and wild oats on June 1 with 70 F, 65% RH, 10 mph southwest wind, and a clear sky at application. 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 replications. Evaluation was on July 18 and wild oats density was 15 plants/sq yd. Harvest for wheat yield was on July 25.

Treatemnt	Rate (oz/A)	Wheat injury (%)	Wild oats control (%)	Wheat yield (bu/A)
AC 222,293-SC	6.1	1	87	25.9
AC 222,293-SC+MCPA ioe	6.1+6	1	89	26.9
AC 222,293-SC+2,4-D bee	6.1+6	1	90	26.7
AC 222,293-SC+DPX-R9674	6.1+0.15	0	82	25.9
AC 222,293-SC+DPX-R9674+X-77	6.1+0.15+0.25%	1	89	26.2
AC 222,293-SC+Bromoxynil	6.1+3	2	85	26.0
AC 222,293-SC+Bromoxynil&MCPA	6.1+6	0	88	29.3
AC 222,293-SC+Clopyralid&24D	6.1+4.75	1	81	27.8
AC 222,293-SC+Clopyralid&MCPA	6.1+4.75	1	96	27.3
AC 222,293-LC	6.1	0	96	28.1
AC 222,293-LC+MCAP ioe	6.1+6	1	94	30.7
AC 222,293-LC+2,4-D bee	6.1+6	0	95	29.6
AC 222,293-LC+DPX-R9674	6.1+0.15	0	98	27.3
AC 222,293-LC+DPX-R9674+X-77	6.1+0.15+0.25%	1	97	28.2
AC 222,293-LC+Bromoxynil	6.1+3	1	94	25.9
AC 222,293-LC+Bromoxynil&MCPA	6.1+6	0	97	30.5
AC 222,293-LC+Clopyralid&2,4-D	6.1+4.75	0	94	26.4
AC 222,293-LC+Clopyralid&MCPA	6.1+4.75	0	99	28.2
Diclofop	16	0	89	25.6
Diclofop+Bromoxynil	12+4	1	90	26.7
Diclofop+Bromoxynil+PO	12+4+0.125G	1	91	25.6
HOE-7125	10.5	0	95	27.2
HOE-7125	12.5	0	94	28.7
Difenzoquat	12	1	94	23.1
Difenzoquat+DPX-R9674	12+0.3	0	91	26.8
Difenzoquat+Clopyralid&MCPA	12+9.5	0	93	25.4
Difenzoquat+Bromoxynil	12+4	1	93	26.6
Untreated	0	0	0	15.4
C.V. %		253	5	21.0
LSD 5%		NS	7	NS
# OF REPS		4	4	4

Summary

None of the herbicide treatments injured wheat. Yields tended to be higher for herbicide treated than untreated wheat, but variabilty prevented statisitcal differences. The LC formulation of AC 222,293 generally gave greater wild oats control than the SC formulation and neither was antagonized by the various herbicides for broadleaf weed control. Further, wild oats control with difenzoquat was not antagonized by DPX-R9674 or Clopyralid & MCPA.

Diclofop antagonism by DPX-R9674, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 26. Treatments were applied to 4.5-leaf wheat and 2- to 4.5-leaf wild oats on June 2 with 65 F, 60% RH, 10 mph northwest wind, and a cloudy sky. Treatments split (/1d) were applied to 5-leaf wheat and 3- to 5-leaf wild oats on June 2 with 65 F, 60% RH, 8 mph wind, and a clear sky. Treatments split (/3d) were applied to 5-leaf wheat and 3- to 5-leaf wild oats on June 5 with 65 F, 70% RH, 8 mph wind and a partly cloudy sky. Treatments split (/5d) were applied to 5- to 6-leaf wheat and 4- to 5-leaf wild oats with 62 F, 60% RH, 10-20 mph northwest wind, and an overcast sky at application. Treatments were applied with a bicycle wheel type plot sprayer in 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 replications. Evaluation was on July 10 and wild oat density was less than 5 plts/sq yd. Wild mustard present, but not an adequate density for evaluation. Harvest for wheat yield was on July 24.

Treatment[a]	Rate	Wheat inj	Wild oat control	Wheat Yield
	(oz/A)	(%)	(%)	(bu/A)
Diclofop+PO	12	0	96	32.6
Diclofop+DPX-R9674+PO	12+0.45	3	97	33.3
Diclofop+DPX-R9674+Bromoxynil+PO	12+0.45+4	0	97	32.0
Diclofop+PO/DPX-R9674+X-77(/1d)	12/0.45	4	89	33.3
Diclofop+PO/DPX-R9674+2,4-D dma+X-77(/1d)	12/0.45+4	1	88	36.8
Diclofop+PO/DPX-R9674+MCPA+X-77(/1d)	12/0.45+4	4	83	34.4
Difp+PO/DPX-R9674+Bromoxynil+X-77(/1d)	12/0.45+4	2	86	34.1
Diclofop+PO/DPX-R9674+X-77(/3d)	12/0.45+	7	96	38.3
Diclofop+PO/DPX-R9674+2,4-D dma+x-77(/3d)	12/0.45+4	2	94	41.3
Diclofop+PO/DPX-R9674+MCPA+X-77(/3d)	12/0.45+4	4	94	36.5
Diclofop+PO/DPX-R9674+Bromoxynil+X-77(/3d)	12/0.45+4	4	91	30.0
Diclofop+PO/DPX-R9674+X-77(/5d)	12/0.45	30	95	20.2
Diclofop+PO/DPX-R9674+2,4-D dma+X-77(/5d)	12/0.45+4	7	92	30.3
Diclofop+PO/DPX-R9674+MCPA+X-77(/5d)	12/0.45+4	8	91	26.8
Diclofop+PO/DPX-R9674+Bromoxynil+X-77(/5d)	12/0.45+4	9	92	28.4
Untreated		0	0	23.5
C.V. %		62	4	14.3
LSD 5%		5	5	6.5
# OF REPS		4	4	4

[a]=PO at 1 pt/A and X-77 at 0.25% (v/v);

Summary

DPX-R9674 applied alone 5 days after diclofop injured wheat, but injury was reduced when applied in combinations with MCPA, 2,4-D, or bromoxynil. A similar trend for injury occurred at 1 and 3 days after diclofop. Observations soon after treatment indicated more severe injury than indicated at evaluation. However, wheat yield was only reduced for the DPX-R9674 treatment 5 days after diclofop. The antagonism of wild oats control by DPX-R9674 alone or with other herbicides occurred with a 1 day split after diclofop application, but not when tank mixed or with a 3 or 5 day split. These usually indicate a possible environmental interaction.

Broadleaf weed control in wheat, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 28. Treatments were applied to 4- to 5-leaf wheat, 0.25 to 2 inch tall kochia, 1 to 8 inch tall wild mustard, 4 to 8 inch common lambsquarters, 3- to 4-leaf green foxtail and cotyledon to 3-leaf redroot piqweed on July 7 with 62 F, 70% RH, 15 to 20 mph northwest wind, and an overcast sky at application. 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 with four replications. The first evaluation was on June 20 and a second evaluation was on July 27. Kochia was the most abundant weed species at about 3 plants/ sq yd. Harvest for wheat yield was on July 28.

Treatment	Rate	Wheat inj	June 20 KOCZ	June 20 Wimu	June 20 Colq	June 20 Grft	July 27 KOCZ	Wheat yield
	(oz/A)	(%)	-------(% control)-------					(bu/A)
2,4-D dma	6	4	68	98	98	0	45	26.05
MCPA dma	6	0	46	99	93	0	33	22.56
MCPA ioe	6	1	37	99	97	6	45	23.62
Dicamba-Na+MCPA dma	1.5+4	7	96	99	98	0	99	26.17
Dicamba+MCPA dma	1.5+4	7	96	99	98	0	99	29.19
Bromoxynil&MCPA	8	0	85	99	99	3	91	32.42
DPX-R9674+X-77	0.3+0.25%	7	98	99	93	8	99	23.40
Metsulfuron+24-D+X-77	0.06+4+0.25%	3	99	99	99	11	99	30.76
Clopyralid&24-D	9.5	26	88	99	98	0	89	22.66
Clopyralid&MCPA	9.5	1	60	99	99	4	75	18.28
Fluroxypyr+2,4-D dma+X-77	1+4+0.25%	4	96	97	98	4	99	26.03
DPX-R9674+2,4-D dma+X-77	0.12+4+0.25%	4	99	99	99	10	99	25.60
DPX-R9674+Bromoxynil+X-77	0.12+3+0.25%	1	99	99	96	0	99	27.01
DPX-R9674+Fluroxypyr+X-77	0.12+1+0.25%	3	99	99	95	0	99	30.96
Diclofop+PO	12+0.25G	2	18	35	5	79	0	21.29
HOE-7125	6.25	7	62	98	98	82	62	23.50
HOE-7125+Bromoxynil	6.25+3	11	92	99	99	82	93	23.78
HOE-7125+Dicamba-NA	6.25+1	5	97	99	98	81	98	28.78
HOE-7125+Bromoxynil	6.25+4	6	95	99	99	60	97	25.73
HOE-7125+MCPA ioe	6.25+4	6	78	99	98	84	77	29.65
HOE-6001	0.6	0	0	0	0	76	8	28.05
HOE-6001+Bromoxynil	0.6+6	3	97	98	99	80	98	36.75
Untreated	0	0	0	0	0	0	0	28.11
C.V. %		70	13	10	4	31	17	24.93
LSD 5%		5	13	12	5	13	17	NS
# OF REPS		4	4	4	4	4	4	4

Summary

The clopyralid & 2,4-D treatment caused injury to the wheat. Observation prior to the evaluation indicated injury to wheat from many of the treatments. However, the wheat had recovered by evaluation. Environment was generally positive for good plant growth at treatment which may have enforced herbicide action. Kochia control was 95% or more with dicamba, DPX-R9674, fluroxypyr, metsulfuron and bromoxynil + HOE-7125 or HOE-6001 treatments. The broadleaf control with diclofop was from one replication indicating "in line" sprayer residual. Green foxtail control with the grass control herbicides, diclofop, HOE-7125 and HO3-6001 was usually greater in open areas indicationg that the wheat canopy prevented spray contact with the small foxtail in larger wheat. Yield differences among treatments were not significant because of variability from mid-season drought.

Boadleaf weed control in wheat, Carrington 1989. 'Stoa' hard red spring wheat was seeded May 15. Treatment were applied to 4-leaf wheat on June 9 with 65 F, 43% RH, 4 mph south wind, and a partly cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide are the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 14. Weed densities were kochia _ 1 plant per sq meter and Russian thistle 2 plants per sq meter.

Treatment	Rate	Wheat	Green foxtail	Kochia
	(oz/A)	(% inj)	---(% control)---	
2,4-D dma	6	0	0	70
MCPA dma	6	0	0	56
MCPA ioe	6	0	0	66
Dicamba-Na+MCPA dma	1.5+4	0	0	99
Dicamba+MCPA dma	1.5+4	0	0	99
Bromoxynil&MCPA	8	0	0	99
DPX-R9674+X-77	0.3+0.25%	0	0	99
Metsulfuron+24-D+X-77	0.06+4+0.25%	0	0	89
Clopyralid&2,4-D	9.5	1	0	99
Clopyralid&MCPA	9.5	0	0	99
Fluroxypyr+2,4-D dma+X-77	1+4+0.25%	0	0	86
DPX-R9674+2,4-D dma+X-77	0.12+4+0.25%	0	0	99
DPX-R9674+Bromoxynil+X-77	0.12+3+0.25%	0	0	99
DPX-R9674+Fluroxypyr+X-77	0.12+1+0.25%	0	0	99
Diclofop+PO	12+0.25G	0	92	18
HOE-7125	6.25	0	81	77
HOE-7125+Bromoxynil	6.25+3	0	74	81
HOE-7125+Dicamba-NA	6.25+1	1	88	91
HOE-7125+Bromoxynil	6.25+4	0	70	91
HOE-7125+MCPA ioe	6.25+4	0	93	10
HOE-6001	0.6	0	75	87
HOE-6001+Bromoxynil	0.6+6	2	96	0
Untreated	0	0	0	0
C.V. %		453	33	20
LSD 5%		NS	14	25
# OF REPS		4	4	3

Summary

None of the herbicide treatments caused injury to wheat. Green foxtail control was 70% or more with diclofop, HOE-7125, AND HOE-6001 treatments. Kochia control was variable because of a sparse stand, but generally all treatments gave acceptable control, except for MCPA, 2,4-D, diclofop, HOE-6001 alone, and HOE-7125 + MCPA.

Broadleaf weed control in wheat, Minot 1989. 'Stoa' Hard Red Spring wheat was seeded on May 1. Treatments were applied to 5.3- to 5.5-leaf wheat and 1 to 4 inch tall kochia and Russian thistle on June 5 with 76 F, 40% RH, 6 mph north wind and clear sky at application. 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 20 ft plots. The experiment was randomized complete block with four replications. Evaluation was on July 14. Kochia was less than 1 plant/sq yd and Russian thistle 2 plants/sq yd. A 4 by 16 sq ft area of wheat was harvested on August 3.

Treatment	Rate (oz/A)	Wheat injury (%)	KOCZ (%	Ruth control)	Test Weight (lb/bu)	Wheat Yield (bu/A)
2,4-D dma	6	0	33	61	58.3	32.7
MCPA dma	6	0	13	13	57.5	25.5
MCPA ioe	6	0	18	25	59.1	38.9
Dicamba-Na+MCPA dma	1.5+4	0	87	83	59.1	26.9
Dicamba+MCPA dma	1.5+4	0	82	78	60.1	37.3
Bromoxynil&MCPA	8	0	92	81	58.6	23.0
DPX-R9674+X-77	0.3+0.25%	0	99	99	59.2	36.7
Metsulfuron+2,4-D+X-77	0.06+4+0.25%	0	99	99	58.8	30.1
Clopyralid&2,4-D	9.5	0	59	95	59.1	21.6
Clopyralid&MCPA	9.5	0	36	54	59.0	22.2
Fluroxypyr+2,4-D dma+X-77	1+4+0.25%	0	97	94	59.1	31.7
DPX-R9674+2,4-D dma+X-77	0.12+4+0.25%	0	99	94	59.1	27.2
DPX-R9674+Bromoxynil+X-77	0.12+3+0.25%	0	98	99	58.4	22.4
DPX-R9674+Fluroxypyr+X-77	0.12+1+0.25%	0	99	98	58.4	24.2
Diclofop+PO	12+0.25G	0	0	0	58.5	34.2
HOE-7125	6.25	0	25	51	58.1	22.3
HOE-7125+Bromoxynil	6.25+3	0	64	90	58.5	21.8
HOE-7125+Dicamba-NA	6.25+1	0	97	88	50.1	31.2
HOE-7125+Bromoxynil	6.25+4	2	91	95	58.7	29.3
HOE-7125+MCPA ioe	6.25+4	0	46	61	58.9	26.9
HOE-6001	0.6	0	0	0	55.1	18.2
HOE-6001+Bromoxynil	0.6+6	0	93	98	59.3	32.0
Untreated	0	0	0	0	56.3	22.9
C.V. %		959	26	16	5.7	31.0
LSD 5%		NS	22	15	NS	NS
# OF REPS		4	4	4	3	3

Summary

None of the treatment injured wheat or significantly influenced grain yield. Weed densities were sparse and drought caused variablility in yields. Kochia control exceeded 90% with treatments containing bromoxynil at 4 oz/A, DPX-R9674, metsulfuron, fluroxypyr, and dicamba + HOE-7125. Treatments effective for kochia were also generally effective for Russian thistle control, except clopyralid & 2,4-D controlled Russian thistle but not kochia and HOE-7125 with bromoxynil at 3 oz/A was more effective on Russian thistle than kochia.

Broadleaf weed control in wheat, Langdon 1989. 'Len' Hard Red Spring wheat was seeded May 11. Treatments were applied to 5-leaf wheat, 3- to 5-leaf redroot pigweed and 3-leaf wild buckwheat on June 20 with 76 F, 15 to 20 mph wind, and a cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer in 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiment was randomized complete block with four replications. Evaluation was on August 1. Mets+2,4-D+X-77 treatment had a light application as 20% of fluid volume remained in sprayer after application, probably due to low pressure.

Treatment	Rate	Wheat inj	Wheat yld	Wheat Twt	Redroot pigweed	Wild buckwheat
	(oz/A)	(%)	(bu/A)	(lb/bu)	(% control)---	
2,4-D dma	6	0	25.1	61.5	89	85
MCPA dma	6	1	32.4	62.0	70	69
MCPA ioe	6	0	35.1	61.5	80	37
Dicamba-Na+MCPA dma	1.5+4	0	32.2	62.5	98	98
Dicamba+MCPA dma	1.5+4	0	37.3	61.0	99	99
Bromoxynil&MCPA	8	0	28.5	61.5	89	97
DPX-R9674+X-77	0.3+0.25%	0	33.5	60.5	99	99
Metsulfuron+2,4-D dma+X-77	0.06+4+0.25%	0	30.4	61.5	99	99
Clopyralid&24-D	9.5	0	30.3	62.0	99	99
Clopyralid&MCPA	9.5	0	32.3	62.0	95	97
Fluroxypyr+2,4-D dma+X-77	1+4+0.25%	0	29.6	62.0	94	99
DPX-R9674+2,4-D dma+X-77	0.12+4+0.25%	0	30.1	62.5	99	96
DPX-R9674+Bromoxynil+X-77	0.12+3+0.25%	13	31.1	60.0	99	99
DPX-R9674+Fluroxypyr+X-77	0.12+1+0.25%	0	31.4	62.0	98	94
Diclofop+PO	12+0.25G	0	33.1	62.5	0	0
HOE-7125	6.25	0	29.1	62.0	92	81
HOE-7125+Bromoxynil	6.25+3	0	29.7	62.0	94	87
HOE-7125+Dicamba-NA	6.25+1	0	27.8	62.5	93	85
HOE-7125+Bromoxynil	6.25+4	0	33.4	61.5	80	98
HOE-7125+MCPA ioe	6.25+4	0	31.5	62.0	96	85
HOE-6001	0.6	0	29.9	62.0	8	8
HOE-6001+Bromoxynil	0.6+6	0	32.9	62.0	77	97
Untreated	0	0	31.3	62.0	0	0
C.V. %		131	20.1		15	19
LSD 5%		1	NS		17	21
# OF REPS		4	4		4	4

Summary

None of the herbicide treatments caused important injury to wheat. All herbicide treatments have 90% or more redroot pigweed control except for 2,4-D, MCPA, diclofop, HOE-7125 alone or with bromoxynil at 4 oz/A and HOE-6001 alone or with bromoxynil. Dicamba as the dma or sodium formulation were equally effective for redroot pigweed and wild buckwheat control. The MCPA isooctyl ester tended to be more effective than the dma salt for redroot pigweed control but less effective for wild buckwheat control. Wild buckwheat control exceeded 90% with the sulfonylureas, clopyralid, fluroxypyr, dicamba + MCPA, bromoxynil & MCPA and HOE-7125 + bromoxynil treatments.

<u>Broadleaf weed control in wheat, Williston 1989.</u> 'Amidon' hard red spring wheat was seeded on fallow May 17. Treatments were applied to 4 to 4.5-leaf wheat, 2 to 3-inch tall tame mustard, 2 to 4-leaf green foxtail, and 1 to 2-inch tall Russian thistle on June 14 with 50 F, 91% RH, 2 mph wind, and a clear sky. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi to an area 8 ft wide the length of 10 by 24 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 12. Weed infestations of tame mustard, Russian thistle, and green foxtail were moderate. Harvest for yield was on August 8.

Treatment[a]	Rate	Wheat Injury	Wheat Yield	Tamu	Ruth	Grft
	(oz/A)	(%)	(bu/A)	----(% control)---		
2,4-D dma	6	0	7.1	99	95	0
MCPA dma	6	1	6.3	95	40	0
MCPA ioe	6	1	6.8	95	28	0
Dicamba-Na+MCPA dma	1.5+4	3	6.1	96	94	5
Dicamba+MCPA dma	1.5+4	2	6.8	99	96	6
Bromoxynil&MCPA	8	3	7.0	97	93	5
DPX-R9674+X-77	0.3	0	7.9	99	98	8
Metsulfuron+24-D+X-77	0.06+4	1	7.6	99	99	15
Clopyralid&24-D	9.5	1	7.4	99	90	0
Clopyralid&MCPA	9.5	2	6.9	99	97	23
Flox+2,4-D dma+X-77	1+4	5	7.2	99	99	13
DPX-R9674+2,4-D dma+X-77	0.12+4	2	7.4	97	99	6
DPX-R9674+Brox+X-77	0.12+3	5	7.6	99	99	10
DPX-R9674+Flox+X-77	0.12+1	1	7.5	99	99	0
Diclofop+PO	12	0	7.8	0	0	93
HOE-7125	6.25	1	8.9	99	87	97
HOE-7125+Bromoxynil	6.25+3	2	9.0	99	97	95
HOE-7125+Dicamba-NA	6.25+1	2	9.2	99	94	96
HOE-7125+Bromoxynil	6.25+4	3	9.7	99	98	93
HOE-7125+MCPA ioe	6.25+4	2	8.8	99	85	95
HOE-6001	0.6	2	7.8	0	0	95
HOE-6001+Bromoxynil	0.6+6	2	9.5	97	96	59
Untreated	0	0	6.3	0	0	0
C.V. %		145	11.1	2	10	34
LSD 5%		NS	1.2	2	11	17
# OF REPS		4	4	4	4	4

[a]dma = dimethyl amine; ioe = isooctyl ester; X-77 = non-ionic surfactant from Valent, applied at 0.25% (v/v); Brox=bromoxynil; Flox = fluroxypyr; PO = petroleum oil with 17% emulsifier (Moract) applied at 1 quart/A; clopyralid&2,4-D or MCPA=3:16 formulated mixture; bromoxynil&MCPA = 1:1 formulated mixture; HOE-7125=1.3:1:3 formulated mixture of fenoxaprop: 2,4-D:MCPA; DPX-R9674=2:1 formulated mixture of DPX-M6316&DPX-L5300.

Summary

None of the herbicide treatments caused important injury to wheat. Wheat yield generally responded to weed control, especially green foxtail control. Russian thistle control exceeded 90% except when treated with MCPA, diclofop, HOE-7125, HOE-7125+MCPA. Green foxtail control with HOE-6001 was antagonized when applied with bromoxynil. However, dicamba or bromoxynil did not antagonize green foxtail control with HOE-7125.

DPX-R9674 combinations for broadleaf weed control, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded April 28. Treatments were applied to 4.5-leaf wheat, 1 to 3 inch tall kochia and 2- to 4-leaf wild mustard on June 5 with 70 F, 65% RH, _ 5 mph wind, and a cloudy sky at application. Treatments were applied with a bicycle wheel type plot sprayer in 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 30 ft plots. The experiments was a randomized complete block with four replications. Evaluations were taken on June 20 and July 27. Kochia density was less than 1 plant/sq. ft, and common lambsquarters and wild mustard 1 plant/sq. yd. Harvest for wheat yield was on July 28.

			June 2			July 27	
Treatment[a]	Rate	Wheat inj	KOCZ	Wimu	Colq	KOCZ	Wheat yield
	(oz/A)	(%)	(----%	control		----)	(bu/A)
DPX-R9674+X-77	0.3	4	99	99	99	99	23.97
DPX-R9674+Dicamba-Na+X-77	0.3+1	3	99	99	99	99	21.42
DPX-R9674+Bromoxynil+X-77	0.3+2	5	99	99	99	99	16.78
DPX-R9674+2,4-D dma+X-77	0.3+4	1	99	99	99	99	20.06
DPX-R9674+2,4-D bee+X-77	0.3+4	1	99	99	99	99	26.09
DPX-R9674+MCPA dma+X-77	0.3+4	1	99	99	99	99	21.92
DPX-R9674+Clopyralid&2,4-D+X-77	0.3+3.6	0	99	99	99	82	18.92
DPX-R9674+Clopyralid&MCPA+X-77	0.3+3.6	3	99	99	99	99	19.42
DPX-R9674+Fluroxypyr+2,4-D+X-77	0.3+1+4	3	99	99	99	99	17.29
DPX-L5300+X-77	0.125	1	99	99	99	99	22.70
DPX-L5300+Dicamba-Na+X-77	0.125+1	3	99	99	99	99	18.80
DPX-L5300+Bromoxynil+X-77	0.125+2	1	99	99	99	94	19.77
DPX-L5300+2,4-D dma+X-77	0.125+4	2	99	99	99	99	20.77
DPX-L5300+2,4-D bee+X-77	0.125+4	3	99	99	99	99	17.80
DPX-L5300+MCPA dma+X-77	0.125+4	0	99	99	99	99	19.04
DPX-L5300+Clopyralid&2,4-D+X-77	0.125+3.6	1	99	99	99	99	25.02
DPX-L5300+Clopyralid&MCPA+X-77	0.125+3.6	1	99	99	99	98	18.88
DPX-L5300+Fluroxypyr+2,4-D+X-77	0.125+1+4	3	99	99	99	99	21.99
Dicamba-Na+X-77	2	6	96	99	96	99	22.22
Dicamba-Na+MCPA dma+X-77	1.5+4	7	98	99	99	99	17.27
Bromoxynil+X-77	4	1	99	99	99	99	23.09
Bromoxynil&MCPA+X-77	8	1	97	99	99	98	20.18
Clopyralid&2,4-D+X-77	7.1	1	80	99	97	88	23.29
Clopyralid&MCPA+X-77	7.1	0	75	99	97	58	20.80
Fluroxypyr+24-D+X-77	1+4	1	98	99	98	99	19.60
2,4-D bee+X-77	4	1	76	99	97	75	18.73
2,4-D dma+X-77	4	1	84	99	97	68	21.08
MCPA dma+X-77	4	1	58	98	98	36	20.88
Untreated	0	0	0	0	0	0	12.79
C.V. %		103	8	0	1	13	23.55
LSD 5%		3	10	0	2	16	NS
# OF REPS		4	4	4	4	4	4

[a] X-77 of 0.25% (v/v) in all treatments.

Summary

None of the herbicide treatments caused any important injury to wheat. However, an observation shortly after treatment indicated chlorosis and a reduced wheat height for DPX-R9674 and DPX-L5300 and prostrate growth for dicamba treatments. Injury symptoms were not obvious at the preharvest evaluation and only slight at the June 20 evaluation. Wild mustard and common lambsquarters were effectively controlled by all treatments. Kochia was controlled (¢ 95%) with DPX-R9674, DPX-L5300 (except for DPX-R9674 with clopyralid & 2,4-D at the July 27 evaluation), bromoxynil & MCPA, and fluroxypyr + 2,4-D. Kochia control with the other treatments was clopyralid & 2,4-D ¢ 2,4-D bee = 2,4-D dma ¢ clopyralid & MCPA ¢ MCPA dma. Wheat yields tended to be increased by most herbicide treatments. Yield differences were not significant because of variability due to the drought and weeds were not competitive because their emergence was about 2 weeks after the wheat.

DPX-R9674 combinations for broadleaf weed, Minot 1989. 'Stoa' Hard Red Spring wheat was seeded on May 1. Treatments were applied to 5.3- to 5.5-leaf wheat, 1 to 4 inch tall kochia and Russian thistle on June 5 with 68 F, 50% RH, 6 mph northwest wind and a sunny sky. 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 20 ft plots. The experiment was a randomized complete block with four replications. Evaluation was taken on July 14. Kochia density was 1 plant/sq. yd and Russian thistle 3 plants/sq. yd. A 4 by 16 sq ft area of wheat was harvested on August 3.

Treatment[a]	Rate (oz/A)	Wheat injury (%)	KOCZ (% control)	Ruth (% control)	Test weight (lb/bu)	Wheat yield (bu/A)
DPX-R9674+X-77	0.3	1	99	99	58.6	22.6
DPX-R9674+Dicamba-Na+X-77	0.3+1	0	99	99	58.7	21.5
DPX-R9674+Bromoxynil+X-77	0.3+2	0	99	99	58.8	22.8
DPX-R9674+2,4-D dma+X-77	0.3+4	0	99	99	58.6	22.1
DPX-R9674+2,4-D bee+X-77	0.3+4	0	99	99	57.4	19.9
DPX-R9674+MCPA dma+X-77	0.3+4	1	99	97	58.7	20.3
DPX-R9674+Clopyralid&24D+X-77	0.3+3.6	1	99	99	58.9	23.2
DPX-R9674+Clopyralid&MCPA+X-77	0.3+3.6	1	99	98	59.0	24.5
DPX-R9674+Fluroxypyr+2,4-D+X-77	0.3+1+4	0	99	99	58.6	21.1
DPX-L5300+X-77	0.125	0	99	94	58.6	22.4
DPX-L5300+Dicamba-Na+X-77	0.125+1	1	99	95	59.7	24.3
DPX-L5300+Bromoxynil+X-77	0.125+2	1	99	95	58.5	21.4
DPX-L5300+2,4-D dma+X-77	0.125+4	3	97	94	58.1	20.3
DPX-L5300+2,4-D bee+X-77	0.125+4	0	99	97	60.0	25.8
DPX-L5300+MCPA dma+X-77	0.125+4	0	99	98	58.8	23.0
DPX-L5300+Clopyralid&24D+X-77	0.125+3.6	0	99	99	58.9	24.0
DPX-L5300+Clopyralid&MCPA+X-77	0.125+3.6	0	99	98	59.0	23.1
DPX-L5300+Fluroxypyr+2,4-D+X-77	0.125+1+4	1	99	98	58.4	21.7
Dicamba-Na+X-77	2	1	93	89	59.6	24.7
Dicamba-Na+MCPA dma+X-77	1.5+4	1	97	94	59.5	21.9
Bromoxynil+X-77	4	0	87	87	58.5	22.5
Bromoxynil&MCPA+X-77	8	0	84	91	59.0	24.3
Clopyralid&24D+X-77	7.1	0	43	92	58.8	22.9
Clopyralid&MCPA+X-77	7.1	0	25	40	58.3	21.6
Fluroxypyr+2,4-D+X-77	1+4	1	95	94	59.2	23.3
2,4-D bee+X-77	4	0	63	94	58.3	21.1
2,4-D dma+X-77	4	1	34	88	58.4	23.4
MCPA dma+X-77	4	0	8	8	58.6	24.8
Untreated	0	0	0	0	57.2	20.1
C.V. %		296	13	9	1.3	11.9
LSD 5%		NS	16	11	1.2	NS
# OF REPS		4	4	4	3	3

[a] X-77 at 0.25% (v/v) in all treatments.

Summary

None of the herbicide treatments caused any important injury to wheat. All treatments containing either DPX-R9674 or DPX-L5300 gave 93% or more kochia and Russian thistle control. The only other treatments with 93% or more kochia and Russian thistle control were dicamba + MCPA and fluroxypyr + 2,4-D. 2,4-D ioe was more effective for Russian thistle. Both 2,4-D formulations were more effective than MCPA dma. The greater effectiveness of the 2,4-D ester than the amine at Minot was contrary to the results at Fargo where the formulation gave similar control and probably reflects the dryer conditions during treatment at Minot. Clopyralid & 2,4-D gave adequate Russian thistle control but not kochia and colpyralid & MCPA was inadequate for both species. Wheat yield was not signifcantly influenced by herbicide treatments probably because weed infestation were sparse.

DPX-R9674 combinations for broadleaf weed control in wheat, Williston 1989. 'Amidon' hard red spring wheat was seeded no-till into standing stubble on May 11 . Treatments were applied to 4-leaf wheat, 1 to 2-inch tall Russian thistle, and emerging to 2-leaf green foxtail on June 8 with 55 F, 68% RH, 5 mph wind, and a clear sky. Treatments were applied with a tractor-mounted sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on June 30. Weed densities were heavy infestation for Russian thistle, light infestation for green foxtail, and a spotty light infestation of kochia. Harvest for yield was on August 7.

		Wheat				Ruth
Treatment	Rate	Inj	Strd	Tw	Yield	control
	(oz/A)	(%)	(%)	(lb/bu)	(bu/A)	(%)
DPX-R9674+X-77	0.3	0	0	58.4	7.3	97
DPX-R9674+Dicamba-Na+X-77	0.3+1	1	0	58.8	8.5	96
DPX-R9674+Bromoxynil+X-77	0.3+2	1	0	58.8	7.6	99
DPX-R9674+2,4-D dma+X-77	0.3+4	1	0	58.7	7.2	98
DPX-R9674+2,4-D bee+X-77	0.3+4	0	0	58.6	7.1	99
DPX-R9674+MCPA dma+X-77	0.3+4	1	0	58.7	6.3	98
DPX-R9674+Clopyralid&2,4-D+X-77	0.3+3.6	1	0	58.8	7.8	98
DPX-R9674+Clopyralid&MCPA+X-77	0.3+3.6	2	0	58.8	7.5	97
DPX-R9674+Fluroxypyr+2,4-D+X-77	0.3+1+4	1	0	58.7	7.3	98
DPX-L5300+X-77	0.125	0	0	58.7	7.6	97
DPX-L5300+Dicamba-Na+X-77	0.125+1	2	0	59.1	8.3	93
DPX-L5300+Bromoxynil+X-77	0.125+2	0	0	58.9	7.8	96
DPX-L5300+2,4-D dma+X-77	0.125+4	0	0	58.4	6.6	97
DPX-L5300+2,4-D bee+X-77	0.125+4	1	0	58.4	6.7	97
DPX-L5300+MCPA dma+X-77	0.125+4	1	0	58.3	6.9	97
DPX-L5300+Clopyralid&2,4-D+X-77	0.125+3.6	1	0	58.9	6.7	95
DPX-L5300+Clopyralid&MCPA+X-77	0.125+3.6	0	0	58.6	6.9	95
DPX-L5300+Fluroxypyr+2,4-D+X-77	0.125+1+4	0	0	58.3	6.8	96
Dicamba-Na+X-77	2	3	0	58.4	3.8	51
Dicamba-Na+MCPA dma+X-77	1.5+4	5	0	58.4	5.3	71
Bromoxynil+X-77	4	0	0	58.7	6.8	96
Bromoxynil&MCPA+X-77	8	1	0	58.7	7.9	98
Clopyralid&2,4-D+X-77	7.1	0	0	58.3	5.8	74
Clopyralid&MCPA+X-77	7.1	-	-	----	---	--
Fluroxypyr+24-D+X-77	1+4	5	3	58.7	6.5	71
2,4-D bee+X-77	4	2	0	58.4	6.2	78
2,4-D dma+X-77	4	0	0	58.5	6.0	70
MCPA dma+X-77	4	0	0	56.9	4.8	20
Untreated	0	0	0	57.2	4.0	0
C.V. %		123	45		26.2	6
LSD 5%		4	2		2.4	7
# OF REPS		4	4	1	4	4

[a]X-77 = non-ionic surfactant from Valent at 0.25%, dma = dimethyl amine Na = sodium; bee = butoxyethanol ester; clopyralid&2,4-D or MCPA was a 3:16 formulated mixture; DPX-R9674 was a 2:1 formulated mixture of DPX-M6316& DPX-L5300; Strd=stand reduction; Tw = test weight.

Summary

None of the heribicide treatments caused important injury to wheat. The clopyralid&MCPA caused severe injury and the data is not included because the injury probably was from spray contamination. Wheat yield was generally increased relative to the degree of Russian thistle control. Russian thistle control exceeded 90% for all DPX-L5300, DPX-R9674, and bromoxynil treatments.

Fluroxypyr for weed control in wheat, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 28. Treatments were applied to 4.5-leaf wheat and 1 to 3 inch tall kochia on June 5 with 65 F, 70% RH, 5 to 8 mph wind and a partly cloudy sky at application. 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 replications. Evaluations were on June 19 and July 27. Kochia was dense and the wheat stand was sparse and variable. Harvest for wheat yield was on July 28.

Treatment	Rate	June 19 Wheat injury	June 19 KOCZ	July 27 KOCZ	Wheat yield
	(oz/A)	(%)	(% control)		(bu/A)
Fluroxypyr+X-77	0.75+.25%	0	90	96	23.7
Fluroxypyr+X-77	1.0+.25%	1	94	97	20.0
Fluroxypyr+X-77	1.5+.25%	2	95	99	21.8
Fluroxypyr+Exp2	0.75+.25G	0	92	97	20.5
Fluroxypyr+DPX-R9674+X-77	0.75+0.125+.25%	2	99	99	27.5
Fluroxypyr+DPX-R9674+X-77	1+0.125+.25%	3	99	99	23.7
Fluroxypyr+DPX-R9674+X-77	0.76+0.25+.25%	3	99	99	23.6
Fluroxypyr+DPX-R9674+X-77	1+0.25+.25%	3	99	99	19.4
DPX-R9674+2,4-D dma+X-77	0.125+4+.25%	0	99	99	23.5
DPX-R9674+Bromoxynil+X-77	0.125+3+.25%	0	99	99	27.6
DPX-R9674+Bromoxynil+X-77	0.06+3+.25%	2	99	97	21.7
DPX-R9674+X-77	0.125+.25%	2	99	99	18.4
DPX-R9674+X-77	0.25+.25%	3	99	99	25.8
DPX-R9674+EXP2	0.125+.25G	1	95	98	20.1
2,4-D dma	6	0	79	75	20.0
Bromoxynil&MCPA	6	1	92	92	20.1
Bromoxynil&MCPA+MCPA ioe	6+2	1	91	86	21.9
Bromoxynil&MCPA	8	1	99	98	18.7
Untreated	0	0	0	0	17.0
C.V. %		152	4	5	19.0
LSD 5%		NS	5	7	5.9
# OF REPS		4	4	4	4

Summary

None of the herbicide treatments caused important injury to wheat. Fluroxypyr alone or with DPX-R9674, DPX-R9674 alone or with all other herbicides, and bromoxynil & MCPA gave 90% or more kochia control at both evaluation dates. 2,4-D dma gave 75 to 79% kochia control. Yield was or tended to be higher for herbicide treated than untreated wheat. However, yields were quite variable because of the drought and weed competition light because of emergence of weeds about 2 to 3 weeks after the wheat.

V-23121 for weed control in spring wheat, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 28. Treatments (21f) were applied to 3-leaf wheat, cotyledon to 1 inch tall kochia, cotyledon to 2 inch tall common lambsquarter, and cotyledon redroot pigweed on May 27 with 60 F, 65% RH, 10 mph wind and a clear sky. Treatments (TS) were applied to 4.5-leaf wheat, 1 to 3 inch tall kochia, 1 to 4 inch tall common lambsquarter, 1 to 3 inch tall wild buckwheat and 2-leaf redroot pigweed on June 5 with 70 F, 70% RH, 8 mph wind, and a cloudy sky. The 2-week rainfall after treatment was 0.05 for S1 and 0.21 inch for TS treatments. 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 randomized complete block with four replications. Evaluations were on June 1, 9, 19, 29, and July 27. Harvest for wheat yield was on July 19.

		June 1					June 9				June 19				June 29					July 19		
Treatment[a]	Rate (oz/A)	Wheat inj (%)	KOCZ	Wimu	Colq	Rrpw	Wheat inj (%)	KOCZ	Colq	Rrpw	Wheat inj (%)	Kocz	Colq	Rrpw	Wheat inj (%)	Kocz	Colq	Wibu	Yeft	Kocz	Colq	Wheat yield (bu/A)
			----(% control)----					-(% control)--				-(% control)--				---------(% control)---------						
V-23121(21f)	0.14	2	87	90	66	98	1	89	79	98	0	76	71	97	3	67	60	85	18	64	75	28.1
V-23121(21f)	0.21	4	95	80	82	99	2	96	96	97	1	85	80	99	0	71	70	90	13	83	65	26.5
V-23121(21f)	0.28	5	96	90	85	99	4	91	96	99	4	96	81	99	4	87	80	99	15	89	60	28.9
V-23121(21f)	0.35	5	96	90	88	99	3	95	86	99	1	95	78	99	3	91	69	70	63	93	69	23.9
V-23121+X-77(21f)	0.14+0.0625%	16	95	98	93	99	10	92	88	98	6	89	87	99	5	82	71	99	30	73	65	26.8
V-23121+X-77(21f)	0.21+0.0625%	23	99	98	99	99	10	95	94	99	4	94	93	99	6	87	90	99	59	87	90	29.6
V-23121+MCPA-dma(21f)	.07+4	1	95	95	97	97	0	95	98	99	1	92	98	99	1	89	99	85	39	87	97	29.7
V-23121+MCPA-dma(21f)	0.14+4	1	96	99	90	97	1	96	91	98	3	96	98	99	5	91	99	80	23	90	99	26.3
V-23121+MCPA-dma(21f)	0.21+4	4	99	99	98	99	3	97	98	99	0	99	99	99	5	99	99	99	45	98	99	27.7
V-23121+Diclofop(21f)	0.28+12	28	99	99	99	99	18	99	99	99	11	99	97	99	11	98	99	99	89	96	96	28.9
Diclofop(21f)	12	23	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	40	0	0	25.1
V-23121+AC-222293(21f)	0.28+5	31	99	99	97	99	18	98	97	99	17	97	96	99	16	95	93	99	89	94	98	20.0
AC-222293(21f)	5	0	18	20	3	8	0	0	0	0	1	5	0	14	0	18	0	70	0	25	8	28.1
MCPA-dma(21f)	4	0	38	40	63	55	0	73	87	70	1	78	99	91	0	59	99	0	0	68	98	27.8
Bromoxynil&MCPA(21f)	8	1	99	97	99	97	0	99	99	99	0	99	99	99	1	99	99	99	44	99	99	29.9
Bromoxynil(21f)	4	0	99	98	96	99	1	98	99	99	1	99	99	98	0	99	99	99	0	99	99	27.6
V-23121(TS)	0.14						6	53	21	89	5	86	50	99	3	49	30	99	24	61	36	22.4
V-23121(TS)	0.21						7	53	24	84	6	83	37	99	3	44	34	0	25	71	48	23.1
V-23121(TS)	0.28						5	56	33	93	7	91	81	99	6	53	8	90	20	87	53	22.4
V-23121(TS)	0.35						9	68	28	88	8	95	58	99	3	71	28	90	59	86	25	24.5
V-23121+X-77(TS)	0.14+0.0625%						40	94	96	99	23	99	96	98	11	84	96	99	59	93	99	21.0
V-23121+X-77(TS)	0.21+0.0625%						43	95	97	99	26	98	96	99	15	95	98	99	69	93	95	27.8
V-23121+24-Ddma(TS)	.07+4						14	86	84	97	8	96	98	99	6	95	99	99	35	97	99	24.6
V-23121+24-Ddma(TS)	0.14+4						17	91	88	97	6	97	97	99	4	95	99	99	44	95	99	25.8
V-23121+24-Ddma(TS)	0.21+4						14	84	82	95	13	97	98	99	8	92	99	99	48	95	99	29.0
V-23121+24-Ddma+X-77(TS)	0.14+4+0.0625%						48	96	97	99	30	98	99	99	25	97	99	99	41	96	99	23.0
24-Ddma(TS)	4						3	43	48	61	2	89	94	98	1	69	97	99	0	75	98	24.4
Bromoxynil&MCPA(TS)	8						3	94	95	94	4	99	99	99	6	99	99	85	42	98	99	22.8
Bromoxynil(TS)	4						3	84	82	95	3	98	98	97	5	98	98	99	13	98	99	26.3
Untreated	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.0
C.V. %		131	11		11	11	34	10	11	10	63	8	13	6	88	20	20		85	13	19	22.9
LSD 5%		17	13		12	14	4	11	11	12	6	9	15	7	6	21	21		41	15	20	NS
# OF REPS		4	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4	4

[a] dma designates the dimethylamine salt; and bromoxynil & MCPA was a 1:1 mixture of the octanoic acid ester of bromoxynil and isooctyl ester of MCPA.

Summary

Wheat yields were not significantly influenced by weed control with the treatments as drought caused variability and weeds generally emerged later than the wheat reducing their competitiveness. V-23121 applied with non-ionic surfactant (X-77), diclofop, or AC-222,293 caused a "burn" to wheat leaves shortly after treatment. V-23121 control of weeds was redroot pigweed ¢ kochia ¢ common lambsquarter. The inclusion of MCPA or 2,4-D with V-23121 enhanced weed control without greatly increasing injury to wheat. These mixtures generally gave weed control similar to that with bromoxynil or bromoxynil & MCPA.

Foxtail control in wheat, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on May 16. Treatments were applied to 3- to 4-leaf wheat, 2- to 4-leaf foxtail and 0.5 to 2 inch tall kochia on June 9 with 67 F, 40% RH, 3 to 6 mph north wind and a clear sky. 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 with 4 replications. Evaluation of green and yellow foxtail was difficult because of drought stress on July 28. Foxtail (green and yellow in equal proportion) and kochia density was ¢ 10 plants/sq ft.

Treatment	Rate	Wheat injury	Foxtail	Kochia
	(oz/A)	(%)	--(% control)---	
Diclofop+petroleum oil	12+0.125G	0	84	0
HOE-7125	6.25	0	99	72
HOE-7125	7.5	0	99	59
HOE-6001	0.6	0	99	0
HOE-6001	0.92	0	99	0
HOE-7125+Dicamba	7.5+1	2	99	99
HOE-7125+Bromoxynil	7.5+2	2	97	95
HOE-7125+MCPA	7.5+3	1	99	57
BAS-514	4	0	70	0
BAS-514+seed oil	4+.25G	0	94	63
BAS-514+methylated seed oil	4+.25G	0	99	81
BAS-514+petroleum oil	4+.25G	0	92	58
BAS-514+BAS-090	4+.25G	2	97	89
BAS-514+DPX-R9674+methylated seed oil	4+0.3+0.25G	0	98	97
BAS-514+DPX-R9674+methylated seed oil	4+0.15+0.25G	0	95	99
Untreated	0	1	25	25
C.V. %		223	20	43
LSD 5%		2	25	34
# OF REPS		4	4	4

Summary

None of the herbicide treatments caused important injury to wheat. Wheat was not harvested for yield because of the drought stress. Foxtail was effectively controlled by HOE-7125, HOE-6001, and BAS-514 with adjuvants. Kochia and foxtail were controlled when dicamba or bromoxynil were included in the HOE-7125 and DPX-R9674 in the BAS-514 + MS treatment.

Lanceleaf sage control in wheat. An experiment was conducted at Christine, North Dakota to evaluate several postemergence herbicides for lanceleaf sage control in hard red spring wheat. Treatments were applied to 3 to 4-leaf wheat and cotyledon to 4-leaf lanceleaf sage on June 3 with 65 F, 50% relative humidity, and clear skies. All treatments were applied with a bicycle wheel plot sprayer delivering 8.5 gpa at 35 psi through 8001 regular flat fan nozzles. The experiment had a randomized complete block design with four replications. Lanceleaf sage control was evaluated on June 6, July 3, and July 26.

Treatment[a]	Rate	June 16	July 3	July 26
	(oz/A)	(% lanceleaf sage control)		
MCPA	6	80	99	95
2,4-D	6	85	99	99
Bromoxynil&MCPA	4&4	99	99	99
Bromoxynil	4	92	95	99
MCPA+Dicamba	4+1.5	82	99	99
DPX-M6316&DPX-L5300+X-77	0.17&0.08+0.25%	66	84	83
DPX-M6316&DPX-L5300+X-77	0.25&0.12+0.25%	69	91	89
DPX-M6316&DPX-L5300+MCPA+X-77	0.08&0.04+0.12%	65	80	85
Clopyralid&2,4-D	1.5&8	88	99	99
Clopyralid&MCPA	1.7&9.3	83	99	99
C.V. %		6	4	5
LSD 5%		7	4	6

[a] & = formulated mixture; X-77 = nonionic surfactant.

Lanceleaf sage control increased from the June 16 evaluation to the July 3 and 26 evaluation. All treatments except DPX-M6316&DPX-L5300 alone or with MCPA provided near complete lanceleaf sage control by the last two evaluations. DPX-M6316&DPX-L5300 treatments did not kill all lanceleaf sage, but severely stunted the plants.

Green foxtail control HRS wheat. Thompson Curtis R. and Ben K. Hoag. An experiment was conducted to evaluate herbicides for foxtail control in Stoa HRS wheat seeded at Minot ND on May 4, 1989. Early postemergence (S1) treatments were applied to 3.5-leaf wheat, 0.25- to 1-inch green foxtail, and 1- to 2-inch common lambsquarters on May 31 with 65 F, 7 mph wind, 55% relative humidity, and clear sky. Late postemergence (S2) treatments were applied to 5- leaf wheat, 0.5- to 3.5-inch green foxtail, and 1- to 3-inch common lambsquarters on June 5 with 76 F, 6 mph wind, 38% relative humidity, and clear sky. All treatments were applied with a shielded bicycle-wheel-type plot sprayer with 8001 nozzles delivering 8.5 gpa at 35 psi to a 7 ft wide area the length of the 10 by 16 ft plots. The experiment was a randomized complete block design with four replicates. Evaluations were made on June 24. A 4 by 16 ft area was harvested for grain yield on August 3.

			Wheat[b]					
Treatment[a]	Stage	Rate	Yield	H_2O	Testwt	Inj	Grft	Colq
		(oz/A)	(bu/A)	(%)	(lb/bu)	(%)	(% control)	
Diclofop+COC	(S1)	12	30.7	15.3	58.1	1	91	0
Propanil&MCPA	(S1)	15&4	33.0	14.6	58.7	6	88	95
Propanil&MCPA+Brox&MCPA	(S1)	15&4+2&2	32.0	14.0	59.2	9	88	98
Fenoxapropxaprop&2,4-D&MCPA	(S2)	1.5&1.2&3.5	32.5	13.6	59.0	5	98	96
Fenox&2,4-D&MCPA+Dicamba-Na	(S2)	1.5&1.2&3.5+1	32.4	13.7	59.6	6	98	96
Fenox&2,4-D&MCPA+MCPA ester	(S2)	1.5&1.2&3.5+4	34.4	14.3	59.4	3	93	95
Fenox&2,4-D&MCPA+Bromoxynil	(S2)	1.5&1.2&3.5+4	34.1	15.1	59.0	5	91	98
Untreated		0	31.8	14.0	58.6	0	0	0
C.V. %			12.7	5.2	1.0	67	4	2
LSD 5%			NS	1.1	.8	4	5	2

[a] COC = 1 pint/A Sunit crop oil concentrate; & = formulated mixture; Na = sodium salt.
[b] H_2O = Grain moisture at harvest; Testwt = test weight; Inj = injury; bu = bushel.

Summary

Stoa wheat was slightly injured initially by some treatments but did not influence grain yield. Differences in grain moisture at harvest indicates a slight delay in crop maturity which may have been caused by herbicide injury or reduction in weed competition. Fenoxaprop&2,4-D&MCPA alone and in combination with dicamba gave the highest foxtail control. All treatments gave adequate control of the moderate infestation of green foxtail. The light infestation of common lambsquarters was controlled with all herbicide treatments except diclofop plus crop oil.

Sulfonylurea combinations for false chamomile control in durum wheat. Thompson, Curtis R. and Jon J. Fisher. An experiment was conducted to evaluate various herbicide treatments for false chamomile control in a commercial durum wheat field. Treatments were applied with a bicycle-wheel-type plot sprayer with 8001 nozzles delivering 8.5 gpa at 35 psi to 1- to 1.5-inch spring emerged false chamomile and 5-leaf durum wheat on June 22, 1989 with partly cloudy skies and 60 F near Mohall, ND. Visual evaluations were made on July 17. The experiment was a randomized complete block with three replicates.

Treatment[a]	Rate (oz/A)	False chamomile control (%)
Chlorsulfuron+R-11	0.25+0.25%	95
Chlorsulfuron+2,4-D amine+R-11	0.25+4+.25%	96
Metsulfuron+R-11	0.06+0.25%	97
Mets+2,4-D amine+R-11	0.06+4+.25%	98
DPX-M6316+R-11	0.25+0.25%	81
DPX-M6316+R-11	0.5+0.25%	83
DPX-M6316+2,4-D amine+R-11	0.25+4+0.25%	63
DPX-M6316+2,4-D amine+R-11	0.5+4+0.25%	70
DPX-L5300+R-11	0.125+0.25%	71
DPX-L5300+R-11	0.25+0.25%	88
DPX-L5300+2,4-D amine+R-11	0.125+4+0.25%	48
DPX-L5300+2,4-D amine+R-11	0.25+4+0.25%	65
DPX-M6316&DPX-L5300+R-11	0.167&0.083+0.25%	82
DPX-M6316&DPX-L5300+R-11	0.33&0.17+0.25%	92
DPX-M6316&DPX-L5300+2,4-D amine+R-11	0.167&0.083+4+0.25%	63
DPX-M6316&DPX-L5300+2,4-D amine+R-11	0.33&0.17+4+0.25%	83
C.V. %		10
LSD 5%		14
F-TRT		10

[a] R-11=a nonionic surfactant from Wilbur Ellis in the spray on a volume percentage.

Summary

Chlorsulfuron and metsulfuron alone and in combination with 2,4-D amine gave 95 to 98% control of false chamomile. DPX-M6316 0.25 at oz/A, DPX-L5300 at 0.125 oz/A and DPX-M6316&DPX-L5300 at 0.25 oz/A gave significantly less false chamomile control than chlorsulfuron or metsulfuron. 2,4-D amine in combination with DPX-M6316 at 0.25, DPX-L5300 at 0.125 and 0.25, and DPX-M6316&DPX-L5300 at 0.167&0.083 oz/A gave 18 to 23% less control of false chamomile than the DPX herbicides at the same rates applied alone. Durum wheat was not injured by any herbicide treatment.

Variety response to DPX-R9674-DPX-5300, Williston, 1989. Crop varieties were seeded to a field which was fallow in 1988, on May 6. Herbicides were applied in 10 gpa at 30 psi to 6 by 10 ft plots on May 31, with 66F, 44% relative humidity, 4 mph wind, and clear sky. Soil surface was dry with 64F at 10 cm under bare soil. Treatment stages for the crops were barley 4-to 4.4-leaf, durum 3.8-to 4.2-leaf, HRS wheat 4-to 4.4-leaf, and oats 3.3-to 3.6-leaf. Bromoxynil + MCPA at 3 + 3 oz/A was applied on May 23. The first rain after treatment was 0.79 in. on June 10-11. The barley was weed free and ratings were as indicated in the tables below:

Barley response to DPX-R9674 and DPX-L5300.

Barley variety	Rated June 19 DPX-R9674 0.45	Rated June 19 DPX-R9674 0.9	Rated June 19 DPX-L5300 0.5	Rated June 30 DPX-R9674 0.45	Rated June 30 DPX-R9674 0.9	Rated June 30 DPX-L5300 0.5	Rated July 26 DPX-R9674 0.45	Rated July 26 DPX-R9674 0.9	Rated July 26 DPX-L5300 0.5
	(% crop injury)								
Morex		NO		NO	00	NO		NO	
Robust		VISIBLE		VISIBLE	00	VISIBLE		VISIBLE	
Azure		INJURY		INJURY	02	INJURY		INJURY	
Hazen		TO		TO	00	TO		TO	
M 52		ANY		ANY	00	ANY		ANY	
B 1602		VARIETY		VARIETY	00	VARIETY		VARIETY	
B 1603		AT		AT	00	AT		AT	
ND 9320W		THIS		THIS	02	THIS		THIS	
ND 9675		RATING		RATE	00	RATE		RATING	
Bowman		DATE			02			DATE	
Ellice					00				
Hector					00				
Lewis					00				
Gallatin					00				
MT 81616					02				
ND 9147					00				
ND 9866					02				
ND 9870					05				

Oats variety response to DPX-R9674 and DPX-L5300

Oat variety	Rated June 19 DPX-R9674 0.45	Rated June 19 DPX-R9674 0.9	Rated June 19 DPX-L5300 0.5	Rated June 30 DPX-R9674 0.45	Rated June 30 DPX-R9674 0.9	Rated June 30 DPX-L5300 0.5
	(% crop injury)					
Russell	00	00	00	00	05	00
Border	00	00	00	10	10	05
Otana	00	00	00	00	05	05
Monida	00	00	00	05	10	05
Dumont	00	00	00	05	10	00
Kelsey	00	05	00	00	10	00
Hytest	00	05	00	05	10	00
ND 810104	00	05	00	00	05	00
Riel	00	00	00	00	10	00
Robert	05	05	00	05	15	00
Steele	00	05	00	05	20	05
Tibor	05	10	00	05	10	00
Trucker	00	05	05	00	05	10
Valley	10	10	10	10	15	10

Durum wheat variety response to DPX-R9674 and DPX-L5300

Durum variety	Rated June 19 DPX-R9674 0.45	Rated June 19 DPX-R9674 0.9	Rated June 19 DPX-L5300 0.5	Rated June 30 DPX-R9674 0.45	Rated June 30 DPX-R9674 0.9	Rated June 30 DPX-L5300 0.5	Rated July 27 DPX-R9674 0.45	Rated July 27 DPX-R9674 0.9	Rated July 27 DPX-L5300 0.5
	(% crop injury)								
Ward	00	00	00	05	05	05	05	10	10
Rugby	05	05	05	05	05	15	05	05	10
Crosby	05	15	20	00	05	10	00	10	05
Vic	00	10	10	00	05	00	00	10	00
Medora	00	00	00	00	00	00	00	05	00
Monroe	00	05	05	00	00	00	00	00	05
Renville	00	15	05	05	10	10	05	10	15
Sceptre	00	05	05	05	10	05	05	10	10
Regal	05	40	25	00	05	00	00	15	00
Kyle	00	05	00	05	10	00	05	15	00
Wakooma	00	10	05	15	15	00	15	20	10
Fjord	00	05	10	00	05	00	00	10	00
Stockholm	05	20	15	00	05	00	00	05	00
Lloyd	00	05	00	05	05	00	05	05	00
Cando	00	05	05	00	05	00	00	05	00
D 8291	00	05	00	00	00	00	00	00	00
D 8302	00	05	10	00	00	00	05	00	00
D 8370	00	05	05	00	00	00	00	00	00
D 8380	00	05	05	00	00	05	00	05	05
D 8460	00	10	20	00	05	00	00	00	00
D 8475	00	05	10	00	00	00	00	00	00
D 8479	00	05	05	00	00	00	00	00	00
D 84130	00	00	NR	00	00	NR	00	00	NR
D 86061	00	00	05	00	00	10	00	00	10
D 86078	00	05	00	00	10	10	00	10	10
D 86013	00	00	10	10	05	15	10	10	15
D 86117	00	05	00	05	10	05	05	10	05
D 86237	05	10	15	00	05	00	00	10	00
D 86398	05	05	10	00	00	05	00	05	05
D 86418	05	10	15	00	00	10	00	05	00
D 86442	00	00	00	00	00	00	00	00	00
D 86462	00	05	10	05	10	10	05	10	10
D 86468	05	10	20	05	10	05	05	10	05
CA 885-312	00	05	10	05	05	10	05	05	05

HRS wheat variety response to DPX-R9674 and DPX-L5300.

HRSW variety	Rated June 19 DPX-R9674 0.45	Rated June 19 DPX-R9674 0.9	Rated June 19 DPX-L5300 0.5	Rated June 30 DPX-R9674 0.45	Rated June 30 DPX-R9674 0.9	Rated June 30 DPX-L5300 0.5	Rated July 27 DPX-R9674 0.45	Rated July 27 DPX-R9674 0.9	Rated July 27 DPX-L5300 0.5
	Evaluation dates and herbicide rates in oz/A.								
	-(% crop injury)-								
Baart	05	05	05	NR	NR	NR	NR	NR	NR
Columbus	05	05	05	10	10	05	05	10	10
Stoa	00	00	00	03	10	02	00	10	05
Butte 86	00	00	00	00	03	00	00	05	00
Roblin	00	00	00	00	07	NR	00	05	NR
Laura	05	05	05	03	15	10	05	10	10
Amidon	05	10	10	05	15	08	10	20	10
Sandy	00	05	00	07	20	03	09	20	05
Waldron	00	05	00	10	15	10	10	15	10
Coteau	15	15	15	10	10	00	10	10	00
Alex	00	05	00	12	12	05	10	10	05
ND 652	00	10	00	15	25	05	05	15	05
ND 654	00	00	00	08	15	03	05	15	05
ND 656	00	00	00	10	10	00	05	10	00
ND 658	00	00	00	00	05	00	00	05	00
W2501	00	05	NR	00	05	NR	00	05	NR
W2502	NR	NR	NR	NR	NR	NR	NR	NR	NR
Len	05	05	00	10	10	10	10	10	05
Marshall	05	10	00	10	15	15	10	15	10
2369	00	10	05	05	15	10	00	10	10
Wheaton	10	10	00	10	25	12	10	15	10
Norak	05	10	05	15	20	10	10	20	10
Leif	05	05	00	10	20	05	05	10	05
Norseman	05	10	05	10	25	10	05	15	15
Celtic	05	10	05	08	15	00	05	05	00
Nordic	00	05	00	12	20	15	05	15	10
Telemark	00	05	00	10	20	15	15	20	15
2385	05	10	10	10	20	05	10	20	05
2375	05	10	00	00	25	03	00	25	00
Prospect	00	05	00	10	20	05	00	10	05
Fjeld	00	00	00	02	05	00	00	10	00
Minnpro	05	05	00	15	20	05	05	05	10
Vance	05	10	00	10	15	08	05	10	10
Gus	00	05	00	00	03	00	00	00	05
Grandin	00	00	00	00	05	00	00	10	05
ND 650	00	05	00	00	07	05	00	05	05
ND 653	00	05	05	00	05	05	00	05	05
ND 655	05	10	00	00	05	05	00	05	10
ND 657	00	05	00	00	20	10	00	10	15
Cutless	00	05	00	03	25	05	05	25	10
Rambo	00	05	05	05	20	10	10	20	15
Lew	00	00	00	25	25	03	25	25	05

HRS and durum wheat variety response to difenzoquat, Langdon 1989. Difenzoquat at 12 oz ai/A was applied in 8.5 gpa at 40 psi to early boot wheat in the "Drill Strip Trials" on June 20 with 85F amd a 10 mph wind. The wheat was seeded on May 1.

HRS wheat (variety)	Injury (%)	Durum wheat (variety)	Injury (%)
Baart	Tr	Cando	0
Len	60	Ward	0
Marshall	30	Rugby	Tr
2369	0	Vic	40
Columbus	10	Lloyd	0
Wheaton	20	Medora	Tr
Stoa	20	Monroe	Tr
Norak	Tr	Renville	Tr
Lief	10	Sceptre	0
Norseman	60	Regal	60
Celtic	60	Fjord	40
Butte 86	10	D8291	Tr
Nordic	40	D8302	Tr
Telemark	10	D8370	10
Roblin	Tr	D8380	60
Laura	20	D8460	Tr
2385	Tr	D8475	60
2375	Tr	D8479	0
Amidon	Tr	D84130	60
Prospect	10	D86061	60
Fjeld	10	D86078	Tr
Minnpro	20	D86013	0
Vance	20	D86117	0
Gus	40	D86237	Tr
Grandin	40	D86398	60
ND650	60	D86418	60
ND652	40	D86442	10
ND653	10	D86464	40
ND654	60	D86468	40
ND655	20	CA885-312	10
ND656	20		
ND658	10		
W2501	40		
W2502	10		
HS85-902	20		
2370	0		

Weed control in oats, Williston, 1989. An Experiment was conducted to determine the response of oats and susceptibility of weeds to various sulfonylureas in comparison to presently commercial herbicides. 'Otana' oats was seeded on May 22 to a Max loam soil with 5.8 pH, 1.8 organic matter, 78N-46P-690K, fallow soil in the previous year. The soil was fertilized with 40 lb N and 25 lb/A P_2O_5. Treatments were applied to 4- to 4.5-leaf oats and 1 to 3 inch tall Russian thistle on June 6 with 61 F, 60 % relative humidity, 8 mph west wind, partly cloudy sky, and bare soil 68 F 10 cm deep. The treatments were applied with a tractor mounted sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The first rain after treatment was 0.08 inch on June 21. Evaluations were on July 11 and harvest on August 9. Russian thistle infestation was moderate.

Treatment[a]	Rate	Injury	Wheat Test weight	Wheat Yield	Ruth control
	(oz/A)	(%)	(lb/bu)	(bu/A)	(%)
2,4-D dma	4	4	31.5	7.5	64
MCPA dma	6	3	30.0	8.0	6
Bromoxynil	6	3	31.9	11.1	98
Bromoxynil&MCPA	5	3	31.6	10.9	90
Metsulfuron+surf	0.06	59	28.4	7.6	99
Chlorsulfuron+surf	0.25+0.25%	1	32.4	10.4	97
DPX-R9674+surf	0.45+0.25%	4	32.3	10.1	98
DPX-L5300+surf	0.25+0.25%	8	32.0	9.4	99
DPX-R9674+MCPA+surf	0.45+4+0.25%	3	31.5	8.5	97
DPX-L5300+MCPA+surf	0.25+4+0.25%	3	33.2	10.2	98
DPX-R9674+2,4-D dma+surf	0.45+4+0.25%	1	32.8	12.5	96
DPX-L5300+2,4-D dma+surf	0.25+4+0.25%	5	33.0	12.4	98
Untreated	0	0	30.9	10.7	0
C.V. %		112		25.2	7
LSD 5%		12		NS	7
# OF REPS		4	1	4	4

[a]surf=non-ionic surfactant; DPX-R9675=is a 2:1 formulated mixture of DPX-M6316 and DPX-L5300; dma=dimethyl amine.

Summary

Metsulfuron caused severe injury to oats, but only tended to reduce yield and test weight. However, yields were not low because of drought which may have masked the effect of herbicide injury on yield. DPX-L5300 also tended to injure oats and injury tended to be reduced when applied in combination with MCPA. All sulfonylurea and bromoxynil treatments gave 90 % or more Russian thistle control. MCPA was ineffective and 2,4-D partly effective for Russian thistle control.

Broadleaf weed control in oats. An experiment was conducted to evaluate herbicides for broadleaf weed control on 'Dumont' oats seeded in a Williams Loam soil with a pH of 7.0 and 4% organic matter on May 4, 1989. Treatments were applied in 8.5 gpa at 35 psi through 8001 nozzles on a shielded bicycle-wheel-type plot sprayer to 4.5-leaf oat, 0.5- to 2-inch prostrate pigweed, 1- to 3-inch redroot pigweed, 1- to 4-inch Russian thistle, and 1- to 3-inch common lambsquarters on June 3 with 68 F, 7 mph wind, 25% RH, and sunny sky. Growing conditions were excellent at the time of treatment. A 7 ft width of the 10 by 16 ft plots were treated. A 4 by 16 ft area was harvested for grain yield on August 1. The study was a randomized complete block with four replicates.

Treatment[a]	Rate	Wheat[b] Yield	Testwt	Inj	Prpw	Rrpw	Ruth	Colq
	(oz/A)	(bu/A)	(lb/bu)	(------%	control	------)		
Bromoxynil	6	43.3	36.0	1	83	85	93	96
Bromoxynil&MCPA	8	33.6	34.9	6	89	90	98	98
MCPA dma	8	44.6	36.2	1	35	30	51	83
Dicamba-Na	2	30.6	34.3	5	36	45	65	58
MCPA dma+Dicamba-Na	6+2	25.5	33.5	15	64	64	80	86
Propanil&MCPA	15&4	37.7	34.9	9	79	80	45	86
Propanil&MCPA+Brox&MCPA	5&4+2&2	43.5	35.2	13	98	98	94	98
DPX-M6316&DPX-L5300+R11	0.30&0.15	44.5	36.2	9	97	97	97	97
DPX-M6&DPX-L5+MCPA dma+R11	0.30&0.15+4	45.8	35.6	3	97	98	98	98
DPX-M6&DPX-L5+2,4-D dma+R11	0.30&0.15+4	35.6	34.8	4	97	97	98	98
DPX-M6&DPX-L5+Dica-SGF+R11	0.30&0.15+1.5	32.2	29.6	18	98	98	98	98
DPX-L5+R11	0.25	49.8	35.5	10	86	91	98	98
DPX-L5+MCPA dma+R11	0.25+4	47.0	35.4	8	86	88	97	97
DPX-L5+2,4-D dma+R11	0.25+4	34.1	32.4	8	86	88	97	97
DPX-L5+Dicamba-SGF+R11	0.25+1.5	37.3	29.6	16	92	94	95	98
DPX-M6+R11	0.5	41.5	34.6	1	97	97	98	98
DPX-M6+MCPA dma+R11	0.5+4	48.1	33.9	1	97	97	98	98
DPX-M6+2,4-D dma+R11	0.5+4	46.9	34.1	5	97	97	97	97
DPX-M6+Dicamba-SGF+R11	0.5+1.5	31.7	28.3	19	96	97	98	98
Control	0	35.5	31.7	0	0	0	0	0
C.V. %		24.8	3.0	45	8	7	5	4
LSD 5%		13.9	1.5	5	9	8	7	6
F-TRT		2.0	20.7	12	73	89	125	135

[a] & = formulated mixture; R-11=a nonionic surfactant from Wilbur Ellis applied at 0.25%; Na =sodium salt formulation; dma=dimethylamine salt;

[b] bu = bushel; Testwt = Test weight; Inj = injury

Summary

Sulfonylurea herbicides (DPX) alone and tank mixes gave higher than 90% control of the broadleaf weeds evaluated, except DPX-L5300 and combinations which gave 86% control of prostrate pigweed and 88 to 91% control of redroot pigweed. MCPA and dicamba alone or combined gave less than 80% pigweed and Russian thistle control. Dicamba alone gave less than 60% common lambsquarters control. Propanil&MCPA was inadequate for Russian thistle control and marginal (™80%) for control pigweed. Visual evaluations of oat injury indicated that dicamba applied in combination with MCPA dma or the sulfonylurea herbicides injured the oats. Oats treated with dicamba in combination with the sulfonyl urea herbicides had lower test weight than untreated oats or oats treated with any other herbicides. Oats treated with bromoxynil&MCPA, dicamba alone, or dicamba and 2,4-D combinations with sulfonylurea herbicides tended to have lower test weight and yield than oats treated with the DPX compounds alone or tank mixed with MCPA dma.

BAS 514 for weed control in wheat Exp 1, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on May 16. Treatments were applied to 5.5- to 6-leaf wheat, 3.5- to 5.5-leaf green and yellow foxtail and 0.5 to 2 inch tall kochia on June 14 with 65 F, 12 to 15 mph north wind and a 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. Evaluations were on July 6, and 28. The experiment was a randomized complete block with four replications. Weed density consisted mostly of green foxtail but yellow foxtail and kochia were also present at more than 10 plants per sq. ft. Harvest for wheat yield was on August 4.

Treatment	Rate	July 6 Wheat inj	July 6 Foxtail control	July 28 Wheat inj	July 28 Foxtail control	July 28 Kochia control	Wheat yield
	(oz/A)	(%)	(%)	(%)	(%)	(%)	(bu/A)
BAS-514	4	0	46	0	77	21	14.9
BAS-514+seed oil	4+.25G	1	91	3	92	64	15.3
BAS-514+methylated seed oil	4+.25G	1	85	2	90	83	18.9
BAS-514+petroleum oil	4+.25G	0	68	3	83	73	17.7
BAS-514	8	0	77	1	83	43	17.8
BAS-514+seed oil	8+.25G	1	89	4	96	80	17.5
BAS-514+methylated seed oil	8+.25G	3	95	3	98	87	16.5
BAS-514+petroleum oil	8+.25G	1	91	2	93	80	16.5
Untreated	0	0	0	0	0	0	17.1
C.V. %		233	13	80	7	17	9.3
LSD 5%		NS	13	2	8	14	2.3
# OF REPS		4	4	4	4	4	4

Summary

BAS-514 did not cause visable injury to wheat regardless of rate or adjuvant. Methylated seed oil tended to enhance BAS-514 more that the other adjuvants enforced BAS-514, except seed oil tended to enhance BAS-514 4 oz/A for foxtail control more that the other adjuvants, at the first evlaluation. All adjuvants enhanced foxtail and kochia control with BAS-514 compared to BAS-514 applied alone. bas-514, except seed oil

BAS-514 for weed control in wheat Exp 2, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on May 16. Treatments were applied to 7-leaf wheat, 5-leaf foxtail and 1 to 8 inch tall kochia on June 19 with 75 F, 10 mph south wind, and 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 with four replications. Evaluations were on July 6, and 28. Weed density of green and yellow foxtail, and kochia was greater than 10 plants per sq ft. Harvest for wheat yield was on August 4.

Treatment	Rate (oz/A)	July 6 Wheat injury (%)	July 6 Fxtl (% control)	July 6 KOCZ (% control)	July 23 Wheat injury (%)	July 23 Fxtl (% control)	July 23 KOCZ (% control)	Wheat yield (bu/A)
BAS-514	4	0	49	20	0	58	24	17.9
BAS-514+seed oil	4+.25G	0	65	30	0	80	44	18.4
BAS-514+methylated seed oil	4+.25G	0	74	30	0	80	64	19.2
BAS-514+petroleum oil	4+.25G	0	62	40	0	66	45	18.9
BAS-514	8	0	67	45	0	67	31	17.7
BAS-514+seed oil	8+.25G	0	74	50	1	86	69	12.8
BAS-514+methylated seed oil	8+.25G	0	75	45	3	85	77	13.8
BAS-514+petroleum oil	8+.25G	0	72	50	1	76	57	16.4
Untreated	0	0	0	0	0	0	0	14.9
C.V. %		0	15		196	10	40	14.9
LSD 5%		NS	13		2	10	27	3.6
# OF REPS		4	4	1	4	4	4	4

Summary

BAS-514 did not cause important injury to wheat regardless of rate or adjuvant evaluated. The adjuvants with BAS-514 for foxtail control tended to be methylated seed oil = seed oil ¢ petroleum oil ¢ alone.

Weed free wheat, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 28. Treatments (2lf) were applied to 2.5-leaf wheat on May 23 with 70 F, 60% RH, 10 mph northeast Wind and a partly cloudy sky. Treatments (4lf) were applied to 4.5-leaf wheat, 2- to 6-leaf wild mustard and 1 inch tall kochia on June 2 with 65 F, 50% RH, 10 mph northwest wind and a hazy sky. Treatments (LT) were applied to jointing to 14 inch tall wheat on June 15 with 70 F, 60% RH, no wind, and a clear sky. Treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replications. All plots were treated with Brox + MCPA at 4 + 4 oz/A on May 29. Harvest was on August 1.

Weed free wheat, Casselton 1989. 'Len' Hard Red Spring wheat was seeded on April 29. Treatments (2lf) were applied to 3-leaf wheat, 2- to 4-leaf wild mustard, cotyledon to 1.5 inch tall kochia and 1 inch tall common lambsquarter on May 23 with 75 F, 70% RH, 5 mph north wind and a partly cloudy sky. Treatments (4lf) were applied to 4- to 4.5-leaf wheat, cotyledon to 6-leaf wild mustard, cotyledon- to 6- inch tall kochia and 4- to 6- leaf common lambsquarters on June 2 with 60 F, 20% RH, 3 to 7 mph wind and a partly cloudy sky. Treatments (LT) was applied to jointing to 14 inch tall wheat on June 15 with 70 F, 60% RH, no wind, and a clear sky. Treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to 8 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block with 4 replications. All plots were treated with Brox + MCPA at 4 + 4 oz/A on May 29. Harvest was on August 8.

Treatment	Rate (oz/A)	Fargo Yield (bu/A)	Casselton Yield (bu/A)
BAS-514+BAS-090(2lf)	4+.25G	35.58	43.09
BAS-514+BAS-090(2lf)	6+.25G	38.22	32.70
BAS-514+BAS-090(2lf)	8+.25G	38.33	27.67
BAS-514(2lf)	8	32.38	31.53
BAS-514+MS(2lf)	8+.25G	37.58	29.56
BAS-514+BAS-090(4lf)	4+.25G	32.26	26.97
BAS-514+BAS-090(4lf)	6+.25G	38.66	22.28
BAS-514+BAS-090(4lf)	8+.25G	29.46	19.45
BAS-514(4lf)	8	38.23	30.80
BAS-514+MS(4lf)	8+.25G	42.07	26.62
BAS-514+BAS-090(LT)	4+.25G	26.89	13.41
BAS-514+BAS-090(LT)	6+.25G	17.02	11.39
BAS-514+BAS-090(LT)	8+.25G	22.56	10.44
BAS-514(LT)	8	35.82	33.87
BAS-514+MS(LT)	8+.25G	39.97	23.36
Untreated	0	43.61	37.20
C.V. %		24.42	20.01
LSD 5%		11.92	7.48
# OF REPS		4	4

Summary

The wheat was relatively weed free so the yield responses should mainly reflect response to the BAS-514 treatments. However, yields were quite variable because of drought conditions mid to late in the growth cycle. Wheat yield generally decreased as BAS-514 treatment was delayed from the 2-leaf to late tillering stage of wheat, at both locations. BAS-514 applied without an adjuvant did not reduce wheat yield regardless of stage at application. BAS-090 adjuvant with BAS-514 tended to reduce wheat yield more than methylated seed oil (MS) with BAS-514. These data indicate that wheat repsonse to BAS-514 is dependent upon adjuvants and wheat growth stage at treatment.

2,4-D with adjuvants, Casselton 1989. Three experiments were conducted with the same treatments but with different water carriers. The carriers were distilled water, distilled water with 1000 ppm (w/v) sodium bicarbonate, and distilled water with $NaHCO_3$, KNO_3, $CaCl_2 \cdot 2H_2O$, and $MgSO_4$ each at 500 ppm as cation (hard water). 'Len' Hard Red Spring wheat was seeded on April 29. Treatments were applied to 4.5- to 5-leaf wheat, 4- to 11-leaf kochia and wild mustard on June 6 with 75 F, 35% RH, 10 to 18 mph southeast wind and a clear sky. Treatments were applied in 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to an 8 ft wide strip the length of 10 by 30 ft plots. The experiments were a randomized complete block with four replications. The distilled water experiment was evaluated on July 5, sodium bicarbonate experiment on June 26, and the "hard water" experiment on June 5. Weed densities were sparse and did not occur in all replication, except in the hard water experiment where weeds were adequate for accurate evaluation.

		Sodium water			Distilled water		Hard Water		
		Wheat	Wimu	Kocz	Wheat	Kocz	Wheat	Vosf	Kocz
Treatment	Rate	inj	control		inj	control	inj	control	
	(oz/A)	(%)	---(%)---		(%)	(%)	(%)	---(%)---	
2,4-D bee	4	0	98	73	2	90	2	92	87
2,4-D dma	4	0	97	33	0	95	0	89	48
2,4-D dma+L1700	4+.25%	0	99	62	0	99	0	83	78
2,4-D dma+SCI40	4+1%	1	96	47			0	75	62
2,4-D dma+X-77	4+.25%	0	98	70	1	40	0	87	82
2,4-D dma+28N	4+1G	0	99	55	1	90	1	97	81
2,4-D dma+PO	4+.25G	1	99	74	0	94	1	98	90
2,4-D dma+MS	4+.25G	1	99	73	2	96	2	98	93
2,4-D dma+Safe-6(pH4-6)	4	0	97	57	0	99	1	84	55
2,4-D dma+FFA	4+.25G	3	99	74	0	70	2	98	89
2,4-D dma+AMS	4+32	1	99	85	0	88	1	95	74
2,4-D dma+MS+28N	4+.25G+1G	2	99	75	2	95	4	96	89
2,4-D dma+Exp1	4+.125G	1	92	58	0	80	0	80	67
2,4-D dma+Exp2	4+.25G	0	96	77	1	92	0	82	81
2,4-D dma+Exp3	4+.25G	0	96	37	0	99	1	91	63
2,4-D dma+Exp4	4+.25G	0	86	33	1	88	1	87	77
Untreated	0	0	0	0	0	0	0	0	0
C.V. %		218	6	17	226		170	10	15
LSD 5%		2	7	20	NS		NS	12	15
# OF REPS		4	4	2	4	1	4	4	4

[a]Hardwater: $NaHCO_3$, KNO_3, $CaCl_2 \cdot 2H_2O$ and $MbSO_4$ all = 500 ppm as cation; $NaHCO_3$ alone 2000 ppm as cation.

Summary

None of the adjuvant increased injury to wheat from 2,4-D, regardless of water carrier. Adjuvants appeared to differ in their enhancement of 2,4-D dma. SCI-40; Exp 1, 2, 3,and 4; caused precipitates which clogged nozzles. Generally the most effective adjuvants were petroleum oil (PO), methylated seed oil (MS), ammonium sulfate, ammonium sulfate with MS, and 28% nitrogen fertilizer.

2,4-D with adjuvants for weed control in wheat, Minot 1989. 'Stoa' Hard Red Spring wheat was seeded on May 1. Treatments were applied to 5.3- to- 5.5 leaf wheat and 1- to-4 inch tall kochia and Russian thistle on June 5 with 75 F, 42% RH, 6 mph north wind and a clear sky. Treatments were in 8.5 gpa at 35 psi with a bicycle wheel type plot sprayer to an 8 ft wide strip the length of 10 by 20 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 16. Kochia density was less than 1 plant/sq yd and Russian thistle 5 plants/sq yd. Treatment 14 and 16 had a problem with precipitate and treatment 14 was resprayed at a fast pace. A 4 by 16 sq ft area of wheat was harvested on August 3.

Treatment	Rate	Wheat injury	Kochia	Russian thistle	Test weight	Wheat yield
	(oz/A)	(%)	--(%	control)--	(lb/bu)	(bu/A)
2,4-D bee	4	0	48	76	58.3	20.2
2,4-D dma	4	0	19	36	58.3	21.4
2,4-D dma+L1700	4+.25%	0	33	79	58.7	20.9
2,4-D dma+SCI40	4+1%	0	25	43	56.5	17.6
2,4-D dma+X-77	4+.25%	0	34	70	58.0	20.9
2,4-D dma+28N	4+1G	0	18	31	57.1	19.4
2,4-D dma+PO	4+.25G	0	49	82	58.7	20.7
2,4-D dma+MS	4+.25G	0	77	90	58.5	21.9
2,4-D dma+Safe-6(pH4-6)	4	0	23	36	56.6	17.4
2,4-D dma+FFA	4+.25G	1	59	87	57.3	18.4
2,4-D dma+AMS	4+32	0	72	81	58.0	18.0
2,4-D dma+MS+28N	4+.25G+1G	3	77	96	57.5	17.4
2,4-D dma+Exp1	4+.125G	0	9	20	57.3	19.9
2,4-D dma+Exp2	4+.25G	0	29	58	55.8	15.2
2,4-D dma+Exp3	4+.25G	0	29	45	57.7	20.1
2,4-D dma+Exp4	4+.25G	0	39	60	58.2	20.3
Untreated	0	0	0	0	55.1	15.6
C.V. %		533	50	25	2.0	17.6
LSD 5%		NS	27	21	1.6	NS
# OF REPS		4	4	4	4	4

Summary

None of the adjuvants increased injury to wheat when applied with 2,4-D. Methylated seed oil (MS), ammonium sulfate, and methylated seed oil + 28% nitrogen fertilizer generally enhanced 2,4-D dma for kochia and Russian thistle control compared to 2,4-D dma or 2,4-D bee alone. Wheat yield was not increased by the 2,4-D treatments because weed densities were sparse.

2,4-D with adjuvants for weed control in wheat, Langdon 1989. 'Len' Hard Red Spring wheat was seeded on May 11. Treatments were applied to 5 leaf wheat and 3- to 5-leaf redroot pigweed and wild buckwheat on June 20 with 76 F, 10 to 15 mph wind and a cloudy sky. 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on August 1.

Treatment	Rate	Wheat inj	Wheat yld	Wheat Twt	Redroot pigweed	Wild buckwheat
	(oz/A)	(%)	(bu/A)	(lb/bu)	---(% control)---	
2,4-D bee	4	0	28.3	61.5	86	80
2,4-D dma	4	0	26.1	61.0	93	71
2,4-D dma+L1700	4+.25%	0	25.7	60.5	96	93
2,4-D dma+SCI40	4+1%	0	19.0	61.0	75	74
2,4-D dma+X-77	4+.25%	0	24.9	60.5	92	86
2,4-D dma+28N	4+1G	0	23.7	60.0	93	97
2,4-D dma+PO	4+.25G	0	24.2	61.5	99	93
2,4-D dma+MS	4+.25G	0	23.4	60.5	90	91
2,4-D dma+Safe-6(pH4-6)	4	0	24.1	60.5	93	94
2,4-D dma+FFA	4+.25G	0	22.0	60.5	93	85
2,4-D dma+AMS	4+32	0	20.8	59.0	96	93
2,4-D dma+MS+28N	4+.25G+1G	0	21.1	58.5	98	96
2,4-D dma+Exp4	4+.25G	0			0	0
Untreated	0	0	24.5	61.5	0	0
C.V. %		0	26.5		13	14
LSD 5%		NS	NS		14	15
# OF REPS		4	4		4	4

Summary

None of the adjuvants increased injury to wheat or influenced wheat yield from 2,4-D. Redroot pigweed control from 2,4-D dma without adjuvants was 93% so enhancement from adjuvants was not obvious. However, wild buckwheat control with 2,4-D dma was enhanced by most adjuvants, except SCI-40 and Experiment 4. The spray carrier water contained:3320 ppm total solids, 260 ppm (15 gr) hardness, 1138 ppm sodium, 322 ppm bicarbonates, 102 ppm chloride, 2168 ppm sulfate, 0.4 ppm iron, 15 ppm nitrate and had a pH = 7.9 and electrical conductivity = 4940 uM/cm.

2,4-D with adjuvants for weed control in wheat. Carrington 1989. 'Stoa' hard red spring wheat was seeded on May 11. Treatments were applied to 4- to 5-leaf wheat, 2- to 5-leaf wild buckwheat, 4-leaf mustard, 2 inch tall kochia and 3 inch tall Russian thistle on June 9 with 60 F, 58% RH, 4 mph south wind, and a 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 25 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 14. Weed densities were wild buckwheat and kochia sparse and all others were not rated because drought confounded evaluation.

Treatment	Rate	Wheat injury	Wild buckwheat	Kochia
	(oz/A)	(%)	-----(% control)-----	
2,4-D bee	4	1	70	91
2,4-D dma	4	0	75	37
2,4-D dma+L1700	4+.25%	0	50	60
2,4-D dma+SCI40	4+1%	0	30	20
2,4-D dma+X-77	4+.25%	0	30	63
2,4-D dma+28N	4+1G	1	40	43
2,4-D dma+PO	4+.25G	1	80	68
2,4-D dma+MS	4+.25G	3	65	88
2,4-D dma+Safe-6(pH4-6)	4	0	80	70
2,4-D dma+FFA	4+.25G	3	80	68
2,4-D dma+AMS	4+32	0	65	70
2,4-D dma+MS+28N	4+.25G+1G	3	70	89
2,4-D dma+Exp1	4+.125G	0	0	5
2,4-D dma+Exp2	4+.25G	0	0	13
2,4-D dma+Exp3	4+.25G	0	0	8
2,4-D dma+Exp4	4+.25G	0	30	18
Untreated	0	0	0	0
C.V. %		222		40
LSD 5%		2		27
# OF REPS		4	1	4

Summary

2,4-D did not cause important injury to wheat regardless of adjuvants. Kochia control with 2,4-D was or tended to be reduced by SCI-40 and all the experimental adjuvants. The greatest Kochia control occurred with 2,4-D bee, and 2,4-D dma with methylated seed oil, methylated seed oil + 28% or Safe-6 liquid nitrogen fertilizer.

2,4-D with additives in wheat, Williston 1989. An experiment was conducted to determine injury to wheat and weed control from 2,4-D dimethyl amine applied with various adjuvants. 'Amidon' hard red spring wheat was seeded to recrop Max loam soil with 1.4 % organic matter, and 6.0 pH. The soil tested 123N-42P-710K and was fertilized with 40 lb nitrogen plus 25 lb/A P_2O_5. Treatments (D1) were applied to 4- to 4.5-leaf wheat, 1 to 2 inch tall Russian thistle, and 1 to 1.5 inch kochia on June 14 with 63 F, 58 % relative humidity and 58 F bare soil 10 cm. Treatments (D2) were to 5- to 5.5-leaf wheat, 2 to 4 inch tall Russian thistle, and 1 to 3 inch tall kochia on June 10 with 75 F, 45 % relative humidity, clear sky, and 6 mph southeast wind and 59 % bare soil at 10 cm. The first rain after treatments was 0.02 inch on June 20. Treatments were applied with a tractor mounted sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Russian thistle infestation was moderate and kochia light and only in three replications. Evaluation was on July 10 and harvest was 76 sq ft area on August 9.

Treatment[a]	Rate	Injury	Wheat Test weight	Wheat Yield	Ruth	KOCZ
	(oz/A)	(%)	(lb/bu)	(GMS/plot)	(% control)	
2,4-D bee(D1)	4	1	60.4	90	94	70
2,4-D dma(D1)	4	0	59.2	98	93	67
2,4-D dma+Li700(D1)	4+0.25%	1	59.6	85	60	7
2,4-D X-77(D1)	4+0.25%	0	58.8	75	84	62
2,4-D dma+PO(D1)	4+0.25G	1	59.2	78	93	80
2,4-D dma+MS+28N(D1)	4+0.25G+1G	4	59.2	78	97	88
2,4-D dma+Safe-6(pH4-6)(D1)	4	1	59.2	102	60	17
2,4-D dma+FFA(D1)	4+0.25G	0	58.8	78	75	60
2,4-D dma+MS(D1)	4+0.25G	0	59.2	78	95	83
2,4-D dma (D2)	4	2	59.2	61	86	58
2,4-D dma+28N(D2)	4+1G	2	60.4	70	91	72
2,4-D dma+AMS(D2)	4+32	3	59.2	97	89	48
2,4-D dma+PO(D2)	4+0.125G	3	59.6	65	85	83
2,4-D dma+MS(D2)	4+0.25G	1	54.4	94	86	77
2,4-D dma+Li700(D2)	4+0.25%	1	54.4	38	50	18
2,4-D dma+X-77(D2)	4+0.25%	3	59.2	68	90	72
Untreated	0	0	53.6	46	0	0
C.V. %		136		49	17	39
LSD 5%		3		NS	19	36
# OF REPS		4	1	4	4	3

[a]IOE=isooctyl ester; dma=dimethyl amine; Li700=Product of Loveland Industries; X-77=non-ionic surfactant from Valent; PO=petroleum oil with 17% emulsifier; MS=methylated seed oil (Sun-it adjuvant from Agsco); Safe-6= adjuvant from Frontier Sales, 2906 third St Moorhead MN; FFA=emulsiifiable free fatty acids; 28N=28 % nitrogen liquid fertilizer; AMS=ammonium sulfate; and pH 4-6 was obtained by adding the Safe-6 with the aid of litmus paper.
[b]% indicates volume per spray volume and G indicates gallons per acre.

Summary

2,4-D either with or without adjuvants did not cause important injury to wheat at either stage of application. Further, wheat yields were low because of the drought effect on the wheat which was seeded late. Russian thistle control by 2,4-D was not enhanced by adjuvants. Li-700 and Safe-6 adjuvants reduced Russian thistle and kochia control with 2,4-D dma. Petroleum oil, methylated seed oil, alone or with 28N tended to enhance kochia control with 2,4-D dma compared to 2,4-D dma alone. The reduced weed control with Li-700 and Safe-6 may have been a result of the precipatate that occured with these adjuvants.

2,4-D dimethanolamine with salts, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 28. Treatments were applied to 4.5- to 5-leaf wheat, 4- to 11-leaf kochia and wild mustard on June 6 with 75 F, 35% RH, 10 to 18 mph southeast wind and a clear sky. 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 with four replications. Evaluation was on June 26. Salt spots in some areas caused variability.

Treatment	Rate	Wheat inj	KOCZ	Colq	Wimu
	(oz/A)	(%)	----(% control)-----		
2,4-D	4	0	58	99	99
2,4-D+NaHCO3	4+4	0	16	64	99
2,4-D+CaCl	4+3	0	29	63	99
2,4-D+NaH+CaCl2	4+2+1.5	0	31	64	99
2,4-D+NaH+AMS	4+4+.25G	1	64	95	99
2,4-D+NaH+AMP	4+4+.25G	0	64	95	99
2,4-D+NaH+AMS(Dow F)	4+4+.25G	1	80	99	99
2,4-D+NaH+AMP(Dow F)	4+4+.25G	0	83	98	99
2,4-D+NaH+AMS+Dow C193	4+4+.25G+.25%	1	71	99	99
2,4-D+NaH+AMP(Dow C193)	4+4+.25G	0	67	99	99
2,4-D+NaH+Dow F	4+4+.25%	0	26	80	98
2,4-D+NaH+Dow C193	4+4+.25%	0	54	97	99
2,4-D+CaCl+AMS	4+3+.25G	0	56	98	99
2,4-D+CaCl+AMP	4+3+.25G	0	59	92	99
2,4-D+CaCl+AMS(Dow F)	4+3+.25G	1	64	99	99
2,4-D+CaCl+AMP(Dow F)	4+3+.25G	0	72	99	99
2,4-D+CaCl+AMS+Dow C193	4+3+.25G+.25%	3	81	99	99
2,4-D+CaCl+AMP(Dow C193)	4+3+.25G	0	80	99	99
2,4-D+CaCl+Dow F	4+3+.25%	0	40	77	97
2,4-D+CaCl+Dow C193	4+3+.25%	0	60	99	99
2,4-D+NaH+CaCl+AMS	4+2+1.5+.25G	0	66	93	99
2,4-D+NaH+CaCl+AMP	4+2+1.5+.25G	0	66	93	99
2,4-D+NaH+CaCl+AMS(Dow F)	4+2+1.5+.25G	0	83	99	99
2,4-D+NaH+CaCl+AMP(Dow F)	4+2+1.5+.25G	0	65	98	99
2,4-D+NaH+CaCl+AMS+Dow C193	4+2+1.5+.25G+.25%	4	82	99	99
2,4-D+NaH+CaCl+AMP(Dow C193)	4+2+1.5+.25G	4	82	99	99
2,4-D+NaH+CaCl+Dow F	4+2+1.5+.25%	1	35	76	99
2,4-D+NaH+CaCl+Dow C193	4+2+1.5+.25%	0	45	74	74
Untreated	0	0	0	0	0
C.V. %		348	28	14	10
LSD 5%		NS	23	18	13
# OF REPS		4	4	4	4

Summary

Sodium bicarbonate, calcium chloride alone or combined antagonized kochia control with 2,4-D. Ammonium sulfate (AMS) and ammonium phoshate (AMP) overcame the antagonism of kochia control by 2,4-D applied with sodium bicarbonate or calcium chloride. Kochia control tended to be further increased when the ammonium salts were applied with Dow F or Dow C193. Dow F surfactant alone generally did not overcome salt antagonixm of 2,4-D. However, Dow C193 generally overcame salt antagonism of 2,4-D. Common lambsquarter control generally responded similarly as kochia to 2,4-D with salts.

2,4-D in hard water in wheat Exp 5, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on May 16. The treatments were applied to 6- to 6.5-leaf wheat and 2 inch tall kochia on June 19 with 75 F, 10 to 15 mph southeast wind and a clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 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 three replications. Evaluation was on July 6. Hard water: $NaHCO_3$, KNO_3, $CaCl_2 \cdot 2H_2O$, and $MgSO_4$ each at 500 ppm as cation except $NaHCO_3$ alone 2000 ppm as cation.

Treatment	Rate	Wheat injury	Kochia control
	(oz/A)	(%)	(%)
2,4-D dma	4	1	53
2,4-D dma+MS	4+.25G	1	65
2,4-D dma+X-77	4+.25%	0	68
2,4-D dma+Exp 5	4+.25G	0	82
2,4-D dma(NaHCO3)	4	3	57
2,4-D dma+MS(NaHCO3)	4+.25G	0	78
2,4-D dma+X-77(NaHCO3)	4+.25%	0	68
2,4-D dma+Exp 5(NaHCO3)	4+.25G	7	78
2,4-D dma(HW)	4	1	48
2,4-D dma+MS(HW)	4+.25G	5	84
2,4-D dma+X-77(HW)	4+.25%	2	82
2,4-D dma+Exp 5(HW)	4+.25G	4	75
V-23121+MCPA dma	.21+4	2	82
Untreated	0	0	0
C.V. %		144	24
LSD 5%		4	27
# OF REPS		3	3

Summary

None of the adjuvants with 2,4-D dma in sodium bicarbonate or "hard" water caused important injury to wheat. However experimental adjuvant No. 5 with sodium bicarbonate and methylated seed oil (MS) with hard water increased injury to wheat. Wheat was not harvested because of the drastic impact of the drought on this late seed wheat. Neither sodium bicarbonate or hard water anotagonized kochia control with 2,4-D dma in this experiment which is contrary to 1988 results which were applied under greater drought stress than in 1989. X-77, methylated seed oil, and experimental NO. 5 all generally enhanced kochia control from 2,4-D dma. V-23121 + MCPA was equally effective as 2,4-D with the best adjuvant.

Weed control in Flax, Fargo 1989. 'Linton' flax was seeded on April 28. Treatments were applied to 2- to 5-inch tall flax, 2-leaf foxtail, 1- to 3-inch tall kochia and common lambsquarters on June 5 with 65 F, 70% RH, 8 mph wind and a cloudy sky. The second treatment of splits (/) were applied to 0.5-to 5-inch tall flax, 2-to 3-leaf foxtail, 0.5- to 6-inch tall kochia and 2-to 4-inch tall common lambsquarters on June 9 with 61 F, 40% RH, 0 to 5 mph south 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 24 ft plots. The experiment was a randomized complete block with 4 replications. Evaluation was on June 19. Harvest for flax yield was on August 22.

Treatment[a]	Rate	Flax inj	Yeft	KOCZ	Colq	Flax Yield
	(oz/A)	(%)	(--%	control	-)	(bu/A)
MCPA dma+Sethoxydim+PO	4+3	3	97	75	92	5.5
MCPA ioe+Sethoxydim+PO	4+3	5	98	79	88	2.6
MCPA ioe+Sethoxydim+BCH	4+3	10	98	76	88	.8
MCPA ioe+Sethoxydim+MS	4+3	7	99	81	91	1.7
MCPA ioe+Sethoxydim+MS1	4+3	11	99	83	89	1.0
MCPA ioe+Sethoxydim+PO	8+3	8	99	79	89	2.4
Bentazon+PO/Sethoxydim+PO	12/3	6	96	96	98	5.8
Bentazon+MCPA dma+PO/S+PO	8+4/3	19	95	97	99	4.4
Bentazon+MCPA dma+PO/S+PO	2+4/3	15	99	99	98	3.3
Bentazon+Bromoxynil+PO/Sethoxydim+PO	8+4/3	3	97	97	97	5.1
Bentazon+Bromoxynil+PO/Sethoxydim+PO	12+4/3	7	98	98	96	7.5
Bromoxynil+Sethoxydim+PO	4+3	1	97	95	98	6.8
Bromoxynil+MCPA+Sethoxydim+PO	8+3	10	99	96	99	8.9
MCPA ioe+Metsulfuron+Sethoxydim+PO	4+0.02+3	43	97	99	99	8.2
Bentazon+MCPA dma+Mets+PO/Sethoxydim+PO	8+4+.02/3	21	97	98	99	7.5
Diclofop+Bromoxynil+PO	12+4	3	88	93	96	3.0
Untreated	0	0	0	0	0	5.6
C.V. %		66	2	7	4	79.1
LSD 5%		9	3	8	5	5.3
# OF REPS		4	4	4	4	4

[a]PO=petroleum oil with 17% emulsifier and MS and MS1 are methylated seed oil adjuvants from Agsco all applied at 1 qt/A; BCH=adjuvant from BASF applied at 1 qt/A;

Summary

Metsulfuron with MCPA ioe, sethoxydim, and petroleum oil were more injurious to flax than metsulfuron with MCPA dma, bentazon, and petroleum oil. Metsulfuron, bentazon, and bromoxynil treatments generally gave greater kochia and common lambsquarter control that MCPA amine or ester treatments. Yellow foxtail was effectively controlled by sethoxydim applied with oil adjuvant alone or with other herbicides.

Weed contol in flax, Carrington 1989. 'Linton' flax was seeded on May 15. Treatments were applied to 4 inch tall flax, 4-leaf wild mustard, 3- to 4-leaf green foxtail, and 2 inch tall kochia and common lambsquarters, on June 16 with 69 F, 48% RH, 15 mph southeast wind, and a clear sky. The second treatment of (/) were applied to the same stage of crop and weeds growth on June 19 with 69 F and a 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 25 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 14. Weed densities were foxtail 30 plants per sq ft, redroot pigweed 5 plants per sq meter, common lambsquarters 3 plants per sq meter, and kochia greater than 1 plant per sq meter and variable.

Treatment[a]	Rate	Flax injury	Grft	KOCZ	Colq	Rrpw
	(oz/A)	(%)	(----%	control	----)	
MCPA dma+Sethoxydim+PO	4+3	1	99	25	99	0
MCPA ioe+Sethoxydim+PO	4+3	4	99	31	99	20
MCPA ioe+Sethoxydim+BCH	4+3	0	99	66	94	25
MCPA ioe+Sethoxydim+MS	4+3	0	99	53	99	35
MCPA ioe+Sethoxydim+MS1	4+3	1	99	42	99	30
MCPA ioe+Sethoxydim+PO	8+3	4	99	75	99	62
Bentazon+PO/Sethoxydim()+PO	12/3	11	98	68	89	70
Bentazon+MCPA dma+PO/Sethoxydim()+PO	8+4/3	6	97	81	99	75
Bentazon+MCPA dma+PO/Sethoxydim()+PO	12+4/3	4	98	68	98	83
Bentazon+Bromoxynil+PO/Sethoxydim()+PO	8+4/3	4	98	71	95	90
Bentazon+Bromoxynil+PO/Sethoxydim()+PO	12+4/3	3	98	83	96	93
Bromoxynil+Sethoxydim+PO	4+3	2	99	53	82	65
Bromoxynil+MCPA+Sethoxydim+PO	8+3	3	98	82	99	83
MCPA ioe+Metsulfuron+Sethoxydim+PO	4+0.02+3	13	98	95	99	87
Bent+MCPA dma+Metsulfuron+PO/Seth()+PO	8+4+0.02/3	10	96	73	99	70
Diclofop+Bromoxynil+PO	12+4	5	79	50	79	58
Untreated	0	0	0	0	25	0
C.V. %		96	2	27	16	29
LSD 5%		6	3	23	21	27
# OF REPS		4	4	4	4	3

[a]PO=petroleum oil at 1 qt/A; MS and MS1=methylated seed oil from Agsco at 1 qt/A; BCH=adjuvant from BASF at 1 qt/A.

Summary

Metsulfuron treatments and bentazon + petroleum oil caused statistically significant injury to flax, but probably not of practical importance. Green foxtail control exceeded 95% with all sethoxydim treatments, regardless of adjuvant. Redroot pigweed control was 90% or more only with bentazon + bromoxynil treatments. Kochia control exceeded 90% with bentazon + MCPA + petroleum oil, bentazon + bromoxynil + petroleum oil, bromoxynil + MCPA + sethoxydim + petrolium oil, and MCPA + metsulfuron + sethoxydim + petroleum oil, disregarding the second (/) application of sethoxydim.

Weed control in Flax, Langdon 1989. 'Flor' flax was seeded on May 19. Treatments were applied to 5 to 6 inch tall flax, 2 to 4 inch tall ladysthumb and 2 inch tall redroot pigweed on June 20 with 80 F, calm wind, and a partly cloudy sky. Treatments split (/) were applied to early bud flax and 8 inch tall wild oats on June 30 with 85 F, 70% RH, and a sunny sky. All treatment 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 24 ft plots. The experiment was randomized complete block with four replications. Evaluation was on August 1. Weed densities were ladysthumb 100 plants per sq. yd., redroot pigweed 5 plants per sq yd and wild oats 3 plants per sq. yd.

Treatment[a]	Rate	Flax Inj	Flax Yld	Flax Twt	Lath	Rrpw	Wioa
	(oz/A)	(%)	(bu/A)	(lb/bu)	-(%	control)-	
MCPA dma+Sethoxydim+PO	4+3	1	7.3	54.0	47	30	90
MCPA ioe+Sethoxydim+PO	4+3	0	6.7	54.0	51	37	99
MCPA ioe+Sethoxydim+BCH	4+3	1	7.2	55.0	67	28	99
MCPA ioe+Sethoxydim+MS	4+3	2	9.2	54.0	75	60	99
MCPA ioe+Sethoxydim+MS1	4+3	3	9.6	54.5	71	43	99
MCPA ioe+Sethoxydim+PO	8+3	3	7.7	54.0	66	72	99
Bentazon+PO/Sethoxydim+PO	12/3	1	9.3	54.0	95	67	97
Bentazon+MCPA dma+PO/Seth+PO	8+4/3	2	10.6	55.0	94		99
Bentazon+MCPA dma+PO/Seth+PO	12+4/3	3	8.6	55.0	95	77	99
Bentazon+Bromoxynil+PO/Seth+PO	8+4/3	2	10.1	54.5	96	68	99
Bentazon+Bromoxynil+PO/Seth+PO	12+4/3	3	10.5	55.0	98	99	99
Bromoxynil+Sethoxydim+PO	4+3	1	9.7	55.0	83	50	99
Bromoxynil+MCPA+Sethoxydim+PO	8+3	8	7.2	53.5	98	89	99
MCPA ioe+Metsulfuron+Seth+PO	4+0.02+3	6	3.8	55.0	78	63	99
Bent+MCPA dma+Mets+PO/Seth+PO	8+4+.02/3	2	8.5	55.0	99	98	99
Diclofop+Bromoxynil+PO	12+4	0	10.7	55.0	94	62	65
Untreated	0	0	7.0	53.0	0	0	0
C.V. %		184	29.4		16	39	6
LSD 5%		NS	3.5		18	36	8
# OF REPS		4	4		4	3	4

[a]PO=petroleum oil with 17% emulsifier and MS and MS1 are methylated seed oil adjuvants from Agsco all applied at 1 qt/A.

Summary

None of the treatments caused important injury to flax. Complete control of all broadleaf weeds was obtained only with bentazon + MCPA + metsulfuron + petroleum oil followed by a separate application of sethoxydim + petroleum oil for grass weed control. All sethoxydim treatments regardless if a separate application or if applied with broadleaf control herbicides gave complete control of wild oats. All treatments with bentazon and bromoxynil & MCPA gave 94% or more ladysthumb control. Redroot pigweed only exceeded 90% control with bentazon at 12 oz/A + bromoxynil at 4 oz/A + petroleum oil and bentazon + MCPA + metsulfuron + petroleum oil, Weed control in Flax, Minot 1989. 'Linton' flax was seeded on May 4. treatments were applied to 3 inch tall flax, emerging to 5-leaf (3 inch tall) foxtail, 1 to 4 inch tall Russian thistle, 1 to 3 inch tall kochia and redroot pigweed and 1 to 5 inch tall common lambsquarters on June 3 with 68 F, 40% RH, 12 mph northwest wind and a partly cloudy sky. The second treatments split (/) were on June 6 with 72 F, 59% RH, 13 mph south wind, and a sunny sky. All treatments were applied in 8.5 gpa at 35 psi with a wheel type plot sprayer to an 8 ft wide area the length of 10 by 24 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 14. Weed densities were Russian thistle ¢ 10 plants per yd, kochia _ 1 plant per yd, common lambsquarters _ 3 plants per yd and variable, foxtail 20 plants per yd, and redroot pigweed 1 plant per sq. yd all moisture stressed. A 4 by 16 sq ft area was harvested for yield on August 23.

Treatment[a]	Rate	Flax inj	Grft	Ruth	KOCZ	Colq	Rrpw	Flax yield
	(oz/A)	(%)	------(% control)-------					(bu/A)
MCPA dma+Seth+PO	4+3	10	99	38	35	99	0	3.1
MCPA ioe+Seth+PO	4+3	3	99	28	21	99	20	3.0
MCPA ioe+Seth+BCH	4+3	6	99	14	26	99	40	2.6
MCPA ioe+Seth+MS	4+3	8	99	25	53	99	60	2.2
MCPA ioe+Seth+MS1	4+3	0	99	19	38	99	40	1.9
MCPA ioe+Seth+PO	8+3	10	99	38	49	99	40	2.5
Bentazon+PO/Seth+PO	12/3	0	99	98	96	99	25	3.9
Bentazon+MCPA dma+PO/Seth+PO	8+4/3	0	99	95	91	99	0	2.0
Bentazon+MCPA dma+PO/Seth+PO	12+4/3	0	99	97	97	99	40	3.1
Bentazon+Bromoxynil+PO/Seth+PO	8+4/3	0	99	99	98	99	88	4.8
Bentazon+Bromoxynil+PO/Seth+PO	12+4/3	0	99	96	98	99	60	3.9
Bromoxynil+Seth+PO	4+3	0	99	90	66	75	0	4.3
Bromoxynil+MCPA+Seth+PO	8+3	4	99	93	75	99	0	2.5
MCPA ioe+Metsulfuron+Seth+PO	4+0.02+3	6	99	96	97	99	95	2.1
Bentazon+MCPA-dma+Mets+PO/Seth+PO	8+4+.02/3	2	99	95	92	97	85	3.0
Diclofop+Bromoxynil+PO	12+4	3	73	95	56	82	0	2.8
Untreated	0	0	0	0	0	0	0	.8
C.V. %		323	14	26	34	8		55.7
LSD 5%		NS	18	24	31	10		NS
# OF REPS		4	4	4	4	4	1	4

[a] PO=petroleum oil with 17 % emulsifier and MS and MS1 are methylated seed oil adjuvants from Agsco all applied at 1 qt/A.

Summary

None of the herbicide treatments cause important injury to flax. Yield was low because of the drought stress. Green foxtail was controlled by treatments with sethoxydim applied in a trials mixture or as a separate application. Russian thistle control was 90% or more with bentazon, bromoxynil, and metsulfuron treatments. Kochia control exceeded 90% for bentazon and metsulfuron treatments. Bentazon + bromoxynil followed by a separate sethoxydim application; MCPA + metsulfuron + sethoxydim + oil adjuvant; and bentazon + MCPA + metsulfuron + oil followed by a separate sethoxydin + oil application adequately controlled all weeds in the experiment.

Weed control in flax, Williston 1989. 'Flor' flax was seeded on fallow May 17. The first treatments were applied to 2 to 3-inch tall flax and wild mustard, 2 to 4-leaf green foxtail, 1 to 2 inch tall Russian thistle, and 2 to 6-leaf redroot pigweed on June 14 with 70 F, 40% RH, 8 mph wind, and a clear sky. Treatments split (/) were applied to 3 to 4-inch tall flax, 4 to 5-inch tall wild mustard, 4 to 6-leaf green foxtail, 1 to 3-inch tall Russian thistle, and 2 to 8-leaf redroot pigweed on June 19 with 65 F, 60% RH, 5 mph wind, and a clear sky. All treatments were applied with a tractor-mounted plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 5. Infestation of all weeds were moderate to heavy. Harvest for flax yield was on August 23.

Treatment[a]	Rate	Flax Inj	Flax Yield	Strd[b]	Grft	Rrpw	Ruth
	(oz/A)	(%)	(bu/A)	----(%	control)	-----	
MCPA dma+Sethoxydim+PO	4+3	5	1.7	3	97	40	31
MCPA ioe+Sethoxydim+PO	4+3	3	1.3	0	98	40	5
MCPA ioe+Sethoxydim+BCH	4+3	10	1.3	3	97	15	30
MCPA ioe+Sethoxydim+MS	4+3	7	1.7	1	98	80	31
MCPA ioe+Sethoxydim+MS1	4+3	2	1.4	0	99	75	35
MCPA ioe+Sethoxydim+PO	8+3	9	1.7	1	97	43	8
Bentazon+PO/Sethoxydim+PO	12/3	2	3.2	1	99	94	97
Bentazon+MCPA dma+PO/S+PO	8+4/3	3	3.4	1	93	97	99
Bentazon+MCPA dma+PO/S+PO	2+4/3	7	3.6	3	96	94	99
Bentazon+Bromoxynil+PO/Sethoxydim+PO	8+4/3	9	2.3	1	94	99	98
Bentazon+Bromoxynil+PO/Sethoxydim+PO	12+4/3	3	2.9	2	91	95	99
Bromoxynil+Sethoxydim+PO	4+3	3	3.1	0	95	93	96
Bromoxynil+MCPA+Sethoxydim+PO	8+3	11	2.8	0	95	89	95
MCPA ioe+Metsulfuron+Sethoxydim+PO	4+0.02+3	18	3.3	6	96	98	95
Bentazon+MCPA dma+Mets+PO/Seth+PO	8+4+0.02/3	9	3.5	4	98	98	92
Diclofop+Bromoxynil+PO	12+4	0	2.4	0	68	86	93
Untreated	0	0	1.5	0	0	0	0
C.V. %		66	26.4	171	4	24	16
LSD 5%		6	1	NS	5	25	16

[a]PO=petroleum oil with 17% emulsifier at 1 qt/A; MS and MS1 are methylated seed oil adjuvants from Agsco all applied at 1 qt/A; dma=dimethyl amine; ioe= isooctyl ester; BCH=DASH adjuvant from BASF.
[b]Strd=stand reduction.

Summary

MCPA + metsulfuron + sethoxydim + PO caused 18% injury to flax but flax yield was second highest because of the control of all weeds. Greater than 90% control of all weed species was obtained with bentazon treatments applied separtely from sethoxydim; bromoxynil and bromoxymil + MCPA with sethoxydim; and metsulfuron treatments.

<u>BAS-0567 with broadleaf herbicides in flax, Fargo 1989.</u> 'Linton' flax was seeded on April 28. Treatments were applied to 0.5 to 5 inch tall flax, 0.5 to 6 inch tall kochia and 2 to 4 inch tall common lambsquarters on June 9 with 61 F, 40% RH, 0 to 5 mph south wind, and a clear sky. 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 24 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 28. Kochia density was ¢ 3 plants per sq ft and common lambsquarters 5 plants per sq yd.

Treatment	Rate	Flax injury	KOCZ	Colq
	(oz/A)	(%)	--(% control)--	
Sethoxydim+MCPA ioe+BCH	3+4+0.25G	0	10	99
BAS-0562+MCPA ioe	3+4	0	19	99
BAS-0562+MCPA ioe+BCH	3+4+0.25G	0	4	99
BAS-0562+MCPA ioe+MS	3+4+0.25G	1	26	99
BAS-0562+MCPA ioe+MS1	3+4+0.25G	1	23	99
Sethoxydim+Bromoxynil+BCH	3+4+0.25G	3	77	90
Sethoxydim+Bromoxynil+MS	3+4+0.25G	3	77	91
Sethoxydim+Bromoxynil+MS1	3+4+0.25G	0	83	98
BAS-0562+Bromoxynil	3+4	0	85	89
BAS-0562+Bromoxynil+BCH	3+4+0.25G	1	69	94
BAS-0562+Bromoxynil+MS	3+4+0.25G	5	69	90
BAS-0562+Bromoxynil+MS1	3+4+0.25G	1	78	96
Sethoxydim+Bromoxynil&MCPA+BCH	3+8+0.25G	1	90	99
Sethoxydim+Bromoxynil&MCPA+MS	3+8+0.25G	0	82	99
Sethoxydim+Bromoxynil&MCPA+MS1	3+8+0.25G	0	89	99
BAS-0562+Bromoxynil&MCPA	3+8	4	76	99
BAS-0562+Bromoxynil&MCPA+BCH	3+8+0.25G	0	85	99
BAS-0562+Bromoxynil&MCPA+MS	3+8+0.25G	0	84	99
BAS-0562+Bromoxynil&MCPA+MS1	3+8+0.25G	0	83	99
Untreated	0	0	0	0
C.V. %		237	21	5
LSD 5%		NS	18	7
# OF REPS		4	4	4

Summary

None of the treaments injured flax. The foxtail density in the area was too sparse for evaluation preventing comparison of BAS-0562 to sethoxydim for grass species control. Kochia control was greater with bromoxynil treatments than MCPA alone treatments and was not greatly influenced by adjuvants and BAS-0562, or sethoxydim.

AC 222,293 formulations in sunflowers, Fargo 1989. 'Interstate 301' sunflower was seeded on June 5. Treatments (4lf) were applied to 4- to 6-leaf sunflower on June 9 with 88 F, 60% RH, 10 mph south wind, and a hazy sky. Treatments (8lf) were applied to 1 to 1.5 ft tall sunflowers on July 7 with 75 F, 25% RH, 0 to 5 mph wind, and a clear sky. Herbicide 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 20 ft plots. The experiment was a randomized complete block with four replications. Evaluation for injury was on July 28 and for height and head malformation on September 13. Height reduction was an estimate and malformed head was number per row. The malformed head number was doubled to represent a percentage as each row contained approximately 50 plants.

Treatment	Rate	July 28 Sunflower injury	September 15 Height reduction	September 15 Malformed heads
	(oz/A)	(%)	(inch)	---(%)---
AC 222,293-SC(4lf)	4	1	3	6
AC 222,293-SC(4lf)	6	1	1	2
AC 222,293-LC(4lf)	4	8	4	9
AC 222,293-LC(4lf)	6	39	7	21
AC 222,293-SC(8lf)	4	5	0	6
AC 222,293-LC(8lf)	4	1	0	6
AC 222,293-SC(8lf)	6	0	2	6
AC 222,293-LC(8lf)	6	2	3	6
Acifluorfen(4lf)	2	1	2	2
Acifluorfen+X-77(4lf)	2+.25%	4	5	5
Acifluorfen(8lf)	2	0	0	2
Acifluorfen+X-77(8lf)	2+.25%	3	4	3
Untreated	0	0	0	2
C.V. %		100	131	93
LSD 5%		7	4	8
# OF REPS		4	4	4

Summary

The LC formlation of AC 222,293 tended to be or was more injurious than the SC formulation, from application to 4- to 6-leaf sunflower.

CGA-144155 for weed control in sunflowers, Fargo 1989. Preplant soil incorporated (ppi) treatments were applied and field cultivator plus harrow incorporated only once because of wet soil condition. 'Interstate 301' sunflower was seeded on June 2. The climate was 65 F, 40 % RH, and a clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 28. Green foxtail density was sparse and variable.

Treatment	Rate (lb/A)	Sunflower injury (%)	Green foxtail (% control)
CGA-144155(ppi)	2	0	84
CGA-144155(ppi)	4	0	91
CGA-144155&Metolachlor(ppi)	2	0	79
CGA-144155&Metolachlor(ppi)	4	0	69
Metolachlor(ppi)	2	0	77
Metolachlor(ppi)	4	0	73
Trifluralin(ppi)	1	0	90
Untreated	0	0	0
C.V. %		0	22
LSD 5%		NS	22
# OF REPS		4	4

Summary

Sunflower was not injured by any of the herbicide treatments. Differences in green foxtail control with the various treatments were not obvious because of the variable stand.

Weed control in soybeans, Casselton 1989. Preplant soil incorporated (ppi) treatments were applied and field cultivator plus harrow incorporated twice 3 inch deep dry soil on May 13 with 65 F, 60% RH, no wind, and a clear sky. 'McCall' soybean was seeded on May 15. Postemergence treatments were applied to first trifoliolate soybean, 4-leaf (2 inch) green and yellow foxtail and common lambsquarters, and 6-leaf (3 inch) wild mustard on June 15 with 70 F, 60% RH, no wind, and a clear sky in dry soil. Postemergence split (/) treatments were applied to second trifoliolate soybean and 4- to 5-leaf foxtail on June 22 with 72 F, 55% RH, and a partly cloudy sky. All treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi for the preplant treatments and 8.5 gpa at 35 psi for the postemergence treatments to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluations were on June 30 and July 7. Weed density was more than 1 plant /ft for all weeds except kochia. Foxtail consisted of both green and yellow.

		June 30					July 7			
Treatment[a]	Rate	SB inj	Fxtl	Wimu	KOCZ	Colq	SB inj	Fxtl	Wimu	Colq
	(oz/A)	(%)	----(% control)----				(%)	---(% control)		
Trifluralin(ppi)	16	0	98	0	98	99	0	99	0	98
Pendimethalin(ppi)	20	0	97	0	99	98	0	96	0	96
Ethalfluralin(ppi)	15	0	99	15	99	99	0	99	11	99
Acetochlor(ppi)	24	1	92	72	60	99	0	87	60	85
Alachlor(ppi)	48	0	83	30	70	96	0	69	23	94
Pendimethalin+Imep(ppi)	14+1	4	98	99	99	99	0	99	99	99
Imazethapyr(ppi)	1	3	98	99	99	99	0	98	99	99
Imazethapyr+Alachlor(ppi)	1+40	2	98	99	99	99	0	99	98	99
Imazethapyr+Meto(ppi)	1+40	3	99	99	99	99	0	99	99	99
Trif+Metr-DF(ppi)	16+3	0	98	94	99	99	0	98	87	99
Trif&Alachlor(ppi)	48	0	96	39	99	99	0	93	40	95
Imazethapyr+X-77	1	5	90	99	99	94	0	71	99	72
Imazethapyr+X-77+28N	1	4	96	99	99	96	0	91	99	90
Imazethapyr+MS+28N	1	5	99	99	99	96	0	98	99	92
Imazethapyr+MS1+28N	1	8	99	99	99	97	0	97	99	77
Imazethapyr+BCH+28N	1	2	99	99	97	94	0	97	99	92
Fluazifop+Imazethapyr+MS	3+0.5	4	98	99	99	95	0	94	99	75
Lactofen+PO/S+MS	3/3	5	98	99	99	62	0	99	98	18
B+Acif+X-77/S+MS	8+2/3	2	97	99	98	90	0	99	98	66
B+Acif+X-77/Flua+PO	8+2/3	2	88	99	95	93	0	87	99	73
B+PO/S+MS	12/3	0	98	99	99	97	0	99	98	89
Acif+X-77/Seth+MS	4/3	1	98	92	55	41	0	99	78	23
DPX-M6316+B+PO/S+MS	0.063+8+/3	1	98	98	99	98	0	98	99	92
DPX-M6316+B+PO/S+MS	0.063+12/3	1	97	99	99	97	0	99	99	92
DPX-M6316+Acif+X-77/S+MS	0.063+2/3	0	96	98	99	96	0	99	95	90
DPX-M6316+Acif+X-77/S+MS	0.063+4/3	1	97	98	94	92	0	98	97	77
DPX-M6316+Lact+PO/S+MS	0.063+3/3	6	98	99	99	99	0	99	99	99
DPX-M6316+X-77+28N/S+MS	0.063/3	2	97	93	97	95	0	97	95	93
C.V. %		105	3	11	4	5	0	6	12	15
LSD 5%		3	3	12	7	6	NS	7	13	17
# OF REPS		4	4	4	2	4	4	4	4	4

[a] X-77=nonionic surfactant at 0.25% (v/v) from Valent, 28N=nitrogen fertilizer at 1 qt/A; PO=petroleum oil with 17% (v/v) Atplus 300 F applied at 1 qt/A; MS & MS1=methylated seed oils applied at 1 qt/A with sethoxydim or 1 pint/A with imazethapyr from Agsco; BCH=adjuvant from BASF at 1 qt/A.

Summary

None of the herbicide treatments caused any important injury to soybean. Imazethapyr alone or in combinations with other herbicides applied preplant soil incorporated gave complete control of all weed species evaluated. The only postemergence treatment to give complete control of all species was DPX-M6316 + lactofen + petroleum oil followed in 7 days by sethoxydim + methylated seed oil. Postemergence application of most herbicides effectively controlled foxtail, wild mustard, and kochia. However, common lambsquarters control varied widely with the various herbicide treatments.

Weed control in soybeans, Carrington 1989. Preplant soil incorporated (ppi) treatments were applied and rototiller incorporated 3 inch deep into moist soil on June 1 with 55 F, 86% RH, 10 mph southwest wind, and a clear sky. 'Maple amber' soybeans was seeded June 1. The first rain after treatment was 1.41 inches on June 11. The soil was a loam with 3.6% organic matter and 7.2 pH. Postemergence treatments were applied to first to second trifoliolate soybeans, 2 inch tall redroot pigweed, 4-leaf common lambsquarters, 3-leaf to tillering green foxtail, and tillering to heading wild oats on June 27 with 72 F, 29% RH, 8 mph wind, and a clear sky. Postemergence split (/) treatments were applied to second trifoliolate soybeans on June 30 with 72 F, 84% RH, 6 mph wind, and a clear sky. Conditions after treatment were dry and plant stages were similar at both postemergence treatments. All treatments were applied with a bicycle wheel plot sprayer delivering 17 gpa at 35 psi for the preplant treatments and 8.5 gpa at 35 psi for the postemergence treatments to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Evaluation was on July 14.

Treatment[a]	Rate	Soybean injury	Grft	Wioa	Rrpw	Colq
	(oz/A)	(%)	(----%	control	----)	
Trifluralin(ppi)	16	1	96	92	98	94
Pendimethalin(ppi)	20	0	95	97	96	99
Ethalfluralin(ppi)	15	0	97	98	96	98
Acetochlor(ppi)	24	1	97	98	99	92
Alachlor(ppi)	48	0	94	96	98	98
Pendimethalin+Imazethapyr(ppi)	14+1	0	99	98	99	99
Imazethapyr(ppi)	1	3	97	97	99	99
Imazethapyr+Alachlor(ppi)	1+40	0	98	99	99	99
Imazethapyr+Metolachlor(ppi)	1+40	0	97	97	99	98
Trifluralin+Metribuzin-DF(ppi)	16+3	0	97	95	97	99
Trifluralin&Alachlor(ppi)	48	0	98	94	98	93
Imazethapyr+X-77+28N	1	0	74	92	93	35
Imazethapyr+MS+28N	1	1	91	93	92	63
Imazethapyr+MS1+28N	1	0	91	86	93	49
Lactofen+PO/Sethoxydim+MS	3/3	4	94	84	93	23
Bentazon+Acifluorfen+X-77/Sethoxydim+MS	8+2/3	3	91	70	90	76
Bentazon+Acifluorfen+X-77	8+2	0	68	95	88	69
Bentazon+PO/Sethoxydim+MS	12/3	4	89	88	87	62
Acifluorfen+X-77/Sethoxydim+MS	4/3	2	92	81	60	3
DPX-M6+X-77+28N/Sethoxydim+MS	0.063/3	0	82	76	93	60
Untreated	0	0	0	0	0	0
C.V. %		272	9	9	8	29
LSD 5%		NS	12	12	11	29
# OF REPS		4	4	4	4	4

[a] X-77=non-ionic surfactant at 0.25% (v/v) from Valent; 28N=nitrogen fertilizer at 1 qt/A except at 1 gal/A with DPX-M6316; PO=petroleum oil with 17% (v/v) Atplus 300 F applied at 1 qt/A; MS & MS1=methylated seed oils applied at 1 qt/A with sethoxydim and 1 pint/A with imazethaypr.

Summary

None of the herbicide treatments injured soybeans. Green foxtail control by postemergence imazethapyr was greater when applied with methylated seed oil than non-ionic surfactant X-77. All other treatments gave more than 80% green foxtail control. Control of all weeds exceeded 90% with all preplant incorporated herbicide treatments and imazethaypr + methylated seed oil + 28% liquid nitrogen fertilizer.

Weed control in soybeans. An experiment was conducted on a silty loam soil with pH 6.8 and 3.5% organic matter to evaluate various herbicide treatments for weed control in soybeans at Mooreton, North Dakota. Preplant incorporated (PPI) treatments were applied and roto-tiller incorporated into a dry cloddy soil on May 15, 1989 with 75 F, 40% relative humidity, and mostly clear skies. 'Evans' soybeans were planted on May 26. Post-emergence (P) treatments were applied to 1 to 2-trifoliolate soybeans, 2 to 6-leaf green and yellow foxtail (1 to 4-inch), 4 to 6-leaf redroot pigweed (1 to 4-inch), and 1.5 to 6-inch kochia on June 23 with 74 F, 58% relative humidity, and clear skies. The experiment had a randomized complete block design with four replications. The plots were 10 by 40 ft, and all treatments were applied to the center two rows of the four 30-inch spaced rows of soybeans. PPI treatments were applied with a tractor-mounted compressed CO_2 sprayer delivering 17 gpa at 35 psi. Postemergence treatments were applied with a bicycle wheel plot sprayer delivering 8.5 gpa at 35 psi. Soybean injury and weed control were evaluated July 3.

Treatment	Rate	Soybean injury	Green foxtail	Redroot pigweed	Kochia
	(oz/A)	(%)	----(% control)------		
Trifluralin (PPI)	16	0	95	95	98
Trifluralin+Metribuzin (PPI)	16+3	0	97	98	100
Pendimethalin (PPI)	20	0	96	94	93
Ethalfluralin (PPI)	15	0	98	97	99
Alachlor (PPI)	48	0	84	86	58
Metolachlor (PPI)	48	0	93	80	46
Acetochlor (PPI)	24	0	82	88	76
Imazethapyr (PPI)	1	0	96	100	100
Imep+Pendimethalin (PPI)	1+14	0	97	100	100
Imep+X-77+28%N (P)	1+0.25%+0.25G	3	97	97	100
Imep+MS+28%N (P)	1+0.25G+0.25G	7	98	98	99
Bentazon+Sethoxydim+PO (P)	12+2.25+0.25G	1	97	54	63
Bent+Malathion+PO (P)	12+9+0.25G	34	5	79	75
Acifluorfen+Seth+X-77 (P)	4+2.25+0.25	9	95	86	69
Bent+Acif+Seth+X-77 (P)	8+2+2.25+0.12%	3	75	60	54
Lactofen+Seth+PO (P)	3+2.25+0.12G	26	99	98	90
DPX-M6316+Seth+X-77 (P)	0.063+2.25+0.25%	0	93	96	88
C.V. %		75	6	8	12
LSD 5%		5	7	9	13

[a] X-77 = nonionic surfactant; MS = methylated vegetable oil with 15% emulsifier; PO = petroleum oil with 17% emulsifier; 28%N = 28% liquid urea ammonium nitrate (UAN) fertilizer.

Summary

The tank-mixture of bentazon plus malathion caused 34% injury to soybeans, compared to 3% or less injury from other treatments containing bentazon. Lactofen plus sethoxydim and petroleum oil was the only other treatment that gave more than 10% soybean injury. Treatments containing trifluralin, pendimethalin, ethalfluralin, and imazethapyr provided 93% or greater control of all weeds evaluated. Postemergence treatments with lactofen, DPX-M6316, or imazethapyr gave 88% or greater control of kochia and redroot pigweed.

Postemergence weed control in soybeans with V-23031, Fargo 1989. McCall soybeans were planted June 3. Early postemergence (EP) treatments were applied June 27 when soybeans had one trifoliolate leaf (4 inches tall), redroot pigweed amd common lambsquarters were 4 to 6-leaf (1 to 2 inches tall), and yellow foxtail was 4 to 5-leaf (5 inches tall). Environmental conditions at time of EP application were: 76 F air temp, 40% relative humidity, very good soil moisture. Late postemergence (LP) treatments were applied July 7 when soybeans had 3 to 3.5 trifoliolate leaves, redroot pigweed was 8 to 10-leaf (5 to 8 inches tall), common lambsquarters was 8 to 10-leaf (4 to 7 inches tall), and yellow foxtail was well-tillered and 5 to 6 inches tall. Environmental conditions at time of LP application were: low soil moisture, 85 F air temp, and 70% relative humidity. All treatments were applied using a bicycle wheel sprayer delivering 8.5 gpa with 8001 nozzles and 40 psi. Visual estimates of percentage soybean injury and weed control were taken on July 15 (foxtail control for the LP application was evaluated on July 22). Plot size was 10 by 25 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate[a]	Soybean injury	Weed control Rrpw	Colq	Yeft
	(oz/A)	--------------(%)------------			
V-23031+PO(EP)	0.42+0.25G	7	72	54	-
V-23031+PO(EP)	0.64+0.25G	7	79	76	-
V-23031+PO(EP)	0.85+0.25G	7	75	59	-
V-23031+PO(EP)	1.06+0.25G	9	63	56	-
V-23031+PO(EP)	1.27+0.25G	8	76	65	-
V-23031+X-77(EP)	0.42+0.25%	6	67	53	-
V-23031+X-77(EP)	0.85+0.25%	7	77	56	-
V-23031+X-77(EP)	1.27+0.25%	8	80	64	-
Lactofen+PO(EP)	3.2+0.125G	9	89	47	-
Bentazon+Acifluorfen(EP)	12+3	4	78	64	-
V-23031+Clethodim+PO(EP)	0.85+1.6+0.25G	5	77	55	94
Clethodim+PO(EP)	1.6+0.25G	0	0	0	96
V-23031+PO(LP)	0.85+0.25G	19	96	78	-
V-23031+PO(LP)	1.27+0.25G	25	97	81	-
Lactofen+PO(LP)	3.2+0.125G	28	85	44	-
Bentazon+Acifluorfen(LP)	12+3	16	87	57	-
V-23031+Clethodim+PO(LP)	0.64+1.6+0.25G	15	82	66	97
Clethodim+PO(LP)	1.6+0.25G	0	0	0	97
Untreated	0	0	0	0	0
C.V. %		21	8	22	2
LSD 5%		3	8	17	NS

[a]PO = petroleum oil adjuvant containing 17% emulsifier; X-77 = non- ionic surfactant; 0.25G = 0.25 gal/A.

Summary

Higher rates (0.85 and 1.27 oz/A) of V-23031 plus adjuvant applied to 4 to 6-leaf redroot pigweed provided control comparable to bentazon + acifluorfen at 12 + 3 oz/A without adjuvant but less than lactofen at 3.2 oz/A plus oil adjuvant. Similar results were seen with 4 to 6-leaf common lambsquarters although overall control of this species was less than with redroot pigweed. V-23031 appeared to be equally effective when applied with X-77 nonionic surfactant or petroleum oil adjuvant at the early application. Late applications of 0.85 or 1.27 oz/A of V-23031, however, gave redroot pigweed and common lambsquarters control that was superior to that provided by lactofen or bentazon + acifluorfen. V-23031 did not appear to antagonize yellow foxtail control by clethodim.

CGA-144155 for Weed Control in Dry Beans, Casselton 1989. Preplant soil incorporated (ppi) treatments were applied and field cultivator plus harrow incorporated twice 3 inch deep to dry soil and 'Hyden' drybean was seeded on May 12. The climate at treatment was 70 F, 40% RH, and a clear sky. Rainfall for 2 weeks after treatment was 1.8 inch occuring after May 18. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on June 5. Foxtail (green and yellow), wild mustard and common lambsquarter density was ¢ 5/sq yd and kochia was only present in the first replication. Yield was not obtained because of drought conditions.

Treatment	Rate (lb/A)	Dry beans (% inj)	Fxtl	Wimu	Colq	Kocz
			(----% control----)			
EPTC(ppi)	3	0	96	68	99	65
CGA-144155(ppi)	3	0	96	3	51	90
CGA-144155(ppi)	6	0	98	16	86	88
CGA-144155&Metolachlor(ppi)	3	0	94	16	81	50
CGA-144155&Metolachlor(ppi)	6	0	98	48	95	88
Metolachlor(ppi)	3	0	95	31	76	50
Metolachlor(ppi)	6	0	97	67	94	30
Trifluralin(ppi)	1	0	98	0	97	97
Untreated	0	0	0	0	0	0
C.V. %		0	2	50	11	
LSD 5%		NS	3	20	13	
# OF REPS		4	4	4	4	1

Summary

None of the herbicides caused any injury to drybean. Foxtail (green and yellow) was effectively controlled by all treatments. Wild mustard was less than 70% regardless of herbicide treatment. Common lambsquarter control exceeded 90% with EPTC; trifluralin; and the 6 lb/A rates of CGA-144155, CGA-144155 & metolachlor, and metolachlor.

<u>Postemergence weed control in drybeans, Casselton 1989.</u> 'Hyden' drybean was seeded May 12. Treatments were applied to second trifoliolate dry bean, 2 to 15 inch tall wild mustard, and 2 to 5 inch tall common lambsquarters, kochia and redroot pigweed on June 23 with 80 F, 65% RH, no wind, and a clear sky. Treatments were applied with a bicycle wheel tupe plot sprayer delivering 8.5 gpa at 35 psi to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 11. Beans were not harvested because of drought condition. Weed populations were 1 to 10 per sq. yd., except for kochia and redroot pigweed which was variable and did not occure in all plots or replications.

Treatment	Rate	Drybean injury	Wimu	Colq	KOCZ	Rrpw
	(oz/A)	(%)	(------%	control	-----)	
Acifluorfen+Bentazon	1.7+12	2	99	47	65	30
Acifluorfen+Bentazon+28N	2.7+12+1G	5	98	67	66	98
Acifluorfen+Bentazon+PO	1.7+12+0.12G	2	99	88	91	88
Acifluorfen+Bentazon+PO	1.7+12+0.25G	2	99	54	67	40
Acifluorfen+Bentazon+BCH	2.7+12+0.12G	7	99	59	-	75
Acifluorfen+Bentazon+BCH	2.7+12+0.25G	8	99	53	-	90
Acifluorfen+Bentazon+MS	2.7+12+0.125G	4	99	52	-	65
Acifluorfen+Bentazon+MS	2.7+12+0.25G	13	99	85	-	95
Acifluorfen+Bentazon+MS1	2.7+12+.125G	6	99	70	82	85
Acifluorfen+Bentazon+MS1	2.7+12+.25G	7	98	78	69	95
Acifluorfen+Bentazon+X-77	2.7+12+.25%	2	99	91	90	80
Acifluorfen+Bentazon+X-77	2.7+12+.5%	4	98	65	81	60
DPX-M6316+X-77	.06+.125%	45	93	75	47	60
DPX-M6316+X-77	.125+.125%	75	99	96	80	99
Untreated	0	0	0	0	0	0
C.V. %		45	2	24	31	
LSD 5%		8	2	22	25	
# OF REPS		4	4	4	3	1

Summary

Acifluorfen + bentazon injury to soybean tended to be greater with methylated seed oil (MS) than the other adjuvants. However, none of the acifluorfen + bentazon treatments cause important injury to drybean. DPX-M6316 caused excessive injury to drybean. Wild mustard was completely controlled regardless of herbicide or adjuvant. Variability in the weed infestation caused the data to be too variable for conclusions on adjuvants. However, most adjuvants tended to enhance common lambsquarter and redroot pigweed control when with bentazon compared to bentazon applied alone.

Weed control in corn. An experiment was conducted at Carrington, ND on a loam soil with 7.2 pH and 3.6% organic matter to evaluate broad-spectrum weed control in corn by various herbicide treatments. Preplant incorporated (PPI) treatments were applied and incorporated by roto-tiller, and 'Pioneer 3963' corn was seeded into moist soil on May 30, 1989. Preemergence (PE) treatments were applied May 31. Postemergence (P) treatments were applied to 4 to 5-leaf corn, 2 to 3-leaf green foxtail, and 2 to 4-leaf redroot pigweed on June 23 with 70 F and partly cloudy skies. Treatments were applied with a bicycle wheel plot sprayer delivering 17 gpa at 35 psi for soil applied treatments and 8.5 gpa at 35 psi for postemergence treatments. The experiment had a randomized complete block design with four replications. Corn injury and weed control were evaluated on July 14.

Treatment	Rate	Corn injury	Green foxtail	Redroot pigweed
	(oz/A)	(%)	---(% control)---	
EPTC&S+Cyanazine(PPI)	64+32	0	98	97
Butylate&S+Cyanazine(PPI)	64+32	0	98	99
Metolachlor+Cyanazine(PE)	40+32	0	95	96
Alachlor+Cyanazine(PE)	40+32	0	96	97
Acetochlor+Cyanazine(PE)	24+32	1	98	99
Pendimethalin+Cyanazine(PE)	16+32	0	90	85
ICIA-5676+Cyanazine(PE)	24+32	0	98	98
Propachlor+Cyanazine(PE)	64+32	1	94	86
Alachlor+AC 310,448+Atrazine(PE)	40+2.4+8	3	92	97
Alachlor(PE)/Atrazine(P)	40+10	0	85	98
Alachlor(PE)/2,4-D iso-octyl ester(P)	40+6	7	92	98
Alachlor(PE)/Dicamba(P)	40+4	0	91	98
Alachlor(PE)/Dicamba+Atrazine(P)	40+4+8	0	86	99
Alachlor(PE)/Bromoxynil(P)	40+6	0	89	99
Alachlor(PE)/Bromoxynil+Atrazine(P)	40+4+8	0	79	98
Alachlor(PE)/Bentazon+Atrazine(P)	40+8+8	1	89	99
Alachlor(PE)/Clopyralid&2,4-D (P)	40+1.5&8	1	89	98
Tridiphane+Cyanazine+X-77(P)	8+24+0.25%	19	88	98
Cyanazine(P)	32	6	57	97
Cyanazine+SO(P)	19+0.25G	9	70	97
Cyanazine+Atrazine+SO(P)	15+5+0.25G	5	75	98
DPX-V9360&DPX-E9636+PO(P)	0.25+0.25+1%	0	93	98
CGA-136872+PO(P)	0.5+1%	6	30	96
C.V. %		164	8	4
LSD 5%		6	9	6

[a] S = dichlormid safener; PO = petroleum oil with 17% emulsifier; SO = vegetable oil with 15% emulsifier; X-77 = nonionic surfactant; & = formulated mixture; G in the rate column represents gallon/acre.

Summary

Tridiphane+cyanazine+X-77 was the only treatment that caused more than 10% corn injury. Several treatments gave good green foxtail control, including ICIA-5676+cyanazine and DPX-V9360& DPX-E9636+PO. All treatments except propachlor+cyanazine and pendimethalin+cyanazine provided 96% or greater redroot pigweed control.

Broad-spectrum weed control in corn. An experiment was conducted at Casselton, ND on a silty clay soil with pH 7.8 and 5% organic matter to evaluate several herbicides for broad-spectrum weed control in corn. Preplant incorporated (PPI) treatments were applied and field cultivator plus harrow incorporated twice in opposite directions to a 3 inch depth, and 'Interstate 201' corn was seeded into a dry loose soil on May 12, 1989 with 70 F, 35% relative humidity, and clear skies. Preemergence (PE) treatments were applied on May 13 with 70F and 40% relative humidity. Precipitation for 2 weeks following corn seeding was 1.78 inches. Postemergence (P) treatments were applied to 4 to 5-leaf corn, 3 to 4- leaf green foxtail, and 4 to 6-leaf wild mustard on June 15 with 75F, 60% relative humidity, and clear skies. Each plot consisted of four rows of corn spaced 30 inches apart and 25 ft long. Treatments were applied to the middle two rows of the four row plots using a bicycle wheel plot sprayer delivering 17 gpa at 35 psi for soil applied treatments and 8.5 gpa at 35 psi for postemergence treatments. The experimental design was a randomized complete block with four replications. Corn injury and weed control were evaluated on June 9 (before the postemergence treatments were applied) and June 30.

		June 9			June 30		
Treatment	Rate	Corn injury	Grft	Wimu	Corn injury	Grft	Wimu
	(oz/A)	(%)	(% control)		(%)	(% control)	
EPTC&S+Cyanazine(PPI)	64+32	1	99	99	4	98	98
EPTC&S&E+Cyan(PPI)	64+32	1	99	99	1	99	99
Butylate&S+Cyan(PPI)	64+32	2	94	98	1	95	95
Metolachlor+Cyan(PE)	40+32	0	94	86	1	81	73
Alachlor+Cyan(PE)	40+32	1	93	93	1	78	80
Acetochlor+Cyan(PE)	32+32	3	98	98	1	89	81
Propachlor+Cyan(PE)	64+32	0	98	96	0	94	87
Pendimethalin+Cyan(PE)	16+32	3	89	88	3	56	43
ICIA-5676+Cyan(PE)	32+32	1	96	95	0	87	88
Tridiphane(PPI)	24	12	94	87	4	62	33
Tridiphane+Cyan(PPI)	24+32	8	98	98	4	93	93
Tridiphane+Cyan+X-77(P)	12+24+0.25%	0	0	0	7	92	99
Tridiphane+Atrazine+Cyan+X-77(P)	12+8+16+0.25%	0	0	0	3	83	99
Alachlor+AC 310,448+Atra(PPI)	40+1.6+8	2	96	97	3	96	93
Alachlor+AC 310,448+Atra(PPI)	40+2.4+8	0	97	97	0	97	93
Alachlor+AC 310,448+Atra(PPI)	40+3.2+8	3	98	98	3	97	97
Alachlor+AC 310,448+Atra(PE)	40+2.4+8	4	92	82	0	88	63
Alachlor(PE)/AC 310,448+Atra(P)	40/2.4+8	1	91	38	2	88	99
Alachlor(PE)/Pyridate+Atra(P)	40/7+9.5	0	91	35	1	94	99
Alachlor(PE)/Pyridate+Atra+PO(P)	40/7+9.5+0.25G	1	93	20	0	93	99
Alachlor(PE)/Pyridate+Cyan(P)	40/7+9.5	0	94	33	3	93	99
ICIA-5676(PE)/Dicamba(P)	28/4	0	92	60	1	82	96
ICIA-5676(PE)/Dicamba(P)	32/4	0	93	50	0	83	95
ICIA-5676(PE)/Dicamba(P)	36/4	3	95	80	0	92	98
ICIA-5676(PE)/Dicamba(P)	40/4	1	95	84	1	90	96
Alachlor(PE)/Dicamba(P)	40/4	3	92	29	1	80	95
Metolachlor(PE)/Dicamba(P)	40/4	2	91	49	1	76	97
C.V. %		159	5	25	186	14	12
LSD 5%		5	6	24	NS	17	15

[a] S = dichlormid safener; E = dietholate extender; PO= petroleum oil with 17% emulsifier; X-77 = nonionic surfactant; G in the rate column represents gallons/acre.

Summary

None of the treatments caused important injury to corn. Weed control tended to decrease over time with most preemergence treatments. All PPI treatments except tridiphane maintained weed control at 93% or greater from the early to the late evaluation. EPTC+cyanazine, butylate+ cyanazine, tridiphane+cyanazine (PPI), and alachlor+AC 310,448+atrazine (PPI) provided 90% or greater control of foxtail and wild mustard at both evaluation dates.

Postemergence grass control herbicides in corn, Casselton 1989. 'Interstate 201' corn was seeded on May 12. Early postemergence (EP) treatments were applied to 4 to 5-leaf corn (4 to 6-inch), 3 to 4-leaf green foxtail, 4 to 6-leaf wild mustard, 3 to 4-leaf common lambsquarters, and 1 to 2-inch kochia on June 15 with 70 F, 65% relative humidity, and clear skies. Postemergence (P) treatments were applied to 6 to 7-leaf corn (10 to 12-inch), 5 to 6-leaf and tillering green foxtail, early bloom wild mustard, 8 to 10-leaf common lambsquarters, and 3 to 5-inch kochia on June 23 with 75 F, 60% relative humidity, and clear skies. Treatments were applied with a bicycle wheel plot sprayer delivering 8.5 gpa at 35 psi to the middle two rows of the four-row plots. The experiment had a randomized complete block with four replications. Evaluation was July 3 for corn injury and 3 and 21 for weed control.

Treatment	Rate	Corn inj	July 3 Grft	July 3 Wimu	July 3 KOCZ	July 21 Grft	July 21 KOCZ	July 21 Colq
	(oz/A)	(%)	---------(% control)---------					
Cyanazine(EP)	32	0	31	99	49	38	50	89
Cyanazine+SO(EP)	19+0.25G	6	80	99	99	65	99	99
Cyanazine+Atrazine+SO(EP)	15+5+0.25G	2	87	99	99	68	99	99
KIH-2665+X-77(EP)	1.5+0.25%	3	88	99	99	78	99	99
KIH-2665+X-77(EP)	2.0+0.25%	0	86	99	99	79	99	99
KIH-2665+X-77(P)	1.5+0.25%	19	75	96	99	76	99	99
KIH-2665+X-77(P)	2.0+0.25%	16	85	95	99	84	99	99
CGA-136872+PO(EP)	0.33+1%	1	81	99	99	69	98	0
CGA-136872+PO(EP)	0.5+1%	0	71	99	98	74	98	20
CGA-136872+PO(P)	0.33+1%	1	70	98	98	66	99	40
CGA-136872+PO(P)	0.5+1%	1	73	99	98	67	99	23
DPX-V9360&DPX-E9636+X-77(EP)	0.25+0.25%	0	70	99	97	71	89	10
DPX-79406+X-77(EP)	0.5+0.25%	0	87	99	98	82	94	0
DPX-79406+X-77(EP)	1.0+0.25%	1	95	99	99	92	96	0
DPX-79406+PO(EP)	0.25+1%	0	89	99	98	87	97	0
DPX-79406+PO(EP)	0.5+1%	0	93	99	99	88	98	35
DPX-79406+PO(EP)	1.0+1%	0	96	99	99	90	98	37
DPX-79406+X-77(P)	0.25+0.25%	2	90	99	98	94	97	28
DPX-79406+X-77(P)	0.5+0.25%	3	94	99	98	96	97	28
DPX-79406+X-77(P)	1.0+0.25%	3	97	99	98	98	98	34
DPX-79406+PO(P)	0.25+1%	0	90	99	99	93	98	23
DPX-79406+PO(P)	0.5+1%	5	91	99	97	96	97	47
DPX-79406+PO(P)	1.0+1%	3	97	99	99	98	99	60
DPX-79406+2,4-D-dma+X-77(EP)	0.25+4+0.12%	0	76	99	99	74	98	99
DPX-79406+2,4-D-dma+X-77(EP)	0.5+4+0.12%	0	81	99	99	74	99	99
DPX-79406+Dicamba+X-77(EP)	0.25+4+0.12%	1	73	99	99	79	99	99
DPX-79406+Dicamba+X-77(EP)	0.5+4+0.12%	0	89	99	99	88	99	99
DPX-79406+Brox+X-77(EP)	0.25+4+0.12%	4	85	99	99	82	99	99
DPX-79406+Brox+X-77(EP)	0.5+4+0.12%	1	92	99	99	85	99	96
DPX-79406+DPX-M6316+X-77(EP)	0.25+0.06+0.25%	0	70	99	98	75	97	0
DPX-79406+DPX-M6316+X-77(EP)	0.5+0.06+0.25%	0	88	99	99	84	96	0
C.V. %		102	9	1	2	12	4	31
LSD 5%		3	10	1	3	13	5	22

[a] SO = vegetable oil with 15% emulsifier; PO = petroleum oil with 17% emulsifier; X-77 = nonionic surfactant; & = formulated mixture; DPX-79406 = DPX-V9360&DPX-E9636 a 1:1 formulated mixture.

Summary

The late (P) applications of KIH-2665 caused 16 to 19% corninjury, but early post-emergence treatments (EP) caused less than 3% injury. Corn injury was not evaluated July 21 because drought stress masked any injury. Cyanazine at 19 oz/A plus vegetable oil provided better weed control than cyanazine at 32 oz/A and no oil. DPX-V9360&DPX-E9636 provided better green foxtail control than CGA-136872 or KIH-2665 at the rates evaluated. Late postemergence treatments of DPX-V9360&DPX-E9636 gave better green foxtail control than early applications. Foxtail control with early applications of DPX-V9360&DPX-E9636 tended to be enhanced more by petroleum oil than by X-77 surfactant. All treatments provided excellent wild mustard control. KIH-2665 controlled common lambsquarters, but CGA-136872 and DPX-V9360&DPX-E9636 did not.

Postemergence grass control herbicides in corn, Casselton 1989. 'Interstate 201' corn was seeded on May 12. Early postemergence (EP) treatments were applied to 4 to 5-leaf corn (4 to 6-inch), 3 to 4-leaf green foxtail, 4 to 6-leaf wild mustard, 3 to 4-leaf common lambsquarters, and 1 to 2-inch kochia on June 15 with 70 F, 65% relative humidity, and clear skies. Postemergence (P) treatments were applied to 6 to 7-leaf corn (10 to 12-inch), 5 to 6-leaf and tillering green foxtail, early bloom wild mustard, 8 to 10-leaf common lambsquarters, and 3 to 5-inch kochia on June 23 with 75 F, 60% relative humidity, and clear skies. Treatments were applied with a bicycle wheel plot sprayer delivering 8.5 gpa at 35 psi to the middle two rows of the four-row plots. The experiment had a randomized complete block with four replications. Evaluation was July 3 for corn injury and 3 and 21 for weed control.

			July 3			July 21		
Treatment	Rate	Corn inj	Grft	Wimu	KOCZ	Grft	KOCZ	Colq
	(oz/A)	(%)	---------(% control)---------					
Cyanazine(EP)	32	0	31	99	49	38	50	89
Cyanazine+SO(EP)	19+0.25G	6	80	99	99	65	99	99
Cyanazine+Atrazine+SO(EP)	15+5+0.25G	2	87	99	99	68	99	99
KIH-2665+X-77(EP)	1.5+0.25%	3	88	99	99	78	99	99
KIH-2665+X-77(EP)	2.0+0.25%	0	86	99	99	79	99	99
KIH-2665+X-77(P)	1.5+0.25%	19	75	96	99	76	99	99
KIH-2665+X-77(P)	2.0+0.25%	16	85	95	99	84	99	99
CGA-136872+PO(EP)	0.33+1%	1	81	99	99	69	98	0
CGA-136872+PO(EP)	0.5+1%	0	71	99	98	74	98	20
CGA-136872+PO(P)	0.33+1%	1	70	98	98	66	99	40
CGA-136872+PO(P)	0.5+1%	1	73	99	98	67	99	23
DPX-V9360&DPX-E9636+X-77(EP)	0.25+0.25%	0	70	99	97	71	89	10
DPX-79406+X-77(EP)	0.5+0.25%	0	87	99	98	82	94	0
DPX-79406+X-77(EP)	1.0+0.25%	1	95	99	99	92	96	0
DPX-79406+PO(EP)	0.25+1%	0	89	99	98	87	97	0
DPX-79406+PO(EP)	0.5+1%	0	93	99	99	88	98	35
DPX-79406+PO(EP)	1.0+1%	0	96	99	99	90	98	37
DPX-79406+X-77(P)	0.25+0.25%	2	90	99	98	94	97	28
DPX-79406+X-77(P)	0.5+0.25%	3	94	99	98	96	97	28
DPX-79406+X-77(P)	1.0+0.25%	3	97	99	98	98	98	34
DPX-79406+PO(P)	0.25+1%	0	90	99	99	93	98	23
DPX-79406+PO(P)	0.5+1%	5	91	99	97	96	97	47
DPX-79406+PO(P)	1.0+1%	3	97	99	99	98	99	60
DPX-79406+2,4-D-dma+X-77(EP)	0.25+4+0.12%	0	76	99	99	74	98	99
DPX-79406+2,4-D-dma+X-77(EP)	0.5+4+0.12%	0	81	99	99	74	99	99
DPX-79406+Dicamba+X-77(EP)	0.25+4+0.12%	1	73	99	99	79	99	99
DPX-79406+Dicamba+X-77(EP)	0.5+4+0.12%	0	89	99	99	88	99	99
DPX-79406+Brox+X-77(EP)	0.25+4+0.12%	4	85	99	99	82	99	99
DPX-79406+Brox+X-77(EP)	0.5+4+0.12%	1	92	99	99	85	99	96
DPX-79406+DPX-M6316+X-77(EP)	0.25+0.06+0.25%	0	70	99	98	75	97	0
DPX-79406+DPX-M6316+X-77(EP)	0.5+0.06+0.25%	0	88	99	99	84	96	0
C.V. %		102	9	1	2	12	4	31
LSD 5%		3	10	1	3	13	5	22

[a] SO = vegetable oil with 15% emulsifier; PO = petroleum oil with 17% emulsifier; X-77 = nonionic surfactant; & = formulated mixture; DPX-79406 = DPX-V9360&DPX-E9636 a 1:1 formulated mixture.

Summary

The late (P) applications of KIH-2665 caused 16 to 19% corninjury, but early post-emergence treatments (EP) caused less than 3% injury. Corn injury was not evaluated July 21 because drought stress masked any injury. Cyanazine at 19 oz/A plus vegetable oil provided better weed control than cyanazine at 32 oz/A and no oil. DPX-V9360&DPX-E9636 provided better green foxtail control than CGA-136872 or KIH-2665 at the rates evaluated. Late postemergence treatments of DPX-V9360&DPX-E9636 gave better green foxtail control than early applications. Foxtail control with early applications of DPX-V9360&DPX-E9636 tended to be enhanced more by petroleum oil than by X-77 surfactant. All treatments provided excellent wild mustard control. KIH-2665 controlled common lambsquarters, but CGA-136872 and DPX-V9360&DPX-E9636 did not.

Weed Control in Corn with DPX-V9360, Casselton 1989. Two experiments were conducted to evaluate various adjuvants with DPX-V9360. Interstate hybrid 201 corn was seeded in 30 inch spaced rows on May 12 for both experiments. Experiment 1 treatments were applied to 4- to 5-leaf corn, 2 inch tall kochia, 4- to 6-leaf wild mustard and 3- to 4-leaf green and yellow foxtail on June 13 with 65 F, 65% relative humidity, clear sky, and no wind. Experiment 2 treatments were applied to 8- to 9-leaf corn, 4 inch tall kochia, 8-leaf common lambsquarters, and 7-leaf green and yellow foxtail on June 23 with 80 F, 60% relative humidity, clear sky, and no wind. Soil was droughty for both experiments, but 0.4 inch of rain occurred 4 days after treatment in experiment 1 and 0.6 inches 2 days after treatment in experiment 2. Treatment were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi to a 7 ft wide area the length of the 25 by 10 ft plots. Weed control and injury to corn were visually evaluated on June 30 and August 8 for experiment 1 and July 6 and August 8 for experiment 2. Evaluations were combined for analysis as the response to adjuvants was similar at both evaluations, except control decreased at the second evaluation for the less effective treatments.

DPX-V9360	Adjuvants[a]											
	Experiment 1				Experiment 2				Average			
rate	None	X-77	PO	Ms	None	X-77	PO	MS	None	X-77	PO	MS
(oz/A)	(% foxtail control)											
0.12	3	17	88	96	2	38	69	88	2	23	79	92
0.25	5	22	93	97	12	14	80	92	8	18	86	95
0.50	19	57	93	99	41	70	90	95	45	63	95	97
LSD 5%	13				14				10			
(oz/A)	(% kochia control)											
0.12	5	22	79	87	0	27	61	68	3	24	70	78
0.25	3	11	84	94	6	16	75	85	4	14	80	90
0.50	7	35	97	98	22	55	95	93	14	45	96	95
LSD 5%	11				10				8			
(oz/A)	(% common lambsquarters control)											
0.12	0	8	70	90	0	26	61	86	0	17	65	88
0.25	15	29	83	93	8	4	83	92	12	17	83	92
0.50	0	42	95	98	41	79	93	96	21	61	94	97
LSD 5%	15				11				9			

[a] X-77 = nonionic surfactant at 0.25% (v/v) in the spray; PO = petroleum oil (Moract); at 1 qt/A; and MS = methylated seed oil (Sun-it) at 1 qt/A.

Summary

Adjuvant enhancement of DPX-V9360 for green and yellow foxtail, kochia, and common lambsquarters generally was methylated seed oil petroleum oil ¢ X-77. Petroleum oil adjuvant increased species control with DPX-V9360 so that 0.12 oz/A was equally or more effective than DPX-V9360 at 0.5 oz/A with X-77 adjuvant. Methylated seed oil enhanced weed control with DPX-V9360 more than petroleum oil, so that control was equal with one half the rates. Corn was not influenced by any of the treatments. These data indicate that DPX-V9360 at 0.25 to 0.5 oz/A applied postemergence with methylated seed oil (Sun-it) would give greater than 90% control of foxtail, kochia and common lambsquarters. Wild mustard occurred in experiment 2 and was completely controlled by DPX-V9360 at 0.25 oz/A or more regardless of adjuvant (data not presented here).

Postemergence weed control in safflower. Riveland, Neil R. and Gordon T. Bradbury. An experiment was conducted to evaluate various postemergence herbicide treatments for broad spectrum weed control in 'Finch' safflower. Safflower was seeded on May 3, 1989 into fallowed Max loam soil with pH of 6.5 and organic matter content of 1.1%. Treatments were applied to 4 to 6-leaf safflower, 5 to 6-leaf wild oats, 2 to 6-leaf green foxtail, emerging to 4-inch-tall tame yellow mustard, 1 to 3-inch tall Russian thistle, and 2 to 4-inch-tall common lambsquarters on June 6 with 66 F, 61% relative humidity, clear sky, and 4 mph wind. Treatments were applied with a tractor mounted sprayer delivering 8.5 gpa at 30 psi to an 8 ft wide strip the length of 10 by 25 ft plots. First rainfall after postemergence was treatment 0.79 inches on June 10 and 11. Precipitation total for May 1 to July 31, 1989 was 3.31 inches compared to an average of 6.67 inches. Trifluralin treatments were applied April 30 with 45 F, 55% relative humidity, 4 mph wind, and clear sky. Incorporation was into dry soil, once after application and once prior to planting. Weed control and safflower response were determined on June 28 and plots were harvested on August 29. The experiment was a randomized complete block design with four replications.

		Safflower			Weed control				
Treatment[a]	Rate	Yield	swt	Inj	Ruth	Tamu	Colq	Grft	Wioa
	(oz/A)	(lb/A)	(lb/bu)	(%)	--------------(%)--------------				
AC 222,293	6	217	**40.9**	4	62	95	5	0	97
AC 222,293+Clsu+surf	6+0.167	315	**41.8**	7	98	99	99	60	95
Imazethapyr+MS	0.25	77	36.4	90	80	95	50	80	62
Imazethapyr+MS	0.5	51	34.7	91	84	95	81	82	71
Imazethapyr+MS	1.0	59	36.6	97	92	96	85	87	89
Imazethapyr+MS	1.5	34	36.2	98	92	97	89	92	89
Imazethapyr+DPX-M6316+MS	1+0.125	59	36.8	96	98	99	98	90	86
Imazethapyr+Clsu+MS	1+0.125	85	38.0	97	99	98	99	94	85
Imazethapyr+DPX-R9674+MS	1+0.125	62	35.7	98	99	98	99	91	85
Imazethapyr+metsulfuron+MS	1+0.03	60	36.8	98	99	99	98	90	90
Imazethapyr+DPX-M6316+MS	0.5+0.125	85	36.5	93	98	98	99	80	77
Propanil	16	159	36.6	4	51	84	82	30	0
Imazethapyr+MS	2	23	37.9	98	98	99	97	95	94
Imazethapyr+DPX-R9674+MS	0.5+0.125	29	37.5	98	99	99	99	94	95
Imazethapyr+Clsu+MS	0.5+0.125	62	36.5	97	98	99	99	90	92
Propanil+DPX-M6316+surf	16+0.125	241	40.6	8	98	93	93	12	0
Propanil+DPX-R9674+surf	16+0.125	24	-	89	98	99	97	5	0
Propanil+AC 222,293	16+6	247	41.2	5	57	72	41	22	70
Clsu+surf	0.167	258	40.7	2	98	99	99	45	0
Clsu+sethoxydim+PO	0.167+4	334	42.4	3	94	99	99	82	46
DPX-M6316+surf	0.2	319	41.9	2	96	95	99	0	0
DPX-M6316+sethoxydim+PO	0.2+4	285	41.4	6	98	96	97	96	83
DPX-R9674+surf	0.167	18	-	90	98	98	99	5	0
DPX-R9674+sethoxydim+PO	0.167+4	61	39.0	96	99	99	99	97	92
Trifluralin (PPI check)	8	123	30.3	0	41	0	76	99	50
Trifluralin (PPI check)	16	272	39.7	0	85	0	89	99	80
Untreated	0	119	34.3	0	0	0	0	0	0
C.V. %		35	3.7	5	11	12	14	17	25
LSD 5%		68	1.8	4	13	14	17	15	22

[a]surf = nonionic surfactant = Activator 90 at 0.25% (v/v); MS = methylated seed oil = Sun-It at 1 pint/A; PO = Petroleum oil concentrate with 17% emulsifier at 1 pint/A; Clsu = Clorsulfuron; Inj = injury; Tswt = test weight; DPX-R9674 = A formulated mixture of 2 parts DPX-M6316 and 1 part DPX-L5300.

Summary

Safflower yields generally related to crop injury. AC 222,293, chlorsulfuron, DPX-M6316, and propanil as postemergence treatments alone, in combination with each other, or with sethoxydim caused less than 10% crop injury. Injury symptoms included delay in maturity, plant height reduction, and slight terminal bud injury. Trifluralin as a preplant incorporated treatment caused no safflower stand reductions or injury. Imazethapyr or DPX-M6316 & DPX-L5300 alone or in combination caused safflower injury in excess of 88%. Injury symptoms include severe plant height reductions, near elimination of reproductive growth and, in some cases, complete death of the plant over time. Drought stress may have aided plant death. Chlorsulfuron and DPX-M6316 provided excellent control of broadleaf weeds and when applied in combination with sethoxydim, adequate control of green foxtail. Propanil was antagonistic to AC 222,293 causing a 27% reduction in wild oat control compared to AC 222,293 alone; wild oat control was reduced by 27% when propanil was added to AC 222,293.

Safflower response to sulfonylurea herbicides. Riveland, Neil R. and Gordon T. Bradbury. An experiment was conducted to evaluate the effect of several sulfonylurea herbicides for broad spectrum weed control on 'Finch' safflower. Safflower was seeded on May 3, 1989 into previously fallowed Max loam soil with pH of 6.5 and organic matter content of 1.1%. Treatments were applied to 3 to 6-leaf safflower, 2 to 6-leaf green foxtail, emerging to 3-inch-tall tame yellow mustard, 1 to 2-inch-tall Russian thistle, and 2 to 3-inch-tall common lambsquarters on June 3 with 52 F, 85% relative humidity, partly cloudy sky, and 4 mph wind. Treatments were applied with a tractor mounted sprayer delivering 8.5 gpa at 30 psi to an 8 ft wide strip the length of 10 by 25 ft plots. The first rainfall after treatment was 0.79 inches on June 10 and 11. Precipitation total for May 1 to July 31 was 3.31 inches in 1989 compared to an average of 6.67 inches. Weed control and safflower response were determined on June 28 and plots were harvested on August 29. The experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Safflower Yield	Safflower Tswt	Safflower Inju	Weed control Ruth	Weed control Tamu	Weed control Colq	Weed control Grft
	(oz/A)	(lb/A)	(lb/bu)	(%)	(%)	(%)	(%)	(%)
Chlorsulfuron+surf	0.125	390	41.9	4	95	100	100	60
Chlorsulfuron+surf	0.167	372	42.2	6	97	100	100	66
Chlorsulfuron+surf	0.25	342	42.0	10	99	100	100	72
DPX-M6316+surf	0.125	368	42.4	2	95	99	99	0
DPX-M6316+surf	0.167	322	42.2	6	98	99	100	0
DPX-M6316+surf	0.2	350	42.2	8	99	97	100	0
DPX-M6316+surf	0.3	307	40.8	8	99	100	100	2
DPX-M6316+surf	0.4	306	41.4	13	99	100	100	17
DPX-R9674+surf	0.125	47	35.6	91	96	100	100	0
DPX-R9674+surf	0.167	13	39.3	93	97	99	100	17
DPX-R9674+surf	0.2	26	37.3	96	98	100	100	17
DPX-R9674+surf	0.3	0	-	98	99	100	100	29
DPX-R9674+surf	0.4	19	40.2	99	99	100	100	24
DPX-L5300+surf	0.125	0	-	95	97	100	100	25
DPX-L5300+surf	0.167	0	-	97	98	98	100	21
DPX-L5300+surf	0.25	0	-	99	99	100	100	36
Metsulfuron+surf	0.03	264	40.2	2	44	100	82	0
Metsulfuron+surf	0.06	332	41.6	10	90	100	96	6
CGA-131036+surf	0.125	122	34.0	93	92	100	42	15
CGA-131036+surf	0.167	79	34.9	98	95	100	54	24
CGA-131036+surf	0.2	78	34.5	98	97	100	49	20
CGA-131036+surf	0.3	32	34.8	99	98	100	58	27
CGA-131036+surf	0.4	23	38.8	99	98	100	59	34
Untreated	0	168	36.1	0	0	0	0	0
C.V. %		32	3.4	4	2	1.3	13	81
LSD 5%		73	1.6	3	3	1.8	15	24

[a] surf = nonionic surfactant (Activator 90) was added to all treatments at a rate of 0.25% v/v; Tswt = test weight in pounds per bushel; DPX-R9674 = a formulated mixture of 2 parts DPX-M6316 and 1 part DPX-L5300.

Summary

Safflower yields were generally related to the degree of crop injury. DPX-M6316 & DPX-L5300, DPX-L5300, and CGA 131036 at all rates caused greater than 90% crop injury. Injury symptoms included severe plant height reductions, near elimination of reproductive growth and, in some cases, complete death of the plant over time. Drought stress may have aided plant death. Chlorsulfuron, DPX-M6316, and metsulfuron caused less than 13% crop injury, even at the highest rates of application. Injury symptoms included delay in maturity, plant height reduction, and slight terminal bud injury. All treatments controlled tame yellow mustard and, with the exception of metsulfuron at 0.03 oz/A, all treatments controlled Russian thistle. CGA-131036 did not control common lambsquarters. Only chlorsulfuron provided green foxtail control above 50%.

Safflower variety response to postemergence chlorsulfuron. Riveland, Neil R. and Gordon T. Bradbury. An experiment was conducted to evaluate the phytotoxic effects of chlorsulfuron applied postemergence to eight safflower varieties. Safflower was seeded on May 16, 1989 into previously fallowed Max loam soil with pH of 6.7 and organic matter content of 1.2%. The experiment was a split plot in a randomized complete block design, with chlorsulfuron treatments (including a control) as whole plots and safflower varieties as split plots. Treatments were applied to 4 to 6-leaf safflower on June 14 with 57 F, 84% relative humidity, clear sky, and 2 mph wind. Treatments were applied with a tractor mounted sprayer delivering 10 gpa at 30 psi to a 15 ft wide strip the length of 15 by 32 ft whole plots. Sub-plots were 4 by 15 ft and were hand weeded. The first rainfall after treatment was 0.10 inch on June 20 and 21. Precipitation total for May 1 to July 31, 1989 was 3.31 inches compared to an average of 6.67 inches. Safflower response was evaluated on July 14 and plots were harvested on September 13. The experiment had 3 replications.

Treatment[a]	Rate	Safflower variety	Flower date	Plant height	Stand reduct	Crop inju	Yield	Tswt
	(oz/A)		(Days)[b]	(cms)	(%)	(%)	(lb/A)	(lb/bu)
Untreated	0	Girard	54.0	31.0	0	0	314	41.0
Untreated	0	Finch	51.7	30.7	0	0	463	42.5
Untreated	0	Mt 3697	53.3	32.0	0	0	258	37.9
Untreated	0	S-541	53.0	32.7	0	0	315	39.1
Untreated	0	S-208	52.3	31.3	0	0	329	38.6
Untreated	0	Oker	52.0	32.7	0	0	262	37.9
Untreated	0	85B 4829	54.0	28.7	0	0	392	40.0
Untreated	0	Hartman	54.0	30.7	0	0	366	41.2
Chlorsulfuron+surf	0.15	Girard	54.7	24.3	1.7	18	247	38.7
Chlorsulfuron+surf	0.15	Finch	53.0	28.7	1.7	7	395	43.1
Chlorsulfuron+surf	0.15	Mt 3697	54.0	27.3	3.3	13	284	38.7
Chlorsulfuron+surf	0.15	S-541	54.3	24.0	0	20	247	37.5
Chlorsulfuron+surf	0.15	S-208	53.7	27.0	3.3	10	281	38.9
Chlorsulfuron+surf	0.15	Oker	55.0	26.3	96.7	8	32	35.3
Chlorsulfuron+surf	0.15	85B 4829	54.3	29.0	1.7	17	331	37.5
Chlorsulfuron+surf	0.15	Hartman	54.7	27.3	1.7	15	309	39.6
Chlorsulfuron+surf	0.30	Girard	54.7	30.3	0	18	287	38.9
Chlorsulfuron+surf	0.30	Finch	52.7	29.7	0	4	420	43.8
Chlorsulfuron+surf	0.30	Mt 3697	54.0	30.7	1.7	15	297	41.0
Chlorsulfuron+surf	0.30	S-541	54.0	29.0	1.7	20	288	37.8
Chlorsulfuron+surf	0.30	S-208	53.0	29.3	1.0	12	331	38.3
Chlorsulfuron+surf	0.30	Oker	54.3	28.0	96.0	10	43	35.1
Chlorsulfuron+surf	0.30	85B 4829	54.7	29.3	0	8	384	38.8
Chlorsulfuron+surf	0.30	Hartman	54.7	29.7	0	5	387	41.6
C.V. %			1.3	11.5	21.2	73	23	6.3
LSD 5%			1.1	NS	3.1	10	113	4.1
Treatment Means								
Untreated	0		53.0	31.2	0	0	337	39.8
Chlorsulfuron	0.15		54.2	26.8	13.8	14	266	38.7
Chlorsulfuron	0.30		54.0	29.5	12.5	12	304	39.4
LSD 5%			NS	2.5	3.2	10	NS	NS
Variety Means								
		Girard	54.4	28.6	0.6	12	283	39.5
		Finch	52.4	29.7	0.6	4	426	43.1
		Mt 3697	53.8	30.0	1.7	9	280	39.2
		S-541	53.8	28.6	0.6	13	283	38.1
		S-208	53.0	29.2	1.4	7	314	38.6
		Oker	53.8	29.0	64.2	6	113	36.1
		85B 4829	54.3	29.0	0.6	8	369	38.8
		Hartman	54.4	29.2	0.6	7	354	40.8
LSD(5%)			0.6	NS	1.4	5	54	2.2

[a] surf = surfactant = Activator 90 applied at the rate of 0.25% v/v.
[b] Days from June 1, Reduct = Reduction, Inju = Injury, Tswt = Test weight.

Summary

The safflower variety Oker was highly susceptible to chlorsulfuron with 96% stand reduction. None of the other varieties had significant stand reductions. Finch was the most tolerant to chlorsulfuron as indicated by crop injury ratings, while Oker, Girard, and S-541 were the least tolerant. Chlorsulfuron tended to delay maturity, reduce plant height, and lower seed test weight of all varieties. Yield response of Safflower varieties tended to be related to the degree of stand reduction or crop injury. The two rates of chlorsulfuron caused similar effects.

Weed control in canola, Carrington 1989. Preplant (ppi) treatments applied and rototiller incorporated 3 inch deep. 'Westor' canola was seeded into moist soil on May 30 with 53 F, 72% RH, 6 mph wind, and a cloudy sky with a light rain falling. Postemergence treatments were applied to 3 inch tall canola, 3- to 5-leaf green foxtail, 2- to 4-leaf wild buckwheat, and 4- to 6-leaf redroot pigweed on June 30 with 86 F, 53% RH, 8 mph east wind, and clear sky. Treatments split (/) were applied to 4 inch tall canola, and 5 inch tall tillering green foxtail on July 6 with 80 F, 44% RH, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi for the preplant treatments and 8.5 gpa at 35 psi for the postemergence treatments to an 8 ft wide area the length of 8 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 14.

Treatment	Rate	Canola injury	Green foxtail	Redroot pigweed
	(oz/A)	(%)	--(% control)--	
Ethalfluralin(ppi)	15	55	98	99
Trifluralin(ppi)	16	40	96	99
BAS-514(ppi)	8	25	45	0
Dicamba-Na/Sethoxydim+MS	1.5/3+0.25G	5	48	28
Clopyralid/Sethoxydim+MS	2/3+0.25G	0	41	0
2,4-DB/Sethoxydim+MS	16/3+0.25G	68	58	30
DPX-A7881-22+X-77/Sethoxydim+MS	0.25+.25%/3+0.25G	0	63	13
DPX-A7881-22+X-77/Sethoxydim+MS	0.5+.25%/3+0.25G	0	77	49
DPX-A7881-22+MS/Sethoxydim+MS	0.25+0.25G/3+0.25G	0	72	50
DPX-A7881-22+MS/Sethoxydim+MS	0.5+0.25G/3+0.25G	0	55	8
DPX-A7881-22+Sethoxydim+MS	0.25+3+0.25G	0	87	65
DPX-A7881-22+Sethoxydim+MS	0.5+3+0.25G	0	89	78
BAS-514+BAS-090	4+0.25G	5	77	21
Untreated	0	0	0	0
C.V. %		59	19	40
LSD 5%		12	17	22
# OF REPS		4	4	4

Summary

2,4-DB, Bas-514, trifluralin, and ethalfluralin caused important injury to canola. Green foxtail control exceeded 85% only with ethalfluralin, trifluralin, and sethoxydim applied with DPX-A7881 at the first postemergence application. The drought stress at the second application may have reduced sethoxydim efficacy.

Weed control in canola, Langdon 1989. Preplant (ppi) treatments applied and rototiller incorporated 3 inch deep. 'Westor' canola was seeded into moist soil on May 19. Postemergence treatments were applied to large rosette canola on June 20 with 80 F, and no wind. Treatments split (/) were applied to bolting with first buds canola and oats up to flag leaf stage on June 20 with 83 F, 70 % RH, and a sunny sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 17 gpa at 35 psi for the preplant treatments and 8.5 gpa at 35 psi for the postemergence treatments to an 8 ft wide area the length of 8 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on August 1. Weed density was 50 to 70 wild oat plants per sq yd and 10 to 15 kochia plants per sq yd. Tame oats was seeded to supplement the natural wild oat.

		Canola			Wild	
Treatment	Rate	inj	yld	flwr	oats	Kochia
	(oz/A)	(%)	(lb/bu)	(July)	(% control)	
Ethalfluralin(ppi)	15	0	608	8	98	89
Trifluralin(ppi)	16	2	508	7	97	87
BAS-514(ppi)	8	0	546	7	0	83
Dicamba-Na/Sethoxydim+MS	1.5/3+0.25G	16	289	8	99	84
Clopyralid/Seth+MS	2/3+0.25G	0	484	6	99	0
24-DB/Seth+MS	16/3+0.25G	89	101	9	98	71
DPX-A7881-22+X-77/Seth+MS	0.25+0.25%/3+0.25G	6	465	6	99	43
DPX-A7881-22+X-77/Seth+MS	0.5+0.25%/3+0.25G	3	696	6	96	85
DPX-A7881-22+MS/Seth+MS	0.25+0.25G/3+0.25G	3	665	6	99	93
DPX-A7881-22+MS/Seth+MS	0.5+0.25G/3+0.25G	3	591	6	99	97
DPX-A7881-22+Seth+MS	0.25+3+0.25G	3	591	6	99	91
DPX-A7881-22+Seth+MS	0.5+3+0.25G	0	793	7	99	96
BAS-514+BAS-090	4+0.25G	21	201	8	0	87
Untreated	0	0	306	6	0	0
C.V. %		82	21		2	14
LSD 5%		12	147		3	14
# OF REPS		4	4		4	4

Summary

Dicamba, 2,4-DB, and BAS-514 + BAS-090 caused important injury to canola. Wild oats (+ tame oats) was effectively controlled by sethoxydim, trifluralin, and ethalfluralin. DPX-A7881-22 at 0.25 and 0.5 g/A alone or in combination with sethoxydim gave 90% or more kochia control when applied with methylated seed oil adjuvant, but not when with X-77 surfactant. These data indicate that DPX-A7881-22 + sethoxydim applied with methylated sunflower oil has potential for broad-spectrum postemergence weed control in canola.

Imazethapyr with adjuvants for weed control in soybeans. Casselton 1989. 'McCall' soybean was seeded on May 15. Treatments were applied to second trifolialate soybean, 5- to 8-leaf foxtail (green and yellow), 2 to 15 inch tall wild mustard, and 2 to 5 inch tall common lambsquarters on June 23 with 80 F, 65% RH, no wind, and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 7.

Treatment	Rate	Soybean injury	Foxtail	Wild mustard	Common lambsquarters
	(oz/A)	(%)	-----------(% control)---------		
Imazethapyr+MSF	0.25+0.25G	0	73	86	70
Imazethapyr+MSF	0.5+0.25G	0	88	97	78
Imazethapyr+MS1	0.25+0.25G	0	78	90	70
Imazethapyr+MS1	0.5+0.25G	0	86	95	76
Imazethapyr+MS2	0.25+0.25G	0	75	86	70
Imazethapyr+MS2	0.5+0.25G	0	85	94	77
Imazethapyr+MS3	0.25+0.25G	0	76	86	66
Imazethapyr+MS3	0.5+0.25G	0	85	94	75
Imazethapyr+PO	0.25+0.25G	0	76	91	71
Imazethapyr+PO	0.5+0.25G	0	81	90	73
Imazethapyr+BCH	0.25+0.25G	0	80	91	73
Imazethapyr+BCH	0.5+0.25G	0	85	96	78
Imazethapyr+X-77	0.25+0.25%	0	68	85	53
Imazethapyr+X-77	0.5+0.25%	0	79	92	71
C.V. %		0	6	4	6
LSD 5%		NS	7	5	6
# OF REPS		4	4	4	4

Summary

Soybean was not injured by imazethapyr regardless of adjuvants. Wild mustard control with Imazethapyr was similar regardless of adjuvants. Oil adjuvants and BCH all similarly enhanced foxtail and common lambsquarter control from Imazethaypr compared to control when with X-77.

Imazethapyr with adjuvants for weed control in soybeans. Fargo 1989. 'McCall' soybeans was seeded on June 3. Treatments were applied to 1- to 2-trifoliolate soybean, 10- to 30-leaf kochia and 3- to 7-leaf redroot pigweed on June 30 with 75 F, 5 to 10 mph wind, and a clear sky. Treatments were applied to an 8 ft wide area the length of 10 by 25 ft plots with a bicycle wheel type plot sprayer delivering 8.5 gpa at 35 psi. The experiment was a randomized complete block with four replications. Evaluation was on July 28. Kochia denstiy was 5 plants per sq ft and redroot pigweed 2 per sq ft. However, when kochia was not controlled redroot pigweed evaluation was difficult as kochia dominated.

Treatment	Rate	Soybean injury	Kochia	Redroot pigweed
	(oz/A)	(%)	----(% control)----	
Imazethapyr+MSF	0.25+0.25G	0	83	36
Imazethapyr+MSF	0.5+0.25G	0	90	82
Imazethapyr+MS1	0.25+0.25G	0	85	36
Imazethapyr+MS1	0.5+0.25G	0	96	94
Imazethapyr+MS2	0.25+0.25G	0	88	58
Imazethapyr+MS2	0.5+0.25G	0	92	86
Imazethapyr+MS3	0.25+0.25G	0	83	59
Imazethapyr+MS3	0.5+0.25G	0	92	89
Imazethapyr+PO	0.25+0.25G	0	74	63
Imazethapyr+PO	0.5+0.25G	0	90	89
Imazethapyr+BCH	0.25+0.25G	1	89	55
Imazethapyr+BCH	0.5+0.25G	0	95	96
Imazethapyr+X-77	0.25+0.25%	0	60	47
Imazethapyr+X-77	0.5+0.25%	0	77	84
C.V. %		748	6	23
LSD 5%		NS	7	23
# OF REPS		4	4	4

Summary

Imazethapyr did not injure soybeans regardless of adjuvant. MSF, MS1, MS2, MS3, and BCH all similarly enhanced kochia control with imazethapyr at 0.25 oz/A compared to PO or X-77. MS2, MS3, PO, and BCH tended to or enhanced redroot pigweed control more than MSF, MS1, and X-77 with imazethapyr at 0.25 oz/A. At the 0.5 oz/A of imazethaypr, all adjuvants were similar, except X-77 was less effective than the others for kochia control.

<u>Bentazon with adjuvants for weed control in soybeans. Casselton 1989.</u> 'McCall' soybean was seeded on May 15. Treatments were applied to second to third trifoliolate soybean, 5 to 15 inch tall (blooming) wild mustard and 3 to 6 inch tall kochia on June 27 with 70 F, 0 to 5 mph northwest wind, and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 7.

Treatment	Rate	Soybean injury	Wild mustard	Kochia
	(oz/A)	(%)	------(% control)-----	
Bentazon+MSF	8+0.25G	0	92	60
Bentazon+MSF	12+0.25G	0	96	78
Bentazon+MS1	8+0.25G	0	90	55
Bentazon+MS1	12+0.25G	0	96	72
Bentazon+MS2	8+0.25G	0	96	70
Bentazon+MS2	12+0.25G	0	97	80
Bentazon+MS3	8+0.25G	0	95	78
Bentazon+MS3	12+0.25G	0	99	70
Bentazon+PO	8+0.25G	0	94	65
Bentazon+PO	12+0.25G	0	98	80
Bentazon+BCH	8+0.25G	0	93	83
Bentazon+BCH	12+0.25G	0	97	70
Bentazon+X-77	8+0.25%	0	97	60
Bentazon+X-77	12+0.25%	0	99	85
C.V. %		0	4	
LSD 5%		NS	NS	
# OF REPS		4	4	1

Summary

Soybean was not injured and wild mustard was completely controlled by bentazon regardless of adjuvant. Kochia only occurred in one replication so no conclusions can be drawn from the data.

Bentazon with adjuvant, Exp 2, Prosper 1989. 'McCall' soybean was seeded on May 19. Treatment was applied to second trifoliolate soybeans, 6 to 8 inch tall wild mustard, 2 to 4 inch tall redroot pigweed, 2 to 4 inch tall common lambsquarters, and 2 to 5 inch tall kochia on June 23 with 75 F, 75 % RH, 5 mph wind, and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 7.

Treatment	Rate	Soybean injury	Wild mustard	Redroot pigweed	Common lambsquarter	Kochia
	(oz/A)	(%)	------------(% control)------------			
Bentazon+MSF	8+0.25G	0	89	39	62	77
Bentazon+MSF	12+0.25G	0	93	63	73	85
Bentazon+MS1	8+0.25G	0	91	63	74	79
Bentazon+MS1	12+0.25G	0	90	60	77	80
Bentazon+MS2	8+0.25G	0	86	59	83	85
Bentazon+MS2	12+0.25G	0	79	49	76	80
Bentazon+MS3	8+0.25G	0	92	40	71	80
Bentazon+MS3	12+0.25G	0	90	65	81	80
Bentazon+PO	8+0.25G	0	88	39	61	79
Bentazon+PO	12+0.25G	0	94	55	86	86
Bentazon+BCH	8+0.25G	0	92	61	86	81
Bentazon+BCH	12+0.25G	0	94	58	73	86
Bentazon+X-77	8+0.25%	0	91	45	67	76
Bentazon+X-77	12+0.25%	0	90	60	80	82
C.V. %		0	10	31	26	15
LSD 5%		NS	NS	NS	NS	NS
# OF REPS		4	4	4	4	4

Summary

Adjuvants did not differ significantly in their enhancement of bentazon for weed control or injury to soybean.

Lactofen with adjuvants for weed control in soybeans. Casselton 1989. 'McCall' soybean was seeded on May 15. Treatments were applied to second trifoliolate soybean, 5- to 8-leaf foxtail, 2 to 15 inch tall wild mustard and 2 to 5 inch tall common lambsquarters on June 23 with 80 F, 65% RH, no wind, and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 7.

Treatment	Rate	Soybean injury	Wild mustard	Common lambsquarter
	(oz/A)	(%)	-------(% control)	------
Lactofen+MSF	1.5+0.25G	5	87	0
Lactofen+MSF	3+0.25G	5	88	0
Lactofen+MS1	1.5+0.25G	6	98	0
Lactofen+MS1	3+0.25G	6	99	0
Lactofen+MS2	1.5+0.25G	5	94	0
Lactofen+MS2	3+0.25G	5	99	0
Lactofen+MS3	1.5+0.25G	6	98	0
Lactofen+MS3	3+0.25G	5	99	0
Lactofen+PO	1.5+0.25G	5	99	0
Lactofen+PO	3+0.25G	6	99	0
Lactofen+BCH	1.5+0.25G	5	98	0
Lactofen+BCH	3+0.25G	5	99	0
Lactofen+X-77	1.5+0.25%	5	96	0
Lactofen+X-77	3+0.25%	5	95	0
C.V. %		13	5	0
LSD 5%		NS	6	NS
# OF REPS		4	4	4

Summary

Lactofen did not cause important injury to soybean regardless of adjuvants. Wild mustard control was complete at both rates of lactofen, except when applied with MSF. Thus, MSF was antagonistic to lactofen action. Common lambsquarter was not controlled by lactofen at 1.5 or 3 oz/A regardless of adjuvant.

Lactofen with adjuvants for weed control in soybeans, Prosper 1989. 'McCall' soybean was seeded on May 19. Treatments were applied to second to third trifoliolate soybean, 5 to 15 inch tall, (blooming) wild mustard and 3 to 6 inch tall kochia on June 27 with 70 F, 0 to 5 mph northwest wind and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 10.

Treatment	Rate	Soybean injury	Wild mustard	Common lambsquarters	Kochia
	(oz/A)	(%)	---------(% control)---------		
Lactofen+MSF	1.5+0.25G	8	33	0	27
Lactofen+MSF	3+0.25G	8	66	0	53
Lactofen+MS1	1.5+0.25G	11	73	6	62
Lactofen+MS1	3+0.25G	12	80	11	86
Lactofen+MS2	1.5+0.25G	9	68	3	61
Lactofen+MS2	3+0.25G	13	78	16	81
Lactofen+MS3	1.5+0.25G	9	74	8	60
Lactofen+MS3	3+0.25G	8	84	12	83
Lactofen+PO	1.5+0.25G	5	76	14	74
Lactofen+PO	3+0.25G	7	77	18	83
Lactofen+BCH	1.5+0.25G	14	77	4	72
Lactofen+BCH	3+0.25G	13	84	19	85
Lactofen+X-77	1.5+0.25%	7	69	11	61
Lactofen+X-77	3+0.25%	7	71	10	74
C.V. %		73	15	73	12
LSD 5%		NS	16	10	12
# OF REPS		4	4	4	4

Summary

Lactofen injury to soybean generally tended to differ with adjuvants, but none caused important injury. Common lambsquarters was not adequately controlled by lactofen regardless of adjuvant. MS1, MS2, MS3, PO, and BCH all similarly enhanced wild mustard and kochia compared to lactofen applied with X-77. MSF adjuvant antagonized weed control with lactofen compared to lactofen with X-77.

Fomesafen with adjuvants for weed control in soybeans, Prosper 1989. 'McCall' soybean was seeded on May 19. Treatments were applied to second to third trifoliolate soybean, 5 to 15 inch tall (blooming) wild mustard, and 3 to 6 inch tall kochia on June 27 with 70 F, 0 to 5 mph northwest wind and a 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 19.

Treatment	Rate	Soybean injury	KOCZ	Colq	Wimu	Rrpw
	(oz/A)	(%)	--------(% control)---------			
Fomesafen+MSF	1.5+0.25G	3	46	37	99	50
Fomesafen+MSF	3+0.25G	3	79	68	99	66
Fomesafen+MS1	1.5+0.25G	2	54	50	99	47
Fomesafen+MS1	3+0.25G	2	74	59	99	68
Fomesafen+MS2	1.5+0.25G	2	66	45	99	48
Fomesafen+MS2	3+0.25G	2	79	52	99	64
Fomesafen+MS3	1.5+0.25G	3	55	42	99	49
Fomesafen+MS3	3+0.25G	4	64	53	99	56
Fomesafen+PO	1.5+0.25G	3	66	55	99	45
Fomesafen+PO	3+0.25G	2	68	48	99	74
Fomesafen+BCH	1.5+0.25G	1	47	48	99	39
Fomesafen+BCH	3+0.25G	1	73	58	99	57
Fomesafen+X-77	1.5+0.25%	0	16	5	99	37
Fomesafen+X-77	3+0.25%	0	17	3	99	39
C.V. %		106	22	40	0	23
LSD 5%		NS	18	25	NS	18
# OF REPS		4	4	4	4	4

Summary

Fomesafen did not cause important injury to soybean, regardless of adjuvant. The methylated seed oil adjuvants were not distinctively more effective than petroleum oil in enhancing fomesafen in this experiment. Previously, (1987 & 1988) methylated seed oil was more effective than petroleum oil. Growing condition at treatment were better in 1989 than other years indicating that the methylated seed oil may be most effective under drought stress.

DPX-79376 with adjuvants, Exp 2, Fargo 1989. 'Valley' oats, 'McCall' soybean and 'Siberian' foxtail millet was seeded on June 5. Treatments were applied to 10 inch tall oats, third trifoliolate soybeans and 12 to 14 inch tall foxtail millet on July 10 with 70 F, 75% RH, 0 to 5 mph north wind,and 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 across the species the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 26.

Treatment	Rate	Oats	Soybeans	Foxtail millet
	(oz/A)	--------(% control)--------		
DPX-79376+MSF	0.25+0.25G	84	0	75
DPX-79376+MSF	0.5+0.25G	93	0	83
DPX-79376+MS1	0.25+0.25G	81	0	75
DPX-79376+MS1	0.5+0.25G	93	0	88
DPX-79376+MS2	0.25+0.25G	81	0	76
DPX-79376+MS2	0.5+0.25G	94	0	85
DPX-79376+MS3	0.25+0.25G	85	0	76
DPX-79376+MS3	0.5+0.25G	94	0	88
DPX-79376+PO	0.25+0.25G	82	0	81
DPX-79376+PO	0.5+0.25G	94	0	87
DPX-79376+BCH	0.25+0.25G	82	0	71
DPX-79376+BCH	0.5+0.25G	93	0	84
DPX-79376+X-77	0.25+0.25%	79	0	69
DPX-79376+X-77	0.5+0.25%	91	0	79
C.V. %		4	0	9
LSD 5%		5	NS	10
# OF REPS		4	4	4

Summary

Oats and foxtail millet control with DPX-79376 was similar regardless of adjuvant, except control tended to be less when DPX-79376 was with X-77. Soybeans were not injured by DPX-79376 with and adjuvant.

Fenoxaprop with adjuvant, Exp 2, Fargo 1989. 'Valley' oats, 'McCall' soybean, and 'Siberian' foxtail millet were seeded on June 5. Treatments were applied to 10 inch tall oats, third trifoliolate soybeans and 12 to 14 inch tall foxtail millet on July 11 with 70 F, 65% RH, 0 to 5 mph north wind, and 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 across the species the length of 10 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 27.

Treatment	Rate	Oats	Soybeans	Foxtail millet
	(oz/A)	-----------(% control)	----------	
Fenoxaprop+MSF	1.5+0.25G	63	0	81
Fenoxaprop+MSF	2+0.25G	78	0	90
Fenoxaprop+MS1	1.5+0.25G	78	0	86
Fenoxaprop+MS1	2+0.25G	80	0	89
Fenoxaprop+MS2	1.5+0.25G	77	0	87
Fenoxaprop+MS2	2+0.25G	81	0	88
Fenoxaprop+MS3	1.5+0.25G	80	0	88
Fenoxaprop+MS3	2+0.25G	82	0	89
Fenoxaprop+PO	1.5+0.25G	79	0	90
Fenoxaprop+PO	2+0.25G	79	0	87
Fenoxaprop+BCH	1.5+0.25G	75	0	88
Fenoxaprop+BCH	2+0.25G	80	0	88
Fenoxaprop+X-77	1.5+0.25%	65	0	80
Fenoxaprop+X-77	2+0.25%	71	0	87
C.V. %		14	0	8
LSD 5%		NS	NS	NS
# OF REPS		4	4	4

Summary

Oats and foxtail millet control or soybean injury from fenoxaprop were not significantly influenced by adjuvants. However, oats and foxtail millet control tended to be lower with MSF or X-77 than the other adjuvants.

Diclofop with adjuvant, Fargo 1989. 'Valley' oat and 'McCall' soybean were seeded on May 28 and 'Siberian' foxtail millet was seeded on June 1. Treatments were applied to 4.5-leaf oats, first trifoliolate soybeans and 6-leaf foxtail millet on June 27 with 75 F, 40% RH, 5 to 10 mph northeast wind, and 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 across the species in plots 10 by 25 ft. The experiment was a randomized complete block with four replications. Evaluation was on July 24.

Treatment	Rate	Oats	Soybean	Foxtail millet
	(oz/A)	--------(% control)		---------
Diclofop+MSF	8+0.25G	81	0	95
Diclofop+MSF	12+0.25G	85	0	97
Diclofop+MS1	8+0.25G	83	0	95
Diclofop+MS1	12+0.25G	87	0	98
Diclofop+MS2	8+0.25G	83	0	96
Diclofop+MS2	12+0.25G	85	0	97
Diclofop+MS3	8+0.25G	85	0	96
Diclofop+MS3	12+0.25G	85	0	97
Diclofop+PO	8+0.25G	82	0	97
Diclofop+PO	12+0.25G	84	0	98
Diclofop+BCH	8+0.25G	83	0	97
Diclofop+BCH	12+0.25G	86	0	98
Diclofop+X-77	8+0.25%	83	0	83
Diclofop+X-77	12+0.25%	89	0	94
C.V. %		4	0	3
LSD 5%		NS	NS	4
# OF REPS		4	4	4

Summary

Oats and foxtail millet control were similar regardless of adjuvants. Soybeans were not injured by diclofop regardless of the adjuvant.

Diclofop with adjuvant, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 26. Treatments were applied to 4.5-leaf wheat and 2- to 4.5-leaf wild oats on June 2 with 65 F, 60% RH, 10 mph northeast wind, and cloudy sky. Treatments were applied with a bicycle wheel type plot sprayer delivering 8.5 gpa to 35 psi to an 8 ft area the length of 10 by 30 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 17. Harvest for wheat yield was on July 17.

Treatment	Rate	Wheat injury	Wild oats control	Yield
	(oz/A)	(%)	(%)	(bu/A)
Diclofop+MSF	8+0.25G	2	80	24.0
Diclofop+MSF	12+0.25G	2	87	26.6
Diclofop+MS1	8+0.25G	3	88	27.0
Diclofop+MS1	12+0.25G	1	89	31.4
Diclofop+MS2	8+0.25G	1	87	28.2
Diclofop+MS2	12+0.25G	1	87	25.6
Diclofop+MS3	8+0.25G	2	85	27.3
Diclofop+MS3	12+0.25G	3	89	28.3
Diclofop+PO	8+0.25G	0	88	30.2
Diclofop+PO	12+0.25G	1	91	30.4
Diclofop+BCH	8+0.25G	0	85	27.7
Diclofop+BCH	12+0.25G	2	86	26.8
Diclofop+X-77	8+0.25%	0	84	30.3
Diclofop+X-77	12+0.25%	4	84	24.8
C.V. %		117	5	13.8
LSD 5%		NS	NS	NS
# OF REPS		4	4	4

Summary

Injury to wheat, wild oats control, and wheat yield were not influenced by adjuvants with diclofop.

AC 222,293 with adjuvant volume, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on April 26. Treatments (S1) were applied to 3-leaf wheat and wild oats, and 3 inch tall common lambsquarters on May 23 with 70 F, 60% RH, 10 mph east wind, and partly cloudy sky. Treatments (S2) were applied to 4.5-leaf wheat, 2- to 4.5-leaf wild oats, and 1 to 4 inch tall common lambsquarters on June 2 with 65 F, 60% RH, 10 mph northwest wind, and cloudy 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 replications. Evaluation was on July 10 and harvest for wheat yield was on July 25.

Treatment	Rate	Wheat injury	Wild oats	Colq	Wheat yield
	(oz/A)	(%)	-(% control)-		(bu/A)
AC 222,293+MSF	4+0.25G	1	96	19	25.4
AC 222,293+MSF	6+0.25G	2	99	38	25.2
AC 222,293+MS1	4+0.25G	1	98	39	28.3
AC 222,293+MS1	6+0.25G	0	99	49	30.7
AC 222,293+MS2	4+0.25G	0	95	8	26.6
AC 222,293+MS2	6+0.25G	2	99	55	26.8
AC 222,293+MS3	4+0.25G	1	92	14	24.3
AC 222,293+MS3	6+0.25G	3	99	41	27.9
AC 222,293+PO	4+0.25G	1	96	25	28.5
AC 222,293+PO	6+0.25G	1	97	29	26.0
AC 222,293+BCH	4+0.25G	0	96	9	25.9
AC 222,293+BCH	6+0.25G	0	98	26	28.8
AC 222,293+X-77	4+0.25%	1	93	5	25.8
AC 222,293+X-77	6+0.25%	0	97	30	25.9
C.V. %		222	3	85	16.9
LSD 5%		NS	4	NS	NS
# OF REPS		4	4	4	4

Summary

Wild oats control with AC 222,293 at 4 oz/A enhanced more by MS1 than X-77 or MS3 adjuvants. Common lambsquarter control or wheat yield was not influenced by adjuvants with AC 222,293.

DPX-79376 with adjuvant mixtures, Fargo 1989. 'Valley' oats and 'McCall' soybean were seeded on May 28 and 'Siberian' foxtail was seeded on June 1. Treatments were applied June 29 with 80 F, 60% RH, 15 mph wind and a 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 across the species the length of 10 by 26 ft plots. The experiment was a randmonized complete block with four replications. Evaluation was on July 24.

Treatment	Rate	Oats	Soybean	Foxtail millet
	(oz/A)	-------(% control)-------		
DPX-79376+BCH	0.3+0.25G	98	0	98
DPX-79376+PO	0.3+0.25G	98	0	97
DPX-79376+MSC-89	0.3+0.25G	98	0	98
DPX-79376+MSUND	0.3+0.25G	99	0	98
DPX-79376+MSF	0.3+0.25G	97	0	98
DPX-79376+MS1	0.3+0.25G	98	0	97
DPX-79376+MS2	0.3+0.25G	97	0	96
DPX-79376+MS3	0.3+0.25G	98	0	96
DPX-79376+FFA	0.3+0.25G	97	0	97
DPX-79376+Orchex	0.3+0.25G	99	0	98
DPX-79376+Octanol	0.3+0.25G	93	0	97
DPX-79376+AE-3	0.3+0.25G	98	0	98
DPX-79376+AR-208	0.3+0.25G	97	0	98
DPX-79376+MSC&Octanol	0.3+0.25G	99	0	98
DPX-79376+MSC&AE-3	0.3+0.25G	98	0	98
DPX-79376+FFA&Octanol	0.3+0.25G	98	0	98
DPX-79376+FFA&AE-3	0.3+0.25G	98	0	98
DPX-79376+FFA&Octanol&AE-3	0.3+0.25G	98	0	96
DPX-79376+Orchex&AE-3	0.3+0.25G	99	0	98
C.V. %		1	0	1
LSD 5%		1	NS	NS
# OF REPS		4	4	4

Summary

Soybeans were not injured by DPX-79376 regardless of adjuvants. Oats and foxtail millet control were complete so differences among adjuvants in their enhancement of DPX-79376 could not be detected.

Fenoxaprop formulations with oils, Fargo 1989. 'Valley' oats and 'McCall' soybean were seeded on May 28 and 'Siberian' foxtail millet was seeded on June 1. Treatments were applied to 5-leaf oats, first trifoliolate soybeans and 4 inch tall foxtail millet on June 29 with 80 F, 60% RH, 15 mph wind, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer to an 8 ft wide area across the species the length of 10 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 24.

Treatment	Rate	Oats	Soybeans	Foxtail millet
	(oz/A)	-----------	(% control)	-----------
HOE-360+PO	0.8+0.25G	97	0	98
HOE-360+PO	1.2+0.25G	99	0	99
HOE-360+MS	0.8+0.25G	97	0	99
HOE-360+MS	1.2+0.25G	98	0	99
HOE-360+MS1	0.8+0.25G	98	0	99
HOE-360+MS1	1.2+0.25G	99	0	99
Fenoxaprop+PO	1.6+0.25G	98	0	99
Fenoxaprop+PO	2.4+0.25G	98	0	99
Fenoxaprop+MS	1.6+0.25G	97	0	99
Fenoxaprop+MS	2.4+0.25G	98	0	99
Fenoxaprop+MS1	1.6+0.25G	98	0	99
Fenoxaprop+MS1	2.4+0.25G	98	0	99
Sethoxydim+BCH	3+0.25G	99	0	99
Untreated	0	0	0	0
C.V. %		1	0	0
LSD 5%		1	NS	1
# OF REPS		4	4	4

Summary

The high degree of oats and foxtail control prevented differentiation in effectivness between formulation and adjuvants. However, soybeans were not injured by either fenoxaprop formulation with any of the adjuvants. Thus, HOE-360 at 0.8 oz/A was equally as effective as fenoxaprop at 1.6 oz/A.

Bentazon with salts, Fargo 1989. 'Wheaton' Hard Red Spring wheat was seeded on May 16. Treatments were applied to 6- to 6.5-leaf wheat, 1 to 2 inch tall kochia, 7- to 10-leaf (2 to 8 inch) wild mustard, and 4- to 6-leaf (0.5 to 1 inch) redroot pigweed on June 16 with 75 F, 40% RH, and a 10 mph southeast wind. 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on June 29.

Treatment	Rate	Wheat injury	Kochia	Wild mustard	Redroot pigweed
	(oz/A)	(%)	-------(% control)-------		
Bentazon	10	1	19	92	40
Bentazon+X-77	10+0.25%	4	63	95	50
Bentazon+MS	10+0.25G	5	60	99	40
Bentazon+PO	10+0.25G	0	85	99	60
Bentazon+AMS	10+32	0	31	95	30
Bentazon+AMN	10+32	3	19	98	40
Bentazon+28N	10+.44G	0	48	99	50
Bentazon+KNO3	10+32	4	40	99	0
Bentazon+NaHCO3	10+32	0	26	94	50
Bentazon+AMS+PO	10+32+0.25G	9	76	99	45
Bentazon+AMN+PO	10+32+0.25G	3	82	99	40
Bentazon+28N+PO	10+.44G+0.25G	4	77	99	50
Bentazon+KNO3+PO	10+32+0.25G	5	88	99	40
Bentazon+NaHCO3+PO	10+32+0.25G	9	84	99	50
Bentazon+AMS+MS	10+32+0.25G	3	84	99	40
Bentazon+AMN+MS	10+32+0.25G	48	63	99	20
Bentazon+28N+MS	10+.44G+0.25G	1	72	99	30
Bentazon+KNO3+MS	10+32+0.25G	0	54	99	30
Bentazon+NaHCO3+MS	10+32+0.25G	4	69	99	55
Untreated	0	4	0	0	0
C.V. %		104	27	5	
LSD 5%		8	22	6	
# OF REPS		4	4	4	1

Summary

Bentazon + ammonium nitrate (AMN) + methylated seed oil (MS) severely injured wheat. However, AMN or MS with bentazon alone did not injure wheat, thus, this specific mixture was toxic or the spray was inadvertently contaminated. Kochia control with bentazon only exceeded 80% when bentazon was applied with petroleum oil (PO), AMS + PO, potassium nitrate +PO, ammonium bicarbonate + PO, and ammonium sulfate (AMS) + MS. Wild mustard was controlled by all treatments. In general oils and surfactants were more effective than salts in enhancement of bentazon for kochia control.

Bentazon with salts. Exp 2. Fargo 1989. 'McCall' soybean was seeded on June 5. Treatments were applied to third trifoliolate soybean and 4 to 6 inch tall redroot pigweed on July 10 with 70 F, 75% RH, 0 to 5 mph wind, and overcast sky. Plants were drought stressed at treatment. 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 28.

Treatment	Rate (oz/A)	Redroot pigweed control (%)
Bentazon	10	75
Bentazon+X-77	10+0.25%	88
Bentazon+MS	10+0.25G	86
Bentazon+PO	10+0.25G	89
Bentazon+AMS	10+32	82
Bentazon+AMN	10+32	77
Bentazon+28N	10+.44G	79
Bentazon+KNO3	10+32	85
Bentazon+NaHCO3	10+32	86
Bentazon+AMS+PO	10+32+0.25G	86
Bentazon+AMN+PO	10+32+0.25G	85
Bentazon+28N+PO	10+.44G+0.25G	86
Bentazon+KNO3+PO	10+32+0.25G	89
Bentazon+NaHCO3+PO	10+32+0.25G	89
Bentazon+AMS+MS	10+32+0.25G	82
Bentazon+AMN+MS	10+32+0.25G	77
Bentazon+28N+MS	10+.44G+0.25G	78
Bentazon+KNO3+MS	10+32+0.25G	82
Bentazon+NaHCO3+MS	10+32+0.25G	87
Untreated	0	0
C.V. %		9
LSD 5%		11
# OF REPS		4

Summary

Redroot pigweed control with bentazon was enhanced by X-77, methylated seed oil (MS), and petroleum oil (PO) adjuvants. Potassium nitrate and sodium bicarbonate were the only salts to enhance bentazon toxicity to redroot pigweed. Salts in addition to oil adjuvants with bentazon did not further enhance the redroot pigweed control compared to the oil adjuvants alone and tended reduced control when with methylated seed oil adjuvant. Among the salts, ammonium nitrate (AMN) and 28% nitrogen fertilizer (28N) tended to be the least effective for bentazon enhancement of redroot pigweed control regardless if alone, with petroleum oil or methylated seed oil. Soybeans were not injured by any treatment.

Bentazon with salts, Prosper 1989. 'McCall' soybean was seeded in moist soil on May 19. Treatments were applied to second trifoliolate soybeans, 2 to 5 inch tall kochia and 2 to 4 inch tall common lambsquarters on June 23 with 75 F, 75% RH, 5 mph southwest wind, and 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on June 30. Kochia exceeded 10 plants and common lambsquarters 5 plants per sq yd.

Treatment	Rate	Soybean	Kochia	Common lambsquarters
	(oz/A)	----------(% control)-----------		
Bentazon	10	0	10	14
Bentazon+X-77	10+0.25%	0	60	71
Bentazon+MS	10+0.25G	0	80	72
Bentazon+PO	10+0.25G	0	79	84
Bentazon+AMS	10+32	0	21	20
Bentazon+AMN	10+32	0	15	19
Bentazon+28N	10+.44G	0	17	19
Bentazon+KNO3	10+32	0	16	19
Bentazon+NaHCO3	10+32	0	23	33
Bentazon+AMS+PO	10+32+0.25G	0	83	82
Bentazon+AMN+PO	10+32+0.25G	1	87	82
Bentazon+28N+PO	10+.44G+0.25G	0	78	74
Bentazon+KNO3+PO	10+32+0.25G	0	66	73
Bentazon+NaHCO3+PO	10+32+0.25G	0	72	83
Bentazon+AMS+MS	10+32+0.25G	0	85	78
Bentazon+AMN+MS	10+32+0.25G	1	82	68
Bentazon+28N+MS	10+.44G+0.25G	0	56	60
Bentazon+KNO3+MS	10+32+0.25G	0	71	70
Bentazon+NaHCO3+MS	10+32+0.25G	0	68	60
Untreated	0	0	0	0
C.V. %		637	25	21
LSD 5%		NS	19	16
# OF REPS		4	4	4

Summary

Methylated seed oil (MS) and petroleum oil (PO) more than X-77 enhanced kochia control with bentazon, but X-77 surfactant and oils similarly enhanced common lambsquarter control. Methylated seed (MS) and petroleum oil (PO) adjuvants were similar in the enhancement of bentazon phytotoxicity, with or without salts. 28% nitrogen fertilizer, potassium nitrate, and sodium bicarbonate with petroleum oil or methylated seed oil tend to reduce bentazon toxicity to kochia and common lambsquarters. The salts without oils did not increase bentazon phytotoxicity.

Glyphosate with waters, Fargo 1989. 'Valley' oats and 'McCall' soybean, and 'Siberian' foxtail millet were seeded on June 5. Treatments were applied to 6.5-leaf oats, second to third trifoliolate soybeans and 6- to 7-leaf foxtail millet on June 30 with 85 F, 50% RH, 0 to 5 mph northeast wind, and a partly 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 across the species the length of 20 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 25.

Treatment	Rate (oz/A)	Soybean (% control)
Glyphosate(DW)	3	96
Glyphosate(DW)+X-77	3+0.25%	95
Glyphosate(DW)+LI-700	3+0.25%	94
Glyphosate(DW)+SCI-40	3+1%	97
Glyphosate(DW)+SAFE-6(pH6)	3	96
Glyphosate(DW)28N	3+1G	96
Glyphosate(DW)+AMS	3+24	95
Glyphosate(DW)+NHS	3+6	96
Glyphosate(DW)+Exp1	3+0.125G	97
Glyphosate(DW)+Exp2	3+0.25G	96
Glyphosate(DW)+Exp3	3+0.25G	95
Glyphosate(DW)+Exp4	3+0.25G	97
Glyphosate(NaHCO3)	3	95
Glyphosate(NaHCO3)+X-77	3+0.25%	94
Glyphosate(NaHCO3)+LI-700	3+0.25%	95
Glyphosate(NaHCO3)+SCI-40	3+1%	95
Glyphosate(NaHCO3)+SAFE-6(pH6)	3	96
Glyphosate(NaHCO3)+28N	3+1G	95
Glyphosate(NaHCO3)+AMS	3+24	94
Glyphosate(NaHCO3)+NHS	3+6	96
Glyphosate(NaHCO3)+Exp1	3+0.125G	97
Glyphosate(NaHCO3)+Exp2	3+0.25G	97
Glyphosate(NaHCO3)+Exp3	3+0.25G	97
Glyphosate(NaHCO3)+Exp4	3+0.25G	97
Glyphosate(SHW)	3	93
Glyphosate(SHW)+X-77	3+0.25%	95
Glyphosate(SHW)+LI-700	3+0.25%	95
Glyphosate(SHW)+SCI-40	3+1%	98
Glyphosate(SHW)+SAFE-6(pH6)	3	93
Glyphosate(SHW)+28N	3+1G	96
Glyphosate(SHW)+AMS	3+24	96
Glyphosate(SHW)+NHS	3+6	97
Glyphosate(SHW)+Exp1	3+0.125G	97
Glyphosate(SHW)+Exp2	3+0.25G	97
Glyphosate(SHW)+Exp3	3+0.25G	96
Glyphosate(SHW)+Exp4	3+0.25G	98
C.V. %		2
LSD 5%		2
# OF REPS		4

[a] DW=distilled water; NaHCO3=2000 ppm; and SHW=800 ppm $CaCl_2 \cdot H_2O$+200ppm $MgCl_2$.

Summary

Oats and foxtail millet were completely controlled by all treatments so the data was not presented. Soybean control tended to be the greatest when glyphosate was applied with the experimental adjuvants in the presence of sodium bicarbonate and "standard hard water".

Adjuvant volume with Imazethapyr, Fargo 1989. 'McCall' soybeans was seeded on June 5. Treatments were applied to second trifoliolate soybeans, 6 to 8 inch tall kochia and 3 to 5 inch tall redroot pigweed on July 7 with 78 F, 25% RH, 2 to 8 mph south wind, and 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 28. Drought prevented accurate soybean injury or redroot pigweed rating.

Treatment	Rate	Soybean injury	Kochia	Redroot pigweed
	(oz/A)	(%)	---(% control)---	
Imazethapyr+X-77	0.25+0.25%	0	54	49
Imazethapyr+X-77	0.5+0.25%	0	71	53
Imazethapyr+28N	0.25+0.25G	0	26	23
Imazethapyr+28N	0.5+0.25G	1	35	48
Imazethapyr+PO	0.25+0.25G	13	86	80
Imazethapyr+PO	0.5+0.25G	1	93	92
Imazethapyr+MS	0.25+.12G	0	69	58
Imazethapyr+MS	0.25+.18G	0	84	79
Imazethapyr+MS	0.25+0.25G	0	86	90
Imazethapyr+MS1	0.25+.12G	0	83	85
Imazethapyr+MS1	0.25+.18G	0	88	82
Imazethapyr+MS1	0.25+0.25G	2	85	84
Imazethapyr+28N+MS	0.25+0.25G+.12G	1	89	86
Imazethapyr+28N+MS	0.25+0.25G+.18G	0	87	85
Imazethapyr+28N+MS	0.25+0.25G+0.25G	1	89	92
Imazethapyr+28N+MS1	0.25+0.25G+.12G	1	87	86
Imazethapyr+28N+MS1	0.25+0.25G+.18G	0	85	89
Imazethapyr+28N+MS1	0.25+0.25G+0.25G	0	87	87
Imazethapyr+MS	0.5+.12G	1	98	97
Imazethapyr+MS	0.5+.18G	1	89	88
Imazethapyr+MS	0.5+0.25G	1	97	93
Imazethapyr+MS1	0.5+.12G	0	87	86
Imazethapyr+MS1	0.5+.18G	1	98	94
Imazethapyr+MS1	0.5+0.25G	0	92	94
Imazethapyr+28N+MS	0.5+0.25G+.12G	1	93	92
Imazethapyr+28N+MS	0.5+0.25G+.18G	0	92	91
Imazethapyr+28N+MS	0.5+0.25G+0.25G	1	95	95
Imazethapyr+28N+MS1	0.5+0.25G+.12G	1	92	90
Imazethapyr+28N+MS1	0.5+0.25G+.18G	1	92	94
Imazethapyr+28N+MS1	0.5+0.25G+0.25G	1	93	95
Imazethapyr+28N+PO	0.25+0.25G+0.25G	2	86	90
Imazethapyr+28N+PO	0.5+0.25G+0.25G	0	92	94
Imazethapyr+NaHCO3	0.25+18	0	24	48
Imazethapyr+NaHCO3+MS	0.25+18+0.25G	1	83	83
Untreated	0	1	0	0
C.V. %		500	6	13
LSD 5%		NS	7	15
# OF REPS		4	4	4

Summary

Imazethapyr did not cause important injury to soybean regardless of adjuvants. Imazethapyr with salts, 28% N and sodium bicarbonate, tended to give less kochia and redroot pigweed control than with X-77 which was less than with petroleum oil (PO) or methylated seed oil (MS, MS1). Weed control with imazethapyr at 0.25 oz/A increased with volume of MS, but not with volume of MS1 or MS + 28N and MS1 + 28N. Thus, 28N only enhanced weed control with imazethapyr when with MS at the 1 pt (0.12G) volume.

Adjuvant volume with Imazethapyr, Casselton 1989. 'McCall' soybeans was seeded on June 3. Treatments were applied to first to second trifoliolate soybeans, 10 inch to blooming wild mustard, 10- to 30-leaf kochia, 6.5- to 7.5-leaf foxtail, and 3 to 5 inch tall common lambsquarters on June 30 with 75 F, 5 to 10 mph wind, and 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 25 ft plots. The experiment was a randomized complete block with three replications. Evaluation was on July 17. Weed densities were 50 wild mustard plants, 5 kochia plants, 100 foxtail plants and 7 common lambsquarter plants per sq yd.

Treatment	Rate	Soybean injury	Wild mustard	Kochia	Foxtail	Colq
	(oz/A)	(%)	--------(% control)--------			
Imazethapyr+X-77	0.5+0.25%	0	85	51	45	8
Imazethapyr+X-77	0.5+0.25%	0	91	84	74	15
Imazethapyr+28N	0.5+0.25G	0	90	27	51	0
Imazethapyr+28N	0.5+0.25G	0	94	27	43	0
Imazethapyr+PO	0.5+0.25G	0	90	79	74	12
Imazethapyr+PO	0.5+0.25G	0	91	82	78	9
Imazethapyr+MS	0.5+0.12G	0	89	71	68	15
Imazethapyr+MS	0.5+0.18G	0	92	77	48	20
Imazethapyr+MS	0.5+0.25G	0	91	81	68	10
Imazethapyr+MS1	0.5+0.12G	0	92	82	63	18
Imazethapyr+MS1	0.5+0.18G	0	89	75	78	0
Imazethapyr+MS1	0.5+0.25G	0	88	79	72	10
Imazethapyr+28N+MS	0.5+0.25G+0.12G	0	92	83	80	18
Imazethapyr+28N+MS	0.5+0.25G+0.18G	0	94	83	81	13
Imazethapyr+28N+MS	0.5+0.25G+0.25G	0	93	86	85	14
Imazethapyr+28N+MS1	0.5+0.25G+0.12G	0	90	79	80	13
Imazethapyr+28N+MS1	0.5+0.25G+0.18G	0	80	85	79	25
Imazethapyr+28N+MS1	0.5+0.25G+0.25G	0	81	81	77	18
Imazethapyr+MS	0.5+0.12G	0	79	91	80	19
Imazethapyr+MS	0.5+0.18G	0	83	84	60	15
Imazethapyr+MS	0.5+0.25G	0	87	81	79	15
Imazethapyr+MS1	0.5+0.12G	0	85	90	81	10
Imazethapyr+MS1	0.5+0.18G	0	87	78	67	25
Imazethapyr+MS1	0.5+0.25G	0	83	84	84	28
Imazethapyr+28N+MS	0.5+0.25G+0.12G	0	86	87	82	18
Imazethapyr+28N+MS	0.5+0.25G+0.18G	0	87	87	76	23
Imazethapyr+28N+MS	0.5+0.25G+0.25G	0	90	91	89	15
Imazethapyr+28N+MS1	0.5+0.25G+0.12G	0	81	86	90	18
Imazethapyr+28N+MS1	0.5+0.25G+0.18G	0	82	79	89	16
Imazethapyr+28N+MS1	0.5+0.25G+0.25G	0	94	89	80	23
Imazethapyr+28N+PO	0.5+0.25G+0.25G	0	89	84	77	14
Imazethapyr+28N+PO	0.5+0.25G+0.25G	0	92	81	82	14
Imazethapyr+NaHCO3	0.5+18	0	85	7	43	5
Imazethapyr+NaHCO3+MS	0.5+18+0.25G	0	95	72	40	13
Untreated	0	0	0	0	0	0
C.V. %		0	10	13	19	42
LSD 5%		NS	14	15	27	12
# OF REPS		3	3	3	2	2

Summary

Imazethapyr generally gave good wild mustard control regardless of adjuvants. Petroleum oil and methylated seed (MS) oil enhanced kochia and foxtail control more than X-77 with imazethapyr. 28% N tended to enhance weed control when with MS and MS1 at the low volumes.

Adjuvants with acifluorfen, Exp 1 Prosper 1989. 'McCall' soybeans was seeded on May 19. Treatments were applied to second to third trifoliolate soybeans, 3 to 7 inch tall kochia and 4 to 5 inch tall common lambsquarters on June 27 with 70 F, 70% RH, 0 to 5 mph northwest wind, and clear sky. Treatments were applied with a bicycle wheel type plot sprayer to an 8 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 19 and the soybeans were not evaluated because of herbicide residue.

Treatment	Rate	Kochia	Common lambsquarters
	(oz/A)	------(% control)-------	
Acifluorfen+X-77	2+0.25%	47	48
Acifluorfen+X-77	4+0.25%	66	56
Acifluorfen+PO	2+0.125G	53	46
Acifluorfen+PO	4+0.125G	83	77
Acifluorfen+MS	2+0.125G	71	75
Acifluorfen+MS	4+0.125G	73	80
Acifluorfen+MS1	2+0.125G	66	55
Acifluorfen+MS1	4+0.125G	74	75
Acifluorfen+PO	2+0.25G	66	63
Acifluorfen+PO	4+0.25G	76	78
Acifluorfen+MS	2+0.25G	61	71
Acifluorfen+MS	4+0.25G	79	86
Acifluorfen+MS1	2+0.25G	75	74
Acifluorfen+MS1	4+0.25G	88	84
Acifluorfen+28N	2+0.5G	54	40
Acifluorfen+28N+MS	2+0.5G+0.125G	79	81
Acifluorfen+28N+MS1	2+0.5G+0.125G	84	85
Acifluorfen+NaHCO3	2+18	6	0
Acifluorfen+NaHCO3+MS	2+18+0.125G	65	68
Acifluorfen+NaHCO3+MS1	2+18+0.125G	62	65
Untreated	0	0	0
C.V. %		18	18
LSD 5%		16	16
# OF REPS		4	4

Summary

Acifluorfen control of kochia and common lambsquarters tended to increase as methylated seed oil (MS1) was increased from 1 pt (0.12G) to 2 pt (0.25G)/A but not methylated seed oil (MS), at the 2 oz/A rate. Acifluorfen at 2 oz/A with MS at 1 pt/A gave equal weed control to 4 oz/A with petroleum oil (PO) at 1 pt/A. Weed control with acifluorfen tended to be enhanced more by MS1 than the other adjuvants at 2 pt/A. 28N adjuvant did not enhance acifluorfen for kochia or common lambsquarter control, but in the presence of MS or MS1 tended to enhance acifluorfen. Sodium bicarbonate tended to reduce acifluorfen phytotoxicity.

Adjuvants with acifluorfen, Exp 2 Prosper. 'McCall' soybean was seeded on May 19. Treatments were applied to second to third trifoliolate soybeans, 5 to 15 inch blooming wild mustard, 3 to 7 inch tall kochia and 4 to 5 inch tall common lambsquarters on June 27 with 70 F, 70% RH, 0 to 5 mph northwest wind , and 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 25 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 18.

Treatment	Rate	Soybean injury	Wild mustard	Kochia	Common lambsquarters
	(oz/A)	(%)	--------(% control)--------		
Acifluorfen+X-77	2+0.25%	16	99	59	31
Acifluorfen+X-77	4+0.25%	11	98	66	39
Acifluorfen+PO	2+0.125G	24	99	76	51
Acifluorfen+PO	4+0.125G	24	99	82	64
Acifluorfen+MS	2+0.125G	13	98	71	67
Acifluorfen+MS	4+0.125G	18	99	91	79
Acifluorfen+MS1	2+0.125G	12	99	78	61
Acifluorfen+MS1	4+0.125G	19	99	87	70
Acifluorfen+PO	2+0.25G	16	97	81	63
Acifluorfen+PO	4+0.25G	18	99	85	78
Acifluorfen+MS	2+0.25G	25	99	82	69
Acifluorfen+MS	4+0.25G	22	99	89	84
Acifluorfen+MS1	2+0.25G	26	99	77	62
Acifluorfen+MS1	4+0.25G	17	99	85	75
Acifluorfen+28N	2+0.5G	15	98	73	53
Acifluorfen+28N+MS	2+0.5G+0.125G	23	99	85	74
Acifluorfen+28N+MS1	2+0.5G+0.125G	17	97	89	81
Acifluorfen+NaHCO3	2+18	5	99	6	0
Acifluorfen+NaHCO3+MS	2+18+0.125G	13	99	76	60
Acifluorfen+NaHCO3+MS1	2+18+0.125G	16	98	86	59
Untreated	0	0	0	0	0
C.V. %		77	2	11	21
LSD 5%		NS	2	11	17
# OF REPS		4	4	4	4

Summary

Acifluorfen injury to soybean did not differ significantly with the various adjuvants. Wild mustard control was complete with acifluorfen at 2 or 4 oz/A, regardless of adjuvant. Acifluorfen for kochia and common lambsquarter control was enhanced more by oils than by X-77. Methylated seed oils did not enhance acifluorfen as much compared to petroleum oil in 1989 as in 1987 and 1988. Condition at treatment was more humid and plants less drought stressed in 1989 which may have reduced the difference between the two oils. However, oils were more effective than X-77 as in the other years.

Bentazon antagonism of sethoxydim, Fargo 1989. 'Valley' oats, 'McCall' soybean, and 'Siberian' foxtail millet were seeded on June 5. Treatments were applied to 6.5-leaf oats, second trifoliolate soybean and 6- to 7-leaf foxtail millet on June 30 with 75 F, 65% RH, 0 to 5 mph west wind, and clear sky. Second split treatments (/) were applied to 10 inch to jointing oats, 4-to-4.5 trifoliolate soybeans and 12 inch tall foxtail millet on July 5 with 85 F, 75% RH, and 10 to 15 mph south wind. 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 20 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 24.

Treatment	Rate	Oats	Soybean	Foxtail millet
	(oz/A)	----(% control)-----		
Sethoxydim+BCH/Bentazon+BCH	2.4+0.25G/16+0.25G	5	9	0
BAS-0562/Bentazon+BCH	2.4/16+0.25G	98	15	99
BAS-0562+BCH/Bentazon+BCH	2.4+0.25G/16+0.25G	99	13	99
BAS-0562+MS/Bentazon+BCH	2.4+0.25G/16+0.25G	99	19	99
BAS-0562+MS1/Bentazon+BCH	2.4+0.25G/16+0.25G	99	9	99
Bentazon+Sethoxydimoxydim+BCH	16+2.4+0.25G	0	2	0
Bentazon+BAS-0562	16+2.4	85	3	97
Bentazon+BAS-0562+BCH	16+2.4+0.25G	93	3	97
Bentazon+BAS-0562+MS	16+2.4+0.25G	87	4	96
Bentazon+BAS-0562+MS1	16+2.4+0.25G	85	1	92
Bentazon+Sethoxydim+BCH+28N	16+2.4+0.25G+.5G	95	1	98
Bentazon+BAS-0562+28N	16+2.4+.5G	94	2	97
Bentazon+BAS-0562+BCH+28N	16+2.4+0.25G+.5G	97	4	98
Bentazon+BAS-0562+MS+28N	16+2.4+0.25G+.5G	98	1	98
Bentazon+BAS-0562+MS1+28N	16+2.4+0.25G+.5G	98	2	98
Bentazon+Sethoxydim+BCH	8+2.4+0.25G	87	1	97
Bentazon+Sethoxydim+MS	8+2.4+0.25G	88	0	97
Bentazon+Sethoxydim+MS1	8+2.4+0.25G	89	1	97
Bentazon+Sethoxydim+BCH	12+2.4+0.25G	89	1	98
Bentazon+Sethoxydim+MS	12+2.4+0.25G	86	1	97
Bentazon+Sethoxydim+MS1	12+2.4+0.25G	86	1	96
C.V. %		4	77	2
LSD 5%		4	5	3
# OF REPS		4	4	4

Summary

The low oats and foxtail control with treatments 1 and 6 probably indicate that the sethoxydim was not included in the treatment container. The BAS-0562 applied as a split application before bentazon generally gave greater oats control then when applied as a tank mixture, regardless of alone, or with BCH, MS, or MS1. The addition of 28N to the tank mixtures with sethoxydim gave similar oats control to mixture with BAS-0562. BCH, MS, and MS1 were all similar as adjuvants with BAS-0562 or sethoxydim. Injury to soybean was greater when bentazon was applied separate from BAS-0562 which may reflect the higher temperature at application.

Sethoxydim Time-of-Day application, Fargo 1989. 'Valley' oats and 'McCall' soybean were seeded on May 28 and 'Siberian' foxtail was seeded on June 1. Treatments were applied to 5-leaf oats, first trifoliolate soybeans, and 4-inch tall foxtail millet on June 30 with 85 F, 50% RH, 0 to 5 mph northeast wind, 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 across the species the length of 10 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluations were on July 21 and 27. NaHCO3 at 2000 ppm.

Treatment[a]	Application	Rate	July 21 Oats	July 21 Soybean	July 21 Fxmi	July 27 Oats
	(time)	(oz/A)	--------(% control)--------			
Sethoxydim+PO	(8 am)	1+0.25G	98	0	99	93
Sethoxydim+MS	(8 am)	1+0.25G	99	0	99	98
Sethoxydim+BCH	(8 am)	1+0.25G	98	0	98	93
Sethoxydim+SO	(8 am)	1+0.25G	98	0	99	93
Sethoxydim+PO	(2 pm)	1+0.25G	98	0	99	93
Sethoxydim+MS	(2 pm)	1+0.25G	99	0	99	98
Sethoxydim+BCH	(2 pm)	1+0.25G	99	0	99	98
Sethoxydim+SO	(2 pm)	1+0.25G	99	0	98	95
Sethoxydim+PO	(2 pm)	1+0.25G	99	0	97	96
Sethoxydim+MS	(8 pm)	1+0.25G	99	0	99	98
Sethoxydim+BCH	(8 pm)	1+0.25G	99	0	99	98
Sethoxydim+SO	(8 pm)	1+0.25G	94	0	98	88
Sethoxydim+NaHCO3+PO	(8 pm)	1+ +0.25G	87	0	98	85
Sethoxydim+NaHCO3+PO	(8 am)	1+ +0.25G	86	0	98	75
C.V. %			1	0	1	2
LSD 5%			1	NS	NS	2
# OF REPS			4	4	4	4

[a]PO=petroleum oil with 17% Atplus 300F; MS= methylated sunflower oil with 15% Atplus 300F (Sun-it); BCH=DASH; S) = soybean oil with 15% Atplus 300F.

Summmary

Soybean was not injured by sethoxydim regardless of adjuvant or application time. Sodium bicarbonate in the spray carrier antagonized oat control from sethoxydim and the antagonixm tended to be more with the 8:00 am than 8:00 pm application. Foxtail millet was controlled regardless of adjuvant or application time. Oat control on July 27 generally was less from the 8:00 am applications than the 8:00 pm applications for sethoxydim applied with petrolium oil or BCH. Oat control was not influenced by time of application of sethoxydim with MS.

Overcoming NaHCO3 antagonism of Sethoxydim, Fargo 1989. 'Valley' oats and 'McCall' soybeans were seeded on May 28 and 'Siberian' foxtail millet was seeded on June 1. Treatments were applied to 5-leaf oats, first trifoliolate soybeans, and 4 inch tall foxtail millet on June 29 with 85 F, 60 % RH, 10 mph wind and 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 across the species the length of 10 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on July 25.

Treatment	Rate	Oats	Soybeans	Foxtail millet
	(oz/A)	--------(% control)-------		
Sethoxydim+NaHCO3+Exp3	1.5+8+.25G	97	0	98
Sethoxydim+NaHCO3+Exp5	1.5+8+.25G	94	0	98
Sethoxydim+Bentazon+Exp5	1.5+16+.25G	29	0	46
Sethoxydim+BCH	1.5+.25G	99	0	99
Sethoxydim+NaHCO3+BCH	1.5+8+.25G	96	0	97
Sethoxydim+NaHCO3+28N+BCH	1.5+8+1G+.25G	98	0	98
Sethoxydim+NaHCO3+NaHSO4+BCH	1.5+8+7+.25G	88	0	89
Sethoxydim+NaHCO3+AMS+BCH	1.5+8+32+.25G	99	0	99
Sethoxydim+NaHCO3+Exp3+BCH	1.5+8+.25G+.25G	99	0	98
Sethoxydim+NaHCO3+Exp5+BCH	1.5+8+.25G+.25G	98	0	99
Sethoxydim+Bentazon+BCH	1.5+16+.25G	86	0	75
Sethoxydim+Bentazon+Exp5+BCH	1.5+16+.25G+.25G	94	0	93
Sethoxydim+NaHCO3+MS	1.5+8+.25G	96	0	97
Sethoxydim+MS	1.5+.25G	99	0	99
Sethoxydim+NaHCO3+28N+MS	1.5+8+1G+.25G	99	0	99
Sethoxydim+NaHCO3+NaHSO4+MS	1.5+8+7+.25G	97	0	98
Sethoxydim+NaHCO3+AMS+MS	1.5+8+32+.25G	98	0	98
Sethoxydim+NaHCO3+Exp3+MS	1.5+8+.25G+.25G	99	0	99
Sethoxydim+NaHCO3+Exp5+MS	1.5+8+.25G+.25G	99	0	98
Sethoxydim+Bentazon+MS	1.5+16+.25G	57	0	92
Sethoxydim+Bentazon+Exp5+MS	1.5+16+.25G+.25G	96	0	94
C.V. %		11	0	9
LSD 5%		14	NS	12
# OF REPS		4	4	4

Summary

Sodium bicarbonate generally was not antagonistic to bentazon in this experiment, except when applied with sodium bisulfate and BCH. Bentazon antagonized oats and foxtail millet control with sethoxydim when with BCH or MS, but the antagonism was overcome by experimental adjuvant No 5. However, at the high level of control obtained partial antagonism would not be expressed.

Glyphosate with salts, Fargo 1989. 'Valley' oats, 'McCall' soybean, and 'Siberian' foxtail millet were seeded on June 5. Treatments were applied to 12 to 16 inch tall oats, 4.5 trifoliolate soybeans and 12 to 20 inch tall foxtail millet on July 20 with 92 F, 60 % RH, 0 to 5 mph wind, and partly 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 across the species the length of 10 by 26 ft plots. The experiment was a randomized complete block with four replications. Evaluation was on August 3. The rate in treatment 1 was applied short of the 2 oz/A and contamination was observed in the container for treatment 12.

Treatment	Rate (oz/A-ppm)	Oats	Soybeans
		-(% control)--	
Glyphosate (DW)	2	67	26
Glyphosate (DW) + NaHCO3	2 + 3000	77	40
Glyphosate (DW) + NaHCO3 + EMulp 877	2 + 3000 + 0.25%	88	42
Glyphosate (DW) + NaHCO3 + DC 193	2 + 3000 + 0.25%	92	55
Glyphosate (DW) + NaHCO3 + AMS	2 + 3000 + 2% w/v	97	77
Glyphosate (DW) + NaHCO3 + AMS	2 + 3000 + 1% w/v	96	81
Glyphosate (DW) + NaHCO3 + AMBS	2 + 3000 + 2% w/v	98	87
Glyphosate (DW) + NaHCO3 + AMP	2 + 3000 + 2% w/v	96	75
Glyphosate (DW) + NaHCO3 + NHS	2 + 3000 + 2% w/v	96	80
Glyphosate (DW) + NaHCO3 + Exp 2	2 + 3000 + 0.25G	97	87
Glyphosate (DW) + NaHCO3 + Exp 3	2 + 3000 + 0.25G	97	83
Glyphosate (DW) + NaHCO3 + Exp 5	2 + 3000 + 0.25G	98	77
Glyphosate (DW) + NaHCO3 + Exp 6	2 + 3000 + 0.25G	98	87
Glyphosate (DW) + CaCl2	2 + 1500	73	18
Glyphosate (DW) + CaCl2 + EMulp 877	2 + 1500 + 0.25%	92	57
Glyphosate (DW) + CaCl2 + DC 193	2 + 1500 + 0.25%	95	55
Glyphosate (DW) + CaCl2 + AMS	2 + 1500 + 2% w/v	95	86
Glyphosate (DW) + CaCl2 + AMS	2 + 1500 + 1% w/v	95	78
Glyphosate (DW) + CaCl2 + AMBS	2 + 1500 + 2% w/v	97	91
Glyphosate (DW) + CaCl2 + AMP	2 + 1500 + 2% w/v	93	66
Glyphosate (DW) + CaCl2 + NHS	2 + 1500 + 2% w/v	95	85
Glyphosate (DW) + CaCl2 + Exp 2	2 + 1500 + 0.25G	98	91
Glyphosate (DW) + CaCl2 + Exp 3	2 + 1500 + 0.25G	98	87
Glyphosate (DW) + CaCl2 + Exp 5	2 + 1500 + 0.25G	95	80
Glyphosate (DW) + CaCl2 + Exp 6	2 + 1500 + 0.25G	96	87
C.V. %		5	13
LSD 5%		6	13
# OF REPS		4	4

Summary

Glyphosate in only distilled water (DW) was applied under the intended rate which probably accounted for the lack of antagonism from sodium bicarbonate or calcium chloride. Oats control was enhanced by all adjuvants when glyphosate was applied with sodium bicarbonate or calcium chloride, except for EMulp 877 with sodium bicarbonate. Soybean control exceeded 82% for glyphosate applied with the salts only when the spray included AMBS, Exp 2, Exp 3, and Exp 6. Also, AMS at 2% with sodium bicarbonate gave ¢ 82% soybean control.

Sulfometuron applied in mid-summer and fall 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 + picloram at 2 + 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. This was 20% higher than control with the picloram treatments alone. 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).

Treatment	Rate	Evaluation date: Aug 86 Con-trol	May 87 Con-trol	May 87 Grass injury	Aug 87 Con-trol	Aug 87 Retreat-ment[a]	May 88 Con-trol	May 88 Retreat-ment[a]	Aug 88 Con-trol	Aug 88 Retreat-ment[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
Treatment	Rate	Con-trol	Grass injury	Con-trol	Grass injury	Con-trol	Retreat-ment	Retreat-ment	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
Sulfometuron + 2,4-D	0.5 + 32	57	0	9	0	1	91	19	89	62
Sulfometuron + picloram	0.5 + 8	96	7	39	0	3	98	43	95	65
Sulfometuron + picloram	0.5 + 12	98	3	68	0	15	99	36	98	76
Sulfometuron + picloram	0.5 + 16	99	4	81	0	16	99	51	99	63
Sulfometuron + 2,4-D	1 + 16	90	5	26	0	5	94	29	93	64
Sulfometuron + 2,4-D	1 + 32	93	6	41	0	8	99	34	96	81
Sulfometuron + picloram	1 + 8	99	8	85	0	36	97	37	99	81
Sulfometuron + picloram	1 + 12	99	6	88	0	34	96	53	97	78
Sulfometuron + picloram	1 + 16	99	8	86	0	45	99	43	99	86
Sulfometuron + 2,4-D	2 + 16	97	34	68	4	10	99	57	98	80
Sulfometuron + 2,4-D	2 + 32	99	29	73	14	13	98	52	97	93
Sulfometuron + picloram	2 + 8	99	49	97	20	52	100	68	98	78
Sulfometuron + picloram	2 + 12	99	41	95	0	45	100	75	98	87
Sulfometuron + picloram	2 + 16	99	37	98	20	80	99	65	93	82
Picloram	16	99	0	63	0	32	97	25	98	61
Control		..	..	..	..	0	98	29	94	58
LSD (0.05)		12	22	22	20	22	7	38	6	32

[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.

Table 3. DPX-L5300 and chlorsulfuron with auxin herbicides for leafy spurge control (Lym and Messersmith).

		Location and evaluation date						
		Chaffee				Dickinson		
		Aug 86		May 87	Aug 87	Sept 86	June 87	Aug 87
Treatment	Rate	Leafy spurge	Grass injury	Leafy spurge	Leafy spurge	Leafy spurge	Leafy spurge	Leafy spurge
	(oz/A)	(% control)						
DPX-L5300	1	0	0	0	0	21	0	0
DPX-L5300	2	0	0	0	0	8	0	0
DPX-L5300 + 2,4-D	1 + 16	3	0	0	0	42	3	0
DPX-L5300 + picloram	1 + 8	67	0	36	20	87	5	15
DPX-L5300 + dicamba	1 + 16	3	0	8	3	42	0	0
Chlorsulfuron + 2,4-D	0.5 + 16	0	0	0	0	57	0	0
Chlorsulfuron + picloram	0.5 + 8	42	10	9	0	63	3	10
Chlorsulfuron + dicamba	0.5 + 16	3	10	3	0	37	0	0
Sulfometuron + amitrole	1 + 32	11	20	6	0	27	6	6
Sulfometuron + fluroxypyr	1 + 16	49	40	30	12	97	15	0
Sulfometuron + picloram	1 + 8	59	30	40	13	..	..	..
Fosamine + X-77 surf.	32 + 0.5%	..	..	..	..	62	14	8
Fosamine + X-77 surf.	64 + 0.5%	..	..	..	..	10	11	0
Fosamine + X-77 surf.	96 + 0.5%	..	..	..	..	68	52	10
LSD (0.05)		18	18	21	11	40	12	NS

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 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 with 92% control was the only spring-applied treatment to provide satisfactory leafy spurge control 12 months after treatment (MAT) (Table). 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 + picloram at 1.5 + 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. There was only slight grass injury with sulfometuron.

Sulfometuron + picloram at 1.5 + 8 oz/A and picloram alone at 16 oz/A without a retreatment provided similar leafy spurge control in September 1989 (15 MAT) and averaged 51% (Table). Leafy spurge control with all original treatments following the 1989 retreatments was similar and averaged 59% except 2,4-D alone. The best retreatments were picloram + 2,4-D at 4 + 16 oz/A, picloram at 8 oz/A, and sulfometuron + picloram at 1.5 + 8 oz/A which averaged 78, 74 and 68% control, respectively. Grass injury increased when sulfometuron at 1.5 oz/A was applied as a retreatment either with 2,4-D or picloram compared to a single application and averaged 43 and 29%, respectively, over all original treatments but 92 and 73%, respectively, when applied 12 months after sulfometuron alone at 3 oz/A.

All treatments fall-applied provided excellent leafy spurge control in June 1989 except 2,4-D at 16 oz/A and picloram at 8 oz/A (Table). However, grass injury averaged 98% with any treatment that included sulfometuron. 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.

Leafy spurge control was improved when sulfometuron was applied with 2,4-D or picloram in the spring compared to the herbicides applied alone with minimal grass injury. Grass injury increased when sulfometuron was applied 2 yr in a row. Sulfometuron fall-applied provided good initial leafy spurge control but nearly 100% grass injury. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

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

				Retreatment and rate (oz/A)/ evaluation Sept. 1989											
		Evaluation June 1989		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	Con trol	Grass inj.	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 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

Leafy spurge control in pasture with sulfometuron and/or picloram plus 2,4-D in a 3 yr rotation. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown that sulfometuron applied with picloram or 2,4-D provides good leafy spurge control especially when fall applied. However, sulfometuron can cause severe grass injury when fall applied. Picloram + 2,4-D at 0.25 + 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 + 2,4-D as spring or fall applied treatments.

The experiment was established at three locations in North Dakota, Chaffee and Valley City in the eastern and Dickinson in the western part of the state. 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. Leafy spurge will receive 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.

Control was similar with all spring applied treatments 12 MAT (months after treatment) and averaged only 18% across all locations and treatments (Table). Grass injury averaged 12% at Chaffee and Valley City when sulfometuron was applied with either 2,4-D or picloram. The initial grass stand at the Dickinson location was too sparse to allow evaluation of grass injury. Leafy spurge control improved to an average of 71% in August 1989 following a retreatment of picloram + 2,4-D at 4 + 16 oz/A in June regardless of the original treatment. A retreatment with sulfometuron + 2,4-D following picloram + 2,4-D provided better leafy spurge control than a retreatment with sulfometuron + picloram.

Leafy spurge control averaged 90 and 74% with fall applied sulfometuron at 1.25 oz/A + picloram at 4 oz/A or 2,4-D at 16 oz/A, respectively, in June 1989 (Table). Leafy spurge control with sulfometuron + 2,4-D or picloram + 2,4-D was higher at Valley City than the other two locations probably because Valley City received near normal rainfall during the 1988 growing season compared to much below normal rainfall at the other two locations, so leafy spurge was not drought stressed. Grass injury was much higher when sulfometuron was applied in the fall (98 to 100%) compared to the spring (6 to 25%). Picloram + 2,4-D at 4 + 16 oz/A provided only 35% control but there was no grass injury. Leafy spurge control declined rapidly by 12 MAT but sulfometuron applied with picloram still provided better leafy spurge control than when applied with 2,4-D.

In general, leafy spurge control with sulfometuron + 2,4-D or picloram was similar to picloram + 2,4-D when applied in the spring but was better 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 in pasture with sulfometuron, picloram, and 2,4-D (Lym and Messersmith).

1988 Date applied and treatment	Rate	1989 Treatment	Rate	Chaffee Au 88 Control	Chaffee June 89 Control	Chaffee June 89 Grass inj	Chaffee Au 89 Control	Chaffee Au 89 Grass inj	Valley City Au 88 Control	Valley City Jun 89 Control	Valley City Jun 89 Grass inj	Valley City Sep 89 Control	Valley City Sep 89 Grass inj	Dickinson Au 88 Control	Dickinson Jun 89 Control	Dickinson Sep 89 Control	Mean 12 MAT[a] Control	Mean 12 MAT[a] Grass inj	Mean 15 MAT[b] Control	Mean 15 MAT[b] Grass inj
	(oz/A)		(oz/A)	(%)																
Spring																				
Sulf+pic	1.25+4	Sulf+pic	1.25+4	16	17	9	48	23	30	22	14	62	34	41	15	27	18	12	45	29
Sulf+pic	1.25+4	Pic+2,4-D	4+16	20	13	12	69	21	28	31	10	76	20	56	11	43	18	11	63	21
Sulf+2,4-D	1.25+16	Sulf+2,4-D	1.25+16	23	28	25	58	25	45	26	7	54	27	52	15	33	21	16	48	26
Sulf+2,4-D	1.25+16	Pic+2,4-D	4+16	26	18	6	74	26	44	50	11	82	27	68	16	73	28	9	76	27
Pic+2,4-D	4+16	Pic+2,4-D	4+16	33	16	0	73	4	33	10	0	80	11	58	13	68	13	0	74	8
Pic+2,4-D	4+16	Sulf+pic	1.25+4	22	18	0	50	11	28	18	0	25	11	62	14	48	17	0	48	11
Pic+2,4-D	4+16	Sulf+2,4-D	1.25+16	28	19	0	71	13	33	11	0	74	13	58	3	75	11	0	74	13
Fall																				
Sulf+pic	1.25+4	Sulf+pic	1.25+4	..	91	99	61	71	..	100	99	44	68	..	81	35	46	70	..	..
Sulf+pic	1.25+4	Pic+2,4-D	4+16	..	90	99	65	75	..	99	99	61	77	..	78	33	52	76	..	..
Sulf+2,4-D	1.25+16	Sulf+2,4-D	1.25+16	..	54	98	38	83	..	98	100	46	77	..	45	8	31	80	..	..
Sulf+2,4-D	1.25+16	Pic+2,4-D	4+16	..	95	98	38	83	..	98	100	23	94	..	55	14	25	89	..	..
Pic+2,4-D	4+16	Pic+2,4-D	4+16	..	28	23	8	0	..	65	26	18	6	..	15	6	10	3	..	..
Pic+2,4-D	4+16	Sulf+pic	1.25+4	..	6	0	1	0	..	57	8	0	0	..	23	18	6	0	..	..
Pic+2,4-D	4+16	Sulf+2,4-D	1.25+16	..	23	0	0	0	..	70	5	2	0	..	20	3	2	0	..	..
LSD (0.05)				17	29	20	13	9	NS	21	20	25	17	26	17	22	12	7	14	7

[a] Mean 12 months after the first treatment.
[b] Mean 15 months after the first treatment and 3 months following the retreatment.

Fluroxypyr alone and with auxin herbicides applied annually for 3 years to control leafy spurge. Lym, Rodney G., and Calvin G. Messersmith. Fluroxypyr is a pyridinecarboxylic acid herbicide similar to picloram but with less soil residual and a different weed control spectrum. The purpose of this experiment was to evaluate fluroxypyr for leafy spurge control when applied alone or with auxin herbicides and when applied in a repetitive treatment program.

The experiment was established and original herbicide treatments were applied to a dense stand of leafy spurge near Dickinson, ND, on July 14, 1986. Previous research had indicated the optimum application time for leafy spurge control with fluroxypyr was post seed-set rather than during true flower as for picloram. 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 56 ft, and the retreatment subplots were 10 by 15 ft. Retreatments were applied in mid-July 1987 and 1988. The final evaluation was made on July 10, 1988, and was based on visible percent stand reduction as compared to the control.

Original treatment	Rate	Retreatment/rate (lb/A) Fluro. 0.5	Pic. 0.25	Pic. 0.5	Fluro. + pic. 0.25+0.25	Fluro. + pic. 0.5+0.25	Pic.+ 2,4-D 0.25+1	Con-trol	Mean
	(lb/A)	(% control July 1989)							
Fluroxypyr	0.5	40	27	56	53	61	29	3	38
Fluroxypyr	1	53	23	62	38	57	37	8	40
Fluroxypyr + picloram	0.25 + 0.25	37	17	43	42	49	32	13	33
Fluroxypyr + picloram	0.5 + 0.25	32	33	50	46	57	32	15	38
Fluroxypyr + 2,4-D	0.5 + 1	47	18	32	24	43	56	15	34
Fluroxypyr + dicamba	0.25 + 0.25	47	22	42	18	42	42	2	31
Picloram + 2,4-D	0.25 + 1	58	39	52	49	44	57	20	46
Picloram	1	58	16	58	38	51	53	7	46
Control		42	8	41	39	32	42	10	31
Mean		46	23	49	39	48	42	10	

LSD (0.05) whole plot = 10; subplots = 9; whole plot x subplot = 25

No treatment provided satisfactory leafy spurge control in July 1989, 12 months following the third retreatment (Table). Picloram at 1 lb/A and picloram plus 2,4-D at 0.25 plus 1 lb/A provided the best leafy spurge control of the original treatments (46%) when averaged over retreatments. All retreatments provided similiar control when averaged over the original treatments except picloram at 0.25 lb/A and fluroxypyr plus picloram at 0.25 plus 0.25 lb/A which tended to provide less control.

Although fluroxypyr alone or fluroxypyr plus dicamba, picloram, or 2,4-D generally provided similar or less leafy spurge control than picloram or picloram plus 2,4-D in 1987, fluroxypyr alone was much better than picloram alone under dry conditions in 1988 (data not shown). Fluroxypyr at 0.5 lb/A averaged 95% control as a retreatment compared to 50 and 70% with picloram at 0.25 or 0.5 lb/A, respectively. Fluroxypyr may be useful in a retreatment program, especially in areas where picloram cannot be used or in late-season treatments during dry conditions. But fluroxypyr does not provide long-term leafy spurge control. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105).

<u>Leafy spurge control with picloram or sulfometuron plus dicamba and various 2,4-D formulations</u>. 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 picloram or sulfometuron + dicamba and various 2,4-D formulations for leafy spurge control.

The initial 2,4-D formulation 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. All plots were 10 by 30 ft in a randomized complete block design with four replications. Evaluations were based on visible percent stand reduction as compared to the control. Treatments were applied annually in the spring or fall through 1988.

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

Leafy spurge control with picloram at 0.5 lb/A averaged 59% 1 yr following the third fall application (Table 1). Control improved to 81% when picloram at 0.5 lb/A was applied with dicamba at 2 lb/A, which is similar to a 3 yr annual application of picloram + 2,4-D at 0.5 + 1 lb/A based on previous research conducted by North Dakota State University. Leafy spurge control with picloram + dicamba was not improved by adding 2,4-D regardless of the 2,4-D formulation.

Two experiments to evaluate sulfometuron applied alone or with various formulations of 2,4-D or dicamba were established at West Fargo on June 3, 1988. Plot design and size and the application procedure were similar to the previous experiment. The leafy spurge was in the true flower growth stage but was under heat and drought stress. The air temperature was 92 F and the soil was 84 and 81 F at the 1 and 3 inch depths, respectively. Leafy spurge control by sulfometuron was poor when evaluated in August 1988 regardless of treatment (Table 2). This is probably due to the poor growing conditions when the herbicides were applied and the subsequent hot and dry summer. Only two replications of the 2,4-D ester + dicamba experiment could be evaluated because the area was burned during a grass fire.

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 but is a much more expensive combination treatment than the commonly used picloram + 2,4-D. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo, 58105)

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

Application date and treatment	Rate	Valley City June	Valley City Aug	Dickinson June	Dickinson Sept	Sheyenne June	Sheyenne Sept	Mean[a]
	(lb/A)	---(% control)---						
Spring								
2,4-D mixed amine[b] + dicamba+picloram	2+1+0.25	63	..	43	..	..	..	53
2,4-D mixed amine[b] + dicamba+picloram	2+0.5+0.25	68	..	44	..	..	..	56
2,4-D mixed amine[b] + picloram+dicamba	1+0.5+0.12	55	..	37	..	..	..	46
2,4-D alkanolamine+ dicamba+picloram	2+1+0.25	58	..	56	..	..	..	62
Dicamba+picloram	1+0.25	54	..	44	..	..	..	49
LSD (0.05)		NS		NS				NS
Fall								
2,4-D mixed amine[b] + dicamba+picloram	2+1+0.25	91	45	73	40	98	48	45
2,4-D alkanolamine+ dicamba+picloram	2+1+0.25	81	34	..	..	98	72	53
2,4-D mixed amine[b] + dicamba+picloram	4+2+0.5	98	91	97	83	99	83	86
2,4-D ester[c] + 2,4-DP +dicamba +picloram	2+2+0.5+0.25	94	40	43	31	98	66	46
2,4-D ester[c] + 2,4-DP +dicamba +picloram	2+2+0.5+0.5	98	80	86	76	99	81	79
2,4-D alkanolamine+ dicamba+picloram	4+2+0.5	99	80	90	75	99	82	79
Dicamba+picloram	2+0.5	98	86	96	80	99	79	81
Picloram	0.5	97	69	59	56	98	51	59
LSD (0.05)		16	23	21	27	NS	25	14

[a] Mean 36 months after 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.

Table 2. Sulfometuron plus various 2,4-D formulations for leafy spurge control (Lym and Messersmith).

Treatment	Rate (oz/A)	Control/evaluation date 22 Aug 88	23 May 89
		----------(%)----------	
2,4-D amine experiment			
2,4-D mixed amine[a]	16	26	11
2,4-D mixed amine[a]	32	18	14
Sulfometuron	0.5	16	16
Sulfometuron	1	15	16
2,4-D mixed amine[a] + sulfometuron	16 + 0.5	14	6
2,4-D mixed amine[a] + sulfometuron	16 + 1	5	2
2,4-D mixed amine[a] + sulfometuron	32 + 0.5	18	11
2,4-D mixed amine[a] + sulfometuron	32 + 1	13	5
2,4-D alkanolamine + sulfometuron	32 + 1	19	14
LSD (0.05)		15	NS
2,4-D ester plus dicamba experiment			
2,4-D ester[b] + 2,4-DP + dicamba	8 + 8 + 0.25	20	..
2,4-D ester[b] + 2.4-DP + dicamba	16 + 16 + 0.5	9	..
Sulfometuron	0.5	29	..
Sulfometuron	1	5	..
2,4-D ester[b] + 2,4-DP + dicamba + sulfometuron	8 + 8 + 0.25 + 0.5	12	..
2,4-D ester[b] + 2,4-DP + dicamba + sulfometuron	8 + 8 + 0.25 + 1	13	..
2,4-D ester[b] + 2,4-DP + dicamba + sulfometuron	16 + 16 + 0.5 + 0.5	23	..
2,4-D ester[b] + 2,4-DP + dicamba + sulfometuron	16 + 16 + 0.5 + 1	24	..
2,4-D alkanolamine + sulfometuron	32 + 1	8	..
LSD (0.05)		16	..

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

[b] 2,4-D isooctyl ester:2,4-DP butoxyethanol ester:dicamba (4:4:1 v/v/v)-EH680.

Picloram plus 2,4-D applied annually for 8 yr 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 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 1981 at Sheldon, and on 11 June 1982 at Valley City. The soil at Dickinson was a loamy fine sand with pH 6.6 and 3.6% organic matter, at Sheldon was a fine sandy loam with pH 7.7 and 2.1% organic matter, and at Valley City was 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 treatments 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. Thus, the Dickinson site has received seven picloram and picloram plus 2,4-D treatments and 13 2,4-D treatments, while the Valley City site has received 7 and 14 treatments, respectively. The plots were 10 by 30 ft 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 maximum leafy spurge control was reached 48 months after the first treatment (MAT) and has remained the same or declined slightly thereafter. Picloram at 0.25, 0.38 and 0.5 lb/A provided 58, 77, and 86% leafy spurge control, respectively, 48 months after treatment, but declined to 38, 67 and 71%, respectively, 72 MAT. 2,4-D alone provided an average of 55% control of leafy spurge after biannual applications for 8 yr.

Leafy spurge control 48 months after treatment increased by an average of 26, 14, and 9% when 2,4-D at 1 to 2 lb/A was applied with picloram at 0.25, 0.38, or 0.5 lb/A, respectively, when compared to the same picloram rate applied alone. The greatest enhancement with 2,4-D + picloram seems to be with 2,4-D at 1.5 lb/A or less and picloram at 0.375 lb/A or less. In general, leafy spurge control was similar at all sites through 1985 and did not seem to be influenced by soil types, pH, or organic matter. However, leafy spurge control at Dickinson has declined since 1985 which may be due to less competition from grass species, poor environmental conditions during application especially in 1987 and 1988, and/or a vigorous leafy spurge biotype.

Picloram at 0.5 lb/A alone and all picloram at 0.38 or 0.5 lb/A plus 2,4-D treatments were near or reached the target of 90% or better leafy spurge control following four annual applications. Control did not increase 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 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 annual picloram or picloram plus 2,4-D treatments and biannual 2,4-D treatments at two locations in North Dakota (Lym and Messersmith).

Herbicide	Rate	Site and 1989 evaluation date								
		Dickinson	Valley City		Months after treatment					
		June	June	Sept.	12[a]	24	36	48	60	72
	(lb/A)	(% control)								
Picloram	0.25	32	45	72	39	48	48	58	49	38
Picloram	0.38	47	90	84	65	62	52	77	69	67
Picloram	0.5	56	85	88	65	71	81	86	77	71
2,4-D bian	1	52	57	68	22	30	38	50	39	55
2,4-D bian	1.5	44	55	75	22	24	26	45	49	49
2,4-D bian	2	60	63	85	19	30	26	54	54	62
Pic+2,4-D	0.25+1	73	79	94	52	66	63	85	73	76
Pic+2,4-D	0.25+1.5	68	55	92	58	66	70	85	77	62
Pic+2,4-D	0.25+2	64	90	92	57	62	66	83	76	77
Pic+2,4-D	0.38+1	64	88	92	69	72	70	90	84	76
Pic+2,4-D	0.38+1.5	75	82	95	68	74	76	93	84	79
Pic+2,4-D	0.38+2	74	90	96	68	59	76	91	86	82
Pic+2,4-D	0.5+1	71	92	96	71	75	84	94	87	82
Pic+2,4-D	0.5+1.5	78	98	98	64	73	80	97	91	88
Pic+2,4-D	0.5+2	79	97	97	76	75	81	95	91	88
LSD (0.05)		20	29	9	18	14	19	14	14	15

[a] Mean values through 48 months after treatment include data from the Sheldon location which was discontinued after 1985.

Various additives applied with dicamba, picloram, and 2,4-D for leafy spurge control. Lym, Rodney G., and Calvin G. Messersmith. Previous research at North Dakota State University has shown only 28% of the picloram applied to leafy spurge is absorbed. Also, only 5% of the picloram applied reaches the roots and over 60% of that portion is released from the roots into the soil. Although the exact mechanism of picloram release is not known it is likely a passive process and thus cannot be inhibited. Therefore, increased picloram efficiency for leafy spurge control will probably come from 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 dicamba, picloram, and 2,4-D for increased leafy spurge control compared to the herbicides applied alone.

The experiments were established on a dense leafy spurge infestation near Hunter, ND, as spring- or fall-applied treatments. The spring treatments were applied on June 16, 1988, and the leafy spurge was beginning seed set. The weather was partly cloudy with 70 F, 60% relative humidity, and soil temperature of 82 and 76 F at 1 and 3 inches, respectively. The fall treatments were applied on September 1, 1988 and the leafy spurge was lush and growing vigorously after several rains following a hot and very dry summer. The weather was 72 F, 66% relative humidity, and the soil temperature was 70 and 68 F at 1 and 3 inches, respectively. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 10 by 25 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 control.

The additives included methylated sunflower oil, $(NH_4)_2SO_4$ (8-0-0-9 N-P-K-S) liquid fertilizer at 0.2 lb N and S/A, respectively, $(NH_4)_2SO_4$ water-soluble dry fertilizer at 2.5 lb N/A, citric acid buffer adjusted to pH 4.8, and a commercial formulation of fertilizer + surfactant equivalent to 15-3-3-2 (N-P-K-S) by weight plus 17% nonionic surfactant.

No treatment applied in June 1988 provided satisfactory leafy spurge control 3 or 12 months after treatment (MAT) (Table). The weather during the summer was very hot with much below normal precipitation. No additive provided better control than picloram + 2,4-D applied alone in these growing conditions.

Picloram + 2,4-D at 4 + 16 oz/A + methylated sunflower oil fall-applied provided better control than the herbicides applied alone at 9 but not 12 MAT (Table). Treatments that included picloram at 8 oz/A provided the best control and averaged 78% 9 MAT. Control generally was similar at similar herbicide application rates regardless of additive 12 MAT except the commercial formulation of fertilizer + surfactant and $(NH_4)_2SO_4$ dry formulation which was lower. No herbicide + additive treatment provided a long-term increase in leafy spurge control compared to the herbicides applied alone, but this may be due to the poor environmental conditions in 1988 and this experiment will be repeated. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table. Leafy spurge control with various herbicides and spray additives (Lym and Messersmith)

Treatment	Rate	Treatment date/evaluation (MAT)[a]			
		June 88		Sept. 88	
		3	12	9	12
	(oz/A)	------(% control)------			
Picloram + 2,4-D + methylated sunflower oil	4 + 16 + 32	4	3	63	34
Picloram + 2,4-D + methylated sunflower oil	8 + 16 + 32	20	0	81	51
Picloram + methylated sunflower oil	8 + 16	16	5	82	60
Dicamba + methylated sunflower oil	32 + 16	0	0	48	29
Picloram + 2,4-D + $(NH_4)_2SO_4$ (liquid)[a]	4 + 16 + 16	9	3	46	21
Picloram + 2,4-D + $(NH_4)_2SO_4$ (liquid)[a]	8 + 16 + 16	31	10	83	43
Picloram + 2,4-D + $(NH_4)_2SO_4$ (dry)	4 + 16 + 40	25	9	41	26
Picloram + 2,4-D + $(NH_4)_2SO_4$ (dry)	8 + 16 + 40	22	7	71	32
Picloram + 2,4-D + citric buffer	4 + 16	4	3	26	8
Picloram + 2,4-D + citric buffer	8 + 16	15	2	84	57
Picloram + 2,4-D + fertilizer + surfactant[b]	4 + 16 + 8	5	0	41	21
Picloram + fertilizer + surfactant[b]	8 + 8	21	6	68	37
Dicamba + fertilizer + surfactant[b]	32 + 8	33	6	38	14
Picloram + 2,4-D	4 + 16	18	8	33	28
LSD (0.05)		19	NS	27	20

[a]Months after treatment.
[b]Commercial formulation (Inhance) MCA Labs, Union Mills, IN 46382.

Leafy spurge control under trees. Lym, Rodney G., and Calvin G. Messersmith. Leafy spurge is difficult to control with herbicides near trees because of potential damage to desirable vegetation. However, these areas provide a source of seed for infestation of nearby areas when leafy spurge is not controlled. The purpose of these experiments was to evaluate several herbicides both for leafy spurge control and for potential to damage desirable vegetation.

Three experiments for leafy spurge control under trees were established in a shelter belt located in a waterfowl rest area near Valley City, ND. The plots were located in a dense stand of leafy spurge growing under mature ash and elm trees that had been planted 5 ft apart in 12-ft rows. The herbicides were applied either with a hand-held single-nozzle sprayer delivering 40 gpa or with a controlled droplet applicator (CDA) which applied about 4 gpa. The hand-held sprayer treatments were applied as a premeasured amount of herbicide:water per plot to assure the correct rate and three passes were made across each plot to assure adequate coverage. The CDA treatments covered each plot only once. The experiment starting dates and leafy spurge stage at treatment were: June 26, 1986, flowering and beginning seed set; September 3, 1986, post-seed set and chlorotic leaves; and June 16, 1987, yellow bract to flowering. Plots were 12 by 24 ft arranged in a randomized complete block design with four replications. Evaluations were based on visible percent stand reduction as compared to the control.

Initial leafy spurge control was poor when glyphosate was applied alone, regardless of rate or treatment date (Table). Control improved to over 90% 12 months after treatment (MAT) following a June but not September application. Grass injury was nearly 100% with all glyphosate treatments. Leafy spurge control declined to 50% or less by June 1989 but very little grass had reestablished.

Sulfometuron alone did not control leafy spurge, but control was improved consistently when sulfometuron was applied with glyphosate regardless of rate or treatment date (Table). Leafy spurge control averaged 97% 12 MAT with sulfometuron plus glyphosate at 1 or 2 + 17 oz/A, declined rapidly to 67% the second year after treatment, but remained at 72% in June 1989. However, grass injury remained at 93% 3 yr after application. Leafy spurge control with sulfometuron plus 2,4-D declined rapidly following the 12 month evaluation. Picloram, applied with the CDA at a picloram:water concentration of 1:7 (v/v), provided over 95% leafy spurge control with no grass injury. Control averaged 76% in June 1989 following application in June 1986 but only 40% when applied in September. Several ash trees had some leaf curling after picloram application but no visible permanent damage occurred. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo 58105)

Table. Leafy spurge control under trees (Lym and Messersmith)

Application date and treatment	Rate	Aug 86	May 87		Aug 87		June 88		Aug 88		June 1989	
		Control	Control	Grass injury	Control	Grass injury	Control	Grass injury	Control	Grass injury	Control	Grass injury
	(oz/A)	-----	-----	-----	-----	-----	(%)	-----	-----	-----	-----	-----
June 26, 1986												
Glyphosate	8.5	9	92	88	79	..	46	70	33	71	15	38
Glyphosate	17	41	96	98	94	..	53	89	54	91	21	38
Sulfometuron	0.5	15	0	0	29	..	4	0	26	0	3	0
Sulfometuron	1	9	0	0	19	..	0	0	14	0	0	0
Sulfometuron	2	9	28	15	19	..	4	0	12	10	0	0
Sulfometuron + glyphosate	0.5 + 8.5	13	98	98	90	..	58	63	50	68	63	58
Sulfometuron + glyphosate	1 + 8.5	13	96	99	95	..	75	96	81	95	86	78
Sulfometuron + glyphosate	2 + 8.5	24	99	96	85	..	71	70	66	94	66	58
Picloram (CDA)	1:7[a]	99	95	0	85	..	76	0	79	0	76	0
LSD (0.05)		19	8	14	23	..	28	31	27	24	30	39
September 3, 1986												
Glyphosate	17	..	65	99	54	..	22	98	10	94	5	75
Sulfometuron + glyphosate	2 + 17	..	99	99	89	..	63	99	55	75	72	93
Sulfometuron + 2,4-D	2 + 17	..	69	66	51	..	6	29	1	25	0	15
Picloram (CDA)	1:7[a]	..	86	9	66	..	67	0	57	0	40	0
LSD (0.05)			26	17	31	..	29	21	25	40	32	21
June 16, 1987												
Glyphosate	8.5	..	..	..	13	98	36	89	18	99	..	..
Glyphosate	17	..	..	..	30	98	76	94	36	100	..	..
Sulfometuron + glyphosate	0.5 + 8.5	..	..	..	9	83	21	60	9	88	..	..
Sulfometuron + glyphosate	1 + 8.5	..	..	..	12	86	51	83	31	96	..	..
Sulfometuron + glyphosate	2 + 8.5	..	..	..	36	76	24	87	11	84	..	..
Sulfometuron + 2,4-D	1 + 17	..	..	..	95	48	55	40	46	23	..	..
Sulfometuron + 2,4-D	2 + 17	..	..	..	99	63	41	14	34	51	..	..
Picloram (CDA)	1:7[a]	..	..	..	96	0	80	0	71	0	..	..
LSD (0.05)					12	25	18	20	16	23		

[a] Solution concentration picloram (Tordon 22K):water, and equals 2 lb picloram/8 gal solution.

Fall treatments for field bindweed control. Lym, Rodney G. Field bindweed is a problem weed in North Dakota, especially where minimum till and strip-fallow farming are common. Previous research has shown dicamba provides good field bindweed control the following growing season but may injure barley if applied just prior to freeze-up or at high rates. The purpose of this experiment was to evaluate several herbicides as single and combination treatments for late-season field bindweed control.

The experiment was established on September 8, 1988, on a dense stand of field bindweed near the Ranch Headquarters of the Dickinson (ND) Experiment Station. The herbicides were applied in 6- to 8-inch corn stubble which had been harvested 7 days prior to treatment. The field bindweed was in the vegetative growth stage with 20 to 24 inch long stems and was growing vigorously following several recent rains. However, the plants had been under severe drought stress most of the growing season. The herbicides were applied using a tractor-mounted sprayer delivering 8.5 gpa at 35 psi. All plots were 9 by 30 ft in a randomized complete block design with four replications. The weather was overcast, 45 F, 71% relative humidity with a soil temperature of 52 F at 4 inches. Field bindweed control evaluations were based on a visual estimate of percent stand and seedling establishment reduction as compared to the control on June 14, 1989. The area again was seeded to corn in 1989 and no further evaluations were made.

All herbicides except fluroxypyr provided satisfactory field bindweed control (Table). Field bindweed regrowth control with picloram at 0.13 lb/A increased from 56 to 94% when 2,4-D at 0.5 lb/A was added, but seedling control was similar. Glyphosate + 2,4-D at 0.6 + 1.1 lb/A provided 94% regrowth control but had little effect on seedling establishment. The addition of dicamba or picloram to the glyphosate + 2,4-D mixture did not increase regrowth control but did reduce seedling establishment similarly to dicamba and picloram applied alone. Dicamba + 2,4-D at 0.13 + 0.5 lb/A provided similar control to dicamba alone at 2 lb/A and averaged 85 and 97%, respectively.

Previous research at North Dakota State University has shown dicamba and picloram provide better long-term field bindweed control than glyphosate. Control generally increases with all three of these herbicides when they are applied with 2,4-D especially if picloram or dicamba are applied at low rates to reduce the potential for crop injury. Subsequent crop rotation and size of the infestation must be considered to determine which herbicide combination(s) are most cost-effective for field bindweed control in specific situations. (Published with approval of the Agric. Exp. Stn., North Dakota State Univ., Fargo).

Table. Field bindweed control with several herbicides applied in September

Treatment	Rate-1	Control	
		Regrowth	Seedling
	(lb/A)	--------(%)--------	
Picloram	0.13	56	63
Picloram	0.25	92	87
Picloram + 2,4-D	0.06 + 0.5	60	58
Picloram + 2,4-D	0.13 + 0.5	94	72
Picloram + glyphosate + 2,4-D	0.06 + 0.6 + 1.1	87	62
Picloram + glyphosate + 2,4-D	0.13 + 0.6 + 1.1	97	72
Glyphosate + 2,4-D	0.6 + 1.1	94	36
Dicamba + 2,4-D	0.13 + 0.5	85	73
Fluroxypyr	0.25	14	61
2,4-D	0.5	80	43
Picloram + fluroxypyr	0.13 + 0.13	57	76
Dicamba + glyphosate + 2,4-D	0.13 + 0.6 + 1.1	82	75
Dicamba + glyphosate + 2,4-D	1 + 1.8 + 3.3	96	77
Dicamba + X-77	2 + 0.5%	97	51
LSD (0.05)		24	36

Incorporated clomazone in fallow, Minot 1989. Treatments were applied in 7-inch wheat stubble. Soil type was a loam with pH 5.9 and 2.8% organic matter. Early treatments were applied April 25, 1989 onto slightly moist soil with 68 F air temperature. Incorporated treatments received two passes (opposite directions, 8 mph, 2-inch incorporation depth) with a 26-ft field cultivator/harrow within 2 hours of application. Late treatments were applied May 23 onto dry soil and incorporated within 3 hours as above. All treatments were applied with a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Plot size was 22 by 25 ft and the experiment was a randomized complete block design with four replications and a split plot arrangement of treatments. Four main plots were 1) April 25 application with immediate incorporation 2) April 25 application, May 23 incorporation 3) May 23 application with immediate incorporation 4) April 25 application, no incorporation. Estimates of percentage weed control were taken on May 23, June 26, and July 26. On each evaluation date, the entire experiment was sprayed with glyphosate at 0.75 lb/A or glyphosate&2,4-D (Landmaster II) at 0.75&0.67 lb/A to destroy emerged vegetation.

Herbicide[a]	Rate (lb/A)	Application date	Incorporation date	Evaluated May 23 Ruth	Evaluated May 23 Grft	Evaluated May 23 KOCZ	Evaluated June 26 Grft	Evaluated June 26 Ruth	Evaluated July 26 Grft	Evaluated July 26 Ruth
				(% control)						
Clomazone	0.5	April 25	April 25	63	48	-	91	-	55	41
Clomazone	0.75			73	61	-	96	-	74	72
Clom+Atra	0.5+0.5			88	45	-	92	-	66	83
Trifluralin	1			78	98	-	98	-	96	76
Clomazone	0.5	April 25	May 23	67	27	82	80	63	36	44
Clomazone	0.75			78	29	91	81	77	38	39
Clom+Atra	0.5+0.5			93	27	100	83	91	49	80
Clom+Atra	0.5+0.4			91	28	100	81	84	35	63
Clomazone	0.5	May 23	May 23	-	-	-	72	62	35	21
Clomazone	0.75			-	-	-	86	77	49	53
Clom+Atra	0.5+0.5			-	-	-	86	90	39	71
Trifluralin	1			-	-	-	90	75	95	62
Clom+Atra	0.5+0.5	May 23	None	94	27	100	83	-	43	82
Control	0	-	-	0	0	0	0	0	0	0
LSD (0.05) Herbicides within a tillage				14	14	14	11	11	38	34
C.V. %				12	21	9	9	9	47	39

[a]Atra = dry flowable formulation of atrazine.

Summary. Incorporation improved green foxtail control by clomazone and the early incorporation on April 25 was more effective than the later incorporation of May 23. No treatment provided excellent (greater then 95%) control of all species. Non-incorporated clomazone plus atrazine gave 100% kochia control at the May 23 evaluation. Trifluralin provided 96 to 98% foxtail control when applied on April 25 but slightly lower control (90 to 95%) when applied on May 23. Incorporated clomazone gave between 90 and 96% foxtail control when applied on April 25 and evaluated on June 26; lower foxtail control was observed for other clomazone applications and evaluation dates.

Carryover injury to wheat by clomazone applied in fallow, Minot 1989. Fall and spring treatments were applied October 14, 1987 and May 18, 1988, respectively, in untilled durum stubble using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. 'Seward' winter wheat was seeded 0.5-inch deep (without tillage) on September 23, 1988. Fifty pounds of 11-52-0 was applied in the seed row at planting. Tilled blocks were disked once (4-inches deep) and 'Stoa' spring wheat was seeded 1-inch deep in both tilled and no-till plots on May 3, with fertilizer applied as above. Visual estimates of percent wheat injury and stand reduction were taken on May 23 when spring wheat was 3-leaf and winter wheat was fully tillered and 8 to 12-inches tall. Winter wheat plots were combine harvested on July 29 and spring wheat was harvested August 8, 1989. Plot size was 16.5 by 25 ft. The experiment was a randomized complete block design with a split-plot arrangement of treatments and four reps. Soil type was a loam with pH 6.8 and 2.8% organic matter.

Wheat tillage system	Clomazone application timing	Clomazone rate	Spring wheat[a] Injury	Spring wheat[a] Grain yield	Winter wheat Injury	Winter wheat Stand reduction	Winter wheat Grain yield
		(lb/A)	(%)	(bu/A)	-------(%)-------		(bu/A)
No-till	-	0	0	37	0	31	34
	Fall	0.5	-	-	1	41	33
		0.75	2	37	1	32	35
		1.0	2	36	1	62	32
		1.25	6	36	2	49	30
		1.5	8	34	1	55	30
		2.0	12	32	-	-	-
	Spring	0.5	3	36	-	-	-
		0.75	5	35	-	-	-
		1.0	9	34	-	-	-
		1.25	18	34	-	-	-
		1.5	16	35	-	-	-
		2.0	39	32	-	-	-
			LSD (0.05) Rate		NS	NS	NS
Tilled	-	0	0	42	-	-	-
	Fall	0.75	5	39	-	-	-
		1.0	6	37	-	-	-
		1.25	9	33	-	-	-
		1.5	12	34	-	-	-
		2.0	37	37	-	-	-
	Spring	0.5	3	38	-	-	-
		0.75	22	37	-	-	-
		1.0	20	36	-	-	-
		1.25	30	35	-	-	-
		1.5	45	31	-	-	-
		2.0	63	30	-	-	-
LSD (0.05) Rate x Tillage			12	7			

[a]There was no significant tillage effect for spring wheat grain yield but spring wheat injury was greater on tilled than no-till plots.

Summary. Injury to spring wheat planted in 1989 was greater when clomazone was applied in the spring of 1988 than when applied in the fall of 1987. Injury by clomazone residues in the soil was also greater when spring wheat was planted under tilled versus no-till conditions. Tillage had no significant effect on spring wheat grain yields. Grain yields were reduced by residues from clomazone spring-applied at rates of 1.5 and 2 lb/A and possibly by 1 and 1.25 lb/A. Apparent reductions in by clomazone residues in stand and grain yield of winter wheat were not significant.

Carryover injury to wheat by clomazone applied in fallow, Williston, 1989. Fall and spring treatments were applied October 15, 1987 and May 16, 1988, respectively, in untilled wheat stubble using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Chlorsulfuron (0.25 oz/A) was applied over the entire experimental area on October 16, 1987 for weed control in 1988. 'Seward' winter wheat was seeded 0.5 inches deep (without tillage) on September 23, 1988. Forty pounds of 11-55-0 was applied in the seed row at planting. Tilled blocks were tilled once with a field cultivator (3-inches deep) on May 17, followed on the same day by planting of 'Stoa' spring wheat (1.5 inches deep) in both tilled and no-till plots. Visual estimates of percent injury and stand reductions of winter wheat (fully tillered) were taken on May 22 while spring wheat (3 to 3.5-leaf) was evaluated on June 7. Plots were combine harvested. Plant height was measured and stand reductions were estimated at harvest. Plot size was 16.5 by 25 feet and the experiment was a randomized complete block design with four replications and a split-plot arrangement of treatments. Soil type was a loam with pH 6.2 and 1.8% organic matter.

Clomazone application timing	Clomazone rate	Spring wheat[a]				Winter wheat				
		Injury	Stand red.	Grain yield	Plant ht.	Injury	Stand red. early	Stand red. late	Grain yield	Plant ht.
	(lb/A)	-----(%)----		(bu/A)	(cm)	--------(%)--------			(bu/A)	(cm)
-	0	0	4	5.1	37	0	7	4	19.2	54
Fall	0.5	-	-	-	-	3	37	26	15.2	59
	0.75	19	14	5.8	39	6	55	52	10.4	61
	1.0	27	21	6.3	39	5	68	56	12.2	61
	1.25	36	22	6.8	40	9	62	49	12.9	61
	1.5	56	53	4.7	41	8	78	76	10.2	61
	2.0	62	46	4.8	40	-	-	-	-	-
Spring	0.5	9	12	6.4	38	-	-	-	-	-
	0.75	19	14	6.5	39	-	-	-	-	-
	1.0	27	21	8.1	43	-	-	-	-	-
	1.25	42	29	6.9	39	-	-	-	-	-
	1.5	51	46	6.7	41	-	-	-	-	-
	2.0	63	54	4.7	42	-	-	-	-	-
LSD (0.05)		18	27	NS	NS	4	24	28	NS	NS
C.V., %		38	27	40	11	59	34	36	37	10

[a]Tillage effect was not significant for both injury and grain yield; data are combined across tillage.

Summary. Wheat injury and stand reductions generally increased as clomazone application rate increased. Grain yield reductions attributable to clomazone residues, however, were not observed. Drought conditions were undoubtedly responsible for low yields and probably contributed to the high degree of experimental error.

Carryover injury to wheat by clomazone applied in soybeans, Casselton 1989. Fall and spring treatments were applied October 28, 1987 and May 21, 1988, respectively, using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. All plots were double-pass incorporated (field cultivator, 3-inch tillage depth) immediately after herbicide application except for the minimum till preemergence treatments which received one tillage pass before spraying and no tillage after spraying. 'McCall' soybeans were planted in 22-inch rows on May 24. Soybeans were bulk-harvested early October, 1988. Treatment tillage was done in mid October, 1988 using a moldboard plow (6-inch depth) for plowed plots and a chisel plow (25 to 40% residue remaining) for minimum till plots. On May 8, 1989, the tilled blocks received a single pass with a field cultivator/harrow (4 inch depth). 'Stoa' wheat was planted 1.5 inches deep on May 8 at 90 lbs/A. The entire experimental area received bromoxynil + MCPA (0.25 + 0.25 lb/A) for weed control. Visual estimates of percent wheat injury (yellowing and bleaching of foliage) were taken on May 31 when the crop was 3-leaf and beginning to tiller. Plots were combine harvested on August 8. Plot size was 12.5 by 25 ft and the experiment was a randomized complete block design with four replications and a split-plot arrangement of treatments. Soil type was a Beardon silty clay with pH 8.0 and 5% organic matter.

Clomazone application timing	Clomazone rate	Wheat injury 1989[a]				Wheat grain yield 1989[a]			
			Min. till				Min. till		
		Plow	PPI	Pre	No-till	Plow	PPI	Pre	No-till
	(lb/A)	(%)				(bu/A)			
-	0	0	0	0	0	46	43	39	50
Fall 1987	0.5	-	2	-	-	-	38	-	-
	0.75	-	6	-	-	-	41	-	-
	1.0	-	4	-	-	-	51	-	-
	1.25	-	9	-	-	-	44	-	-
	1.5	-	23	-	-	-	42	-	-
	2.0	-	30	-	-	-	42	-	-
Spring 1988	0.5	19	8	6	7	46	44	46	53
	0.75	31	25	18	13	36	51	46	47
	1.0	53	21	19	18	36	44	43	45
	1.25	64	51	30	45	30	33	46	47
	1.5	75	55	36	27	27	29	46	40
	2.0	81	67	44	60	24	24	39	32
LSD(5%) RatexTillage		14				11			

[a]Tillage effect was significant for wheat injury but not for grain yield; treatment effect was significant for both wheat injury and grain yield.

Summary. Wheat injury from carryover residues of clomazone increased as clomazone rate increased. Grain yields were not affected by clomazone until rates of the herbicide were high enough to produce about 50% visually-estimated injury. Injury and grain yield reductions were greater from spring than from fall clomazone applications. Moldboard plowing before wheat planting produced the greatest crop injury and yield reductions.

Postemergence treatments in fallow, Carrington 1989. Treatments were applied June 1 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzle tips and 40 psi. Conditions at time of application were: Air temp 75 F, relative humidity 40%, wind 5 to 7 mph, partly cloudy, good soil moisture and growing conditions, foxtail (about 60% green and 40% yellow foxtail) was 1 to 4-leaf (1.5 inches and less), and wild buckwheat was cotyledon to 6-leaf (mostly 3 to 4-leaf, 1 to 2 inches tall). Estimates of percentage control were taken June 8 and again on June 14. Plot size was 10 by 25 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Evaluated June 8		Evaluated June 14	
		Foxtail	Wild buckwheat	Foxtail	Wild buckwheat
	(lb/A)	(% control)			
Paraquat+X-77	0.375+0.5%	80	66	69	59
Paraquat+X-77	0.5+0.5%	86	73	75	66
Paraquat+X-77	0.75+0.5%	89	77	69	59
Paraquat+X-77	1+0.5%	91	83	74	77
Paraquat+2,4-D+X-77	0.5+0.25+0.5%	90	83	64	77
Paraquat+2,4-D+X-77	1+0.25+0.5%	87	88	75	85
Paraquat+Dicamba+X-77	0.5+0.125+0.5%	87	72	67	80
Paraquat+Dicamba+X-77	1+0.125+0.5%	84	91	73	96
Paraquat+Atrazine+X-77	0.5+0.25+0.5%	87	67	81	64
Paraquat+Atrazine+X-77	1+0.25+0.5%	93	90	80	88
Glyphosate&2,4-D+AS	0.19&0.17+2.5	56	44	57	80
Glyphosate&2,4-D+AS	0.28&0.25+2.5	79	50	74	80
Glyphosate&2,4-D+AS	0.38&0.34+2.5	86	56	74	75
Glyphosate&2,4-D	0.28&0.25	80	48	51	68
Control	0	0	0	0	0
C.V. %		10	9	20	17
LSD 5%		12	9	NS	18

[a]AS = ammonium sulfate; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb/gal glyphosate plus 0.8 lb/gal 2,4-D; butoxyethyl ester of 2,4-D was used; dry flowable formulation of atrazine was used; X-77 = nonionic surfactant.

Summary. None of the treatments provided complete control of foxtail or wild buckwheat. Control appeared to decrease from the first to the second evaluation. Paraquat performed best when applied at the 1 lb/A rate. Dicamba and 2,4-D seemed to increase control of wild buckwheat provided by paraquat treatments. Ammonium sulfate appeared to increase wild buckwheat control by glyphosate&2,4-D at the second evaluation.

Haloxyfop plus 2,4-D for chemical fallow, Fargo 1989. 'Valley' oats, Siberian foxtail millet, and 'Wheaton' wheat were seeded May 22, 1989. Treatments were applied June 29 using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi with 8001 nozzle tips. Conditions at time of spraying were as follows: 79 F, sunny; 65% relative humidity; wind 8 to 12 mph (shield used); oats 3.5-leaf, 5 inches tall, 1 tiller emerging; foxtail millet 3.5-leaf, 3.5 to 4 inches tall; wheat 4-leaf, 4.5 inches tall, 1 to 2 tillers. Estimates of percentage control were taken on July 15. Plot size was 10 by 18 ft with one third of each plot planted to the three respective species. The experiment was a completely randomized block design having four replications.

Treatment[a]	Rate[a]	Oats	Foxtail millet	Wheat
	(oz/A)	----(%	control)-----	
Haloxyfop+POC	1+0.25G	99	87	98
Haloxyfop+POC	2+0.25G	100	95	99
Haloxyfop+POC	4+0.25G	100	98	100
Glyphosate+X-77	3+0.5%	99	98	99
Glyphosate+X-77	4+0.5%	99	98	99
Haloxyfop+2,4-D-bee+POC	1+8+0.25G	98	70	96
Haloxyfop+2,4-D-bee+POC	2+8+0.25G	100	91	100
Haloxyfop+2,4-D-bee+POC	4+8+0.25G	100	95	100
Haloxyfop+2,4-D-dma+POC	2+8+0.25G	100	89	99
Halx+Clopyralid+2,4-D-dma+POC	2+1.5+8+0.25G	99	88	98
Control	0	0	0	0
C.V. %		1	3	1
LSD 5%		1	4	1

[a]POC = Petroleum oil adjuvant containing 17% emulsifier; 2,4-D-bee = butoxyethyl ester of 2,4-D; 2,4-D-dma = dimethylamine salt of 2,4-D; 0.25G = 0.25 gal/A.

Summary. Addition of 2,4-D ester to haloxyfop caused substantial antagonism of foxtail millet control but only slight if any antagonism was observed on wheat and oats. In comparison with 2,4-D ester, 2,4-D amine did not appear to further reduce grass control by haloxyfop. Haloxyfop at 4 oz/A plus oil adjuvant appeared to be required to give grass control equal to 3 oz/A of glyphosate plus X-77 surfactant.

Post-harvest chemical fallow treatments, Leonard 1989. Treatments were applied August 9 using an ATV-mounted sprayer delivering 8 gpa at 35 psi and 4.5 mph. Environmental conditions at time of spraying (2:30 to 4 pm) were as follows: 89 F air temperature, 20% relative humidity, sunny, very dry soil conditions. Wheat stubble was 5 to 6 inches tall, light density. Wheat had been harvested 5 days earlier. Foxtail (about 60% green and 40% yellow foxtail) was 5 to 8 inches tall, about 30% headed, moderately dense (about 80 plants per m^2), and showing significant drought stress. More than 1 inch of rain fell 4 days after spraying. Russian thistle was 4 to 7 inches tall, spaced at about 0.5 plant per m^2. Visual estimates of percent control were taken on August 29. Plot size was 10 by 40 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Fxtl	Ruth
	(lb/A)	----(%)----	
Paraquat+X77	0.375+0.5%	82	100
Paraquat+X77	0.5+0.5%	86	100
Paraquat+X77	0.75+0.5%	94	100
Paraquat+X77	1+0.5%	99	100
Paraquat+2,4-D+X77	0.375+0.25+0.5%	85	100
Paraquat+2,4-D+X77	0.5+0.25+0.5%	84	100
Paraquat+2,4-D+X77	1+0.25+0.5%	99	100
Paraquat+Dicamba+X77	0.375+0.125+0.5%	83	100
Paraquat+Dicamba+X77	0.5+0.125+0.5%	90	100
Paraquat+Dicamba+X77	1+0.125+0.5%	100	100
Paraquat+Atrazine+X77	0.5+0.25+0.5%	93	100
Paraquat+Atrazine+X77	1+0.25+0.5%	98	100
Glyphosate&2,4-D+AS	0.28&0.25+1.5	71	91
Glyphosate&2,4-D+AS	0.38&0.35+1.5	77	96
Glyphosate&Dicamba+AS	0.28&0.13+1.5	79	87
Glyphosate&Dicamba+AS	0.38&0.17+1.5	89	90
C.V. %		8	3
LSD 5%		11	5

[a]Butoxyethyl ester of 2,4-D was used; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb/gal glyphosate and 0.8 lb/A 2,4-D; Glyphosate&dicamba = Fallowmaster herbicide containing 1.1 lb/gal glyphosate and 0.5 lb/gal dicamba; AS = ammonium sulfate; dry flowable formulation of atrazine was used.

Summary. Foxtail control increased as paraquat rate increased. Complete foxtail control, however, required 1 lb/A of paraquat. Foxtail control by paraquat was not affected by mixing with 2,4-D ester, dicamba, or atrazine. All paraquat treatments provided complete control of Russian thistle. Glyphosate applied at 0.28 or 0.38 lb/A and in package mix combination with either 2,4-D or dicamba provided between 70 and 90% control of foxtail and 90 to 95% Russian thistle control.

Post-harvest chemical fallow treatments, Page 1989. Treatments were applied August 23, 7 days after wheat harvest, using an ATV-mounted sprayer delivering 8 gal/A at 4.5 mph with 80015 nozzle tips and 30 psi. Wheat stubble was 7 inches tall. Conditions at time of application (10 am to noon) were: 78 F air temp, 68% relative humidity, clear skies, wind 5 to 10 mph, moist soil (good growing conditions), green foxtail headed, 6 to 10 inches tall with about 20 to 40 plants/sq yd. Estimates of percentage control were taken on September 7. Plot size was 20 by 40 ft and the experiment was a randomized complete block design having four replications.

Treatment	Rate	Green foxtail control
	(lb/A)	(%)
Paraquat+X-77	0.375+0.5%	89
Paraquat+X-77	0.5+0.5%	95
Paraquat+X-77	0.75+0.5%	95
Paraquat+X-77	1+0.5%	99
Paraquat+2,4-D+X-77	0.375+0.25+0.5%	89
Paraquat+2,4-D+X-77	0.5+0.25+0.5%	96
Paraquat+2,4-D+X-77	1+0.25+0.5%	99
Paraquat+Atrazine+X-77	0.5+0.25+0.5%	96
Paraquat+Atrazine+X-77	1+0.25+0.5%	98
Glyphosate+X-77+AS	0.188+0.5%+1.5	100
Glyphosate+X-77+AS	0.28+0.38%+1.5	100
Glyphosate+X-77+AS	0.375+0.25%+1.5	100
Glyphosate+X-77+AS	0.5+0.19%+1.5	99
Glyphosate&2,4-D+AS	0.28&0.25+1.5	100
Glyphosate&2,4-D+AS	0.38&0.34+1.5	100
Control	0	0
C.V. %		2
LSD 5%		3

[a]X-77 = nonionic surfactant; atrazine dry flowable was used; butoxyethyl ester of 2,4-D was used; AS = ammonium sulfate; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb/gal glyphosate plus 0.8 lb/gal 2,4-D.

Summary. Complete green foxtail control by paraquat was only achieved with the 1 lb/A rate, although 0.5 and 0.75 lb/A paraquat provided 95% control. The addition of 0.25 lb/A of either 2,4-D ester or atrazine did not affect foxtail control with paraquat. All glyphosate treatments gave 100% control of green foxtail.

ZIP 99 for enhancement of glyphosate efficacy, Expt. 1, Fargo 1989. 'Wheaton' wheat was seeded May 9, 1989. Treatments were applied June 6 using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi with 8001 nozzle tips. Conditions at time of spraying were as follows: 80 F; 35% relative humidity; wind 5 to 10 mph (shield used); good growing conditions; wheat 3-leaf, 5 to 6 inches tall, 2 tillers; wild mustard 2 to 5-leaf; kochia 1 to 3 inches tall. Plot size was 10 by 30 ft and the experiment was a randomized complete block design with four replications.

Treatment	Rate	Wheat	Wild mustard	Kochia
	(lb/A)	-----(% control)------		
Glyphosate	0.28	99	100	98
Glyphosate	0.14	92	98	88
Glyphosate+R-11	0.28+0.5%	100	100	98
Glyphosate+R-11	0.14+0.5%	97	100	81
Glyphosate+R-11+AS	0.28+0.5%+1.45	100	100	99
Glyphosate+R-11+AS	0.14+0.5%+1.45	99	99	95
Glyphosate+ZIP99	0.28+0.5%	100	100	99
Glyphosate+ZIP99	0.14+0.5%	95	100	96
Glyphosate&2,4-D	0.28&0.25	99	100	100
Glyphosate&2,4-D	0.14&0.125	95	100	96
Glyphosate&2,4-D+AS	0.28&0.25+1.45	100	100	99
Glyphosate&2,4-D+AS	0.14&0.125+1.45	95	100	94
Glyphosate&2,4-D+ZIP99	0.28&0.25+0.5%	100	100	100
Glyphosate&2,4-D+ZIP99	0.14&0.125+0.5%	93	100	94
Control	0	0	0	0
C.V. %		1	1	3
LSD 5%		2	1	4

[a]R-11 = R-11 surfactant; AS = ammonium sulfate; ZIP99 = surfactant of proprietary composition and containing ammonium sulfate; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb/gal glyphosate plus 0.8 lb/gal 2,4-D.

Summary. R-11 increased control by glyphosate applied at the low rates of 0.14 and 0.28 lb/A. Ammonium sulfate further increased control of wheat and particularly kochia when glyphosate was applied at the 0.14 lb/A rate. ZIP 99 may have been slightly less effective than R-11 plus ammonium sulfate in increasing control of wheat by the low rate of glyphosate and by the low rate of glyphosate&2,4-D.

ZIP 99 for enhancement of glyphosate efficacy, Expt. 2, Fargo 1989. 'Valley' oats, Siberian foxtail millet, and 'Wheaton' wheat were seeded May 22, 1989. Treatments were applied July 6 using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi with 8001 nozzle tips. Conditions at time of spraying were as follows: 79 F, partly cloudy; 45% relative humidity; wind 10 to 15 mph (shield used); oats 5-leaf, 7 inches tall, 2 tillers; foxtail millet 6-leaf, 7 inches tall, 2 tillers; wheat 5-leaf, 6 inches tall, 2 tillers. Estimates of percentage control were taken on July 14. Plot size was 10 by 18 ft with one third of each plot planted to the three respective species. The experiment was a completely randomized block design having four replications.

Treatment[a]	Rate	Oats	Foxtail millet	Wheat
	(lb/A)	-----(% control)-----		
Glyphosate	0.188	85	98	92
Glyphosate	0.094	53	85	54
Glyphosate+R-11	0.188+0.5%	98	100	99
Glyphosate+R-11	0.094+0.5%	79	92	81
Glyphosate+R-11+AS	0.188+0.5%+1.45	97	99	98
Glyphosate+R-11+AS	0.094+0.5%+1.45	86	95	90
Glyphosate+ZIP99	0.188+0.5%	92	99	96
Glyphosate+ZIP99	0.094+0.5%	77	93	82
Glyphosate&2,4-D	0.188&0.16	93	99	94
Glyphosate&2,4-D	0.094&0.081	74	95	75
Glyphosate&2,4-D+AS	0.188&0.16+1.45	94	99	95
Glyphosate&2,4-D+AS	0.094&0.081+1.45	81	97	84
Glyphosate&2,4-D+ZIP99	0.188&0.16+0.5%	92	99	91
Glyphosate&2,4-D+ZIP99	0.094&0.081+0.5%	78	95	76
Control	0	0	0	0
C.V. %		5	2	4
LSD 5%		6	3	5

[a]R-11 = R-11 surfactant; AS = ammonium sulfate; ZIP99 = surfactant of proprietary composition and containing ammonium sulfate; Glyphosate&2,4-D = Landmaster II herbicide containing 0.9 lb/gal glyphosate plus 0.8 lb/gal 2,4-D.

Summary. The addition of R-11 surfactant to glyphosate increased control of oats, foxtail millet, and wheat while the addition of both R-11 and ammonium sulfate generally provided a further increase in control. Similarly, ammonium sulfate tended to increase control provided by glyphosate&2,4-D. ZIP 99 appeared to be slightly less effective in promoting control by glyphosate and glyphosate&2,4-D than was ammonium sulfate.

Longevity of soil-applied BAS-514 in fallow, Fargo 1989. Experiment was established on an untilled sight with light weed and crop residue and a silty clay soil with pH 7.9 and 4.5% organic matter. Fall (F) treatments were applied October 26, 1988 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Spring (S) treatments were applied May 1, 1989. A few kochia (0.25 to 0.38 inch tall) and wild buckwheat (cotyledon) were present on May 1. Estimates of percentage weed control were taken on June 5, and July 13 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 existing vegetation. Each evaluation thus represents weeds that emerged after the previous evaluation. Plot size was 20 by 30 ft and the experiment was a randomized complete block design with four replications.

Treatment	Rate	Evaluated June 5					Evaluated July 13	
		Wibw	Prle	Colq	KOCZ	Yeft	Yeft	KOCZ
	(lb/A)	(% control)						
BAS-514(F)	1	19	99	78	95	99	85	100
BAS-514(F)	1.5	24	99	83	98	99	94	100
BAS-514(F)	2	35	100	89	97	100	99	100
BAS-514(S)	1	19	99	85	90	96	85	100
BAS-514(S)	1.25	13	100	76	92	99	87	100
BAS-514(S)	1.5	7	99	82	93	96	85	100
BAS-514(S)	2	23	99	76	94	97	89	100
BAS-514+Atrazine(S)	1+0.5	100	95	99	100	98	78	100
BAS-514+Atrazine(S)	1.25+0.5	83	96	100	100	99	83	100
BAS-514+Atrazine(S)	1.5+0.5	99	96	100	100	99	89	100
BAS-514+Atra+Clom(S)	1+0.5+0.5	100	100	100	100	100	87	100
BAS-514+Atra+Clom(S)	1.25+0.5+0.5	100	100	100	100	100	83	100
BAS-514+Atra+Clom(S)	1.5+0.5+0.5	100	100	100	100	100	89	100
Clomazone+Atrazine(S)	0.5+0.5	100	100	98	100	90	46	100
Control	0	0	0	0	0	0	0	0
C.V. %		21	4	11	5	3	12	0
LSD 5%		17	5	13	6	4	14	0

[a]Atrazine dry flowable formulation was used; BAS-090 adjuvant at 1 quart/A was added to all spring treatments.

Summary. Yellow foxtail control evaluated on June 5 was near 100% for all treatments except clomazone plus atrazine. Foxtail control evaluated in July, however, typically ranged between 85 and 90% for BAS-514 treatments. Complete foxtail control at the late evaluation required 2 lb/A of BAS-514 applied the previous fall. All treatments provided nearly complete control of prickly lettuce. BAS-514 did not control wild buckwheat but treatments involving clomazone plus atrazine gave complete control. Kochia control at the July evaluation was 100% for all treatments. All treatments involving atrazine gave complete kochia control at the June evaluation while control by BAS-514 ranged between 70 and 90%. This inadequate kochia by BAS-514 was attributed to the presence at application time of a few emerged plants which were injured but not killed.

Longevity of soil-applied BAS-514 in fallow, Leonard 1989. Experiment was established in standing wheat stubble on a sandy loam soil with pH 8.2 and 2.3% organic matter. Fall (F) treatments were applied October 26, 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 May 25, June 22, and July 28 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 existing vegetation. Each evaluation thus represents weeds that emerged after the previous evaluation. Plot size was 20 by 30 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Evaluated May 25			Eval. June 22	Eval. July 28
		Fxtl	Colq	Ruth	Fxtl	Fxtl
	(lb/A)	(% control)				
BAS-514(F)	0.75	88	91	98	66	36
BAS-514(F)	1	90	92	98	70	49
BAS-514(F)	1.5	97	92	100	88	74
BAS-514(S)	0.5	70	78	84	99	86
BAS-514(S)	0.75	77	86	91	100	93
BAS-514(S)	1	78	80	82	100	94
BAS-514(S)	1.25	86	90	92	100	98
BAS-514(S)	1.5	86	94	94	100	100
BAS-514+Atrazine(S)	0.75+0.5	77	99	86	100	99
BAS-514+Atrazine(S)	1+0.5	71	97	93	99	95
BAS-514+Atrazine(S)	1.25+0.5	78	97	91	100	96
BAS-514+Atra+Clom(S)	0.75+0.5+0.5	84	99	91	99	97
BAS-514+Atra+Clom(S)	1+0.5+0.5	90	99	97	100	100
BAS-514+Atra+Clom(S)	1.25+0.5+0.5	96	99	91	100	100
Clomazone+Atrazine(S)	0.5+0.5	94	99	97	79	73
Control	0	0	0	0	0	0
C.V. %		10	7	7	7	17
LSD 5%		12	10	9	9	20

[a]Dry flowable formulation of atrazine was used; BAS-090 adjuvant at 1 qt/A was applied with all treatments.

Summary. Fall applications of BAS-514 gave complete Russian thistle control but spring applications were not as effective. Common lambsquarter control was not adequate with BAS-514 alone while treatments involving atrazine or atrazine plus clomazone gave essentially complete control. With both Russian thistle and common lambsquarters, incomplete control by spring-applied BAS-514 was attributed to the presence at application time of a few emerged plants which were injured but not killed. At the early evaluation, foxtail (about 60% green and 40% yellow foxtail) control by BAS-514 alone was better when fall-applied than when spring-applied. At the June and July evaluations, foxtail control by fall-applied BAS-514 had declined substantially while spring applications provided excellent control. BAS-514 at 1.25 lb/A (spring-applied) was required to give essentially complete foxtail control. Foxtail control evaluated in May was 94% for clomazone plus atrazine but declined to 73% by the late July evaluation.

Longevity of soil-applied BAS-514 in fallow, Minot 1989. 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 existing vegetation. Each evaluation thus represents weeds that emerged after the previous evaluation. Plot size was 20 by 30 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate	Evaluated May 28						Eval 6/26	Evaluated July 26				
		KOCZ	Wioa & Vowh	Colq	Tamu	Fipe	Ruth	Fxtl	Fxtl	Rrpw	KOCZ	Colq	Ruth
	(lb/A)	(% control)											
BAS-514(F)	1	96	0	96	0	0	100	80	60	97	89	92	99
BAS-514(F)	1.5	99	19	100	0	0	100	90	82	95	98	97	100
BAS-514(F)	2	99	22	100	0	10	100	93	79	97	98	100	100
BAS-514(S)	0.75	96	0	89	0	0	100	100	96	98	100	100	100
BAS-514(S)	1	95	0	90	0	0	100	100	99	99	99	100	100
BAS-514(S)	1.25	92	0	77	7	0	99	100	99	100	99	100	100
BAS-514(S)	1.5	92	0	79	0	0	100	100	100	100	100	100	100
BAS-514+Atrazine(S)	0.75+0.5	100	9	100	53	82	99	100	98	100	100	100	100
BAS-514+Atrazine(S)	1+0.5	100	0	100	44	78	100	100	98	100	100	100	100
BAS-514+Atrazine(S)	1.25+0.5	100	0	100	49	69	99	100	99	100	100	100	100
BAS514+Atra+Clom(S)	0.75+0.5+0.5	100	89	100	85	100	100	100	98	100	100	100	100
BAS514+Atra+Clom(S)	1+0.5+0.5	100	82	100	56	100	100	100	100	100	100	100	100
BAS514+Atra+Clom(S)	1.25+0.5+0.5	100	79	100	77	100	100	100	100	100	100	100	100
Clomazone+Atrazine(S)	0.5+0.5	100	68	99	73	100	100	85	85	100	100	100	100
Control	0	0	0	0	0	0	0	0	0	0	0	0	0
C.V. %		3	67	9	51	20	1	4	5	1	3	2	1
LSD 5%		5	25	12	23	13	NS	6	7	2	5	3	NS

[a]Dry flowable formulation of atrazine was used; methylated seed oil adjuvant containing 17% emulsifier ('Sun-It') was added to all spring treatments.

Summary. Kochia control from BAS-514 was excellent but supplemental atrazine was required for complete control at the May evaluation. Similar results were obtained with common lambsquarters. With both kochia and common lambsquarters, incomplete control provided by spring-applied BAS-514 was attributed to the presence at application time of a few emerged plants which were injured but not killed. Russian thistle was controlled by all treatments. Field pennycress was partially controlled by atrazine but combinations of atrazine plus clomazone gave complete control. Complete or nearly complete control of redroot pigweed was achieved by all treatments. Spring-applied BAS-514 gave essentially complete control of foxtail (mostly green with some yellow foxtail) through the July 26 evaluation while clomazone plus atrazine provided 85% control of these species.

Longevity of soil-applied BAS-514 in fallow, Carrington 1989. 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 completely control all existing vegetation. Each evaluation thus represents weeds that emerged after the previous evaluation. Plot size was 20 by 30 ft and the experiment was a randomized complete block design having four replications.

		Evaluated June 1						Eval 6/27	Evaluated August 22	
Treatment[a]	Rate	Fxtl	Wimu	KOCZ	Ruth	Colq	Wibw	Fxtl	Fxtl	Rrpw
	(lb/A)	(% control)								
BAS514(F)	1	100	23	97	100	98	28	99	86	52
BAS514(F)	1.5	100	38	100	100	100	29	100	96	84
BAS514(F)	2	100	57	100	100	100	34	100	95	94
BAS514(S)	0.75	100	27	96	94	100	20	99	89	75
BAS514(S)	1	99	20	94	98	98	29	100	96	70
BAS514(S)	1.25	100	29	96	98	98	28	100	99	88
BAS514(S)	1.5	100	22	98	99	100	30	100	98	87
BAS514+Atrazine(S)	0.75+0.5	99	97	100	100	100	100	100	92	99
BAS514+Atrazine(S)	1+0.5	100	97	100	99	100	87	100	94	100
BAS514+Atrazine(S)	1.25+0.5	100	99	100	100	100	93	100	98	100
BAS514+Atra+Clom(S)	0.75+0.5+0.5	100	99	100	99	100	100	100	92	100
BAS514+Atra+Clom(S)	1+0.5+0.5	100	99	100	100	100	100	96	93	100
BAS514+Atra+Clom(S)	1.25+0.5+0.5	100	99	100	100	100	100	100	99	100
Clomazone+Atrazine(S)	0.5+0.5	95	99	100	100	100	100	87	75	98
C.V. %		0	21	2	3	2	15	3	7	12
LSD 5%		1	19	3	NS	NS	14	5	10	15

[a]Dry flowable formulation of atrazine was used.

Summary. Fall applications of BAS-514 provided complete Russian thistle and kochia control. Incomplete control of these species by spring-applied BAS-514 was attributed to the presence at application time of a few emerged plants which were injured but not killed. Mixtures involving atrazine gave complete control of kochia and Russian thistle. BAS-514 gave poor control of wild mustard but the addition of atrazine increased control to near 100%. All treatments gave complete or nearly complete common lambsquarter control. Complete wild buckwheat control was achieved only with mixtures involving clomazone. Redroot pigweed emerging after the July 27 evaluation was controlled up to about 90% by BAS-514 while treatments involving atrazine gave 100% control. BAS-514 at all rates gave complete control of foxtail (mostly green with some yellow foxtail) at the June and July evaluations but 1.25 lb/A of BAS-514 was required for complete foxtail control at the August evaluation. Foxtail control by clomazone plus atrazine was 95% in early June and declined in later evaluations.

<u>Longevity of soil-applied BAS-514 in fallow, Devil's Lake 1989</u>. Experiment was established in standing barley stubble on a clay loam soil with pH 7.6 and 4.0% organ-ic matter. Fall (F) treatments were applied October 26, 1988 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 35 psi. Spring (S) treatments were applied April 21, 1989. Estimates of percentage weed control were taken on June 14 when weeds in the check strips between plots were 6 to 12 inches tall. Plot size was 20 by 30 ft and the experiment was a randomized complete block design hav-ing four replications.

Treatment[a]	Rate	Weed control				
		Grft	KOCZ	Wibw	Wioa	Prpw
	(lb/A)	(%)				
BAS-514(F)	1	95	51	13	6	0
BAS-514(F)	1.5	100	81	13	13	15
BAS-514(F)	2	99	90	14	16	21
BAS-514(S)	0.75	88	73	33	20	24
BAS-514(S)	1	94	35	29	5	20
BAS-514(S)	1.25	99	65	13	13	23
BAS-514(S)	1.5	95	74	8	0	23
BAS-514+Atrazine(S)	0.75+0.5	90	91	55	23	48
BAS-514+Atrazine(S)	1+0.5	98	93	56	20	51
BAS-514+Atrazine(S)	1.25+0.5	94	89	28	0	44
BAS-514+Atra+Clom(S)	0.75+0.5+0.5	99	99	93	35	78
BAS-514+Atra+Clom(S)	1+0.5+0.5	99	100	94	30	84
BAS-514+Atra+Clom(S)	1.25+0.5+0.5	100	100	97	66	80
Clomazone+Atrazine(S)	0.5+0.5	69	99	100	45	81
Control	0	0	0	0	0	0
C.V. %		5	24	63	129	89
LSD 5%		7	29	41	NS	54

[a]Dry flowable formulation of atrazine was used.

<u>Summary</u>. None of the treatments provided acceptable control of wild oats or pros-trate pigweed. Greater than 95% wild buckwheat control was achieved only by treat-ments with atrazine plus clomazone. BAS-514 did not provide kochia control adequate for a fallow situation. Kochia control greater than 95% was observed only with treatments involving clomazone. Green foxtail control exceeding 95% was provided by BAS-514 at 1 lb/A when applied alone or with atrazine; BAS-514 at 0.75 lb/A, howev-er, gave nearly complete green foxtail control when mixed with clomazone plus atra-zine. Clomazone plus atrazine gave only 70% control of green foxtail.

Fall and early spring BAS-514 in fallow, Williston 1989. Fall (F) and spring (S) treatments were applied October 19, 1988 and April 24, 1989, respectively, using a bicycle wheel sprayer delivering 17 gal/A at 40 psi with 8002 nozzles. Treatments were applied in standing wheat stubble on a loam soil with pH 6.3 and 1.1% organic matter. Estimates of percentage weed control were taken on June 7. The entire experimental area was mowed on June 9 to destroy a heavy infestation of tansy mustard. Percentage weed control was again evaluated on July 13. Plot size was 11 by 25 ft and the experiment was a randomized complete block design with four replications.

		Eval. June 7			Evaluated July 13				
Treatment	Rate	Ruth	KOCZ	Tamu	Ruth	KOCZ	Ftba	Tamu	Grft
	(lb/A)	(% control)							
BAS-514(F)	1	99	98	17	99	94	67	23	97
BAS-514(F)	1.25	100	100	24	98	95	78	69	91
BAS-514(F)	1.5	99	100	38	98	99	70	52	95
BAS-514+Atrazine(F)	0.75+0.625	100	100	58	65	73	56	62	40
BAS-514+Atrazine(F)	1+0.625	100	100	91	95	98	55	92	85
BAS-514+Atrazine(F)	1.25+0.625	100	100	95	98	99	65	98	93
BAS-514+Atrazine(F)	1.5+0.625	100	100	93	99	99	87	96	96
BAS-514+Clomazone+Atra(F)	0.75+0.75+0.625	100	100	100	90	97	62	99	83
BAS-514+Clomazone+Atra(F)	1+0.75+0.625	100	100	100	99	100	54	100	87
BAS-514+Clomazone+Atra(F)	1.25+0.75+0.625	100	100	100	99	100	81	100	95
BAS-514+Clomazone+Atra(F)	1.5+0.75+0.625	100	100	100	99	100	88	99	94
BAS-514(S)	0.75	47	50	4	34	30	28	20	58
BAS-514(S)	1	45	51	4	63	59	31	38	86
BAS-514(S)	1.25	48	52	4	71	73	66	20	95
BAS-514+Atrazine(S)	0.75+0.5	69	97	18	61	88	56	40	95
BAS-514+Atrazine(S)	1+0.5	45	87	44	40	76	40	47	89
BAS-514+Atrazine(S)	1.25+0.5	64	94	28	63	86	41	65	95
BAS-514+Clomazone+Atra(S)	0.75+0.5+0.5	89	100	46	71	97	72	53	73
BAS-514+Clomazone+Atra(S)	1+0.5+0.5	92	100	42	88	98	95	64	99
BAS-514+Clomazone+Atra(S)	1.25+0.5+0.5	90	100	53	73	96	77	53	98
Clomazone+Atrazine(S)	0.5+0.5	94	100	53	82	99	76	48	65
Control	0	0	0	0	0	0	0	0	0
C.V. %		14	8	34	29	22	43	38	25
LSD 5%		17	10	25	32	26	38	33	29

[a]Dry flowable formulation of atrazine was used; a methylated seed oil adjuvant containing 17% emulsifier ('Sun-It') was added to all treatments at 1 quart/A.

Summary. Fall applications of BAS-514 gave excellent control of kochia and Russian thistle but spring applications provided poor control. The addition of atrazine to BAS-514 improved control of kochia and tansy mustard. Further addition of clomazone to BAS-514 plus atrazine improved control of kochia and Russian thistle. Green foxtail control was only achieved with higher rates of BAS-514 with or without atrazine or atrazine plus clomazone.

Herbicide-insecticide tank mixes in wheat, Fargo 1989. 'Wheaton' wheat was seeded on April 28, 1989 at 90 lbs per acre. Treatments were applied June 9 using a bicycle wheel sprayer delivering 8.5 gallons per acre at 40 psi. Conditions at time of spraying were as follows: sunny skies, 68 F, 35% relative humidity, 8 to 9-inch-tall wheat with 4 leaves on the main stem and 2 to 3 tillers. Wheat injury was estimated on June 19 and included stunting, and some leaf burn. Chlorpyrifos + 2,4-D plots also showed chlorosis ("yellowing"). The entire experiment was sprayed on June 23 (wheat in early boot) with thiameturon at 0.38 oz ai per acre plus AG98 surfactant at 0.25% for kochia control. Plots were machine-harvested on August 1. Plot size was 10 by 25 ft and the experiment was a randomized complete block design with four replications.

Treatment[a]	Rate	Wheat injury	Grain yield
	(oz/A)	(%)	(Bu/A)
Clopyralid&2,4-D	1.5&8	4	31
Clopyralid&2,4-D+Chlorpyrifos	1.5&8+8	12	34
Clopyralid+Chlorpyrifos	1.5+8	2	31
2,4-D-dma+Chlorpyrifos	8+8	13	41
Chlorpyrifos	8	1	33
Disulfoton	12	0	36
Dimethoate	6	0	33
AC 222,293	7.5	7	31
AC 222,293+Chlorpyrifos	7.5+8	6	38
Control	0	1	37
C.V. %		41	15
LSD 5%		3	NS

[a]Clopyralid&2,4-D = package mix containing 0.4 lbs/gal clopyralid plus 2.1 lbs/gal 2,4-D (called 'Curtail'); Chlorpyrifos = 'Lorsban 4E'.

Summary. None of the insecticides alone caused wheat injury. Stunting and yellowing of wheat was observed when 2,4-D and chlorpyrifos were applied together. AC 222,293 caused a low level of wheat injury with or without a tank-mix with chlorpyrifos. None of the treatments significantly reduced grain yield.

ICIA5676 for weed control in no-till corn, Fargo 1989. Early preplant (EPP) treatments were applied May 2, 1989 using a bicycle wheel sprayer delivering 17 gal/A with 8002 nozzles and 40 psi. Previous year's crop residue was very light with much bare soil exposed. 'Interstate 201' corn was seeded on May 15 at 2 inches deep and about 22,000 seeds per acre using a Hiniker no-till planter on 30-inch rows. Preemergence (Pre) treatments were applied May 17 prior to significant rainfall occurring later that day. Glyphosate&dicamba (Fallowmaster herbicide), supplying 0.5 lb/A of glyphosate and 0.2 lb/A dicamba, was applied over the entire experiment on May 16 for control of emerged vegetation. Estimates of percentage corn injury were taken on May 29 when corn was 2 to 3-leaf. On June 20 when the corn was about 12 inches tall, the number of plants in the two center rows (representing the treated area) was counted. Soil type was a silty clay with pH 7.8 and 4% organic matter. Plot size was 10 by 26 ft and the experiment was a randomized complete block design having four replications.

Treatment[a]	Rate[a]	Corn injury	Corn population
	(lb/A)	(%)	(Plts/A)
ICIA5676(EPP)	1.75	0	22,100
ICIA5676(EPP)	2	0	21,500
ICIA5676(EPP)	2.5	0	22,500
ICIA5676+ATS(EPP)	1.75+4G	0	22,100
Alachlor(EPP)	2	0	21,900
Metolachlor(EPP)	2	0	22,300
ICIA5676(Pre)	1.75	0	22,200
ICIA5676(Pre)	2	0	22,500
ICIA5676(Pre)	2.5	0	21,800
ICIA5676+ATS(Pre)	1.75+4G	0	20,600
Alachlor(Pre)	2	0	20,900
Metolachlor(Pre)	2	0	21,400
Control	0	0	20,600
C.V. %		0	8
LSD 5%		NS	NS

[a]ATS = ammonium thiosulfate; G = gal/A.

Summary. None of the treatments caused observable corn injury or reductions in corn plant population.

Effect of corn growth stage on injury by DPX-M6316-insecticide tank mixes, Fargo. 'Interstate 201' corn was seeded in 30-inch rows on May 15 in a silty clay soil with 5% organic matter. Ammonium nitrate was applied on June 10 at 100 lb N/A. Metolachlor at 2 lb/A was applied on May 16 over the entire experimental area for foxtail control. Other weeds were controlled by hand-weeding. Two-leaf corn was sprayed June 1 with 70 F and 52% relative humidity (RH). Four-leaf, 7-leaf, and 10-leaf corn was sprayed June 9 with 58 F and 62% RH, June 19 with 84 F and 42% RH, and June 26 with 74 F and 41% RH, respectively. All treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi. Visual estimates of percentage corn injury were taken 12 days after each application (first evaluation) which corresponded to June 13, June 21, July 1, and July 8 for 2-leaf, 4-leaf, 7-leaf, and 10-leaf stages, respectively. A second evaluation of corn injury was taken on July 28. The three center rows of plots from selected treatments were hand-harvested at maturity and grain yields were adjusted to 15.5% moisture. Plot size was 10 by 27 ft and the experiment was designed as a randomized complete block with four replications.

Summary. DPX-M6316 did not injure corn when applied at the 2, 4, or 7-leaf stages, but caused substantial injury when applied to 10-leaf corn. Chlorpyrifos or carbaryl insecticides did not injure corn when applied alone. Chlorpyrifos applied in tank-mix combination with DPX-M6316 caused considerable corn injury at all growth stages. Corn yield reductions due to drought probably masked treatment effects on yield. Corn injured by application at the 7 and 10-leaf growth stages did not recover fully and late-season visual observations of these treatments indicated that yield reductions would be expected.

See next page for data

Treatment[a]	Rate	Corn injury First evaluation	Corn injury Second evaluation	Grain yield
	(oz/A)	----------(%)---------		(bu/A)
DPX-M6316(2-leaf)	0.0625	0	0	-
DPX-M6316(2-leaf)	0.125	0	0	-
DPX-M6316(2-leaf)	0.25	0	0	-
DPX-M6316+Chlorpyrifos(2-leaf)	0.0625+8	28	1	-
DPX-M6316+Chlorpyrifos(2-leaf)	0.125+8	42	5	-
DPX-M6316+Chlorpyrifos(2-leaf)	0.25+8	44	12	-
DPX-M6316+Carbaryl(2-leaf)	0.0625+8	0	2	-
DPX-M6316+Carbaryl(2-leaf)	0.125+8	1	0	-
DPX-M6316+Carbaryl(2-leaf)	0.25+8	2	2	-
Chlorpyrifos(2-leaf)	8	0	0	-
Carbaryl(2-leaf)	8	0	0	-
DPX-M6316(4-leaf)	0.0625	0	0	-
DPX-M6316(4-leaf)	0.125	0	0	-
DPX-M6316(4-leaf)	0.25	0	0	-
DPX-M6316+Chlorpyrifos(4-leaf)	0.0625+8	16	3	52.8
DPX-M6316+Chlorpyrifos(4-leaf)	0.125+8	35	4	-
DPX-M6316+Chlorpyrifos(4-leaf)	0.25+8	62	12	41.3
DPX-M6316+Carbaryl(4-leaf)	0.0625+8	0	0	-
DPX-M6316+Carbaryl(4-leaf)	0.125+8	0	0	-
DPX-M6316+Carbaryl(4-leaf)	0.25+8	0	0	-
Chlorpyrifos(4-leaf)	8	0	0	-
Carbaryl(4-leaf)	8	0	0	-
DPX-M6316(7-leaf)	0.0625	0	0	-
DPX-M6316(7-leaf)	0.125	0	0	-
DPX-M6316(7-leaf)	0.25	0	0	-
DPX-M6316+Chlorpyrifos(7-leaf)	0.0625+8	11	3	32.8
DPX-M6316+Chlorpyrifos(7-leaf)	0.125+8	64	25	41.2
DPX-M6316+Chlorpyrifos(7-leaf)	0.25+8	64	20	-
DPX-M6316+Carbaryl(7-leaf)	0.0625+8	0	0	-
DPX-M6316+Carbaryl(7-leaf)	0.125+8	0	0	-
DPX-M6316+Carbaryl(7-leaf)	0.25+8	0	0	-
Chlorpyrifos(7-leaf)	8	0	0	-
Carbaryl(7-leaf)	8	0	0	-
DPX-M6316(10-leaf)	0.0625	4	1	-
DPX-M6316(10-leaf)	0.125	22	6	-
DPX-M6316(10-leaf)	0.25	63	41	-
DPX-M6316+Chlorpyrifos(10-leaf)	0.0625+8	71	57	-
DPX-M6316+Chlorpyrifos(10-leaf)	0.125+8	74	44	-
DPX-M6316+Chlorpyrifos(10-leaf)	0.25+8	76	92	-
DPX-M6316+Carbaryl(10-leaf)	0.0625+8	8	5	-
DPX-M6316+Carbaryl(10-leaf)	0.125+8	28	13	-
DPX-M6316+Carbaryl(10-leaf)	0.25+8	63	38	-
Chlorpyrifos(10-leaf)	8	0	0	-
Carbaryl(10-leaf)	8	0	0	-
Control	0	0	0	43.3
C.V. %		24	70	30
LSD 5%		6	8	NS

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

Burndown treatments for no-till soybeans, Fargo 1989. Treatments were applied 8:30 am on June 3 when the sky was sunny, air temp was 65 F, wind was calm, relative humidity was 40%, soil was moist beneath the surface, wild buckwheat was 3 to 4 inches tall, wild oats were 3 to 4-leaf, and prickly lettuce ranged to 12 inches tall. Treatments were applied using a bicycle wheel sprayer delivering 17 gal/A (high carrier volume used because of dense weed canopy) using 8002 nozzle tips at 40 psi. Following herbicide treatment, 'McCall' soybeans were seeded 1.5 inches deep in 30-inch rows using a Hiniker no-till planter. Visual estimates of crop injury and weed control were taken June 23. The experiment was a randomized complete block design having four replications.

Treatment[a]	Rate[a]	Soybean injury	Weed control Wibw	KOCZ	Prle	Wioa	Colq
	(lb/A)	(%)					
Sethoxydim+2,4-D+Dash	0.1+0.5+0.25G	0	61	89	85	93	97
Seth+Acif+2,4-D+Dash	0.1+0.188+0.5+0.25G	0	93	100	99	84	100
Acifluorfen+2,4-D+Dash	0.188+0.5+0.25G	0	92	97	100	17	99
BAS562-16H+2,4-D+Dash	0.1+0.5+0.25G	0	71	98	88	96	98
BAS562-16H+Acif+2,4-D+Dash	0.1+0.188+0.5+0.25G	0	90	99	100	94	99
Glyphosate+AS+X-77	0.25+2.5+0.25%	0	75	99	98	100	96
Glyphosate+AS+X-77	0.375+2.5+0.25%	0	77	98	98	100	100
Glyphosate&2,4-D+AS	0.25&0.22+2.5	0	85	100	92	100	100
Paraquat+X-77	0.375+0.5%	0	10	97	79	47	79
Paraquat+X-77	0.5+0.5%	0	26	97	98	78	87
Control	0	0	0	0	0	0	0
C.V. %		0	16	3	5	11	6
LSD 5%		NS	16	5	7	13	8

[a]Dash = BASF adjuvant of proprietary composition; butoxyethyl ester of 2,4-D was used; AS = ammonium sulfate; Glyphosate&2,4-D = Landmaster II herbicide; X-77 = nonionic surfactant from Valent.

Summary. None of the treatments injured soybeans. Best wild buckwheat control was only about 93% and was achieved with mixtures involving 2,4-D, Dash, and 0.188 lb/A acifluorfen. Nearly all treatments gave complete control of kochia. Wild oats were completely controlled by treatments involving glyphosate. Wild oat control from 93 to 96% provided by BAS562-16H and sethoxydim was probably commercially acceptable since the surviving plants were greatly injured and would likely not compete with the establishing soybean crop. Complete or nearly complete common lambsquarters control was provided by all treatments except paraquat.

Early preplant imazethapyr and cyanazine in no-till soybeans, Minot 1989. Early preplant (EPP) treatments were applied April 25 onto standing triticale stubble using a bicycle wheel sprayer delivering 17 gal/A at 40 psi with 8002 nozzle tips. A low density of 0.25-inch-tall kochia was present. The entire experimental area was treated with glyphosate at 1.5 lb/A on May 22 to control existing vegetation. Estimates of percentage weed control were taken on May 23 prior to planting. 'McCall' soybeans were seeded 1.5 inches deep in 30-inch rows using a Buffalo Till planter and a seeding rate of 175,000 seeds per acre. Preemergence (Pre) treatments were applied on May 23 immediately after planting. Estimates of percentage foxtail (about 70% green and 30% yellow foxtail) control were taken on June 26 and the entire experimental area was sprayed on June 30 with sethoxydim at 0.2 lb/A plus 1 qt/A oil adjuvant for control of wild oats and foxtail. Broadleaf weed control was estimated on July 14. Plots were machine harvested on October 4 and grain yields were adjusted to 12% moisture. Plot size was 10 by 26 ft and the experiment was a randomized complete block design with four replications.

		Eval 5/23		Eval 6/26	Evaluated 7/14					
Treatment[a]	Rate[a]	KOCZ	Colq	Fxtl	KOCZ	Colq	Ruth	Sobe inj	Plt ht	Grain yield
	(lb/A)	(%)							(cm)	(bu/A)
Imazethapyr(EPP)	0.047	99	99	94	93	99	99	0	52	13.6
Imazethapyr(EPP)	0.063	100	100	98	99	100	99	0	55	16.6
Imazethapyr(EPP)	0.078	100	100	96	99	100	99	0	52	15.4
Imazethapyr+ATS(EPP)	0.047+4G	100	100	97	96	100	95	0	58	16.2
Imazethapyr+Pend(EPP)	0.047+1	99	100	98	94	100	97	0	53	15.1
Imazethapyr+Pend(EPP)	0.047+1.5	100	100	99	99	100	99	0	54	15.3
Cyanazine+Pend(EPP)	1.25+1.25	100	100	85	97	70	18	0	46	9.9
Cyanazine+Pend(EPP)	1.5+1.5	99	100	90	99	79	15	0	55	14.0
Cyanazine+Pend(EPP)	2+2	100	100	96	96	89	86	0	56	15.6
Cyan+Pend+ATS(EPP)	1.25+1.25+4G	99	100	87	93	62	10	0	42	7.9
Cyan+Oryzalin(EPP)	1.5+1.25	98	99	84	94	56	38	0	47	15.7
Imazethapyr(Pre)	0.047	-	-	89	75	100	84	0	51	15.9
Imazethapyr(Pre)	0.063	-	-	94	53	97	97	0	57	14.4
Imazethapyr(Pre)	0.078	-	-	93	84	99	80	0	56	15.3
Imazethapyr+Pend(Pre)	0.047+1	-	-	95	76	99	96	0	50	13.2
Imazethapyr+Pend(Pre)	0.047+1.5	-	-	97	69	100	98	0	56	15.4
Control	0	-	-	0	0	0	0	0	32	2.7
C.V. %		2	1	4	19	10	25	0	14	28.3
LSD 5%		NS	NS	5	24	13	26	NS	10	5.5

[a] Cyanazine dry flowable formulation was used; ATS = ammonium thiosulfate; early preplant treatment were mixed with R-11 surfactant at 0.5% because of a few kochia emerged at time of spraying.

Summary. All early preplant treatments gave complete control of kochia and common lambsquarters when evaluated at planting time. Foxtail control estimates on June 26 indicated that EPP applications of imazethapyr gave better control than did preemergence applications. At the July 15 evaluation, EPP imazethapyr gave superior kochia and Russian thistle control compared to Pre applications, while common lambsquarter control was 100% for EPP and Pre treatments. EPP cyanazine treatments gave nearly complete kochia control at the July evaluation, although control of common lambsquarters was less effective and Russian thistle control was poor. None of the treatments injured soybeans. Where low rates of cyanazine plus pendimethalin were used, grain yields were reduced because of poor Russian thistle control.

Total postemergence weed control in soybeans, Fargo 1989. 'McCall' soybeans were planted June 3 in 30-inch rows. Early postemergence (P1) treatments were applied at 3:00 pm June 29 when air temp was 88 F, relative humidity was 65%, wind 6 to 10 mph, sky was sunny, soybeans were 1 to 2-trifoliolate (4 to 5 inches tall), redroot pigweed was 4 to 6-leaf (1.5 to 3 inches tall), common lambsquarters was 4 to 10-leaf (1 to 3 inches tall), and yellow foxtail was 5 to 6-leaf (5 to 7 inches tall) with 2 tillers. Soil conditions were dry. Treatments without a split application were sprayed on June 3. Split application treatments received a second application (P2) on July 5 when air temp was 98 F, relative humidity 36%, wind 5 to 10 mph, sky was sunny, soybeans were 3 to 4 trifoliolate (5 to 7 inches tall), redroot pigweed was 8 to 10-leaf (5 to 8 inches tall), common lambsquarters was 8 to 12-leaf (4 to 7 inches tall), and yellow foxtail was fully tillered and 5 to 6 inches tall. Estimates of percentage crop injury and weed control were taken on July 25. Weed densities at time of evaluation were 6/sq yd for pigweed, 10/sq yd for lambsquarters, and 50/sq yd for foxtail. Plot size was 10 by 27 ft and the experiment was a randomized complete design with four replications.

Treatment[a]	Rate[a] (lb/A)	Soybean injury (%)	Weed control Yeft (%)	Weed control Rrpw (%)	Weed control Colq (%)
Bentazon+Acifluorfen+POC(P1)/ Bentazon+Sethoxydim+Dash+28%UAN(P2)	0.5+0.25+0.25G/ 0.5+0.15+0.25G+1G	12	82	96	84
Bentazon+Acifluorfen+POC(P1)/ Bentazon+Sethoxydim+Dash+28%UAN(P2)	0.375+0.188+0.25G/ 0.375+0.15+0.25G+1G	11	92	96	67
Bentazon+Acifluorfen+POC(P1)/ Bentazon+BAS562-16H+Dash(P2)	0.5+0.25+0.25G/ 0.5+0.15+0.25G	2	90	97	79
Bentazon+Acifluorfen+POC(P1)/ Bentazon+BAS562-16H+Dash(P2)	0.375+0.188+0.25G/ 0.375+0.15+0.25G	3	92	96	77
Bentazon+Acifluorfen+POC(P1)/ Sethoxydim+Dash+28%UAN(P2)	1+0.25+0.25G/ 0.15+0.25G+1G	9	98	94	89
Bentazon+Acifluorfen+28%UAN(P1)/ Sethoxydim+Dash+28%UAN(P2)	1+0.25+1G/ 0.15+0.25G+1G	14	96	97	86
Bentazon&Acifluorfen+POC(P1)/ Sethoxydim+Dash+28%UAN(P2)	0.75&0.17+0.25G/ 0.15+0.25G+1G	12	98	90	78
Bentazon&Acifluorfen+POC(P1)/ Bentazon+Sethoxydim+Dash+28%UAN(P2)	0.75&0.17+0.25G/ 0.25+0.15+0.25G+1G	12	93	96	80
Bentazon+Acifluorfen+Sethoxydim+Dash	0.75+0.188+0.15+0.25G	1	89	97	77
Bentazon+Acifluorfen+Sethoxydim+Dash	0.5+.125+0.15+0.25G	1	69	92	75
Imazethapyr+X-77	0.05+0.25%	1	94	97	56
DPX-M6316+X-77+28%UAN	0.00391+0.125%+1G	0	10	95	88
Control	0	0	0	0	0
C.V. %		31	14	3	17
LSD 5%		3	17	4	NS

[a]POC = petroleum oil adjuvant containing 17% emulsifier; 28%UAN = 28% urea ammonium nitrate liquid fertilizer; Dash = BASF adjuvant of proprietary composition; Bentazon&Acifluorfen = 'Galaxy' package mix of bentazon plus acifluorfen; G = gal/A.

Summary. Greatest soybean injury was associated with treatments involving 28% urea ammonium nitrate used as an adjuvant. Yellow foxtail control of 96% or better was only achieved when broadleaf herbicides were applied prior to sethoxydim treatment. Excellent redroot pigweed was obtained with most treatments.

Herbicide-insecticide tank-mixes in soybeans, Fargo. 'McCall' soybeans were planted June 3 in 30-inch rows in a silty clay soil with 5% organic matter. Metolachlor was applied preemergence over the entire experimental area on June 5 for foxtail control. Supplemental hand-weeding maintained these plots weed-free for the duration of the experiment. Treatments were applied July 14 using a bicycle wheel sprayer delivering 8.5 gal/A with 8001 nozzle tips and 40 psi, when soybeans had 4.5 trifoliolate leaves and were 10 inches tall. Environmental conditions at time of spraying were: 82 F, 40% relative humidity, sunny skies, dry soil. Visual estimates of percentage crop injury were taken on July 27. Plots were machine harvested at maturity by taking the 3 center rows. Plot size was 10 by 27 ft and the experiment was designed as a randomized complete block with four replications.

Treatment	Rate	Soybean injury	Grain yield
	(oz/A)	(%)	(Bu/A)
Imazethapyr+X-77	1+0.25%	1	31.2
Imazethapyr+Chlorpyrifos+X-77	1+8+0.25%	3	26.0
Imazethapyr+Malathion+X-77	1+8+0.25%	5	30.9
Imazethapyr+Methomyl+X-77	1+8+0.25%	2	30.5
Imazethapyr+Carbaryl+X-77	1+8+0.25%	2	27.7
Imazethapyr+Mefluidide+X-77	1+4+0.25%	31	21.8
DPX-M6316+X-77	0.125+0.25%	10	30.0
DPX-M6316+Malathion+X-77	0.125+8+0.25%	40	29.0
DPX-M6316+Mefluidide+X-77	0.125+4+0.25%	22	28.8
C.V. %		28	9.5
LSD 5%		5	4.0

[a]Chlorpyrifos = Lorsban 4E insecticide; Malathion = Cythion insecticide; Methomyl = Lannate insecticide; Carbaryl = Sevin 4F insecticide; Mefluidide = Embark growth regulator.

Summary. Injury by imazethapyr alone or mixed with the insecticides chlorpyrifos, malathion, methomyl, or carbaryl was expressed only as a slight stunting. Injury by DPX-M6316 alone or mixed with malathion involved stunting, smaller leaves, mild chlorosis (lighter green color of plants), and some severe chlorosis/necrosis of the youngest leaves at time of spraying. Mefluidide treatments caused stunting of the plant as well as crinkling and cupping of the uppermost leaves. Mefluidide plus DPX-M6316 caused twice as much injury as DPX-M6316 alone. Mefluidide, however, did not seem to be contributing to phytotoxicity by DPX-M6316 since the increase in injury involved symptoms typical of mefluidide and not of DPX-M6316.

Although insecticides tank-mixed with imazethapyr caused very low observable soybean injury, yield reductions apparently occurred when chlorpyrifos + imazethapyr was applied. A substantial yield reduction was observed when imazethapyr was tank-mixed with mefluidide. Malathion + DPX-M6316 caused greater injury than did DPX-M6316 alone, but grain yield was not reduced by the tank mix.

Effect of soybean growth stage on injury by DPX-M6316-insecticide tank mixes, Fargo. 'McCall' soybeans were seeded June 3 in 30-inch rows in a silty clay soil having 5% organic matter. Metolachlor at 2 lb/A was applied June 5 and sethoxydim at 0.15 lb/A was applied June 19 over the entire experimental area for foxtail control. Other weeds were controlled by hand-weeding. Unifoliolate (Unifol) soybeans were sprayed June 22 with 78 F and 32% relative humidity (RH). First, second, and third trifoliolate soybeans were sprayed June 29 with 79 F and 47% RH, July 1 with 86 F and 44% RH, and July 7 with 70 F and 59% RH, respectively. All treatments were applied using a bicycle wheel sprayer delivering 8.5 gal/A at 40 psi. Visual estimates of percentage soybean injury were taken 12 days after each application which corresponded to July 4, July 11, July 13, and July 19 for unifoliolate, 1-trifoliolate, 2-trifoliolate, and 3-trifoliolate stages, respectively. The three center rows of each plot were 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. Soybeans seemed to be most tolerant of DPX-M6316 when treated at the unifoliolate growth stage. Chlorpyrifos and carbaryl insecticides caused no appreciable crop injury when applied alone. Carbaryl + DPX-M6316 tank mixes did not injure soybeans more than did DPX-M6316 applied alone. Chlorpyrifos + DPX-M6316 tank mixes, however, caused between 60 and 80% injury and resulted in grain yield reductions, particularly with the higher rates of DPX-M6316.

See next page for data

See previous page for experimental conditions and summary.

Treatment[a]	Rate (oz/A)	Soybean injury (%)	Grain yield (bu/A)
DPX-M6316(Unifol)	0.0625	1	20.4
DPX-M6316(Unifol)	0.125	1	22.5
DPX-M6316(Unifol)	0.25	3	22.8
DPX-M6316+Chlorpyrifos(Unifol)	0.0625+8	66	18.6
DPX-M6316+Chlorpyrifos(Unifol)	0.125+8	79	12.0
DPX-M6316+Chlorpyrifos(Unifol)	0.25+8	83	13.1
DPX-M6316+Carbaryl(Unifol)	0.0625+8	1	22.8
DPX-M6316+Carbaryl(Unifol)	0.125+8	2	22.0
DPX-M6316+Carbaryl(Unifol)	0.25+8	4	20.1
Chlorpyrifos(Unifol)	8	5	23.2
Carbaryl(Unifol)	8	0	23.8
DPX-M6316(1-Trifol)	0.0625	0	24.4
DPX-M6316(1-Trifol)	0.125	5	21.7
DPX-M6316(1-Trifol)	0.25	32	24.0
DPX-M6316+Chlorpyrifos(1-Trifol)	0.0625+8	66	15.6
DPX-M6316+Chlorpyrifos(1-Trifol)	0.125+8	75	9.8
DPX-M6316+Chlorpyrifos(1-Trifol)	0.25+8	65	4.3
DPX-M6316+Carbaryl(1-Trifol)	0.0625+8	4	20.9
DPX-M6316+Carbaryl(1-Trifol)	0.125+8	12	19.1
DPX-M6316+Carbaryl(1-Trifol)	0.25+8	32	19.1
Chlorpyrifos(1-Trifol)	8	4	22.5
Carbaryl(1-Trifol)	8	3	18.4
DPX-M6316(2-Trifol)	0.0625	3	22.9
DPX-M6316(2-Trifol)	0.125	8	26.4
DPX-M6316(2-Trifol)	0.25	15	22.0
DPX-M6316+Chlorpyrifos(2-Trifol)	0.0625+8	59	17.7
DPX-M6316+Chlorpyrifos(2-Trifol)	0.125+8	68	9.9
DPX-M6316+Chlorpyrifos(2-Trifol)	0.25+8	75	5.5
DPX-M6316+Carbaryl(2-Trifol)	0.0625+8	6	18.4
DPX-M6316+Carbaryl(2-Trifol)	0.125+8	8	20.0
DPX-M6316+Carbaryl(2-Trifol)	0.25+8	18	22.6
Chlorpyrifos(2-Trifol)	8	0	20.5
Carbaryl(2-Trifol)	8	0	25.3
DPX-M6316(3-Trifol)	0.0625	2	23.9
DPX-M6316(3-Trifol)	0.125	14	26.8
DPX-M6316(3-Trifol)	0.25	20	18.4
DPX-M6316+Chlorpyrifos(3-Trifol)	0.0625+8	67	11.1
DPX-M6316+Chlorpyrifos(3-Trifol)	0.125+8	75	9.8
DPX-M6316+Chlorpyrifos(3-Trifol)	0.25+8	81	4.8
DPX-M6316+Carbaryl(3-Trifol)	0.0625+8	3	26.1
DPX-M6316+Carbaryl(3-Trifol)	0.125+8	8	21.9
DPX-M6316+Carbaryl(3-Trifol)	0.25+8	19	24.0
Chlorpyrifos(3-Trifol)	8	0	24.8
Carbaryl(3-Trifol)	8	0	19.8
Control	0	0	22.0
C.V. %		29	24.3
LSD 5%		10	6.5

[a]Chlorpyrifos = Lorsban 4E insecticide; Carbaryl = Sevin 4F insecticide; all DPX-M6316 treatments were applied with X-77 surfactant + 28% urea ammonium nitrate at 0.125% + 1 gal/A.

Effect of relative application timing on soybean injury by DPX-M6316-insecticide treatments, Fargo. 'McCall' soybeans were seeded in 30-inch rows on June 3 in a silty clay soil with 5% organic matter. Metolachlor at 2 lb/A was applied on June 5 and sethoxydim at 0.15 lb/A was applied on June 19 over the entire experimental area for foxtail control. Other weeds were controlled by hand-weeding. All DPX-M6316 treatments and insecticides alone were applied on June 28 when soybeans were in the first trifoliolate stage (4 to 4.5 inches tall) and environmental conditions were: 79 F, 48% relative humidity (RH), sunny. Insecticides applied 5 days earlier than DPX-M6316 treatments (5DE) were applied on June 23 with 74 F and 60% RH. Treatments applied 3 days early (3DE), 1 day early (1DE), 1 day later (1DL), 3 days later (3DL), and 5 days later (5DL) were applied with 74 F and 60% RH, 76 F and 41% RH, 79 F and 47% RH, 86 F and 44% RH, and 86 F and 26% RH, respectively. By July 3, at the 5DL application timing, soybeans appeared to be experiencing moisture stress. Visual estimates of percentage soybean injury were taken on July 10. Nine meters of row from each plot were clipped at soil level on July 31 when soybeans in the control plots were about 15 inches tall; dry weights were obtained. Plot size was 10 by 27 ft and the experiment was designed as a randomized complete block with four replications.

Summary. Tank-mix combination of DPX-M6316 + chlorpyrifos caused soybean injury equivalent to injury by DPX-M6316 alone. However, when chlorpyrifos was applied 1 day after DPX-M6316 or 1, 3, or 5 days prior to DPX-M6316 application, soybean injury was greater than that caused by DPX-M6316 alone and suggested a synergistic interaction between the herbicide and insecticide. These results also were evident in soybean dry weight data taken 8 weeks after DPX-M6316 application. Carbaryl did not increase soybean injury by DPX-M6316.

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Treatment[a]	Rate	Soybean Injury	Soybean Dry weight per m of row
	(oz/A)	(%)	(g)
DPX-M6316	0.063	12	96.1
DPX-M6316	0.125	30	87.5
DPX-M6316	0.25	37	67.7
Chlorpyrifos	8	24	94.0
Carbaryl	8	0	123.8
Chlorpyrifos(5DE)/DPX-M6316	8/0.063	53	66.6
Carbaryl(5DE)/DPX-M6316	8/0.063	12	87.3
Chlorpyrifos(5DE)/DPX-M6316	8/0.125	79	30.7
Carbaryl(5DE)/DPX-M6316	8/0.125	22	98.2
Chlorpyrifos(3DE)/DPX-M6316	8/0.063	68	45.7
Carbaryl(3DE)/DPX-M6316	8/0.063	14	100.4
Chlorpyrifos(3DE)/DPX-M6316	8/0.125	80	34.3
Carbaryl(3DE)/DPX-M6316	8/0.125	33	82.5
Chlorpyrifos(1DE)/DPX-M6316	8/0.063	75	52.8
Carbaryl(1DE)/DPX-M6316	8/0.063	16	102.3
Chlorpyrifos(1DE)/DPX-M6316	8/0.125	79	38.5
Carbaryl(1DE)/DPX-M6316	8/0.125	20	100.7
DPX-M6316+Chlorpyrifos	0.063+8	11	101.2
DPX-M6316+Carbaryl	0.063+8	8	99.9
DPX-M6316+Chlorpyrifos	0.125+8	22	89.0
DPX-M6316+Carbaryl	0.125+8	22	94.5
DPX-M6316+Chlorpyrifos	0.25+8	39	104.0
DPX-M6316+Carbaryl	0.25+8	33	70.9
DPX-M6316/Chlorpyrifos(1DL)	0.063/8	33	87.1
DPX-M6316/Carbaryl(1DL)	0.063/8	13	99.5
DPX-M6316/Chlorpyrifos(1DL)	0.125/8	53	61.1
DPX-M6316/Carbaryl(1DL)	0.125/8	19	101.4
DPX-M6316/Chlorpyrifos(3DL)	0.063/8	16	81.4
DPX-M6316/Carbaryl(3DL)	0.063/8	6	113.3
DPX-M6316/Chlorpyrifos(3DL)	0.125/8	19	87.7
DPX-M6316/Carbaryl(3DL)	0.125/8	26	80.8
DPX-M6316/Chlorpyrifos(5DL)	0.063/8	8	104.5
DPX-M6316/Carbaryl(5DL)	0.063/8	14	105.5
DPX-M6316/Chlorpyrifos(5DL)	0.125/8	25	92.9
DPX-M6316/Carbaryl(5DL)	0.125/8	22	96.2
Control	0	0	116.0
C.V. %		36	21.8
LSD 5%		15	26.3

[a]All DPX-M6316 was applied with 0.125% X-77 surfactant and 1 gal/A 28% urea ammonium nitrate solution.

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

Soybeans, 1989

Minimum till plots were chisel plowed in late October 1988. McCall soybeans were seeded 1.5 inches deep at 195,000 seeds per acre on June 2 using a Hiniker no-till

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

Planned herbicide treatment			As-needed burndown treatment			Follow-up post-emergence treatment		
Herbicide	Rate	Date	Herbicide	Rate	Date	Herbicide	Rate	Date
	(lb/A)			(lb/A)			(lb/A)	
TILLED, 30-INCH ROWS								
Trif+Metr(PPI)	1+0.2	6/1	None	-	-	Sethoxydm	0.17	7/7
Trif+Imep(PPI)	1+0.063	6/1	None	-	-	None		-
Trif+Clom(PPI)	1+0.75	6/1	None	-	-	Sethoxydm	0.17	7/7
Trif+Clam(PPI)	1+2.5	6/1	None	-	-	Sethoxydm	0.15	7/7
Seth(Po)/	0.15/	6/22						
Bent+Acif(Po)	0.75+0.25	7/7	None	-	-	None	-	-
HWC - Trif+	0.75+							
Imep+Clom(PPI)	0.04+0.4	6/1	None	-	-	None	-	-
NO-TILL, 30-INCH ROWS								
Imazethapyr(EPP)	0.063	4/27	Para+2,4-D	0.4+0.38	6/2	None	-	-
Cyanazine(EPP)/	3/	4/27	Paraquat	0.4				
Sethoxydim(Po)	0.15	6/22	+2,4-D	0.38	6/2	None	-	-
Metribuzin(EPP)/	0.25/	4/27	Glyt&2,4-D	0.85		Bentazon+	0.75	
Sethoxydim(Po)	0.15	6/22	+Am Sulf	+1.5	6/2	Acifluorf	0.25	7/7
Metribuzin(Pre)/	0.2/	6/5	Glyt&2,4-D	0.85				
Sethoxydim(Po)	0.15	6/22	+Am Sulf	+1.5	6/2	None	-	-
Sethoxydim(Po)/	0.15/	6/22	Glyt&2,4-D	0.85				
Bent+Acif(Po)	0.75+0.25	7/7	+Am Sulf	+1.5	6/2	None	-	-
HWC - Pend+	2/							
Imep+Clom(EPP)	0.04+0.4	4/27	Glyphosate	0.75	6/2	None	-	-
NO-TILL, 7-INCH ROWS								
Imazethapyr(EPP)	0.063	4/27	Para+2,4-D	0.4+0.38	6/2	None	-	-
Cyanazine(EPP)/	3/	4/27	Paraquat	0.4				
Sethoxydim(Po)	0.15	6/22	+2,4-D	0.38	6/2	Acifluorf	0.3	7/7
Metribuzin(EPP)/	0.25/	4/27	Glyt&2,4-D	0.85				
Sethoxydim(Po)	0.15	6/22	+Am Sulf	+1.5	6/2	None	-	-
Metribuzin(Pre)/	0.2/	6/5	Glyt&2,4-D	0.85		Bentazon+	0.75+	
Sethoxydim(Po)	0.15	6/22	+Am Sulf	+1.5	6/2	Acifluor	0.25	7/7
Sethoxydim(Po)/	0.2/	6/22	Glyt&2,4-D	0.85				
Bent+Acif(Po)	0.75+0.25	7/7	+Am Sulf	+1.5	6/2	None	-	-
HWC - Pend+	2+	4/27						
Imep+Clom(EPP)	0.04+0.4		Glyphosate	0.75	6/2	None	-	-

[a]See Table 4 for information on spray adjuvants used; EPP = early preplant; PPI = preplant incorporated; Pre = preemergence; Po = postemergence; HWC = hand weeded.

planter for 30-inch rows and a Haybuster drill for 7-inch rows. Herbicides were applied using a bicycle wheel sprayer delivering 8.5 gal/A for all treatments involving glyphosate or sethoxydim and 17 gal/A for all other treatments. All postemergence (planned or as-needed) and burndown treatments were applied only as required and at a rate deemed necessary by the investigator. Rates and dates of all herbicide applications are given in Table 1. Cultivation of 30-inch row plots also was done on an as-needed basis, and took place on July 7. Broadleaf weeds taller than 6 inches and foxtail plants of any size found within a plot were counted just prior to harvest. Grain yields were machine harvested on September 28 and values adjusted to 12% moisture. Plots requiring post-harvest Canada thistle control were treated on October 10.
*Note: Poor stand establishment on narrow row soybeans rendered these data unreliable.

Table 2. Weed control and grain yield of minimum till versus no-till soybeans.

Planned herbicide treatment: Herbicide	Rate	Weeds present at harvest: Yeft	KOCZ	Rrpw	Colq	Cath	Soybean grain yield
	(lb/A)	----(Plants per 100 m^2)-----					(Bu/A)
TILLED (30-inch rows)							
Trifluralin+Metribuzin(PPI)	1+0.2	12	5	19	9	3	15.8
Trifluralin+Imazethapyr(PPI)	1+0.063	46	1	1	2	28	17.9
Trifluralin+Clomazone(PPI)	1+0.75	5	4	19	12	0	18.2
Trifluralin+Chloramben(PPI)	1+2.5	164	1	0	1	19	16.9
Seth(Po)/Bentazon+Acifluor(Po)	0.15/0.75+0.25	6	13	0	37	19	14.0
Hand-weeded check[a]	-	0	0	0	0	0	18.3
NO-TILL (30-inch rows)							
Imazethapyr(EPP)	0.063	9	7	0	0	2	15.9
Cyanazine(EPP)/Sethoxydim(Po)	3/0.15	0	2	22	2	36	14.3
Metribuzin(EPP)/Sethoxydim(Po)	0.25/0.15	0	2	3	0	0	15.0
Metribuzin(Pre)/Sethoxydim(Po)	0.2/0.15	1	14	5	2	46	13.9
Seth(Po)/Bentazon+Acifluor(Po)	0.15/0.75+0.25	3	38	1	1	3	14.4
Hand-weeded check[b]	-	0	0	0	0	0	18.3
LSD 5% (Treatment within a tillage)		38	5	NS	8	NS	NS
Tillage effect		*	**	NS	**	NS	NS

[a]Handweeded check was treated with trifluralin + imazethapyr + clomazone (PPI) at 0.75 + 0.04 + 0.4 lb/A plus hand weeding.
[b]Handweeded check was treated with pendimethalin + imazethapyr + clomazone (EPP) at 2 + 0.04 + 0.4 lb/A plus hand weeding.

Table 3. Weed control and grain yield of no-till soybeans planted in 7-inch rows.

Planned herbicide treatment: Herbicide	Rate	Weeds present at harvest: Yeft	KOCZ	Rrpw	Colq	Cath	Soybean grain yield
	(lb/A)	----(Plants per 100 m^2)-----					(Bu/A)
7-INCH ROWS (no-till)							
Imazethapyr(EPP)	0.063	16	1	0	0	41	11.6
Cyanazine(EPP)/Sethoxydim(Po)	3/0.15	23	2	1	6	52	14.4
Metribuzin(EPP)/Sethoxydim(Po)	0.25/0.15	13	12	11	14	72	17.9
Metribuzin(Pre)/Sethoxydim(Po)	0.2/0.15	18	15	1	0	93	14.7
Seth(Po)/Bentazon+Acifluor(Po)	0.15/0.75+0.25	46	68	169	3	4	9.9
Handweeded check[a]	-	0	0	0	0	0	17.6

[a]Handweeded check was treated with pendimethalin + imazethapyr + clomazone (EPP) at 1.5 + 0.04 + 0.4 lb/A plus hand weeding.

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

Planned treatment: Herbicide or adjuvant	Rate	Cost	Burndown treatment: Herbicide or adjuvant	Rate	Cost	Follow-up post treatment: Herbicide or adjuvant	Rate	Cost	Post-harvest[a]
	(lb/A)	($/A)		(lb/A)	($/A)		(lb/A)	($/A)	($/A)
TILLED, 30-INCH ROWS									
Trifluralin	1	6.00	None	-	-	Sethoxydim	0.17	9.98	1.30
Metribuzin	0.2	4.80				Dash	1 qt	2.00	
Trifluralin	1	6.00	None	-	-	None	-	-	1.30
Imazethapyr	0.063	18.00							
Trifluralin	1	6.00	None	-	-	Sethoxydim	0.17	9.98	None
Clomazone	0.75	12.00				Dash	1 qt	2.00	
Trifluralin	1	6.00	None	-	-	None	-	-	1.30
Chloramben	2.5	22.33							
Sethoxydim	0.15	8.81	None	-	-	None	-	-	None
Dash	1 qt	2.00							
Bentazon	0.75	9.94							
Acifluorfen	0.25	6.37							
X-77 surf.	0.5%	.76							
NO-TILL, 30-INCH ROWS									
Imazethapyr	0.063	18.00	Paraquat	0.4	6.40	None	-	-	None
			2,4-D	0.25	.75				
			X-77 surf	0.5%	.76				
Cyanazine	3	13.67	Paraquat	0.4	6.40	None	-	-	1.30
Sethoxydim	0.15	8.81	X-77 surf	0.5%	.76				
Dash	1 qt	2.00							
Metribuzin	0.25	6.00	Glyt&2,4-D	0.53	6.08	Bentazon	0.75	9.94	None
Sethoxydim	0.15	8.81	Ammon. Sulf.	1.5	.38	Acifluorfen	0.25	6.37	
Dash	1 qt	2.00				X-77	0.5%	.76	
Metribuzin	0.2	4.80	Glyt&2,4-D	0.53	6.08	None	-	-	1.30
Sethoxydim	0.15	8.81	Ammon. Sulf.	1.5	.38				
Dash	1 qt	2.00							
Sethoxydim	0.15	8.81	Glyt&2,4-D	0.53	6.08	None	-	-	None
Dash	1 qt	2.00	Ammon. Sulf.	1.5	.38				
Bentazon	0.75	9.94							
Acifluorfen	0.25	6.37							
X-77 surf.	0.5%	.76							
NO-TILL, 7-INCH ROWS									
Data unreliable in 1989 because of poor stand establishment.									

[a] Post-harvest Canada thistle spraying: 'Spot-sprayed' with clopyralid&2,4-D (Curtail) at 0.135&0.75 lb/A. One replicate plot out of four required spraying and cost was figured at $1.00/A for chemical plus $.30 for application assuming 1/8 of the field was sprayed.

Table 5. Economic analysis for weed control systems in minimum till versus no-till soybeans.

Planned herbicide treatment: Herbicide	Rate	Variable production costs[a]: Herbicide plus adjuvant	Herbicide appl. and incorp.	Culti-vation	Chisel plowing	Crop value[b]	Net return
	(lb/A)	($/A)					
TILLED, 30-INCH ROWS							
Trif+Metr(PPI)	1+0.2	24.08	6.04	0	3.45	86.90	53.33
Trif+Imep(PPI)	1+0.063	25.30	5.42	2.00	3.45	98.45	62.28
Trif+Clom(PPI)	1+0.75	29.98	6.04	0	3.45	100.10	60.63
Trif+Clam(PPI)	1+2.5	29.63	5.42	2.00	3.45	92.95	52.45
Seth(Po)/ Bent+Acif(Po)	0.15/ 0.75+0.25	27.88	1.24	2.00	3.45	77.00	42.43
NO-TILL, 30-INCH ROWS							
Imazethapyr(EPP)	0.063	25.91	1.24	0	0	87.45	60.30
Cyanazine(EPP)/ Sethoxydim(Po)	3/ 0.15	32.94	1.86	2.00	0	78.65	41.85
Metribuzin(EPP)/ Sethoxydim(Po)	0.25/ 0.15	40.34	2.48	2.00	0	82.50	37.68
Metribuzin(Pre)/ Sethoxydim(Po)	0.2/ 0.15	23.37	1.86	2.00	0	76.45	49.22
Sethoxydim(Po)/ Bent+Acif(Po)	0.15/ 0.75+0.25	34.33	1.86	2.00	0	79.20	41.01
NO-TILL, 7-INCH ROWS							
Data unreliable in 1989 because of poor stand establishment.							

[a]Variable cost rates derived from University of Minnesota values reduced by 30% (Minnesota values assume a farmer owns all new equipment). Included in variable cost rates is equipment overhead, repairs, maintenance, and fuel. Labor is not included. Spraying cost = $.62/A, herbicide incorporation cost = $2.40/A, cultivation cost = $2.00/A.

[b]1989 soybeans were valued at $5.50 per bushel.

Summary. Table 1 shows the herbicides applied as planned treatments as well as those applied on an as-needed basis. Follow-up postemergence applications of sethoxydim were needed in tilled plots receiving trifluralin, except where trifluralin was mixed with imazethapyr. The failure of trifluralin to adequately control yellow foxtail was probably a result of dry soil conditions during the drought of 1989. Imazethapyr is primarily active against broadleaf weeds but yellow foxtail control by this herbicide was evident in tilled as well as no-till plots. Follow-up postemergence treatments for broadleaf weeds were not needed in tilled plots, but became necessary in certain no-till treatments. Metribuzin applied early preplant in no-till, 30-inch-row soybeans or applied preemergence in no-till, 7-inch-row soybeans required acifluorfen plus bentazon for control of kochia, redroot pigweed, and common lambsquarters. Cyanazine applied early preplant in no-till, 7-inch-row soybeans allowed pigweed escapes and required a follow-up treatment with acifluorfen.

Burndown herbicides were needed on all no-till plots (Table 1). Plots receiving no early preplant treatment were treated with glyphosate plus 2,4-D to control 1 to 2-leaf yellow foxtail along with broadleaf weeds (wild buckwheat, kochia, redroot

pigweed, and common lambsquarters) that were 1 to 6 inches tall. Early preplant metribuzin provided only limited control of these broadleaf weeds at planting and required the same burndown treatment. Cyanazine applied early preplant gave good control of most broadleaf weeds and received paraquat plus 2,4-D primarily for light populations of redroot pigweed and kochia. Early preplant imazethapyr allowed only sparse populations of common lambsquarters. All burndown treatments provided complete control of vegetation present at planting time.

Soybean grain yields were not different between treatments within a tillage system (Table 2). There also was no influence of tillage system on grain yield. Poor stand establishment of no-till soybeans planted in 7-inch rows was attributed to poor seed coverage during planting and caused low yields (Table 3).

Differences between treatments in the number of weeds present at harvest were not dramatic (Table 2). Trifluralin plus chloramben allowed considerably more foxtail escapes than any other treatment even though this treatment received follow-up sethoxydim and cultivation. The total postemergence program (sethoxydim + bentazon + acifluorfen) tended to allow escapes of kochia and common lambsquarters; these species are not easily controlled by bentazon and acifluorfen. Similarly, treatments involving clomazone and cyanazine allowed redroot pigweed escapes which is consistent with the known weakness of these herbicides on pigweed.

Wheat, 1989

Tilled plots were chisel plowed in late October 1988. Wheaton hard red spring wheat was seeded 1.5-inch deep on April 28, 1989 using a Haybuster drill. Tilled plots were worked once with a field cultivator/harrow (2.5 to 3-inches deep) immediately prior to seeding. On May 12, 60 lbs N per acre of ammonium nitrate was surface-applied as called for by soil test results. On June 7, all plots were sprayed with DPX-M6316 at 0.33 oz ai/A plus X-77 surfactant at 0.25% with a follow-up treatment of fenoxaprop&MCPA&2,4-D (Tiller) at 0.11&0.26&0.087 lb ai/A. Wheat stand counts were taken on June 13. Plots were machine-harvested August 4. Post-harvest tillage or herbicide treatments was done on September 7. All tilled plots received one pass with a field cultivator/harrow (2-inch depth). No-till plots were treated with 1.25 lb/A 2,4-D ester when kochia, dandelion, or redroot pigweed was present. When Canada thistle was present (with or without kochia), dicamba was applied at 0.75 lb/A (see Table 7 for details).

<u>Summary</u>. There was no difference in wheat stands or grain yield between tillage systems or between herbicide approaches applied to soybeans the previous year (Table 6). Net dollar returns, however, for no-till treatments were generally higher than those of tilled treatments (Table 7). This was due to the fact that herbicide costs and grain yields were the same under both tillage systems while tillage cost savings were realized in no-till. Some chlorosis (about 5 to 10% injury) was observed on wheat planted on plots that received 0.75 lb/A of clomazone the previous year.

Table 6. Wheat stand density and grain yield.

1988 soybean herbicide treatments: Planned herbicides	Rate (lb/A)	1989 wheat plants per meter of row (No.)	1989 wheat grain yield (Bu/A)
TILLED (30-inch rows)			
Trifluralin+Metribuzin(PPI)	1+0.2	-	27.8
Trifluralin+Imazethapyr(PPI)	1+0.063	-	27.7
Trifluralin+Clomazone(PPI)	1+0.75	-	28.7
Trifluralin+Chloramben(PPI)	1+2.5	-	27.2
Sethoxydim(Po)/Bentazon+Acifluorfen(Po)	0.2/0.75+0.13	-	27.4
Hand-weeded check	-	28	28.0
NO-TILL (30-inch rows)			
Imazethapyr(EPP)	0.063	-	28.9
Cyanazine(EPP)/Sethoxydim(Po)	3/0.15	-	26.8
Metribuzin(EPP)/Sethoxydim(Po)	0.25/0.15	-	26.9
Metribuzin(Pre)/Sethoxydim(Po)	0.2/0.15	-	30.8
Sethoxydim(Po)/Bentazon+Acifluorfen(Po)	0.2/0.75+0.13	-	27.6
Hand-weeded check[b]	-	27	29.2
NO-TILL (7-inch rows)			
Imazethapyr(EPP)	0.063	-	27.9
Cyanazine(EPP)/Sethoxydim(Po)	3/0.15	-	27.5
Metribuzin(EPP)/Sethoxydim(Po)	0.25/0.15	-	27.1
Metribuzin(Pre)/Sethoxydim(Po)	0.2/0.15	-	28.0
Sethoxydim(Po)/Bentazon+Acifluorfen(Po)	0.2/0.75+0.13	-	28.5
Hand-weeded check[b]	-	25	28.3
Treatment within a tillage		-	NS
Tillage effect		NS	NS

Table 7. Economic analysis for weed control systems in minimum till versus no-till spring wheat.

1988 planned herbicide treatment in soybeans	Herbicide plus adjuvant[b]	Herbicide application	Chisel plowing	Seedbed preparation	Post-harvest[c]	1989 HRSW value[d]	Net return
	1989 Variable production costs[a]						
	($/A)						
TILLED, 30-INCH ROWS							
Trif+Metr(PPI)	14.00	1.24	3.45	4.80	2.40[e]	102.86	76.97
Trif+Imep(PPI)	14.00	1.24	3.45	4.80	2.40	102.49	76.60
Trif+Clom(PPI)	14.00	1.24	3.45	4.80	2.40	106.19	80.30
Trif+Clam(PPI)	14.00	1.24	3.45	4.80	2.40	100.64	74.75
Seth(Po)/ Bent+Acif(Po)	14.00	1.24	3.45	4.80	2.40	101.38	75.49
NO-TILL, 30-INCH ROWS							
Imazethapyr(EPP)	14.00	1.24	0	0	4.37[f]	106.93	87.32
Cyanazine(EPP)/ Sethoxydim(Po)	14.00	1.24	0	0	1.93[g]	99.16	81.99
Metribuzin(EPP)/ Sethoxydim(Po)	14.00	1.24	0	0	4.37	99.53	79.92
Metribuzin(Pre)/ Sethoxydim(Po)	14.00	1.24	0	0	4.37	113.96	94.35
Sethoxydim(Po)/ Bent+Acif(Po)	14.00	1.24	0	0	4.37	102.12	82.51
NO-TILL, 7-INCH ROWS							
Imazethapyr(EPP)	14.00	1.24	0	0	1.93	103.23	86.06
Cyanazine(EPP)/ Sethoxydim(Po)	14.00	1.24	0	0	4.37	101.75	82.14
Metribuzin(EPP)/ Sethoxydim(Po)	14.00	1.24	0	0	5.22[h]	100.27	79.81
Metribuzin(Pre)/ Sethoxydim(Po)	14.00	1.24	0	0	4.37	103.60	83.99
Sethoxydim(Po)/ Bent+Acif(Po)	14.00	1.24	0	0	5.22	105.45	84.99

[a] Variable cost rates derived from University of Minnesota values reduced by 30% (Minnesota values assume a farmer owns all new equipment). Included in variable cost rates is equipment overhead, repairs, maintenance, and fuel. Labor is not included. Spraying cost = $0.62/A.

[b] All plots were sprayed with DPX-M6316 at 0.33 oz ai/A ($4.62/A) plus X-77 surfactant at 0.25% ($.38/A) with a follow-up treatment of fenoxaprop&MCPA&2,4-D (Tiller) at 0.11&0.26&0.087 lb ai/A ($9.00/A).

[c] Post-harvest costs include $0.62/A application costs for no-till plots.

[d] 1989 hard red spring wheat was valued at $3.70 per bushel.

[e] Tilled plots received one field cultivator pass following harvest.

[f] Received 1.25 lb ai/A 2,4-D butoxyethyl ester ($3.75/A) following harvest.

[g] 'Spot-sprayed' 1/8 of the field area post-harvest for Canada thistle using 0.75 lb ai/A of dicamba ($10.48/treated acre = $1.31/field acre).

[h] 'Spot-sprayed' 1/8 of the field area post-harvest for Canada thistle using 0.75 lb ai/A of dicamba; remainder of field treated with 1.25 lb ai/A 2,4-D ester.