Horticultural Weed Control 1994 Report

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Not intended nor authorized for publication

Data contained in this report are compiled annually as an aide to complete minor crop registrations for horticultural crops. Data are neither intended nor authorized for publication. Information and interpretation cannot be construed as recommendations for application of any herbicide mentioned in this report.

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Weed Biology

Small Fruits

Miscellaneous

The Report

Results from vegetation management trials involving horticultural crops conducted during the past year are compiled and reported by faculty members of the Oregon Agricultural Experiment Station, the Oregon State Extension Service, and colleagues who cooperated from adjacent states. This work was conducted throughout Oregon and involved many individuals. This work has expanded beyond conventional herbicide technology and includes research on the impacts of cover crop vegetation management on weed control, techniques such as propane flaming for selective weed control, and the effects of vegetation management strategies on other organisms such as symphylans. The contributors sincerely appreciate the cooperative efforts of the many growers, university employees, and local representatives of the production and agrichemical industries. We also gratefully acknowledge financial assistance from individual growers, grower organizations, and companies which contributed to this work.

Information and Evaluation

Crops were grown at the experimental farms using accepted cultural practices within the limits of experimentation or trials were conducted on growers' fields. Most experiments were designed as randomized complete blocks with three to five replications. Herbicide treatments were applied uniformly with precision plot sprays, or granular formulations were distributed from quart jar shakers. Unless otherwise indicated, preplant herbicide applications were incorporated with a PTO horizontal rotary tiller operated at a depth of approximately two inches. After critical application stages, crops were irrigated with overhead sprinklers at weekly intervals or as needed.

Crop and weed responses are primarily visual evaluations of stand reduction (SR) and growth reduction (GR), ranging from 0-100 with 100 as the maximum response for each rating, or an over-all rating of 0-10 for crop response or control of specific weed species with 10 being complete control of the weed or good crop vigor (no injury). Additional data such as crop yields are reported for certain studies and may be reported in either English or metric systems.

Abbreviations

DAP Days after planting
WBP Weeks before planting
WAP Weeks after planting
PRE Preemergence herbicide application
POST Postemergence herbicide application
PPI Preplant incorporated herbicide application
ai Active ingredient

HERBICIDES TESTED

Common Name	Manufacturer	Trade Name	Page Number
Acetochlor	Monsanto	Harness	19,25
Alachlor	Monsanto	Lasso	25
Atrazine	CIBA-Geigy	Aatrex	25
Bentazon	BASF	Basagran	9
Besulide	ICI	Prefar	7
Clomazone	FMC Corp	Command	7
Clopyralid	Dow Elanco	Stinger	49
Dimethenamid	Sandoz	Frontier	5,19,25
Diuron	DuPont	Karmex	63
Ethalfluralin	Dow Elanco	Curbit	7
Ethofumesate	Nor-Am	Nortron	59
Fenoxaprop	Hoechst	Horizon	59
Flumetsalam	Ciba Giegy	Broadstrike	25
Glufosinate	Hoechst Roussel	Ignite	53
Glyphosate	Monsanto	Roundup	11,15,67
Halosulfuron	Monsanto	Battalion	25
Lactofen	Valent	Cobra	5,19
Metolachlor	CIBA-Geigy	Dual	5,19,25
Naptalam	Uniroyal	Alanap	7
Nicosulfuron	DuPont	Accent	25
Oxyflourfen	Rohm and Haas Co.	Goal	53
Paraquat	ICI	Gramoxone	53
Trifluralin	Dow Elanco	Treflan	41

COVER CROPS TESTED

Micah barley	11,15,37,57
Steptoe barley	11,15
Hesk barley	11,15,57
Wheeler rye	11,15
Martiginia white mustard	11
Humus rape	15

Corvallis

Weather Data 1994

daily precipitation and temperatures (°F minimum and maximum)

Day	March in.	March max	March min	April in.	April max	April min	May in.	May max	May min	June in.	June max	June min	July in.	July max	July min	August in.	August max	August min	September in.	September max	September min	October in.	October max	October min
1	.01	59	47	.04	57	45		62	38	.18	66	44		79	46		87	47		82	49		71	53
2	.03	63	50		61	40	.05	62	45		68	47		74	45		88	50		76	39		76	47
3	.38	56	50	.02	62	40	.01	61	45		70	38		73	48		89	54	.13	75	50		69	48
4	.07	65	46	.03	58	35	.28	61	52	.11	69	53		74	48		87	54		72	48		71	49
5		65	32		57	32		66	51		68	49		69	52		77	52		76	50		74	35
6		53	31	.42	49	39		78	54	.42	64	49		73	47		82	47		86	46		73	41
7		57	36	.18	54	42		82	52	.43	62	45		80	55		84	54		86	43		68	42
8		59	34	.17	53	45		80	41	.12	66	42		91	53		74	49	.04	82	51		68	38
9		60	37	.25	56	42		75	42		74	42		89	47		74	48	.11	67	47		76	40
10	.29	63	41	.06	57	42		76	43		79	48		85	45		82	52	.06	66	47		74	42
11	.01	57	32		60	35		84	51		82	53		85	49		86	48	.24	66	48		59	30
12		58	32	.14	66	47		73	50		77	49		88	44		84	48		70	42		62	36
13		65	38	T	60	35		69	36	.32	72	51		86	47		85	50		76	43		63	31
14		67	36		58	35		68	42	.17	60	47		87	49		87	51		77	47	.22	61	35
15		66	55		60	40	.04	67	48	.12	61	46		82	51		81	50		77	47	.24	57	41
16	.05	60	43		72	43	.43	60	47	.02	64	41		82	52		81	47		83	55		58	34
17	.16	54	43		73	45	.05	60	48		70	43		91	49		82	53		91	52		59	35
18	.17	52	42		75	48		61	48	T	66	44		89	56		82	48		85	49		60	36
19	.21	48	34		72	42		67	45		69	45		85	57		81	52		84	54		60	39
20	.07	51	36		67	41		61	51		79	47		97	52		78	51		85	53	.01	65	40
21	.48	52	36	.07	70	48	T	60	48		80	46		99	58		78	49		87	60	.13	65	49
22	.15	50	34	T	65	37		67	46		76	54		102	66		75	56		95	57		64	33
23	.22	47	33	T	64	41		73	44		73	53	.01	96	58		79	53		93	46		56	35
24	.11	50	39	.01	62	45		79	44		69	42		95	55		80	52		86	44		63	35
25		63	39	.27	62	43		81	49		74	46		70	52		81	52		76	45		69	37
26		65	36	T	64	42		72	43		68	53		84	49		83	46		87	50	.26	65	40
27		70	35	.11	61	43		65	37		72	54		88	53		83	47		85	51	1.76	61	57
28		75	36		63	38	.03	66	47		85	50		92	50		88	52		86	55	.97	57	43
29		73	35		67	44	.19	57	47		85	50		85	49		78	45	.16	73	58	.05	57	36
30	.22	73	48	.17	58	36	.01	63	38		79	47		78	52		78	50	.15	63	54	.06	47	40
31	.83	56	47					74	48					81	50		85	48				.14	56	44
mean		59.7	39.1		62.1	41.0		68.7	45.8		71.6	47.3		84.8	51.1		81.9	50.2		79.8	49.3		64.0	40.0
ttl	3.46			.62			1.09			1.89			.01			.00			.89			3.84		

Eugene

Weather Data 1994

daily precipitation and temperatures (°F minimum and maximum)

Day	March in.	March max	March min	April in.	April max	April min	May in.	May max	May min	June in.	June max	June min
1	0	66	49	0	62	47	0	64	36	0	70	47
2	.82	56	50	0	64	42	.14	64	47	0	71	76
3	.64	62	49	T	60	40	.20	65	51	.09	69	41
4	T	68	42	0	59	37	.05	67	54	.04	69	55
5	0	51	33	.41	50	34	0	77	48	.42	66	52
6	0	55	28	.33	57	44	0	82	49	.10	63	49
7	0	59	29	.17	56	43	0	78	51	T	66	49
8	0	62	31	.17	58	46	0	74	48	0	76	39
9	.23	66	36	.16	59	45	0	76	45	0	80	49
10	T	57	36	0	62	44	0	81	45	0	84	48
11	0	57	30	0	72	35	0	73	52	0	80	53
12	0	64	29	.07	63	39	0	72	44	T	75	53
13	0	68	37	0	59	37	0	73	39	.16	63	49
14	0	66	35	0	61	37	0	68	44	.30	63	48
15	.01	63	35	0	72	39	.62	59	49	T	65	46
16	.39	53	42	0	73	47	.06	61	46	0	73	46
17	T	55	43	0	71	50	.01	63	49	.02	67	47
18	.38	50	33	T	72	49	0	68	49	0	72	48
19	T	52	32	0	68	48	.02	61	51	0	80	43
20	.45	55	34	0	73	40	0	62	51	0	83	49
21	.18	50	34	.10	68	48	0	65	44	0	73	52
22	.25	43	30	0	66	41	0	74	39	T	69	55
23	.04	49	36	T	53	44	0	79	43	0	71	48
24	.04	63	37	.19	62	45	0	81	45	0	76	42
25	0	64	32	.10	64	44	0	75	52	.01	71	54
26	0	68	32	.04	62	44	0	67	45	0	73	48
27	0	72	34	0	63	48	0	67	39	0	85	48
28	0	71	38	0	67	40	.21	63	47	0	86	50
29	.20	71	38	.28	58	43	.11	63	47	0	82	51
30	1.59	53	48	0	62	37	0	74	39	0	81	50
31	.36	60	47				.16	65	52			
avg		59.4	36.7		63.4	42.6		69.7	46.5		73.4	48.6
ttl	5.58			2.02			1.58			1.14		

Day	July in.	July max	July min	August in.	August max	August min	September in.	September max	September min	October in.	October max	October min
1	.02	77	50	0	88	53	0	77	50	0	76	48
2	T	75	52	0	89	54	.02	75	45	0	69	45
3	0	76	46	0	86	55	.22	73	54	0	72	41
4	0	72	48	0	77	54	0	77	47	0	75	38
5	T	75	52	0	82	48	0	86	47	0	73	38
6	0	83	48	0	85	48	0	87	50	0	68	45
7	0	92	55	T	73	53	0	80	47	0	69	39
8	0	91	54	0	76	51	.36	69	54	0	77	40
9	0	87	49	0	83	47	.18	69	50	0	72	44
10	0	88	48	0	81	52	.34	65	48	0	59	42
11	0	90	49	0	84	48	T	70	47	0	64	32
12	0	88	50	0	85	53	0	75	44	0	65	41
13	0	89	50	0	87	55	0	77	44	.19	62	35
14	0	84	50	0	83	55	0	78	47	.34	62	43
15	0	84	53	0	82	52	0	83	50	T	61	40
16	0	92	53	0	84	50	0	91	50	0	60	35
17	0	92	51	0	83	52	0	83	57	.04	64	37
18	0	88	55	0	82	52	0	85	52	0	61	38
19	0	97	57	0	79	54	0	84	52	0	67	45
20	0	101	60	0	79	52	0	87	52	T	65	47
21	0	102	62	T	76	54	0	95	53	.10	67	41
22	T	89	64	0	80	51	0	93	51	0	60	33
23	T	98	57	0	81	51	0	86	49	0	64	36
24	T	70	58	0	82	50	0	76	55	0	74	36
25	0	87	61	0	85	46	0	87	46	.14	66	39
26	0	89	50	0	84	47	0	85	50	.49	66	57
27	0	92	53	0	87	49	0	86	49	2.22	62	49
28	0	86	54	0	77	53	.30	69	55	.24	59	41
29	0	78	50	0	79	45	.62	64	53	0	50	40
30	0	80	50	0	84	48	0	70	53	.03	54	40
31	0	88	47	0	84	54				3.70	60	45
avg		86.5	52.8		82.2	51.2		79.4	50.0		65.3	41.0
ttl	.02			T			2.04			7.49		

Salem

Weather Data 1994

daily precipitation and temperatures (°F minimum and maximum)

	March			April			May			June			July			August			September			October		
Day	in.	max	min	in.	max	min	in.	max	min	in.	max	min	in.	max	min	in.	max	min	in.	max	min	in.	max	min
1	0	67	51	0	61	43	0	64	36	0	71	48	0	76	47	0	88	50	0	76	47	0	76	57
2	.29	57	52	0	62	42	.06	62	47	0	75	45	0	74	51	0	90	53	.01	75	43	0	69	45
3	.17	66	51	T	60	40	.27	63	45	.03	75	39	0	74	44	0	87	55	.10	74	51	0	72	41
4	.01	59	41	0	59	39	.01	70	51	.05	70	53	0	70	46	0	78	55	0	77	52	0	75	42
5	0	54	34	.20	52	33	0	81	49	.20	64	50	T	76	51	0	80	53	0	88	47	0	74	38
6	0	59	32	.39	58	44	0	86	52	.35	64	48	0	82	45	0	84	49	0	87	51	0	69	46
7	0	61	30	.22	55	44	0	85	50	.20	69	46	0	93	55	0	72	52	0	84	48	0	68	40
8	0	61	32	.64	57	47	0	78	47	0	75	40	0	90	51	.02	74	54	.30	66	57	0	76	39
9	.18	67	38	.21	59	47	0	80	45	0	82	46	0	87	45	0	82	53	.51	68	52	0	76	44
10	T	58	42	0	62	42	0	87	44	0	86	49	0	87	.42	0	88	51	.50	68	50	T	61	43
11	0	58	34	0	70	36	0	76	54	0	83	54	0	90	43	0	85	52	0	71	49	0	64	32
12	0	67	31	.15	62	38	0	70	42	.07	75	54	0	88	43	0	86	52	0	76	44	0	64	39
13	0	70	40	T	58	37	0	71	39	.17	64	50	0	88	46	0	87	52	0	77	45	.08	61	35
14	0	70	37	0	61	36	0	68	44	.01	64	49	0	82	46	0	82	54	0	77	52	.30	59	41
15	T	63	34	0	76	38	.54	61	50	T	69	47	0	82	55	0	81	52	0	83	49	0	61	38
16	T	55	44	0	78	44	.49	62	49	0	76	42	0	93	51	0	82	53	0	93	50	0	61	34
17	.14	55	45	0	74	47	T	63	49	.06	70	46	0	91	48	0	81	53	0	85	56	T	55	37
18	.29	52	37	.05	74	48	0	67	50	0	72	43	0	86	58	0	81	51	0	83	52	0	60	34
19	.01	53	37	0	70	44	T	65	48	0	83	43	0	100	54	0	79	57	0	84	52	0	66	42
20	.38	54	40	0	74	40	T	63	53	0	85	48	0	103	60	0	79	53	0	87	54	T	64	50
21	.15	52	37	.03	67	46	0	70	47	0	83	49	0	103	59	0	76	52	0	95	56	.27	64	41
22	.10	48	36	0	66	38	0	77	46	0	78	58	0	100	65	0	79	56	0	95	50	0	60	34
23	.11	54	36	.04	63	42	0	82	45	0	73	48	0	97	61	0	80	53	0	86	48	0	63	38
24	0	66	41	.14	62	47	0	84	46	0	78	41	0	76	55	0	80	47	0	76	48	0	69	36
25	0	68	34	.01	67	47	0	75	52	0	73	45	0	87	56	0	83	48	0	85	48	.29	65	36
26	0	74	32	0	64	47	0	67	48	0	75	54	0	90	50	0	83	50	0	82	52	1.71	61	57
27	0	77	35	0	65	45	0	69	37	0	88	50	0	93	53	.03	91	50	0	85	49	2.53	60	50
28	0	75	38	0	70	40	.08	59	49	0	87	48	0	87	52	0	80	55	.02	70	56	0	61	39
29	0	74	35	.08	59	43	.02	67	50	0	80	48	0	79	53	0	78	50	.20	65	57	0	48	35
30	.66	58	50	0	64	39	0	76	37	0	81	50	0	80	55	0	85	46	0	71	55	.07	55	43
31	.07	54	49				.14	69	52				0	88	50	0	83	51				2.71	56	44
avg		61.5	38.9		64.3	42.1		71.5	46.9		75.6	47.7		86.8	51.3		82.1	52.0		79.6	50.7		64.3	41.0
ttl	2.56			2.16			1.61			1.14			T			.05			1.64			7.96		

Weed Control in Cucurbits with Activated Charcoal and Preemergence Herbicides

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Previous research indicated that metolachlor (Dual) and lactofen (Cobra) have potential for preemergence weed control in cucumbers, zucchini, and processing squash if the seed row is protected with a two-inch band of activated charcoal. Dimethenamid (Frontier) is chemically similar to metolachlor, and it was included in research this year because of registration problems for Dual.

Methodology

Experiment 1 (Planted June 9, 1994; sandy loam soil). Cucumbers (Pioneer), zucchini (Elite), and squash (50% Golden Delicious and 50% NK 530) were planted in separate experimental blocks on June 9, 1994. Seeds were planted with a two row, 'double disk opener' belt planter adapted to charcoal application. Finely ground activated charcoal was applied immediately after seeding in a two-inch band over the seed row in a slurry of 60 g activated charcoal/l of water (0.5 lbs/gal) with 8006 nozzles operating at 30 psi. The effective rate for the area covered was 300 lbs/acre (the rate per acre for a 6 foot row spacing is 8.33 lbs/acre; 4.16 lbs/acre for a 12 foot row spacing).

Metolachlor, lactofen and dimethenamid were applied broadcast shortly after planting with a unicycle sprayer equipped with 8003 nozzles operating at 30 psi, then incorporated with 0.5-inch of irrigation water. Approximately one inch of rain fell on June 15. Herbicides applied to squash plots were only applied in a 6 foot band over the row. The control plot was left unweeded until the initial weed evaluation. Then all plots were kept weed-free the duration of the season by hand weeding and cultivating.

Emerged seedlings were counted 15 DAP and weed control was evaluated visually at 19 DAP. Seedlings were thinned to equal numbers per plot at 20 DAP and spaced at 4, 15, and 22 inches for cucumbers, zucchini, and squash, respectively. Cucumbers were harvested once from 4.7 feet of row and zucchini three times from 10 feet of row. The entire 25 foot row of each squash plot was harvested on October 14.

Experiment 2. (Initiated July 20, 1994; silty clay loam soil; cucumbers only). Because of the success of the first experiment, a second trial was initiated later in the season on a different soil type with cucumbers only. Herbicides and activated charcoal were applied as described above and herbicides activated with 0.5-inches of irrigation water. Injury to cucumbers was assessed 3 weeks after planting and cucumber plants thinned to 3 plants/foot. Cucumbers were harvested one time only from 10 feet of row on September 28.

Results and Discussion

Cucumbers. As in previous trials, activated charcoal protected cucumbers when metolachlor was applied broadcast (Table 1,Figure 1). Some injury was noted at 4.0 lbs ai/acre, but this injury only slightly reduced yields. Weed control was exceptional between rows and also provided acceptable weed control within rows. Weed control within rows was better than in previous years, possibly because of the very sandy soil conditions. Weeds present at this site included pigweed, purslane, and corn spurry.

The band of activated charcoal also protected cucumbers when dimethenamid was applied broadcast. However, damage was severe without the activated charcoal and both crop emergence and yield were reduced by nearly 80 percent in the treatment with 2.5 lbs ai/acre. Fruit number and cucumber yield were unaffected by the 1.25 lb rate when protected with activated charcoal. Weed control both within and between rows was excellent.

In the second experiment initiated in August, damage was more apparent than in the early summer experiment from both metolachlor and dimethenamid treatments with the activated charcoal (Table 2, Figure 2). However, this did not translate into a yield reduction. Dimethenamid at both 1.25 and 2.5 lbs ai/acre performed better than the control plots and tended to have higher yield than the metolachlor plots. All treatments without activated charcoal greatly reduced cucumber plant biomass and fruit yield. The early season damage noted in this experiment may have been related to soil moisture at planting, which was at near field capacity.

Zucchini. Zucchini was much less sensitive to both metolachlor and dimethenamid than cucumbers. Very little injury was noted at 19 days after planting and emergence was unaffected (Table 3). The greatest yield was with activated charcoal and dimethenamid at 1.25 lbs ai/acre; the smallest was with dimethenamid at 2.5 lbs ai/acre. Though statistically insignificant, early season zucchini yield was improved by the activated charcoal. As in previous years, lactofen seriously damaged early season zucchini growth but only slightly reduced yield.

Winter Squash. Winter squash was very tolerant of both metolachlor and dimethenamid and was unaffected by dimethenamid even when not protected with activated charcoal at 1.25 lbs ai/acre (Table 4). However, damage was severe when unprotected at 2.5 lbs ai/acre. Emergence, number of fruit produced per plot, and average fruit weight were unaffected across all treatments. Differences in yield also were statistically insignificant, but trends indicated that yields were depressed when squash seed was not protected with activated charcoal.

Table 1. Response of cucumbers to preemergence herbicides and activated charcoal (Cucumber experiment #1).

	Herbicide	Rate	Charcoal	Emergence[1] (15 DAP) No./10 ft row	Percent crop injury (19 DAP) 0=no injury	Percent weed control (weed density)		Crop yield [2]	
						Between rows	Within rows (2" band)	Number fruit (4.7 ft row)	Tons/ acre
1.	Metolachlor	2.0	+	48	0	99	85	42	10.4
2.	Metolachlor	4.0	+	43	8	96	93	39	9.2
3.	Dimethenamid	1.25	+	58	4	100	96	42	10.3
4.	Dimethenamid	1.25	-	28	63	100	100	37	8.3
5.	Dimethenamid	2.5	+	42	4	100	96	35	8.7
6.	Dimethenamid	2.5	-	12	89	100	100	13	2.2
7.	Lactofen	0.125	+	43	18	100	91	42	10.2
8.	Control	0	-	55	0	0	0	42	10.6
LSD				19	15	3	8	19	4.9

[1] Plots thinned to equal stands after emergence counts.
[2] Data from first harvest only.

Table 2. Response of cucumbers to preemergence herbicides and activated charcoal, 1994 (Cucumber experiment #2).

	Herbicide	Rate	Charcoal	Percent crop injury (21 DAP) 0=no injury	Plants harvested (No./10 ft row)	Total plant biomass (lbs/10'row)	No. fruit harvested (10 'of row)	Cucumber fruit yield (tons/acre)
1.	Metolachlor	2.0	+	8	11	15.5	43	8.1
2.	Metolachlor	2.0	-	65	9	8.1	25	5.2
3.	Dimethenamid	1.25	+	35	9	17.4	46	9.7
4.	Dimethenamid	1.25	-	81	8	7.3	26	3.5
5.	Dimethenamid	2.5	+	55	11	17.4	48	9.1
6.	Dimethenamid	2.5	-	94	10	5.3	22	2.3
7.	Weedfree control	0	-	0	9	15.7	42	7.9
LSD				17	NS	2.2	12	2.7

[1] Data from first harvest only.

Table 3. Response of Zucchini (var. Elite) to preemergence herbicides and activated charcoal: 1994.

	Herbicide	Rate	Charcoal	Emergence[1] (15 DAP) no./15'row	Percent crop injury (19 DAP) 0=no injury	Percent weed control (weed density)		Crop yield [2]		
						Between rows	Within rows (2" band)	No. fruit (10 ft row)	Avg wt. (lbs)	Tons /acre
1.	Metolachlor	2.0	+	38	0	100	90	51	103	5.8
2.	Metolachlor	4.0	+	33	0	100	95	58	118	6.7
3.	Dimethenamid	1.25	+	35	5	100	95	61	109	7.8
4.	Dimethenamid	1.25	-	35	10	100	100	56	111	5.7
5.	Dimethenamid	2.5	+	39	0	100	100	54	100	5.5
6.	Dimethenamid	2.5	-	40	0	100	100	54	118	5.2
7.	Lactofen	0.125	+	36	23	100	90	50	99	5.6
8.	Control	0	-	33	0	0	0	59	107	6.5
LSD				NS	12	0	6	NS	NS	NS

Table 4. Response of winter squash (var. Golden Delicious and NK 470) to preemergence herbicides and activated charcoal: 1994.

	Herbicide	Rate	Charcoal	Emergence[1] (15 DAP) No./15'row	Percent crop injury (19 DAP) 0=no injury	Percent weed control (weed density)		Crop yield		
						Between rows	Within rows (2" band)	No. fruit (25 ft row)	Avg fruit wt.(lbs)	Tons /acre
1.	Metolachlor	2.0	+	22	0	99	63	31	16	28.4
2.	Metolachlor	4.0	+	19	0	100	75	28	17	27.9
3.	Dimethenamid	1.25	+	18	3	100	87	26	17	25.1
4.	Dimethenamid	1.25	-	23	3	100	100	25	17	23.5
5.	Dimethenamid	2.5	+	24	0	100	93	27	16	25.1
6.	Dimethenamid	2.5	-	22	46	100	100	20	16	19.1
7.	Lactofen	0.125	+	24	2	100	96	31	15	25.1
8.	Control	0	-	24	0	0	0	29	16	26.4
LSD				NS	23	0.3	19	NS	NS	NS

[1] Plots thinned to equal stands after emergence counts.
[2] Total of first three harvests.

Table 5. Herbicide Application Record Sheet

Trial name: Activated charcoal (Experiment #1)
Crop and planting date: June 9 & 10
Soil type: sandy loam
Plot size: 15 x 25, squash; 66 x 20, cukes & zukes
Location: Veg. farm, Corvallis, OR

	Squash	Cucumber and Zucchini
	Application 1	Application 2
Application date	June 9	June 10
Application timing	Pre	Pre
Start/end time	7:30–8:45 PM	6:30–7:30 AM
Air temp/soil temp (2")	69/77	60/63
Rel humidity	48%	60%
Wind direction/velocity	0–5 W	0
Cloud cover	0	0
Soil moisture	0	0
Plant moisture	0	0
Sprayer/PSI	40	40
Mix size	2000 ml 500/plot	1332 ml 333/plot
Gallons H_20/acre	2934	29
Nozzle type	8003	8003
Nozzle spacing and height	20/18	20/18
Soil inc depth (PPI/PRE)	—	—
Soil inc method/implement	—	—
Irrigation : 0.5 inches 1 day after planting		

Table 6. Herbicide Application Record Sheet

Trial name: Activated charcoal (Experiment #2)
Crop and planting date: July 20, 1994
Soil type: silty clay loam
Plot size: 10 X 20 ft
Location: Veg. farm, Corvallis OR

	Metolachlor, dimethenamid
	Application 2
Application date	July 21
Application timing	Pre
Start/end time	9:00–9:45 AM
Air temp/soil temp (2")	83/81
Rel humidity	—
Wind direction/velocity	0
Cloud cover	0
Soil moisture	dry surface
Plant moisture	—
Sprayer/PSI	40
Mix size	2000 ml/4 plots
Gallons H_2O/acre	35 gal/acre
Nozzle type	SS 8003
Nozzle spacing and height	20/18
Soil inc depth (PPI/PRE)	Irrig 2" 7/21
Soil inc method/implement	"
Irrigation: 0.5 inches after planting and herbicide application. Soil was very wet at planting.	

Comparison of Low Rates of Clomazone in Pickling Cucumber.

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Introduction

Efforts to identify replacement herbicides for chloramben on pickling cucumbers in the Willamette Valley of Oregon have focused on clomazone (Command). In other regions of the country, there has been concern over potential damage to non-target vegetation, and residual effects on subsequent crops. This research was designed to evaluate the weed control effectiveness of low rates of clomazone that might reduce the injury potential to non-target plants and residues, yet still provide acceptable weed control. A field trial was conducted that included two rates of clomazone applied both preplant incorporated and preemergence, other registered herbicides, and untreated controls.

Methods

The PPI treatments were applied with a CO_2 backpack sprayer (40 psi, four 8002 nozzles spaced 19 in, 2400 ml of spray solution) to a dry soil surface and incorporated three inches deep with a PTO-driven power tiller on May 24, 1994. The trial was seeded with a Massey-Ferguson planter the following day and the preemergence treatments were applied. Subsequently, the plot was irrigated with approximately 1 inch of water. The trial was a randomized complete block design with four replications. Soil type was a Woodburn Silt Loam. Four rows were planted to a 12 by 30 foot plot. Shepherds purse, groundsel, and pigweed were distributed fairly uniformly throughout the trial area. Weed densities were measured on June 26, 1994. The hand-weeded control was weeded on June 27, 1994 and kept weed-free until harvest. Ten feet of the two center rows of each replicate were stripped of fruit to simulate a mechanical harvest on August 3, 1994.

Results

The high rate, 0.025 lb ai/a, of clomazone applied preemergence produced yields significantly greater than most other treatments in the trial and was the only one to out-yield the hand-weeded control. Even the lower, 0.125 lb ai/a, preemergence rate of clomazone was an excellent treatment. Clomazone pre-plant incorporated resulted in significantly lower yields and reduced weed control compared to the same rates applied preemergence. The high rate of clomazone preemergence reduced stands slightly compared to most other treatments, but yield was not adversely affected. Neither weed control nor yield were improved with the combination of either bensulide or naptalam with clomazone. The combination of ethalfluralin and naptalam was superior to ethalfluralin alone for both weed control and yield. Very minor phytotoxic symptoms of yellow leaf margins were observed at the clomazone 0.25 lb ai/a rate.

Table 1. Effect of herbicides on stand count and yield of Flurry-M pickling cucumber, and weed control.

Treatment	Rate	Yield	Stand count	Weed[1] density	Weed[2] control
	lb ai/a	lbs/plot	3 feet	1 ft^2	
Clomazone PRE	0.125	36.3	34	6.5	8.5
Clomazone PRE	0.25	43.6	26	4.5	9.4
Clomazone PPI	0.125	19.8	33	19.3	4.3
Clomazone PPI	0.25	32.6	33	13.0	5.7
Clomazone PPI Bensulide	0.125 6	30.4	34	24.3	3.6
Clomazone PPI Naptalam	0.125 4	29.7	32	8.5	7.0
Ethalfluralin PRE	1.5	26.0	29	9.5	5.7
Ethalfluralin PRE Naptalam	1.5 4	33.7	33	4.0	9.0
Naptalam PPI Bensulide	4 6	38.3	33	9.3	7.2
Handweeded	---	30.2	32	21.3	1.2
Untreated	---	7.9	34	23.0	1.2
LSD 0.05		10.1	6	14.7	

[1] Represents the average of 2 one-foot-square/replicates.
[2] 0=no control, 10=complete control. Ratings represent the mean rating of the three project leaders.

Cucumber Tolerance to Bentazon

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Introduction

Researchers in the Northeast US are exploring the possibility of registering bentazon (Basagran) for postemergence weed control in cucumber production. While potential may be limited because of climatic conditions in the PNW, bentazon may have application as a selective postemergence herbicide in cucumbers.

Methods

The soil was tilled four weeks prior to planting, and glyphosate applied to kill emerged weeds one day before the cucumbers were planted. Cucumbers were planted on June 10 with a single row cross-slot planter. Bentazon was applied at 0.75 or 1.0 lbs ai/acre at either the 1.5 or 3.0 leaf stage of growth. Plant biomass was cut and weighed at flowering and cucumbers harvested once on August 12 (8 WAP).

Results and discussion

Cucumbers were initially damaged by bentazon and the yield of the first harvest was reduced (Table 1). However, visual evaluation after the first harvest indicated that cucumber growth in the bentazon treatments was equal to or greater than the control plots. Cucumbers were most sensitive to bentazon at the 1.5 leaf stage as noted by plant biomass reduction at flowering. However, this was the best stage for controlling emerging weed seedlings. First harvest of cucumbers for all bentazon treatments was reduced, but impacted least by bentazon applied at the 3 leaf stage and 0.75 lbs ai/acre rate. This indicates that bentazon may be used successfully when applied at the 3.0 leaf stage at as much as 1.0 lbs ai/acre. However, to maximize weed control efficacy, bentazon may need to applied at less than 0.75 lbs ai/acre and at the 1.5 leaf stage. Preliminary trials on zucchini and squash indicated that bentazon had very little potential with these crops because of severe crop injury.

Table 1. Effect of bentazon on first yield of cucumber, planted June 10, 1994 at Vegetable Research Farm, Corvallis OR.

Treatment	Rate (lbs ai/a)	Timing	Plant biomass reduction (at flower)	Cucumber first harvest			Weed suppression rating 7 WAP (100=complete control)
				Number fruit	Ave. wt	Yield	
			-%-	-no/20'-	-g-	-t/a-	-%-
1. Bentazon	0.75	1.5 leaf	33	169	136	4.7	91
2. Bentazon	0.75	3.0 leaf	28	150	190	5.7	57
3. Bentazon	1.0	1.5 leaf	40	147	156	4.6	91
4. Bentazon	1.0	3.0 leaf	25	140	175	4.9	73
5. Control	-	-	0	176	195	6.9	15
LSD(.05)			15	44	57	2.0	34

Weed Suppression with Spring Planted Cereals in Cucumbers and Snap Beans

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Introduction

Research continued on weed suppression with cereal residues because of success in 1992 and problems related to planting equipment in 1993. Results of previous years' work indicated that weed control can be greatly improved by relay planting large-seeded vegetable crops into cereals that have attained a height of 8 to 12 inches. Changes in light quality at the soil surface, soil temperature, or allelopathy may cause these effects. Past experience also indicates that success will be dependent on minimizing soil disturbance. The objectives of this experiment were to determine differences in weed control between cover crops and evaluate the efficiency of the cross-slot planter.

Methodology

Fertilizer was broadcast at 600 lbs (12-29-10) on May 11 and the whole plot rototilled with a Lely rotara. On May 13 (4 weeks before snap bean planting), *Micah* barley, *Steptoe* barley, *Wheeler* rye and *Martiginia* white mustard were broadcast on the soil at 45 seeds/sq foot for the cereals and 25 lbs/acre for the mustard (a high rate because of suspected poor seed viability of the mustard). After broadcasting the seed, all plots except the conventional tillage plots were rototilled to 2 inches. The conventional tillage plot was not rototilled a second time. Irrigation was applied the same day for 1 hour.

Snap beans

Three rows of snap beans were planted on June 10 in each plot with the cross slot planter on 36-inch centers. Fertilizer was banded next to the snap bean row at 230 lbs/acre of 12-29-10. Glyphosate was applied to cover crop treatments and the cover crop control just before snap bean emergence. Weed density and biomass were determined in a 1 m sq area on July 22 (6 WAP). Snap beans were harvested from 10 feet of the center row of each plot and graded. A second harvest was made to determine the delay in maturity caused by cover crop treatments.

Cucumbers

Cucumbers were planted through the growing cereals on June 10 with a single row cross-slot planter on 4 foot rows. The cereals were killed with glyphosate just as the cucumbers emerged. Seedling emergence was evaluated 19 DAP and then thinned to 3 plants/foot. Weed density and biomass were determined in a 1 m sq area on July 22 (6 WAP). Cucumber plant biomass was harvested at flowering and fruit harvested twice.

Results and Discussion

Snap beans

Micah barley and *Wheeler* rye residue reduced weed biomass by 80 percent compared to conventional tillage at 6 weeks after planting (Table 1). Compared to the cover crop control (same tillage regime but no cover crop) weed biomass was reduced by 50 percent, and this difference was not significant ($p=0.05$). Differences in weed density also were insignificant.

Weed emergence was encouraged by soil disturbance from tractor wheel marks at planting. Snap beans were planted with a one row planter on 36 inch rows. Results in a similar experiment with a wider row spacing and less traffic indicated as much as a 90 percent weed biomass reduction compared to the stale seed bed control. *Steptoe* barley residue actually increased weed emergence, probably due to the amount of residue on the surface. This residue may have protected emerging weed seedlings from glyphosate and improved soil moisture conditions at the soil surface that favored germination.

Snap bean yield was reduced by cover crops, most severely by the heavy residue of *Steptoe* barley (Table 2). In the case of *Micah* barley, *Wheeler* rye, and white mustard, this yield reduction was primarily due to a delay in maturity. A second harvest indicated snap beans planted into *Micah* barley yielded nearly as great as the conventional tillage treatment. The overall low yield within this experiment was due to the low plant population (29,040/acre) as determined by limitations within the planter unit.

Cucumbers

Micah barley residue of 0.8 tons of drymatter (10 inches tall) provided 78 percent weed control compared to the conventional tillage control and 43 percent weed control compared to the stale seedbed control (Table 3). This weed evaluation included weeds that emerged from areas where soil had been disturbed, including tire tracks. Planting with a one row unit greatly increased weed emergence. Excluding areas of disturbance, weed biomass and emerged weeds were reduced by 93 percent and 74 percent, respectively compared to the stale seed bed control (data not shown). Steptoe barley residue averaged 1.4 tons drymatter/acre and suppressed weeds by 87 percent. However, this level of residue reduced cucumber emergence by nearly 80 percent. Emergence and first harvest yields also were suppressed by the Micah barley residue, but the yield of cucumbers in the second harvest were equal to or greater than the conventional tillage and stale seedbed controls.

These results compare with results of research in 1992. In 1993, this strategy completely failed because of unsuccessful planting with a double disk opener, underscoring the need for planters such as the cross-slot that can plant through moderate amounts of residue without disturbing the soil. Minimizing soil disturbance is critical to successful weed management in this system. Additionally, maintaining adequate yields may require increased planting rates and scheduling slightly delayed harvests.

Table 1. Effect of spring-planted cereals on weed biomass and density in snap bean system.

Treatment	Cover crop/weed biomass at planting (t/ac)	Total weed density (6 WAP) no./m^2	Total weed drymatter (g/m^2)
Micah barley	0.8	7	160
Steptoe barley	1.4	21	365
Wheeler rye	0.5	10	183
White mustard	0.9	10	388
Cover crop control	0.4	6	338
Conventional tillage	0	10	892
LSD (P=0.05)	0.3	9	515

Table 2. Effect of spring-planted cereals on snap bean yield.

Treatment	Plant number	Pod yield	Average yield per plant	Grade	Delay to maturity	Predicted yield
	no./10 ft	t/acre	lbs/plant	% 2-4 sieve	(days)	t/ac
Micah barley	20	5.7	0.38	49	2	6.8
Steptoe barley	13	3.4	0.35	60	4	5.4
Wheeler rye	12	3.9	0.44	54	3	5.5
Martiginia white mustard	17	5.0	0.40	46	2	5.9
Cover crop control	25	5.9	0.33	43	1	6.6
Conventional tillage	20	7.0	0.49	35	0	7.0
LSD (0.05)	6	1.9	0.12	-	-	NS

Table 3. Cucumber yield and weed suppression with allelopathic cereals, planted June 10, 1994, Vegetable Research Farm, Corvallis OR.

Treatment	Emergence (19 DAP)	Plant biomass (at flower)	First harvest			Second Harvest	Weed suppression rating (7 WAP)
			Cucumbers	Average fruit wt	Yield	Yield	
	-No./3 ft-	-kg-	-No./20 ft-	-g-	-t/acre-	-t/acre-	
1. Micah barley	30	2.7	102	161	3.1	5.6	78
2. Steptoe barley	12	1.6	70	137	1.8	4.8	87
3. Stale seedbed control	45	5.2	204	165	6.4	4.8	35
4. Tilled at planting	53	4.8	174	230	8.0	5.2	0
LSD(.05)	NS	1.6	44	57	2.0	NS	3

Weed Suppression, White Mold Incidence, and Snap Bean Yield in Fall Planted Cover Crop Residue Systems

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Introduction

Limited herbicide options and the tentative state of registration for Ronilan fungicide in snap bean production require development of additional management strategies for suppression of weeds and white mold (*Sclerotinia sclerotiorum*). One possibility employs cereal residues derived from cover crops. Cereal cover crop residues left on the soil effectively suppress many small-seeded, annual weeds through allelopathy and mulch barriers. In addition, several compounds have been isolated from cereals that have antifungal properties. These compounds, coupled with other influences of the cereal residue, may reduce the effect of disease organisms in vegetable production systems. In 1993, minimum tillage and cover crop residues significantly reduced white mold incidence with little or no effect on crop yield. The objectives of this research were to evaluate weed suppression, white mold incidence, and snap bean yield in reduced tillage systems with two cereal residue management options.

Methodology

Micah, *Hesk* and *Steptoe* barley were drilled on October 18, 1993 into a field that was fall disked. Barley was planted at 45 seeds/sq ft. (an average of 160 lbs/acre). Glyphosate was applied to all plots on April 15 just prior to cereal booting (1.5 lbs ai/acre). Half of each main plot was rolled and the other half rolled and flailed on May 24. Conventional tillage plots were winter fallow with no cover crop, chisel plowed and rototilled on May 25. Snap beans (OR 91G) were planted on May 26 in 15-inch rows with a John Deere no-till grain drill adapted to snap bean planting. Liquid fertilizer (70 gal/acre: 50 lbs N, 100 P, 50 K, 20 S) was shanked into the soil ahead of the disk opener. Beginning at first bloom, the experiment was lightly irrigated every evening until harvest to encourage white mold development. In addition, four rows of sweet corn were planted around the perimeter of the field to reduce air flow.

Bentazon was applied June 23, 28 days after planting (DAP) at the first to second trifoliate stage. Ronilan 50DF (0.5 lbs ai/acre with 38 gal of water/acre at 50 PSI) was applied July 21 at first bloom to one half of the conventional tillage plot with both overhead and drop nozzles targeted toward both sides of the row.

Evaluations during the growing season included cereal residue drymatter at planting, bean emergence from a 4 ft sq area 27 DAP and weed density by species 27 DAP, just before herbicide application. The conventional tillage plots were hand hoed twice after the herbicide application in an attempt to reduce competition with the bean plants.

Snap beans were harvested on August 5 by pulling plants from 20 foot of two rows from each plot. From these same plants, 20 plants were randomly selected and evaluated for presence of white mold growth or evidence of grey mold on any part of the plant. White mold incidence was negligible in this experiment and did not require further evaluation. Weeds were pulled from the area cleared of snap beans in each plot, separated by species, and weighed.

Results and Discussion

Snap bean yield. Emergence was unaffected by either minimum tillage or cover crop residues. Reduced tillage treatments with flailed cereal residues generally yielded as well or better than the conventionally tilled plot (Table 1). Flailing increased yield in the *Micah* and *Steptoe* barley plots but did not improve yields in the *Hesk* barley or winter fallow plot. Bean plant biomass followed a trend nearly identical to pod yield. Low yields in the tilled plots were probably due to intense weed competition. Bentazon was not effective at controlling the high density of weeds that emerged in these plots, even though plots were hoed twice to keep suppress weed growth. The lowest yield was caused by excessive residue of *Steptoe* barley, which hindered efficient seed placement by the planter and resulted in fewer bean plants in one area of the field. Slugs also damaged beans in one block of the field.

Grade evaluations indicated that minimum tillage plots were slightly delayed in maturity. A second harvest sample was taken 5 days after the first harvest and indicated that yields were about 35 percent less than potential. Thus, scheduling bean harvests may require a slight delay.

Weeds. Early season weed density of nightshade and pigweed, the predominate weeds at this site, was reduced 96 and 67 percent respectively by eliminating tillage (Table 1, Fig. 1). Cover crop residues also reduced emergence but statistical differences were insignificant. Flailing tended to increase weed emergence. Nightshade was the most sensitive to tillage and cover crop residues. Unflailed *Micah* barley provided nearly 100 percent control of nightshade.

Weed biomass at harvest. The bentazon application was only partially effective in reducing weed density. And weed biomass at harvest averaged about 10 percent of the total bean plant biomass, more than acceptable in field conditions and enough to compete seriously with the crop. Nightshade biomass was greatly reduced by the cover crop residues, and pigweed to some extent. Flailing did not influence weed biomass at harvest.

White mold. There was little evidence of white mold infection in this plot, inspite of the high moisture of the canopy and the barrier of corn to reduce air flow. Therefore, it was not possible to determine if any of these systems were impacting white mold development.

Table 1. Effect of cereal cover crop residues and management on a snap bean production system.

Tillage	Treatment: Cereal cover crop	Residue management	Bean emergence (3 WAP)	Bean harvest: Pod yield	Grade	Bean plant biomass	Weed emergence (3 WAP): Nightshade	Pigweed	Weed biomass (at bean harvest): Nightshade	Pigweed	Total	Cover crop biomass
			(no./4 ft row)	(t/ac)	(% 2-4)	(t/ac)	------no./4 sq ft-----		------------gr/50 ft sq-----------			(t/ac)
Reduced tillage	*Micah* barley	Flailed	10	6.1 (9.5)[1]	68 (58)	11.8	0.5	4.3	134	1256	1,390	2.1
		Unflailed	11	4.1	64	10.3	0	0.5	0	356	356	
	Steptoe barley	Flailed	15	6.9	61	14.9	0	1.0	17	707	724	2.9
		Unflailed	13	2.3	56	6.3	0.3	0.8	37	759	796	
	Hesk barley	Flailed	13	6.8 (9.1)	62 (58)	13.1	0.8	1.8	17	2053	2,070	2.0
		Unflailed	10	7.6	56	14.8	0.3	0.5	0	1260	1,260	
	No cover crop	Flailed	13	5.8	57	11.2	1.3	2.0	144	2392	2,536	0
		Unflailed	13	6.2	64	12.8	2.8	4.8	737	1805	2,542	
	Conventional tillage	No Ronilan	12	6.7	43	13.0	57.0	10.5	1275	677	1,952	0
		Ronilan	-	6.7	48	12.3	-	-	1641	797	2,438	
LSD (0.05)			NS	2.4	-	4.4	34.0	4.6	1017	2132	NS	NS
Analysis of variance without conventional tillage treatments.												
Treat (cover crop)			0.11	0.16	-	0.30	0.02	0.30	0.02	0.33	0.21	-
Flail (residue management)			0.68	0.01	-	0.12	0.70	0.47	0.11	0.42	0.52	-
Treat * Flail			0.91	0.05	-	0.006	0.43	0.10	0.01	0.89	0.82	-

[1] Yield and grades in parentheses are from samples taken three days after initial harvest.

Table 2. Pesticide application record sheet

	Bentazon, 1 lb ai/acre	Ronilan 50DF, 0.5 lbs ai/acre
Application date	6/23	7/9
Application timing	POST, 1-2 trifoliate	Early bloom
Start/end time	11:30-12:15 PM	2-2:30 PM
Air temp	71	100
Soil temp (2 ")	73	92
Wind direction	W	NE
Wind velocity	5-10	0-2
Cloud cover	80 %	none
Soil moisture	dry	very wet
Plant moisture	dry	dry
Sprayer/PSI	Kubota pak tank/ 45 PSI	50 PSI
Mix size	25 gal	2 liter
Gallons H_2O/acre	30	57.5
Nozzle type	8002	8002 drop nozzles
Nozzle spacing and height	20/18	15", on both sides of the row and one above

Effect of Chloroacetamide Herbicides on Snap Bean Growth and Weed Emergence at Two Irrigation Levels

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Introduction

Dimethenamid, acetochlor, and metolachlor are of the same herbicide class as and have potential for weed control in snap bean production. The objective of this experiment was to evaluate tolerance of snap beans to dimethenamid and acetochlor, and compare weed control efficacy under two irrigation regimes.

Methods

Snap beans were planted on 30-inch rows on May 24, 1994 at the Vegetable Research Farm, Corvallis OR. The experiment was divided into high and low irrigation blocks, with 3 replications in each block. Only the higher herbicide rates were included in the 'high level' irrigation block. Herbicides were applied on May 25 to 7.5 by 30 foot plots with 26 gal water/acre (Table 3). Irrigation water was applied to both blocks on May 26 (1 inch). On May 27 another 0.66 inches of water was applied to the 'high level' irrigation plots. However, rainy periods for the next 3 days added another 0.3 inches and cool cloudy conditions kept the surface very wet and prevented application of more irrigation water before bean emergence.

Snap bean emergence, weed density, and injury to snap bean plants were evaluated on June 23 (4 WAP). Thereafter, cultivation and hand pulling were used to keep to the plots weed free. Snap beans were harvested from 10 foot of row on August 3 (71 DAP) and graded. The experiment was analyzed as a completely randomized design as presented in Table 1 and 2. The high herbicide rates were analyzed as a split plot design with irrigation as the split.

Results and Discussion

Because rain occurred shortly after planting, differences in the amount of irrigation water received by the two blocks were small. The 'high level' irrigation block received approximately 30 percent more water (through both irrigation and rainfall) than the 'low level' block within the first week.

Snap bean tolerance. Though bean seedling emergence was unaffected, snap beans showed some early signs of damage one month after planting, and were particularly sensitive to the acetochlor treatments. Both dimethenamid and metolachlor caused a slight amount of damage at the low herbicide rate, but differences in injury were not noted between irrigation regimes. However these signs of damage soon dissipated in all of the treatments.

Snap bean yield was highest for dimethenamid (1.25 lbs ai/acre) and metolachlor (2.0 lbs ai/acre). Yields in all the high irrigation level plots were less than the low irrigation plots. Snap bean yield in the acetochlor and lactofen treatments were reduced most by the additional irrigation. The yield of the control plot was very low because of constant weeding to keep the plot weed free. The 'high irrigation level' may have decreased snap bean yield overall because of saturated soil conditions soon after planting.

Weed control. The predominant weed at this site was nightshade. Dimethenamid, acetochlor, and lactofen controlled nightshade much better than metolachlor. Pigweed control was excellent with all treatments. Irrigation level had no significant effect on weed control. Weeds not completely controlled included lambsquarter in the dimethenamid treatment and petty spurge in the lactofen treatments.

Summary

Tolerance of snap beans to dimethenamid (1.25 lbs ai/ac) was comparable to both metolachlor and lactofen. However, acetochlor significantly damaged snap beans and reduced yield. A lower rate of acetochlor may have reduced injury and controlled weeds. Irrigation level did not have a major affect on early season injury within treatments. However, the higher rate of irrigation water decreased snap bean yield for all herbicides, but most significantly for lactofen and acetochlor. Dimethenamid controlled nightshade better than metolachlor at similar crop injury levels.

Table 1. Tolerance of snap bean to dimethenamid, acetochlor, metolachlor, and lactofen under two irrigation regimes.

Herbicide	Rate (lbs ai/ac)	Irrigation level	Emerge (4 WAP) (no./2 ft of row	Damage estimate (4 WAP) 0=none; 10=high	Snap bean yield (t/ac)
1. Dimethenamid	1.25	Lo	12	1.0	9.7
2. Dimethenamid	1.5	Lo	18	1.3	9.4
3. Dimethenamid	1.5	Hi	16	1.3	8.8
4. Acetochlor	1.25	Lo	11	4.0	8.8
5. Acetochlor	1.5	Lo	15	4.0	8.6
6. Acetochlor	1.5	Hi	15	2.7	7.4
7. Metolachlor	2	Lo	15	1.0	9.8
8. Metolachlor	2	Hi	16	0.6	9.3
9. Lactofen	0.187	Lo	18	0.7	9.2
10.Lactofen	0.187	Hi	15	0.3	7.7
11.Control	-	-	12	0	6.0
LSD			NS	1.1	2.0

Table 2. Weed control efficacy of dimethenamid, acetochlor, metolachlor, and lactofen under two irrigation regimes.

Herbicide	Rate lbs ai/ac	Irrigation level	Nightshade (no./m sq)	Pigweed (no/m sq)	Misc (no/m sq)
1. Dimethenamid	1.25	Lo	3.0	0	0.3
2. Dimethenamid	1.5	Lo	1.0	0	0.3
2. Dimethenamid	1.5	Hi	3.0	0	2.3
3. Acetochlor	1.25	Lo	0.3	0	0.7
4. Acetochlor	1.5	Lo	0	0	0
4. Acetochlor	1.5	Hi	0.3	0	0
5. Metolachlor	2	Lo	67.0	0	0
5. Metolachlor	2	Hi	51.0	0	0
6. Lactofen	0.187	Lo	1.0	0	3.0
6. Lactofen	0.187	Hi	0.6	0	4.6
7. Control	-	Lo	177.0	5.4	3.2
LSD			65.0	NS	NS

Table 3. Herbicide Application Record Sheet

Application date	May 25, 1994
Application timing	Preemergence
Start/end time	7:00/8:15 AM
Air temp/Soil temp (2")	63.4/66 F
Rel humidity	41 %
Wind direction/Velocity	E/0-1 mph
Cloud Cover	Clear
Soil moisture	Dry surface, moist at 2"
Plant moisture	-
Sprayer/PSI	plot sprayer/40 PSI
Mix size	1500 ml/3 plots
Gallons H_2O/acre	26
Nozzle type	8003
Nozzle spacing and height	22/18

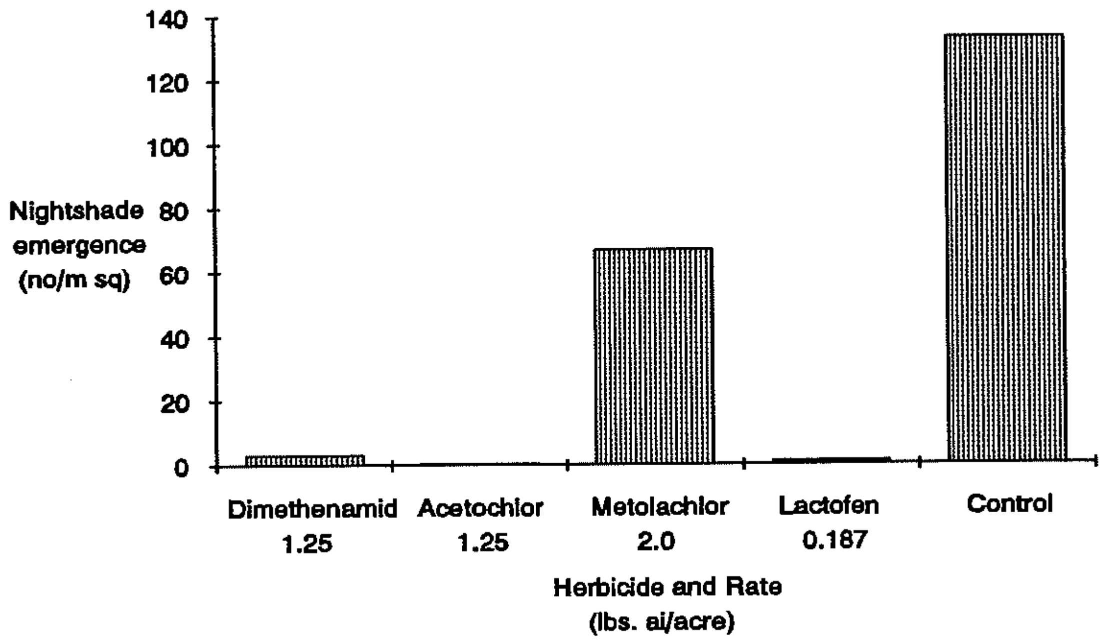

Figure 1. Nightshade control with dimethenamid, acetochlor, metolachlor, and lactofen with the lowest amount off irrigation.

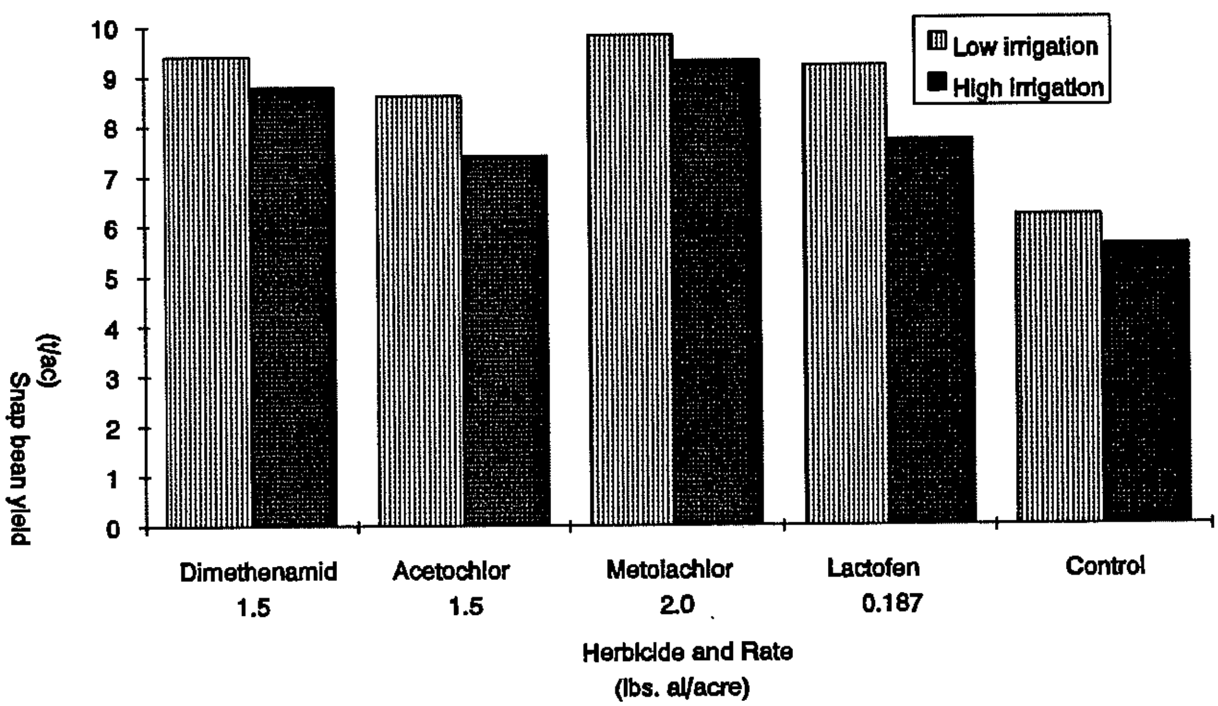

Figure 2. Snap bean yield response to preemergence application of dimethenamid, acetochlor, metolachlor and lactofen under two irrigation regimes

Herbicide Alternatives to Atrazine Tolerant Weeds in Sweet Corn

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Introduction

A two-to-three decade reliance on triazine herbicides in sweet corn production, particularly atrazine, has led to the selective development of populations of certain weed species resistant to control with herbicides in this chemical family. Additionally, concern for the presence of triazine herbicides in agricultural area aquifers has caused these materials to be classed as "restricted use" herbicides. These factors encourage the development of additional weed control strategies to maintain profitability in sweet corn production.
The objectives of this research were to continue evaluation of new herbicides that may be available in the near future such as dimethenamid, acetochlor, nicosulfuron, and flumetsalam for control of atrazine tolerant weeds in sweet corn production.

Methodology

Trials were conducted at two grower operated sites near Junction city and Stayton. Treatments were evaluated through the 5 to 6 leaf stage of corn for tolerance and weed control. A third trial was located at the Vegetable Research Farm near Corvallis to assess herbicide impacts on crop yield.

Herbicides were applied pre-plant incorporated (PPI), preemergence (PRE) or post emergence (POST) at several rates and combinations. All treatments were applied with a CO_2 unicycle plot sprayer. Golden Jubilee sweet corn was planted at Corvallis and Stayton, and super sweet Golden Jubilee at Junction City. Dyfonate was applied at Stayton and Junction City.

All plots were hoed and cultivated twice at Corvallis after the weed evaluation at 40 days after planting. The weeded treatment was hoed prior to the weed evaluation and the unweeded check plot was cultivated and hand hoed after the initial weed evaluation.

Results and Discussion

Site specifics. Atrazine was effective in controlling pigweed only at the Vegetable Research Farm. Pigweed at Junction City was very tolerant. Pigweed was also tolerant at the Stayton site based on the poor pigweed control with atrazine in the surrounding field. Sweet corn (super sweet Golden Jubilee) injury was very low at the May 10 planting in Junction City for all treatments even though this was a super sweet variety and dyfonate insecticide was applied. This site had nearly perfect moisture at planting and irrigation was not applied until mid-June.

Herbicide Performance (Tables 1-6)

Acetochlor: Excellent pigweed, purslane, nightshade, and barnyard grass control for both PPI and PRE applications. Good control of proso millet at Stayton site. Slight corn injury was noted at higher rates of 1.75 and 2.75 lbs ai/A.

Acetochlor plus atrazine (PRE): Slight increase in weed control compared to acetochlor applied alone. Low corn injury.

Acetochlor plus dimethenamid (PPI): Excellent pigweed, purslane, nightshade and barnyard grass control. Good control of proso millet at the Stayton site, but no better than acetochlor plus atrazine and alachlor plus atrazine. Slight corn injury except at Corvallis.

Acetochlor plus halosulfuron (only at Junction city site, PPI): Excellent pigweed and nightshade control. Good control on barnyard grass. Low corn injury.

Dimethenamid: Excellent pigweed control at Junction city when applied PPI, but poor control when applied PRE at same location. Excellent pigweed control at both Corvallis and Stayton. Moderate corn injury when applied at the rate above 1.25 lbs ai/A. Moderate corn injury when applied PPI at the Corvallis site. Better nightshade and proso millet control than metolachlor.

Dimethenamid plus atrazine (PPI/PRE and PRE/PRE): Excellent weed control and no corn injury at Corvallis when applied PRE; slight injury if applied PPI/PRE. Injury severe at Stayton with PPI/PRE and weed control fair. At Junction city, definite advantage in weed control of combined PRE application than either herbicide alone. No advantage if dimethenamid applied PPI. Other sites suggest safety problem with PPI applications however. This combination more effective than metolachlor plus atrazine.

Halosulfuron (both applied tank mix and alone): Excellent pigweed control. Extremely high corn injury except at Junction city site where there was good weed control and very little corn injury.

Nicosulfuron (both applied tank mix and alone): Excellent pigweed control, except for Stayton site. High corn injury at all sites except Junction city. No advantage to combination with halosulfuron.

Metolachlor+flumetsalam (Broadstrike): Excellent weed control at all sites. Extremely high corn injury at Corvallis and Stayton, but very low injury at Junction City.

Table 1. Corn yield and weed control at Vegetable Research Farm, Corvallis, OR, 1994.

Treatment	Rate	Timing	Weed control (6 WAP)[1]			Corn injury	Sweet corn harvest			
	(lbs ai/A)		Pigweed	Night shade	Purslane	(6 WAP)	Unhusked wt	Husked wt	Ears	Culls[2]
			--------------	%	--------------	%	t/ac	t/ac	no/12'	%
1.[3] Atrazine	1.00	PRE	100	100	100	3	13.1	8.7	28	13
2. Atrazine Metolachlor	1.00 2.00	PRE PRE	100	100	100	3	12.2	7.9	20	2
3. Metolachlor	2.00	PRE	100	88	100	6	13.9	9.1	27	12
4. Metolachlor[4] Flumetsalam	2.10 0.0625	PRE	100	100	100	55	13.4	8.2	25	24
5. Alachlor	2.75	PPI	92	53	77	0	11.8	8.2	24	3
6. Alachlor	2.75	PRE	100	100	100	0	12.5	8.1	22	12
8. Dimethenamid	1.25	PPI	100	99	88	17	11.3	7.4	21	24
10. Dimethenamid	1.25	PRE	100	100	100	8	13.4	8.8	25	7
12. Dimethenamid Acetochlor	0.75 1.50	PPI PPI	100	99	100	4	12.6	8.4	26	15
13a. Dimethenamid Atrazine	1.25 1.00	PRE PRE	100	100	100	0	11.6	7.5	22	10
14a. Dimethenamid Atrazine	1.25 1.00	PPI PRE	100	100	100	5	14.9	9.4	29	15
15. Acetochlor	1.50	PPI	95	98	88	1	12.2	8.5	25	22
16. Acetochlor	1.75	PPI	100	100	100	0	12.3	8.1	23	9
18. Acetochlor	1.50	PRE	100	95	85	5	13.3	9.2	25	5
21. Acetochlor Atrazine	1.75 1.00	PRE PRE	100	100	100	5	13.7	9.3	27	12
22. Halosulfuron	0.0375	PPI	100	58	95	31	12.3	7.0	21	17
24. Halosulfuron Alachlor	0.0375 2.75	PPI PPI	100	100	100	41	9.7	6.7	22	22
25. Halosulfuron	0.075	PRE	100	80	100	45	9.6	6.1	23	21
27a. Halosulfuron Nicosulfuron	0.0375 0.0320	POST POST	100	71	100	35	11.0	7.0	23	20
28. Nicosulfuron	0.0320	POST	100	80	100	34	12.7	8.5	26	13
30. Untreated[5]	-	-	0	0	0	0	10.8	7.1	22	5
31. Weeded	-	-	75	40	30	0	10.9	7.9	21	6
LSD (0.05)			15	22	22	12	4.1	2.9	NS	16

[1] WAP: weeks after planting

[2] Includes unfilled and damaged ears.

[3] Treatment numbers coordinated among sites.

[4] Broadstrike=metolachlor (7.47 lbs ai/gal) and flumetsalam (0.20 lbs ai/gal).

[5] Cultivated after initial weed control estimate.

Table 2. Herbicide Application Record Sheet for Corvallis site.

Location: Vegetable Research Farm, Corvallis
Crop and planting date: sweet corn (Golden Jubilee) June 2, 1994.
Soil type: silty clay loam

	Application 1	Application 2	Application 3
Application date	June 2, 1994	June 2	June 28
Application timing	PPI	PRE	POST
Start/end time	8:00-9:30 AM	11:00-12:30 PM	7:30-8:30 AM
Air temp	70	70	62
Relative humidity	45	45	NA
Soil moisture	Moisture at 1"	Dry surface	Dry surface
Plant moisture	-	-	Wet from dew
Sprayer/PSI	40	40	40
Gallons H_2O/acre	32	32	32
Soil inc depth (PPI/PRE)	2 inch	-	-
Soil inc method/implement	Lely rotera	-	-

Table 3. Weed control and corn injury at Junction city site, 1994.

Treatment	Rate (lbs ai/A)	Timing	Percent weed control (7 WAP)			Sweet corn injury
			Pigweed	Nightshade	Barnyard grass	%
1. Atrazine	1.0	PRE	61	48	78	1
2. Atrazine Metolachlor	1.0 2.0	PRE PRE	73	93	98	2
3. Metolachlor	2.0	PRE	71	100	94	1
4. Metolachlor[1] Flumetsalam	2.1 0.0625	PRE	89	95	93	1
5. Alachlor	2.75	PPI	90	95	98	1
6. Alachlor	2.75	PRE	89	100	88	1
8. Dimethenamid	1.25	PPI	97	95	95	0
9. Dimethenamid	1.5	PPI	96	100	92	1
10. Dimethenamid	1.25	PRE	70	100	92	1
11. Dimethenamid	1.5	PRE	65	100	96	2
12. Dimethenamid Acetochlor	0.75 1.5	PPI PPI	96	95	96	2
13. Dimethenamid Atrazine	1.25 1.0	PRE PRE	90	70	91	0
14. Dimethenamid Atrazine	1.75 1.0	PPI PRE	96	87	98	1
15. Acetochlor	1.5	PPI	98	100	92	1
16. Acetochlor	1.75	PPI	95	95	100	2
18. Acetochlor	1.5	PRE	99	100	98	2
19. Acetochlor	1.75	PRE	98	100	96	1
20. Acetochlor	2.0	PRE	94	100	95	2
21. Acetochlor Atrazine	1.75 1.0	PRE PRE	99	100	97	0
22. Halosulfuron	0.0375	PPI	78	100	70	3
23. Halosulfuron Acetochlor	0.0375 2.75	PPI PPI	97	100	92	2
25. Halosulfuron	0.075	PRE	92	100	68	0
26. Halosulfuron	0.094	PRE	90	100	76	1
27. Halosulfuron Nicosulfuron	0.0375 0.75	POST POST	57	47	67	0
29. Nicosulfuron	0.75	POST	75	77	67	2
30. Untreated	-	-	0	0	0	0
LSD (0.05)			19	15	16	NS

[1] Broadstrike=metolachlor (7.47 # ai/gal) and flumetsalam (0.20 # ai/gal).

Table 4. Herbicide application record sheet for Junction City site.

Location: Junction City
Crop and Planting date: Sweet corn (super sweet Golden Jubilee), May 9 1994.
Soil type: loam

	Application 1	Application 2	Application 3
Application date	May 6, 1994	May 12	June 8
Application timing	PPI	PRE	POST
Start/end time	6:00-8:00 AM	8-11:00 AM	3:00-3:30 PM
Air temp/soil temp (2")	60/58	70/70	80/93
Rel humidity	62	47	37
Wind direction/velocity	N/0-1	NW/ 0-2	NW 0-2
Cloud cover	0	0	0
Soil moisture	Dry surface	Dry surface	Dry surface
Plant moisture	-	-	Very dry
Sprayer/PSI	40	40	40
Gallons H_2O/acre	30	30	30
Soil inc depth (PPI/PRE)	2 inch	-	-
Soil inc method/implement	vibrashank	none	-

Notes

1. Dyfonate insecticide applied at this site.
2. Preemergence halosulfuron applied 5/13; air temp 56, soil temp 60, humidity 66%.

Table 5. Weed control and corn injury at Stayton site, 1994.

Treatment	Rate	Timing	Percent weed control (6 WAP)			Sweet corn injury
	(lbs ai/ac)		Pigweed	Lambsquarter	Wild proso millet	%
3. Metolachlor	2.0	PRE	82	100	55	1
7. Alachlor Atrazine	2.75 1.0	PRE PRE	99	100	91	6
9. Dimethenamid	1.5	PPI	98	100	81	12
10. Dimethenamid	1.25	PRE	97	62	80	10
12. Dimethenamid Acetochlor	0.75 1.5	PPI PPI	99	100	87	10
14a. Dimethenamid Atrazine	1.25 1.0	PPI PRE	95	87	86	20
15. Acetochlor	1.5	PPI	100	82	81	7
16. Acetochlor	1.75	PPI	100	100	76	10
17. Acetochlor	2.75	PPI	87	100	81	5
18. Acetochlor	1.5	PRE	99	100	67	2
19. Acetochlor	1.75	PRE	100	100	80	1
21. Acetochlor Atrazine	1.75 1.0	PRE PRE	100	100	93	1
24. Halosulfuron Alachlor	0.0375 2.75	PPI PPI	100	100	68	51
27a. Halosulfuron Nicosulfuron	0.032 0.029	POST POST	99	100	97	48
28. Nicosulfuron	0.032	POST	99	25	98	23
30. Unweeded	-	-	0	0	0	0
LSD (0.05)			14	28	26	18

Table 6. Herbicide application record sheet for Stayton site.

Location: Stayton
Crop and planting date: sweet corn (Golden Jubilee), June 23, 1994
Soil type: Gravelly silt loam

	Application 1	Application 2	Application 3
Application date	June 20, 1994	June 24	July 22
Application timing	PPI	PRE	POST
Start/end time	1:00-3:00 PM	3-3:45 PM	10:15-10:45 AM
Air temp/soil temp (2")	87/86	75/83	90/NA
Rel humidity	50	50	70
Soil moisture	Dry	Dry	Moist
Plant moisture	-	-	Dry leaf surface
Sprayer/PSI	40	40	40
Gallons H_2O/acre	30	30	30
Soil inc depth (PPI/PRE)	3 inch	-	-
Soil inc method/implement	rototiller	none	-

Propane Flaming for In-row Weed Control in Sweet Corn.

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Introduction

Propane flaming is used to control weeds in field corn and cotton production on a limited scale. Typically, the propane nozzle is targeted at the base of the corn plant at an angle of 45 to 75 degrees with propane pressures of 25 to 40 lbs/sq in. Whether flaming can become an important weed control tool may depend on its success in cool and possibly wet conditions that occur in early spring, flexibility of application timing, and efficiency of killing in-row weeds. The objectives of this research were to determine tolerance of sweet corn to propane flaming and efficiency of in-row weed control.

Methodology

Sweet corn (Golden Jubilee) was planted on 36-inch rows on June 1, 1994. The flame dispensers were mounted on directed-sprayer skids to keep the nozzles at an even height above the ground. Flame was applied with two shielded nozzles directed from both sides of the row, offset 12 inches from each other, and held 8 inches from the corn row. The shielded flamers were directed at the base of the corn plants at a 45 degree angle. Each plot consisted of two rows in the middle of the plot that were flamed and two outside rows in each plot that were not flamed, allowing a more reliable assessment of flaming as each flamed section had an unflamed treatment immediately adjacent. All treatments were applied at 3 MPH.

Treatments 2-6 were flamed (See Table 1 for timing and rate) 27 days after planting (DAP). Then the entire experimental plot was cultivated and soil was hilled next to the corn. Thereafter, treatments were flamed according to the schedule in Table 1. The entire plot was again cultivated 38 DAP (July 8).

Weed biomass was collected from adjacent flamed and unflamed rows on July 14 (43 DAP) from 3 foot of row and in a band that included 4 inches on both sides of the row. After weed samples were cut, Trs. 1-7, 9, and 11-13 were hand hoed to reduce weed competition effects on growth and permit evaluation of corn growth responses to burning without competition factors. Treatments 8 and 10 had good weed control at this point and remained unweeded for a full-season weed evaluation. The last flame application was applied to Trs. 10 and 13 after the plots were weeded.

Results

All treatments listed in Table 2 except Tr. 2 reduced weed biomass compared to the unflamed controls, even though purslane was very common and the predominate weed at some locations within this trial. Purslane is very tolerant to flaming because of its fleshy leaves. Crop yield was significantly reduced in only one treatment (Tr. 3), where extensive burning of the foliage occurred (see Table 1). There was little advantage for weed control when the corn was flamed at less than 10 inches. At 10 inches, sweet corn tolerated rates of to 2.3 gal/A and reduced weed biomass by nearly 50 percent. Increasing the number of applications greatly improved weed control. Corn tolerated very intense heat at rates as high as 6.8 gal/A when 16 inches tall, indicating that higher pressures may be possible at the 24-inch stage. As a rule of thumb at 3 MPH and this configuration, corn can tolerate approximately 1 gal/acre for every four inches of corn growth.

The plots that were not handweeded for the full season demonstrated propane flaming can be effective for full season, in-row weed control in sweet corn with these flaming units and configuration (data not shown). Treatment 8 with two applications reduced weed biomass by 90 percent at harvest and had a yield comparable to the control. Treatment 10 with 3 flamings had the highest yield and controlled weeds throughout the season (greater than 90 percent control at harvest). However, cost, inconvenience, and timeliness of application may deter use unless inexpensive herbicides such as atrazine are unavailable. Cost of Trs. 8 and 10 for the propane only was approximately $6.10 and $12.90/acre, respectively[1]. Comparatively, the cost of the herbicide only for Atrazine (2 lbs ai/A) and Dual (2 lbs ai/acre) in an 8-inch band would be $1.57 and $3.85 respectively on 36 inch rows.

Another trial was set up late in the season to evaluate tolerance of sweet corn when flamed at emergence. Sweet corn was affected very little when propane flame at 3.8 gal/acre was oriented directly over the row just as the corn emerged from the soil. Future research will evaluate full season corn growth with this system.

[1] Estimate based on 36-inch row spacing and propane price of $0.99/gal.

Table 1. Effect of propane flaming on sweet corn yield, Corvallis, OR, 1994.

	Treatment				Unhusked wt.	Shucked wt	Total no ears	Ear wt	Filled ears
	Corn ht.	DAP[1]	Propane (gal/A)						
	in. (max.)		gal/A/ application	total gal/A[2]	t/ac[3]	t/ac	no/20' row	lbs	%
1.	Control (handweeded, no flaming)				11.4	7.4	44	0.72	95
2.	6	27	1.6	1.6	10.6	7.4	37	0.76	99
3.	6	27	2.3	2.3	8.7*	5.9*	29	0.83	93
4.	6 10	27 31	0.9 2.3	3.2	10.7	7.6	42	0.71	99*
5.	6 10 16	27 31 37	0.9 2.3 3.8	7.0	9.8	7.3	36	0.75	99*
6.	6 18	27 39	0.9 7.0	7.9	10.8	7.8	36	0.81	98
7.	10	31	2.3	2.3	12.3	8.5	38	0.87	100*
8.	10 16	31 37	2.3 3.8	6.1	11.1	7.8	37	0.81	98*
9.	10 16 18	31 37 39	2.3 3.8 6.8	12.9	9.9	6.9	31	0.85	93
10.	10 16 24	31 37 43	2.3 3.8 6.8	12.9	12.3	7.6	38	0.90	98
11.	10 16	31 39	2.3 6.8	9.1	10.4	7.3	36	0.79	98
12.	16	37	6.8	6.8	10.6	8.1	47	0.65	96
13.	16 24	37 43	6.8 6.8	13.6	9.9	7.3	38	0.72	99

1 DAP: days after planting that propane was applied to corn.

2 Propane use for 36" rows at 3 MPH. Propane cost approximately $0.99/gal.

3 Values designated with (*) within the same column differ statistically with the control (Treatment 1).

Table 2. Effect of propane flaming on weed biomass and sweet corn yield 7 weeks after planting, Corvallis, OR, 1994.

Treatment					Weed biomass reduction	Sweet corn yield
No.	Corn ht	DAP[1]	Propane use[2]			
	in (max.)		gal/acre/ application	total gal/A	%	t/ac
1		Control			-	11.4
2	6	27	1.6	1.6	0	10.6
3	6	27	2.3	2.3	6	
4	6	27	0.9	3.2	48	10.7
	10	31	2.3			
5	6	27	0.9	7.0	72	9.8
	10	31	2.3			
	16	37	3.8			
6	6	27	0.9	7.7	58	10.8
	18	39	6.8			
7	10	31	3.8	3.8	47	12.3
8	10	31	2.3	6.1	80	11.1
	16	37	3.8			
11	10	31	2.3	9.1	70	10.4
	18	39	6.8			
12	16	37	6.8	6.8	68	10.6

1 DAP: days after planting that propane was applied,

2 Propane application rate is for 36" rows at 3 MPH. Propane cost is $0.99/gal.

Effect of Spring-planted Cover Crops on Weeds, Symphylan Density, and Sweet Corn Growth

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Introduction

The garden symphylan (*Scutigerella immaculata*) is a serious agricultural soil pest in the Pacific Northwest and elsewhere. In 1991 and 1993 we noted that symphylan density was less under spring-planted *Micah* barley residue than other cereals, conventional tillage, and soil with no cereal residue. The objectives of this trial were to further evaluate the impact of several plant species on the density of symphylans in sweet corn. Cover crops and non-crop vegetation may have potential to partially address non-chemical symphylan control either through direct impacts on the pest or through habitat modification.

Methods

The entire plot was tilled with the rotera on May 3, 1994. Fertilizer was applied at 900 lbs (12-29-10) and the soil worked again with the rotera. On May 6, plots were staked and seeds of annual ryegrass (20 lbs/acre) and Humus rape seed (14 lbs acre) were broadcast with a hand spreader and plots raked by hand. Irrigation followed immediately at 1.5 hours and was applied each evening for the next three days. On May 13, seeds of Micah barley and Wheeler rye (45 seeds/sq foot) were broadcast with a hand spreader. These plots were rototilled to 2 inches to incorporate the seed. The adjacent control plots for these treatments also were rototilled. Irrigation was again applied on May 13 for 1 hour and the plots kept wet for three days.

Glyphosate was applied on June 17 to kill the growing cereal. On June 29 the entire plot was flailed and the kelp meal and dyfonate plots plus associated control plots were rototilled to 4 inches. On June 30, 400 lbs kelp meal and 2 lbs dyfonate/acre were broadcast on respective plots and rototilled into the soil to 2 inches. On June 30, sweet corn *Golden Jubilee* was planted with the cross-slot planter on 36-inch rows banded with 230 lbs 12-29-10.

Cereal and weed biomass was cut and weighed on June 17. Corn emergence was determined from 4 foot of row, and weed emergence by species was evaluated in a 36-foot sq area on July 28 (4 WAP). To assess symphylan density, 3 soil cores (4-inch dia by 6.6 inch deep) were taken alongside the center row of each plot. Each sample was searched for 2 minutes to estimate symphylan density. Corn biomass was cut on August 30 from 10 foot of one row in each plot.

The accuracy of our sampling technique was tested by cutting random soil cores in half and counting the symphylans in one half for one minute and then extracting the symphylans from the other half with Berlaise funnels (see Table 3). Two soil cores one inch in diameter and 6 inches deep were taken from the same area in each plot as symphylan cores taken. The soil was weighed, dryed and weighed again to determine percent moisture.

Results and Discussion

Micah barley and *Wheeler* rye produced 1.4 and 1.0 tons of dry matter, respectively. This amount of residue did not affect sweet corn growth (Table 1). Weed control was exceptional, particularly in regard to nightshade control (Table 2 and Figure 1). Both *Micah* barley and *Wheeler* rye reduced symphylan populations to the same level as the Dyfonate treated plot (Fig. 2). Compared to the conventional tillage plot without Dyfonate, cover crops reduced symphylan populations by nearly 75 percent. Symphylan density at this site was sufficient to cause erratic corn growth in some areas. Visual two-minute soil searches gave consistent estimation of symphylan density even though only one-third of the symphylans were accounted for visually.

Soil moisture percentage correlated very poorly with symphylan density, as did soil temperature that was monitored in 1993, leading us to believe that other mechanisms are responsible for this reduction. We have speculated that changes in soil physical or food web structure, or allelopathic compounds may be responsible for the reduction in symphylans.

Table 1. Effect of cover crops and tillage system on symphylans, corn emergence and growth, and soil moisture.

Treatment	Symphylans (no/3 cores)	Corn emergence (no./4 ft row)	Corn biomass at harvest (kg/10' row)	Cereal biomass (t/acre)	Weed biomass before killed (t/ac)	Soil moisture
Micah barley	5 b	28	17.6 a	1.5 a	0.10 d	17.6 a
Wheeler rye	4 b	25	17.2 a	1.0 bc	0.15 cd	17.2 a
Barley/rye control	12 ab	21	17.2 a	0 d	-	17.2 a
Annual ryegrass	12 ab	25	16.6 a	0.7 c	0.38 bcd	16.6 a
Humus rape seed	20 a	21	16.6 a	1.2 ab	0.42 bc	16.6 a
Ryegrass/rape control	16 ab	25	17.7 a	0 d	-	17.7 a
Dyfonate Conventional tillage	5 b	23	17.0 a	0 d	0.55 ab	17.0 a
Kelp meal/conventional tillage	11 ab	25	17.1 a	0 d	0.79 a	17.1 a
Conventional tillage	18 a	23	17.4 a	0 d	-	17.4 a
LSD	12	NS	1.6 a	0.4	0.31	1.6

Table 2. Effect of cover crops and tillage system on weed density.

Treatment	Pigweed density (no/36 ft sq)	Nightshade density (no/36 ft sq)	Total weed density
Micah barley	4 a	0.6 a	6 a
Wheeler rye	9 a	1.4 a	11 a
Barley/rye control	33 a	1.3 a	35 a
Annual ryegrass	9 a	1.4 a	10 a
Humus rape seed	6 a	2.6 a	9 a
Ryegrass/rape control	14 a	0.4 a	15 a
Dyfonate Conventional tillage	51 a	121 c	176 c
Kelp meal/ conventional tillage	149 b	27 ab	177 c
Conventional tillage	58 a	52 b	111 b

Table 3. Comparison of symphylan density by Berlaise extraction and visual sampling.

Sample (4" dia * 6.5")/2	Visual 1 minute count	Berlaise extraction
1	2	3
2	7	10
3	16	50
4	18	52
5	18	35
6	11	37
7	3	25
8	3	7
9	1	23
Total	79	221
Factor	1	2.8
r^2	0.80	

Effect of Time and Location of Nightshade Emergence on Nightshade Berry and Seed Production.

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Introduction

The objective of this experiment was to determine the impact of nightshade (NS) emergence time on nightshade berry and seed production. Though nightshade competition for light, nutrients, and water limits yield of snap beans, nightshade berry and seed production are important concerns for both growers and processors. Products may become contaminated with nightshade berries that are picked during harvest of snap beans, and growers penalized for contaminated product. Also, nightshade is becoming a difficult weed to control in many crops due to the loss of effective herbicides. A spatial and temporal model to predict the potential of NS to produce seeds or berries under varying conditions would facilitate decisions on whether to apply postemergence herbicides such as bentazon.

Methodology

Snap beans were planted in east to west rows at two sites that were loaded with nightshade seeds. At the first site, trifluralin was applied preplant emergence to insure a dominant population of nightshade. Snap beans were planted on May 26 and harvested August 4. The second site was planted at a site with higher fertility on June 10 and harvested August 19. Fertilizer was banded in both plantings at the same rate at 2 inches south of each bean row. This established a fertility gradient in regards to the nightshade emergence site (see Figure 1). NS seedlings emerging 10 inches north of the bean row were 12 inches north and 18 south of the fertilizer band, while NS emerging 20-inches north of the row were 22 inches north of the fertilizer band and 8 inches south of the band. The 20-inch north emergence site was 50 percent closer to the fertilizer band than the 10-inch north emergence site.

Nightshade seeds were planted in three hills in each plot, at three locations within the row for each treatment (immediately within the row, 10 inches north of the row, and at 20 inches north of the row), and at two successive timings for each treatment. The first timing was to coincide with opening of the second bean trifoliate. At this stage of snap bean growth, a nightshade plant with two true leaves was selected from each hill, and the other seedlings removed. This stage of NS development was selected because it is easy to recognize and easily controlled with bentazon. This procedure was implemented for two later emergence times (2 NS leaves at first bloom), but because only a few of these nightshade plants developed flowers, only the first emergence time will be included in this report.

At snap bean harvest, nightshade plants were cut at the soil surface and weighed, then dried and weighed again. Berries were stripped, counted, and weighed in the field, then stored for 3 months in paper bags at 8 C. Berries were crushed and seeds extracted and germinated on filter paper in a growth chamber at alternating 20 (16 hr) to 30C (8 hours) with one hour of light near the end of the 8 hour period. The seeds were inspected with a dissecting scope to determine maturity and percent germination. Seeds that had developed a hard seed coat were reported as mature.

Results and Discussion

The first planting had poorer fertility conditions than the second planting, and may have had an influence on the nightshade interaction with the snap beans. Snap beans yielded more at the second site and plant growth was very vigorous (see Table 1).

Location of the emerging nightshade had an important effect on nightshade development. In Experiment #1, all plants at all locations produced flowers, although not all of the plants survived. Only 41 percent of the plants located within the row were found at snap bean harvest. Dry matter production of NS was greater on the north side of the row than the south. The percent of mature seeds was greater within the row than at 10 inches north of the row, but this did not seem to effect the percent of seeds that germinated.

In the second planting, survival of nightshade immediately in the snap bean row was greater than survival in Experiment #1. Dry matter production was higher between rows but did not differ from north to the south side. No berries were produced by the plants in the bean row. The highest amount of seed produced was at 10 inches north of the row. Seed development also was greater on the north side of the row. Some plants of NS did not produce flowers.

These results indicate the importance of site of emergence with NS development and ability to predict the potential for NS seed or berry development. As expected, NS in the bean row performed very poorly. Although survival was reduced, some did manage to produce mature berries (> 6mm in diameter) but only in experiment #1 with the lower fertility conditions. NS between rows survived better, and had a higher dry matter production. However, in the low fertility site, those plants that did survive in the bean row produced nearly as many berries as plants between rows, and as many seeds/plant. These results must be seen in light of the fact that the probability of producing seed or berries was always higher between rows than immediately within the row (see Figures 1 and 2).

The difference in results between Exp #1 and #2 may be related to fertility. In low fertility conditions, NS growth was influenced by the location of fertilizer. Survival may have been influenced by the higher fertility conditions also. NS is very able to compensate for changes in light, indicating that fertility may have been the important factor. The stronger plant growth at Exp #2 may have decreased the ability of NS to produce berries and seeds.

In any case, NS with two true leaves at emergence of the second trifoliate may produce both berries of an important size and germinable seeds. NS at the same stage when beans are just showing flowers will produce flowers but no berries. Location within the row will affect berry and seed production, but this is dependent on fertility level.

Table 1. Snap bean yield, grade, and plant density at harvest in two nightshade experiments.

	Experiment 1	Experiment 2
Plants per foot	5.1	5.8
Snap bean yield (t/ac)	7.7	10.1
Grade at harvest (% 2-4)	40 %	50 %

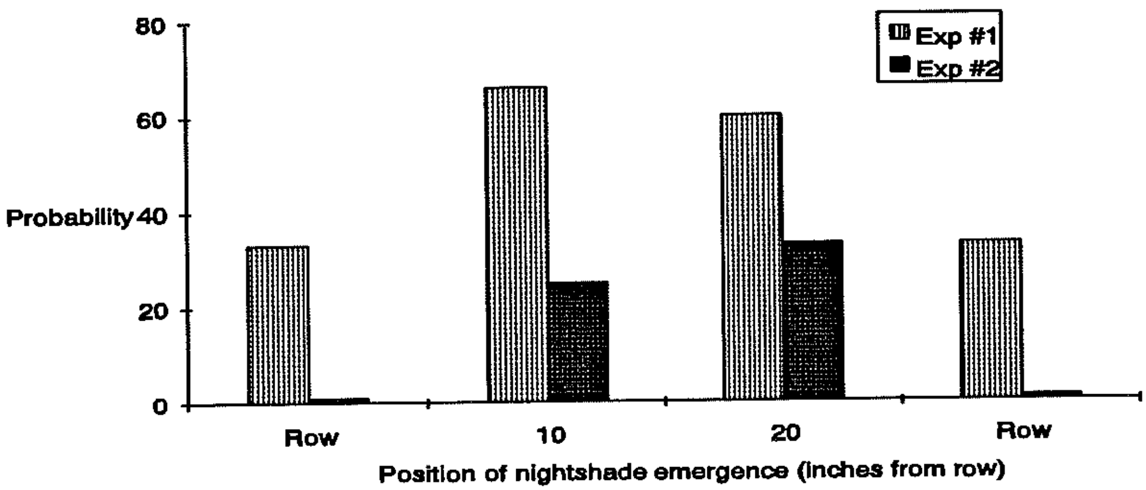

Figure 1. Effect of nightshade emergence site on probability of nightshade producing mature berries.

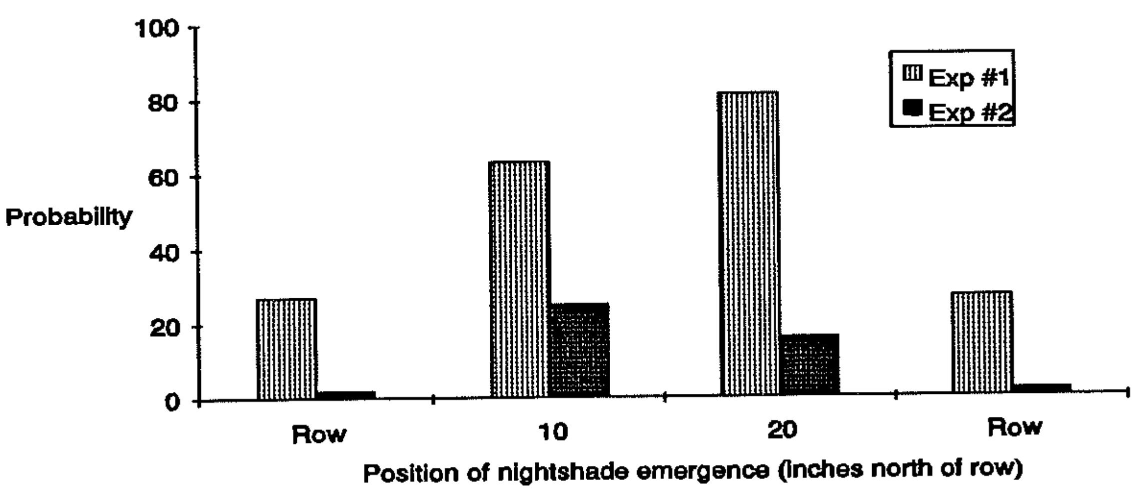

Figure 2. Effect of nightshade emergence site on probability of nightshade producing germinable seeds.

Table 2. Effect of nightshade emergence site on nightshade development, berry yield, seed production, and seed germination (Experiment 1). Averages calculated only on plants that survived until harvest.

Position of emerging nightshade	Survival of nightshade plants (%)	Dry matter (g/plant)	Berries produced (no/plant)	Average berry weight (mg)	Mature berries (no./plant >6mm)	Total seed produced (no./plant)	Seed maturity (%)	Nightshade seed germination (%)
1. In row	41	5.4 a[1]	18 a	278 a	5 a	57 a	46 ab	20 a
2. 10 inches north	91	5.8 a	16 a	113 a	6 a	55 a	32 a	18 a
3. 20 inches north	91	10.7 ab	25 a	134 a	8 a	62 a	55 b	25 a

Table 3 . Effect of nightshade emergence site on nightshade growth, and berry and seed development in snap beans (experiment 2). Averages calculated only on plants that survived until harvest.

Position of emerging nightshade	Survival of nightshade plants (%)	Dry matter (g/plant)	Berry produced (no./plant)	Average berry wt. (mg)	Mature berries (no/plant >6mm)	Total seed produced (no./plant)	Seed maturity (%)	Nightshade seed germination (%)	% Plants with flowers
1. In row	9/10	1.0 a[1]	0 a	0 a	0 a	0 a	0 a	0 a	70
2. 10 inches north	9/10	5.1 b	5.5 ab	43 b	1.0 ab	45 b	16.8 a	1.3 b	90
3. 20 inches north	10/10	4.3 b	7.1 b	44 b	2.2 b	20 a	15.5 a	0.3 a	90

[1] Figures followed by the same letter are statistically equal.

Effect of Soil Solarization, Vapam, and Vapam + Solarization on Weed Seed Survival

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Introduction

This report originated from data collected for an experiment quantifying the effect of soil solarization on a soilborne pathogen of cherry trees, and the effect solarization has on disease incidence and severity during the early establishment phase of cherries. Producer interest in this technology would increase if other pests such as weeds were also negatively affected. Hence, interest was expressed in determining the effect of solarization and solarization plus a low rate of Vapam (metham sodium) on weed seed survival.

Methodology

These field experiments were conducted at the OSU Botany and Plant Pathology Experimental Farm near Corvallis, OR at three sites with two different soil types. Plots were mechanically rototilled to a fine texture and irrigated to field capacity. Twenty four hours later, the soil was inoculated with a suspension of A. tumefaciens strain B49c Rifr to a final concentration of $1x10^6$ cfu/gr dry weight soil and again mixed thoroughly with a rototiller to 6 inches. Annual bluegrass seeds were spread on a 1 m^2 area in the center of each plot at this time. Forty eight hours after inoculation, the soil was irrigated to field capacity and a 1mm plastic tarp was placed over the plots. Soil was covered with plastic tarp from 15 July until 30 September.

The vapam treatments were applied at the sandy loam site. Plots were irrigated to field capacity 24 hours before vapam application. Vapam was applied at 2 liters/plot of a water vapam solution. Rates were 100 and 25 gal/acre of product. The soil was rototilled to 6-8 inches within 10 minutes of applying the material, and the plots rolled with a water-filled lawn roller to seal the surface.

In September of 1994, one soil core 2 inch in diameter by 6 inches deep was taken from each plot. The core was cut in segments of 0-1, 1-2, 2-4, 4-6 inches and bagged separately bagged. The samples were allowed to air dry at 70-75 F for 1 week, then stored at 40 F until February 22, 1995. The soil was removed from the cooler, pulverized, and stones removed from the sample. The field soil (200 gr from each sample) was placed on top of greenhouse soil that was filled to within one inch of the top of 4 X 4 X 4 inch pots. The pots were placed in trays and sub-irrigated. Temperature was set at 75 day and 65 night, with 8 hours of supplemental lighting during the day. Emerged seedlings were counted on March 7, 1995. Because a few samples did not have enough soil to make 200 gr, seedling emergence was weighted according to volume of soil. Annual bluegrass emergence in the field was evaluated on December 15.

Results and Discussion

Soil solarization reduced weed emergence at both locations. The effect of solarization reduced weed seed survival by 100 percent in the lighter soil type. An 80 percent reduction was noted at the silty loam location at the same level. Though the effect of solarization was most apparent at the upper soil depths, weed seeds were affected at the 2-4 inch depth.

In the solarization plus Vapam study at the sandy loam site (light soil), the trends were similar. Annual bluegrass germination was eliminated from the top one inch of soil by solarization. The effect was evident to the 2-4 inch depth. Vapam at the high rate totally controlled weeds at the lower levels but a few survived near the surface, possibly due to volatility losses even though the soil was sealed mechanically after application. The low rate of Vapam (25 gal/acre) plus solarization significantly improved weed control at all levels.

Soil temperatures at the 2 inch depth averaged as high as 104 F in the sandy loam soil. In the heavier silt loam soil, the average daily temperature was as high as 100 F at 2 inches.

Table 1. Weed seed survival (#/200 grams of soil) in solarized and unsolarized soil at four depths (average of silty clay loam and sandy loam soil).

	Annual bluegrass		Total weeds	
Depth (inches)	Solarized[1]	Check	Solarized	Check
0-1	0.13	1.14	0.50*	8.20
1-2	0.25*	1.70	0.88*	7.31
2-4	0.88	1.50	3.25*	7.25
4-6	1.50	0.75	5.38	6.53

[1] An asterisk indicates a significant difference (P=0.05) with the control treatment in the adjacent column.

Table 2. Effect of soil type on solarization efficiency for total weeds evaluated.

	Sandy loam		Silty loam	
Depth	Solarized[1]	Check	Solarized	Check
0-1	0*	9.75	1.0	6.6
1-2	0.25*	5.00	1.5*	9.6
2-4	1.25*	4.50	5.3	10.0
4-6	2.00	3.50	8.8	9.6

Table 3. Effect of Vapam and soil solarization on weed seed survival at four depths in a sandy loam soil.

	Treatments									
	1. Check[1]		2.Solarized		3.Solar+Vapam(25)		4. Vapam 25		5. Vapam 100	
Depth	Annual bluegrass	Total weeds	Annual bluegrass	Total weeds	Annual bluegrass	Total weeds	Annual bluegrass	Total weeds	Annual bluegrass	Total weeds
0-1	4.5	25.5	0	1.0	0	0	1.2	4.6	1.0	1.0
1-2	5.6	25.0	2.0	4.0	0	0.3	0.6	4.0	0	0.3
2-4	5.3	22.0	8.0	14.0	0	0.3	0.3	1.6	0	0
4-6	6.0	18.6	11.3	18.3	0.3	0.3	0	3.0	0	0

1994

Weed Control In Strawberries with Clopyralid (Stinger)

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Introduction

Previous research has demonstrated the potential for selective weed control with clopyralid in strawberries and provided the basis for submitting a request to EPA for registration. More use data are needed in Oregon to make this an effective weed control program, however. A knowledge of the best timing of clopyralid applications for maximum weed control and crop selectivity is critical. Significant yield reductions were seen following spring applications of 0.25 lbs ai/A, indicating that a split application of clopyralid may be essential to limit crop injury and achieve adequate thistle control. Also, fall applications in mint appeared to improve Canada thistle control and improve crop tolerance.

Crop tolerance with repeated use of clopyralid was evaluated from 1990-1993 over a range of fall application dates with or without a spring application. Although strawberry yields were not significantly affected by clopyralid applications in these trials, there was evidence that clopyralid applied at greater than 0.25 lbs ai/acre during flower bud initiation decreased strawberry yield. Moreover, there was evidence that the effect was more severe on older plantings. Therefore, the objectives of this research were to again assess: 1)single and split application rates (mid-October application coupled with May application) for strawberry tolerance to clopyralid in a 'third year' planting; and 2) thistle control with the same application timing.

Methodology

An experiment was established in the fall of 1993 with plots 25' long by 10' wide (40-inch row spacing) and treatments applied in a randomized complete block design with 4 replications. Clopyralid was applied at 3 rates on October 19, 1993 to both 'single fall' and 'fall plus spring' herbicide treatments (see Table 1 for treatment description). Spring treatments were applied on April 30, 30 days before predicted first harvest. Growth response of strawberries to clopyralid was evaluated on November 11, 1993 and May 20, 1994. Strawberries were harvested on June 6 and June 12, 1994 from two 7.5 foot sections of the two middle rows. Percent irregular berries and average berry weight were determined from a 25 berry sample. Six rows on the east side of this plot were Benton variety while the remainder were Totem. Yield data were adjusted to account for slight differences in yields of the control plots between these two varieties.

In addition, a second plot was established in the spring of 1993 at the Lewis Brown Horticulture Research farm near Corvallis, OR in an area infested with Canada thistle. Treatments were applied to the Canada thistle on the same dates and rates as at the Mt.Angel site (see Table 1 and 2). Emerged thistle shoots were counted on April 30, 1994, and thistle control estimated visually on a biomass basis on April 30, 1994 and November 18, 1994.

Results and discussion

Total strawberry yield was unaffected by the application of clopyralid at the timing and rates listed in Table 1. Average berry weight may have been reduced in some treatments but the results were inconsistent. The high rate of clopyralid (0.25 lbs ai/ac) applied in the spring (treatment 6) increased the percent of irregular fruit. However, there was no effect on number of irregular fruit in the fall/spring split application at the highest rates (Treatment 4), indicating that the increase in irregular fruit may not be related to clopyralid.

Thistle control after the winter of 93/94 was best for the fall application of clopyralid (see Table 2). However there was still a strong residual effect from the spring application of one year before. At the November '94 evaluation, all treatments with clopyralid performed well with the exception of the low fall rate. Both fall and spring applications were effective at controlling Canada thistle.

These results confirm previous experience and indicate that the split application of clopyralid with a total of 0.375 lbs ai/acre will provide excellent control of thistle with adequate strawberry tolerance. However, this field of strawberries was exceptionally vigorous for the third year of production, and possibly did not fully test the effect of clopyralid on fields in serious decline. This trial will be kept in place for one more year during the fourth year of production.

Table 1. Tolerance of strawberries to split and single applications of clopyralid (Stinger), Bucholz farm, Mt. Angel, OR, 1994.

Timing	Rate	Strawberry yield			Average berry wt	Irregular fruit
	(lbs ai/A)	First pick (t/ac)	Second pick (t/ac)	Total (t/ac)	(g)	(%)
1. Fall	0.125	4.7	5.5	10.2	10.2	5.6
2. Fall	0.250	5.2	4.8	10.5	9.0	9.2
3. Fall Spring	0.250 0.125	5.5	4.3	9.7	10.0	5.2
4. Fall Spring	0.500 0.250	4.8	5.1	10.0	9.4	6.0
5. Spring	0.125	4.9	6.3	11.2	9.5	8.0
6. Spring	0.250	6.1	4.2	10.3	10.6	9.6
7. Control	-	4.5	5.7	10.1	10.2	6.8
LSD (.05)		1.2	1.7	2.0	1.2	2.8

Table 2. Efficacy of clopyralid on Canada thistle with split (spring 93 and/or fall 93) applications.

Timing	Year	Rate	April 30, 1994[3]		November 18, 1994[4]
		(lbs ai/acre)	Thistle shoots (no./plot)	Thistle control (100=total; 0=none)	Thistle control (100=total; 0=none)
1. Fall	93,94	0.125	40	70	86
2. Fall	93,94	0.250	40	63	99
3. Spring Fall	93,94 94	0.125 0.250	58	35	96
5. Spring	93,94	0.125	53	40	99
6. Spring	93,94	0.250	23	55	98
7. Untreated		-	101	0	10
LSD (.05)			35	40	20

[3] Evaluated before spring 1994 application.

[4] Evaluated after fall 1994 application

Primocane Suppression in 'Evergreen' and 'Marion' blackberries

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Two trials were established in 2-year old Marion and Evergreen blackberry fields located at North Willlamette Research and Extension Center, Aurora, Oregon, to evaluate the efficacy of Ignite (glufosinate), Goal (oxyfluorfen), and paraquat for cane control. Each plot consisted of 5 plants, replicated 3 times in the Evergreens and, due to space limitations, once in the Marions.

Initial treatments were applied when newly-emerged primocanes were 10 to 25 centimeters long (April 15 for Marions, April 22 for Evergreens). Subsequent treatments were applied on an "as needed" basis (if and when newly-emerged primocanes were about 18 centimeters in length). All chemical treatments used a water carrier; a non-ionic surfactant was added to the water when applying Goal.

Primocane and floricane control was evaluated one week after each treatment application. At each application, five primocanes per plot were tagged and their growth recorded every 2 weeks. Number of trainable primocanes per plant was determined at the end of the growing season. All treatments were compared to a untreated control.

In both Marions and Evergreens, the Goal + Goal treatment provided the best primocane and floricane control (Tables I and 2). All chemical treatments were more effective in the Evergreens than in the Marions. Growth comparisons in both the Evergreens and Marions indicate that most of the chemical treatments suppressed primocane growth for several weeks after initial applications (Tables 3 and 4), even though, in some cases, primocanes appeared undamaged. Paraquat-treated primocanes turned yellow but did not slow in growth; more effective control may have resulted if the subsequent Ignite treatment were made 2 or 3 days after the paraquat treatment.

Number of trainable primocanes at the end of the season were generally low for all treatments (Tables 3 and 4), which may be a reflection of a plant age by heavy crop load interaction rather than the treatments themselves.

Herbicide application summary

Date:	4/15	4/22	5/3*	5/9	5/23	6/9
Air temp:	45 F	47 F	55 F	60 F	56 F	62 F
Wind:	<2 mph	0 mph	<2 mph	0 mph	0 mph	0 mph
Skies:	sunny/clear	partly cloudy	overcast	sunny/clear	sunny/clear	sun/clr
Dew:	no	yes	no	no	no	no

* light rain occurred about 30 minutes after treatment application

Table 1. Primocane and floricane control, 'Evergreen' blackberry, NWREC, 1994.

Treatment	Rate #ai/A	Date of Application	Primocane Control[a] 4/28	5/12	6/1	6/9	Avg.	Floricane Control[a] Avg.
Ignite + Ignite	0.75 + 0.75	4/22 + 5/9	6.3	6.3	-	-	6.3	6.3
Ignite + Ignite + Ignite	0.5 + 0.5 + 0.5	4/22 + 5/9 + 6/9	5.7	5.0	-	4.0	4.9	6.4
Goal + Ignite + Ignite	0.8 + 0.75 + 0.75	4/22 + 5/23 + 6/9	8.0	7.0	6.7	4.3	6.5	8.0
Goal + Ignite + Ignite	0.8 + 0.5 + 0.5	4/22 + 5/23 + 6/9	8.7	7.0	4.7	4.7	6.3	8.2
Goal + Goal	0.8 + 0.6	4/22 + 5/23	9.0	7.7	8.0	-	8.2	9.0
Paraquat + Ignite	0.5 + 0.75	4/22 + 5/3	6.0	5.0	-	-	5.5	5.6
Untreated Control			1.0	1.0	1.0	1.0	1.0	1.0

[a] Rating: 1 = green, healthy tissue, 10 = brown, dead tissue

Table 2. Primocane and floricane control, 'Marion' blackberry, NWREC, 1994.

Treatment	Rate #ai/A	Date of Application	Primocane Control[a] 4/22	5/12	6/1	Avg	Floricane Control[a] Avg.
Ignite + Ignite	0.75 + 0.75	4/15 + 5/9	4.0	6.0	-	5.0	5.0
Ignite + Ignite + Ignite	0.5 + 0.5 + 0.5	4/15 + 5/3 + 5/23	4.0	6.0	3.0	4.3	5.7
Goal + Ignite	0.8 + 0.75	4/15 + 5/9	7.0	5.0	-	6.0	7.0
Goal + Ignite	0.8 + 0.5	4/15 + 5/9	7.0	3.0	-	5.0	5.5
Goal + Goal	0.8 + 0.6	4/15 + 5/9	7.0	7.0	-	7.0	7.5
Paraquat + Ignite	0.5 + 0.75	4/15 + 5/3	7.0	4.0	-	5.5	5.5
Untreated Control			1.0	1.0	1.0	1.0	1.0

[a] Rating: 1 = green, healthy tissue, 10 = brown, dead tissue

Table 3. Primocane regrowth and suppression, 'Evergreen' blackberry, NWREC, 1994.

Treatment	Rate #ai/A	Date of Application	Primocane[a] Length (cm) 5/5	Length (cm) 5/23	% Suppression 5/5	% Suppression 5/23	Number of trainable canes
Ignite + Ignite	0.75 + 0.75	4/22 + 5/9	16	16	60	86	1.9
Ignite + Ignite + Ignite	0.5 + 0.5 + 0.5	4/22 + 5/9 + 6/9	22	28	44	76	1.5
Goal + Ignite + Ignite	0.8 + 0.75 + 0.75	4/22 + 5/23 + 6/9	17	28	57	76	1.1
Goal + Ignite + Ignite	0.8 + 0.5 + 0.5	4/22 + 5/23 + 6/9	19	48	50	58	1.5
Goal + Goal	0.8 + 0.6	4/22 + 5/23	17	35	57	69	2.3
Paraquat + Ignite	0.5 + 0.75	4/22 + 5/3	27	62	31	46	3.6
Untreated Control			39	114	0	0	4.0

[a] Measurements based on, and calculated from, first primocanes of the season

Table 4. Primocane regrowth and suppression, 'Marion' blackberry, NWREC, 1994.

Treatment	Rate #ai/A	Date of Application	Primocane[a] Length (cm) 4/28	5/12	% Suppression 4/28	5/12	Number of trainable canes
Ignite + Ignite	0.75 + 0.75	4/15 + 5/9	34	49	47	58	3.6
Ignite + Ignite + Ignite	0.5 + 0.5 + 0.5	4/15 + 5/3 + 5/23	43	53	33	55	3.2
Goal + Ignite	0.8 + 0.75	4/15 + 5/9	17	53	73	55	3.2
Goal + Ignite	0.8 + 0.5	4/15 + 5/9	27	80	58	32	4.2
Goal + Goal	0.8 + 0.6	4/15 + 5/9	26	54	59	54	4.4
Paraquat + Ignite	0.5 + 0.75	4/15 + 5/3	14	112	14	5	3.2
Untreated Control			64	118	0	0	4.0

[a] Measurements based on, and calculated from, first primocanes of the season

Cross-slot Planter Evaluation

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Introduction

Significant improvements in weed control may be pioneered by improving or fine tuning tillage or planting strategies and equipment. Emergence of some weed species such as nightshade can be greatly reduced by avoiding tillage in the spring or limiting disturbance at planting in both no-till and stale seedbed systems. Cover crop residues also decrease weed emergence in no-till systems. However, double disk openers have difficulty planting through even moderate crop residues and cause excessive soil disturbance because of the double disk arrangement and shanks or disks for banded fertilizer placement. The cross-slot planter has been designed to challenge these problems. The cross-slot planter can plant through residues of up to 1.5 tons drymatter per acre with very little soil disturbance while precisely placing fertilizer without additional shanks or openers.

A single row unit of the cross-slot planter was tested in three different systems for sweet corn planting. These included untilled soil with residues of fall-planted *Hesk* barley, untilled soil with spring-planted cereal and mustard cover crops, and conventional tillage.

Hesk barley was fall drilled on Oct 21, 1993 and killed with glyphosate on April 15, 1994. Sweet corn was planted in 36-inch rows on May 21 along with 250 lbs of banded 12-29-10 fertilizer. Corn biomass was cut on August 21 and weighed. Additionally, sweet corn was planted into residues of *Micah* barley, *Wheeler* rye, annual ryegrass, and *Humus* rape seed that were planted May 10 and killed with glyphosate June 6. On June 21 the standing cover crop residues were flailed and sweet corn planted with the cross-slot planter. This trial also included a rototilled treatment.

Results

Sweet corn emergence and sweet corn biomass (after 8 weeks) were equal to seedling emergence and biomass in the conventionally tilled control in a fall-planted cover crop (Table 1). Weed suppression was exceptional in the cover crop residue plot. Nightshade plants completely covered the soil within a few weeks after planting in the tilled plot, while the undisturbed cover crop plots were nearly weed-free. Mowing was used to reduce competition in the tilled plot.

The cross slot planter also performed well in residues of spring planted cereals (Table 2). While emergence was unaffected, corn biomass in the cover crop plots was greater than or equal to biomass in the conventionally tilled plots. However, this trial was planted near the end of June, and soil conditions were warm. Earlier planting may have reduced this effect. Though a one-row unit was used in these experiments, plans are being developed for a two-row unit.

Table 1. Efficiency of cross slot planter in untilled soil with residues of fall-planted cereals.

Treatment	Emergence	Corn biomass (lbs/10 ft row)
Cover crop residue, untilled	35	30.4
Conventional tillage	36	30.4

Table 2. Efficiency of cross-slot planter in minimum tillage situation with cover crop residues.

Treatment	Corn emergence (no./4 ft row)	Corn biomass 12 weeks after planting (lbs/10' row)	Cereal biomass (t/acre)
Micah barley	28	25.3	1.5
Wheeler rye	25	29.9	1.0
Annual ryegrass	25	24.3	0.7
Humus rape	21	30.2	1.2
Conventional tillage	23	22.1	0
LSD	NS	7.5	0.4

Weed Suppression with Fall-Planted Cereals in the Establishment Year of Perennial Ryegrass

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Introduction

Weed control options are changing for many Willamette Valley crops. One strategy with potential to manage weed populations is use of non-crop vegetation for weed suppression. Cereals such as spring barley establish very quickly in the fall with the potential of winter kill, thus modifying seed bed ecology through changes in both light quality and quantity, reduced soil temperature, and possible allelopathic effects on weed seed germination and growth.

This project focused on interplanted barley as a tool to reduce weed biomass in perennial ryegrass through competition, the physical mulch, or toxin release with selective removal of the barley with fenoxaprop to optimize weed suppression and minimize competition with the perennial ryegrass. Side benefits to this approach include reduced soil erosion, improved water infiltration, and nutrient recycling. Project objectives included:
1) evaluate weed suppression during establishment of perennial ryegrass seed crops using specific cereal cultivars and management practices that reduce or minimize competition and crop loss from small-seeded, annual weeds, including grasses and the cereal itself; 2) evaluate the effect of barley interplanting on perennial ryegrass growth; and 3) determine the optimum growth stage at which to kill barley to maximize weed suppression and minimize interference with perennial ryegrass seedling establishment and seed yield.

Methodology

Ryegrass and barley establishment. Spring barley seed (vars. *Micah* and *Steptoe*; 45 seeds/sq ft) and fertilizer (30 lbs N, 20 lbs P/acre) was broadcast on 30 X 12 ft plots and incorporated into the soil at last tillage on October 10, 1993 at the Hyslop Research Farm. Immediately following, perennial ryegrass (var. *Citation II*) was drilled into the plots in 12-inch rows at 12 lbs acre. Annual ryegrass, California brome, and Roughstalk bluegrass were seeded in strips perpendicular to the main plots and incorporated at last tillage. However, only the Annual ryegrass emerged.

Treatment description. Treatments were based on timing and method of selectively removing the cereal. Fenoxaprop was applied on November 18, January 19, and March 1 to selectively remove the barley in Trs. 1, 2, and 3 respectively (see Table 1). Perennial ryegrass growth stages were 2.7, 4.8 and 6.0 respectively on the dates listed above (Haun system adapted for perennial grasses; Chastain, pers.comm). Fenoxaprop was applied at 0.2 lbs ai/acre to Tr. 1, but the rate was increased to 0.25 lbs ai/acre for Trs. 2 and 3 because of inadequate kill of the barley.

Fenoxaprop was applied at 0.15 lbs ai/acre to Tr. 4 to suppress the barley but allow continued soil coverage through the winter. The barley was later killed with a glyphosate wick wipe on March 10. The cereal in Tr. 5 was killed with glyphosate applied February 2 by a 10 foot wide wick applicator set to contact the barley but not the ryegrass. The plan specified that this application be made at the same time as Tr. 2, but because of weather that kept the plants very wet, glyphosate was applied on February 2.

Control treatments. Each of the treatments listed above was complimented by a control treatment of the exact schedule except that barley was not interplanted with the ryegrass. Other controls treatments included Tr. 11 with no weed control measures, and Tr. 12 with diuron/activated charcoal applied at planting plus ethofumesate applied December 12 and January 19.

Urea (40 lbs n/acre) was applied to the entire experiment on March 9; on March 19, half of each plot was treated with Buctril and MCPA.

Weed biomass was cut from a 4 ft. sq. area that encompassed two rows, and weeds were separated by species and weighed. Visual estimation of percent reduction in ryegrass was made along with the effect of the cereal on annual ryegrass. Perennial ryegrass was cut from 4 ft sq on July 8 and weighed to assess impact on ryegrass growth.

Statistical analysis. Weed biomass data were log transformed to improve homogeneity of variance among treatments. Means were separated using Fishers protected LSD with an alpha value of 0.05.

Results and Discussion

Rain immediately after planting gave the barley a good start and it reached 6 inches in height by November 19, the first application date for fenoxaprop. By mid January, winter conditions were causing mortality of the *Micah* barley but *Steptoe* barley was not impacted.

The first application of fenoxaprop appeared to act very slowly because of the cool conditions and the low rate applied. Subsequent applications were increased to O.25 lbs/acre, but even at this rate barley kill was marginal, particularly as the barley grew taller than 12 inches (Table 2). Fenoxaprop applied on January 19 proved best at killing the barley although *Micah* barley was easier to kill than *Steptoe* barley.

Total weed biomass. Total weed biomass was significantly reduced by interplanting barley (Figure 1 and Table 2). Weed biomass in plots with barley suppressed with fenoxaprop and later killed with glyphosate (Tr.4) was equal to weed biomass in the diuron/ethofumesate plots (Tr.12). This same treatment reduced weed biomass by 78 percent compared to the unweeded control (tr.11). However, some of the reduction in Tr. 4 may have been due to actual glyphosate contact with the weeds. Interplanted *Micah* barley with fenoxaprop for selective kill (Trs.1, 2, and 3) tended to reduce total weed biomass compared to the unweeded control but the differences were statistically insignificant. In contrast, *Steptoe* barley killed with fenoxaprop in January reduced total weed biomass to a level comparable to the diuron/ethofumesate control (Tr. 12). In similar treatments, *Steptoe* barley was more effective at reducing total weed biomass than *Micah* barley, probably because *Steptoe* has a more prostate growth habit in early growth stages and did not show signs of winter kill early in December and early January.

Broadleaves. The trend for total broadleaf weeds was nearly the same as for total weed biomass. However, of the weeds found and collected at this location, treatment differences in biomass within species were statistically significant only for western bittercress because of the distribution variability among broadleaf weeds at this site. And for Western bittercress, interplanting barley actually tended to increase bittercress biomass (data not shown), a possible response to decreased ryegrass competition as seen in Table 3. This trend was reversed with *Steptoe* barley, however. Overall, broadleaf weed biomass in the interplanted treatments was similar to that in both the unweeded and diuron control. The glyphosate wick wipe (Tr 4) and *Steptoe* with fenoxaprop in January slightly reduced weed broadleaf biomass compared to both control treatments, although statistically the difference was insignificant.

Grasses. The trend for Annual bluegrass was much different than broadleaf weeds. On average Annual bluegrass biomass was reduced by 77 percent when comparing the *Micah* barley treatments with all treatments without barley interplanting[1]. The greatest biomass reduction was noted in Tr. 4 (*Steptoe* barley suppressed by fenoxaprop and later killed with Roundup). Annual bluegrass was suppressed by 90 percent compared to the unweeded control, but some of this reduction may have been due to actual contact with glyphosate. Similar to this level of reduction was the two treatments with *Micah* and *Steptoe* barley interplanted and killed with fenoxaprop in January. These treatments suppressed annual bluegrass by 82 percent. Annual bluegrass biomass in Tr. 8 indicates that this suppression was due to direct interference of the interplanted barley rather than fenoxaprop effects.

Treatment differences were not significant for volunteer perennial ryegrass emerging between rows. However, trends in percent reduction were similar to those with annual bluegrass. Annual ryegrass control was best in the glyphosate wick-wipe treatment, and biomass reduction also was noted in the interplanted barley plots.

Perennial ryegrass performance. In general, perennial ryegrass biomass was reduced by the interplanted cereals. In the wick-wipe treatments damage may have been due to the glyphosate itself. Treatment 1 had the least impact on perennial ryegrass growth. Fenoxaprop may have injured perennial ryegrass when applied in January, accounting for some of the poor

[1] Single degree of freedom contrast of Micah barley treatments (1,2,3) vs all treatments without cereals (7,8,9,11).

performance in Tr.2 with the cereal interplant and Tr. 8 without. On average, cereal interplanting reduced perennial ryegrass growth by 44 percent.

Summary

These results indicate the potential of using non-crop vegetation as a tool to manage weeds in perennial ryegrass production, in particular for annual bluegrass. Annual bluegrass was suppressed an average of 77 percent. Suppression of Annual ryegrass was less than for annual bluegrass, and was likely due to the fenoxaprop application. Suppression of volunteer perennial ryegrass between rows indicates the potential effect of barley on perennial ryegrass when in direct competition with barley.

Barley was difficult to kill with fenoxaprop after it grew taller than 12 inches. But killing the barley in November actually increased broadleaf growth compared to the control treatment, even though there was still a significant reduction in annual bluegrass biomass. Barley control was also difficult in this situation because some barley seed had not yet germinated. Barley was killed best when fenoxaprop was applied in January.

Perennial ryegrass growth also was reduced, although much less than annual bluegrass. Some of the injury to the perennial ryegrass may have been due to fenoxaprop as indicated by the trend toward lower biomass accumulation in Tr 8. However, January 19 treatment with fenoxaprop and *Steptoe* or *Micah* barley interplanting was one the best treatments when considering removal of the barley, the affect on ryegrass, and suppression of annual bluegrass biomass accumulation.

Though annual bluegrass and total weed biomass suppression was significant with some of the interplanted barley treatments, the impact on perennial ryegrass was unacceptable. Techniques which reduce competition with the perennial ryegrass must be explored. Options include banding fertilizer beneath the seed row, and confining cereals to the area between rows rather than broadcasting the cereal. As with most weed control strategies, if used in concert with other tools it may improve current weed control practices. For instance, banding Nortron in the row or including it as a broadcast with the fenoxaprop may improve weed control.

Table 1. Treatment summary and schedule.

	Cereal	Cereal height at herbicide application date		Comments
		Cereal height (max)	Fenoxaprop/ glyphosate application date	
1.	Micah barley	6"	11/19	Cereals planted with ryegrass
2.	Micah barley	11"	1/19	"
3.	Micah barley	14"	3/1	"
4.	Steptoe barley	10"	1/19 Rup 3/10	Sublethal rate (0.15#) Roundup rope wicked
5.	Steptoe barley	12"	2/2	Wick wipe to kill
6.	Steptoe barley	11"	1/19	Compliment to Tr 2
7.	None	-	11/19	Complimentary to tr 1
8.	None	-	1/19	Complimentary to tr 2
9.	None	-	3/1	Complimentary to tr 3
10.	None	-	1/19 Rup 3/10	Sub lethal rate; compliment of tr 4
11.	Unweeded	-		
12..	None: activated charcoal and diuron	-	-	Diuron applied 10/10 Nortron 12/3 1/19

Table 2. Effect of cereal interplanting on weed biomass in perennial ryegrass, Hyslop Farm, 1994.

Treatment	Grass weeds: Annual bluegrass[1]	Grass weeds: Volunteer ryegrass	Grass weeds: Annual ryegrass[2]	Broadleaf weeds[3]	Total weed biomass
	-g/0.4m²-	-g/0.4m²-	-%-	-g/0.4m²-	-g/0.4m²-
1. Micah barley + fenoxaprop (11/19)	26 b	2	35	193	221
2. Micah barley + fenoxaprop (1/19)	15 b	8	68	132 a	155
3. Micah barley + fenoxaprop (3/1)	31 b	9	40	129 a	168
4. Steptoe barley Sublethal fenoxaprop (1/19) Glyphosate (3/10)	8 b	0.3	35	43 a	51 a
5. Steptoe barley Glyphosate wick wipe (2/2)	37 b	3	80	109 a	149 a
6. Steptoe barley + fenoxaprop (1/19)	16 b	2	25	61 a	79 a
7. No cereal + fenoxaprop (11/19)	71	13	33	211	289
8. No cereal + fenoxaprop (1/19)	85	47	40	217	348
9. No cereal + fenoxaprop (3/1)	108	19	48	143 a	269
10. No cereal Sublethal fenoxaprop (1/19) Glyphosate (3/10)	36	13	20	144 a	197
11. No weed control measures	85	28	0	118 a	231
12. No cereal Diuron (10/10) Norton (12/3 and 1/19)	0 a	0	0	71 a	71 a

1 Means followed by the same letter are statistically equal (p=.05).
2 Annual ryegrass suppression estimated on a biomass basis.
3 Significant species monitored at this location included speedwell (*Veronica spp.*), shepherdspurse (*Capsella bursa-pastoris*), Common chickweed (*Stellaria media*), Western bittercress (*Cardamine oligosperma*), Cutleaf geranium (*Geranium dissectum*), Mayweed chamomile (*Anthemis cotula*), and Red dead nettle (*Lamium purpureum*)

Table 3. Impact of interplanted cereals on perennial ryegrass growth and herbicide efficacy for controlling barley.

Treatment	Perennial ryegrass biomass[1]	Barley control
	-t/acre-	- % -
1. Micah barley + fenoxaprop (11/19)	1.5 a	5
2. Micah barley + fenoxaprop (1/19)	0.8	9 a
3. Micah barley + fenoxaprop (3/1)	0.7	1
4. Steptoe barley Sublethal fenoxaprop (1/19) Glyphosate (3/10)	0.6	4
5. Steptoe barley Glyphosate wick wipe (2/2)	1.4 a	10 a
6. Steptoe barley + fenoxaprop (1/19)	0.7	3
7. No cereal + fenoxaprop (11/19)	1.8 a	-
8. No cereal + fenoxaprop (1/19)	1.5 a	-
9. No cereal + fenoxaprop (3/1)	1.8 a	-
10.No cereal Sublethal fenoxaprop (1/19) Glyphosate (3/10)	1.9 a	-
11. No weed control measures	1.9 a	-
12. No cereal Diuron (10/10) Norton (12/3 and 1/19)	1.8 a	-

[1] Means followed by the same letter are statistically equal ($p=.05$).

Symphylan *(Scutigerella immaculata)* Trapping in Weeds and Cover Crops

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Introduction

Farmers and scientists have been exploring weed, symphylan, and white mold suppression in vegetable cropping systems. The symphylan is a myriapod, in the class of arthropods, about 3-6 mm long. They are problems in many crops because they eat roots of germinating seeds, thereby reducing crop yields. Farmers scout their fields with shovels to determine infestations. This method of sampling can be tedious. Farmers have requested a trapping system.

The objectives of this experiment were to: 1) make a trap; 2) compare attractants; and 3) determine placement of the trap in or on the soil.

Methodology

A trap was constructed out of mesh screen, 4 x 4 inches. Moist peat moss was placed inside the screen with 16 baits. Limas, peas, squash, and wheat were selected for subsequent studies. Bait comparisons were continued, along with testing the trap vs. no trap. Next, traps were placed on the soil surface or vertically 2-inches below the surface, and kept moist with a brown bag covering. The trapping idea came from farmers, so we considered the results based on convenience for farmers. Farmers saw simplicity and preferred uniformity with traps. Placing the traps above soil would not only be more convenient for farmers but also wouldn't disturb symphylan channels. In fields that haven't been rifled greater symphylan populations were counted, maybe because their tunnel system wasn't destroyed.

Results and Conclusions

Wheat, peas, squash, and limas all attracted symphylans, but numbers were variable. To improve predictability, a combined bait of 2 or 3 types of seeds is suggested. Through a statistic test, traps and no traps were not significantly different. in the interest of farmers and their needs, a trap would be preferred. The experiments of above soil vs. below soil resulted in a preference to place the trap on the soil surface. Thus, we would place 6-8 seeds of 3 baits in moist peat moss inside a screen bag. Then set it on the soil surface, water with 2 liters, and secure a paper bag over the traps for 3-5 days. The next step will be to trap symphylans at the soil surface through various cover crop treatments to assess suppression.

Table 1. Symphylan numbers caught in traps with various baits placed on or vertically 2-inches beneath soil surface, Kenagy Farm, Albany.

	Exp.1	Exp.2		Exp.3		Exp. 4			
Baits	Below*	Above*	Below	Above	Below	Above	Below		Ave.
Limas	41	13	5	11	10	1	3	12	
Peas	60	17	6	7	15	2	2	16	
Peppermint	36	2	1	1	-	-	-	-	
Corn	-	-	-	7	4	0	0	-	
Wheat	52	24	30	2	2	10	2	17	
Squash	100	26	8	1	10	1	0	21	
Total	**289**	**82**	**50**	**28**	**41**	**14**	**7**		

* Above soil- trap placed in depression on soil surface, watered with 2 liters, and paper bag secured with shovel of soil.

* Below soil- trap placed vertically 2-inches below soil surface, then watered with 2 liters, and paper bag secured with shovel of soil.