CONTROLLING PERENNIAL CRANBERRY BOG WEEDS WITH PRUNER-APPLIED HERBICIDES

John C. Porter, Thomas A. Bewick, and Dana Warrick[1]

ABSTRACT

Wiper applications of non-selective herbicides are used in many horticultural crops for the control of perennial weeds. Over time, this application method can lead to selection of new weed species, or of biotypes of current weeds, that grow within the crop canopy. This situation has occurred in cranberry plantings. An alternative to wiping is to apply herbicides on the blades of pruners. Experiments were done in a greenhouse to determine if pruner application was an effective method for controlling perennial weeds that are troublesome in cranberry. A rate titration of glyphosate and 2,4-D was used for control of slender-leaved goldenrod (Solidago tenuifolia Pursh.), black chokeberry (Aronia melanocarpa (Michx.) Willd.), bristly dewberry (Rubus hispidus L.), glaucous greenbriar (Smilax glauca Walter), red maple (Acer rubrum L.) and poison-ivy (Toxicodendron radicans (L.) Kuntze). Experiments with poison-ivy also included a rate titration of triclopyr. Visual estimates of weed injury were made weekly for eight weeks. At eight weeks after initiation, all shoots were harvested and dry weight determined. Susceptibility to the herbicides was as follows: slender-leaved goldenrod: neither herbicide had an effect; black chokeberry: both herbicides were equally damaging; bristly dewberry: only glyphosate had an effect; glaucous greenbriar: neither herbicide had an effect; red maple: glyphosate was more effective than 2,4-D; and poison-ivy: triclopyr was much more effective than glyphosate, which was more effective than 2,4-D.

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EFFECT OF AZAFENIDIN AND RIMSULFURON ON WEEDS IN WILD BLUEBERRIES

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ABSTRACT

Relying on hexazinone at reduced rates as the principal preemergence herbicide for weed control in wild blueberries *(Vaccinium angustifolium)* over the past 15 years has resulted in a shift to many weed species not controlled by this herbicide. Other selective herbicides that will not leach into the groundwater are need to rotate with hexazinone in order to have an effective weed management program. Two herbicides were evaluated at Blueberry Hill Experiment Station in Jonesboro, ME. The first preemergence treatment was applied on May 1, 1998 with azafenidin as Milestone ® at 5, 10, 15 or 20 oz product/a. Additional treatments applied on May 16, 1998 included 5 or 10 oz/a Milestone ® plus hexazinone as Velpar DF ® at 1.3 lb/a, and 10 oz/a Milestone ® with Velpar DF ® at 2.6 lb/a, and 30 oz /a Milestone ® alone and an untreated control. Treatments of azafenidin at the 10 oz rate and higher gave good weed control of both grass and annual herbaceous weeds. No phytotoxic effects to blueberries were observed at any of the treatments. Further work on timing and weed species controlled are needed to develop this product for use in wild blueberries. In a second study, rimsulfuron as Matrix ® was applied at 0, 0.5, 1 or 2 oz product/a on May 14, 1998 in section of the station with heavy weed pressure. Evaluations of weed cover assessed in mid July and early September showed good weed suppression even at the 0.5 oz/a rate. No phytotoxicity to blueberry was noted. This material is currently registered in potatoes in Maine and appears to have a promise as an alternative herbicide to hexazinone for wild blueberries. More testing on timing and weeds controlled are planned to further evaluate this herbicide.

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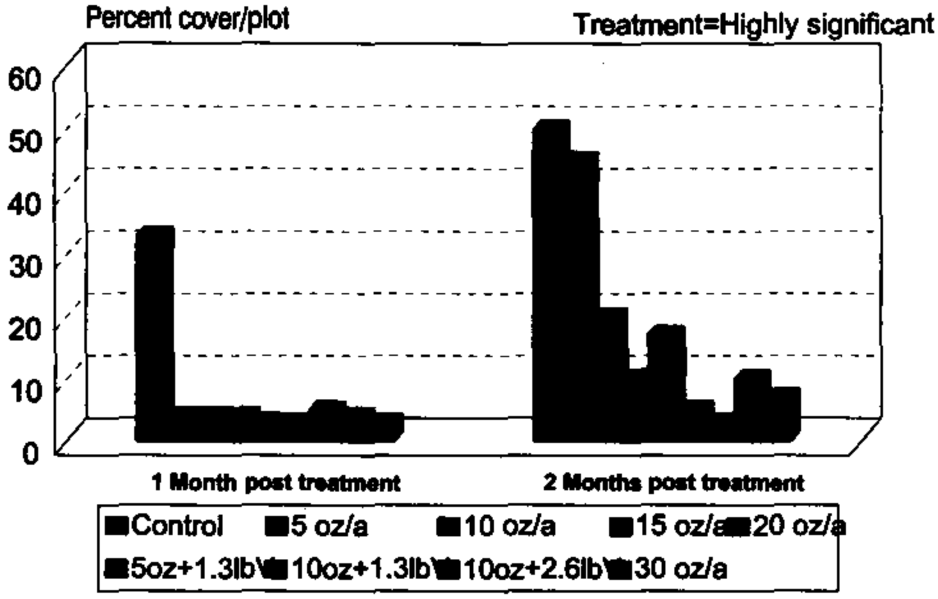
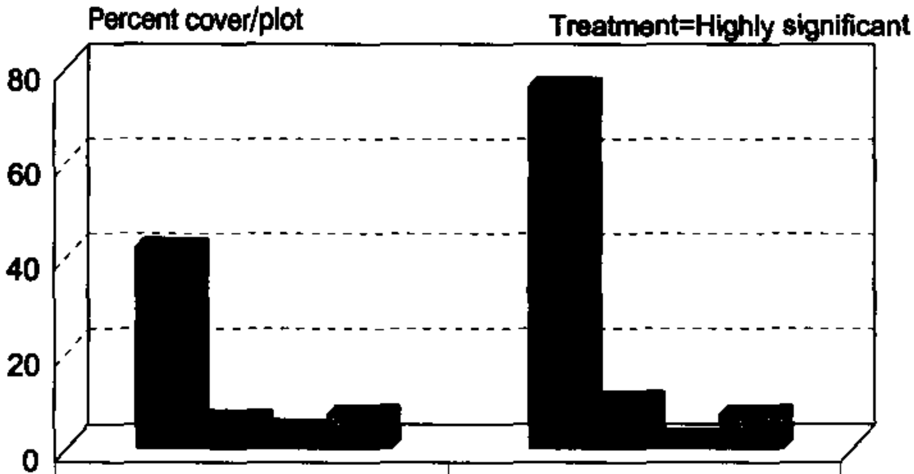
Effect of Azefenidin on weeds in wild blueberries



All rates are in product/acre V = Velpar DF

Effect of Rimsulfuron on weeds in wild blueberries



	1 Month post treatment	2 Months post treatment
Control	42	76
0.5 oz/a	6	10
1.0 oz/a	4	2
2.0 oz/a	7	7

All rates are in product/acre

EFFECTIVENESS OF ROW SPACING, HERBICIDE RATE, AND APPLICATION METHOD ON HARVEST EFFICIENCY OF LIMA BEANS

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ABSTRACT

Reduced herbicide rates and band applications proved to be effective methods in reducing the total amount of herbicide in crops such as corn and soybeans. Few studies have addressed the effect of reduced herbicide rates and band applications in a less-competitive crop, lima beans (Phaseolus lunatus L.). Furthermore, no research has evaluated the effect of narrower row spacing on weed suppression in lima beans. Reducing the row spacing may not only impact yield but also effect the ease of harvest and harvest efficiency. Field experiments were conducted in 1997 and 1998 at University of Delaware's Warrington Farm, Harbeson, DE and on a grower's farm, Dover, DE, respectively, to evaluate the effectiveness of row spacing, herbicide rate, and application method on commercial harvestability and harvest efficiency of lima beans.

The experimental design was a randomized complete block with 4 replications in 1997 and 3 replications in 1998. Lima bean variety, 'Maffei-15' was planted in either 38- or 76-cm rows at similar plant population with either row spacings (175,000/ha). Plot size was 9 m by 213 m in 1997 and 9 m by 274 m in 1998, with 12 and 21 planted rows for 76- and 38-cm rows, respectively. A tank-mixture of metolachlor plus imazethapyr was applied at 1X and 0.5X rates as a preemergence treatment. Full rates were equivalent to 1.5 and 0.05 kg ai/ha of metolachlor and imazethapyr, respectively. The 38-cm spaced treatments were applied broadcast while 76-cm rows received both broadcast or band applications. All the 76-cm spaced rows were cultivated once 3 weeks after planting using a tractor drawn cultivator in both years.

Parameters measured were weed counts prior to harvest, lima bean yield, percent marketable beans, marketable yield, and percent trash. In addition, as a measure of harvest efficacy number of pods left on plants by pod stripper, and weight of beans left on ground in $1m^2$ area were determined.

In both years, weed control was similar between various treatments. In 1997, except for marketable yield and weight of beans lost on $1m^2$ ground, no differences were noted between treatments regarding other parameters. Highest marketable yield was recorded from 38-cm rows when 1X rate of herbicide was applied broadcast. Rest of the treatments had similar yield. Loss of beans was also greatest when 1X rate of herbicide was applied broadcast in 38-cm rows. On the other hand, losses were only half with the same herbicide rate applied broadcast in 76-cm rows. All other treatments were similar in bean losses. In 1998, none of the treatments differed amongst each other on any of the parameters evaluated.

It appears that there is no added advantage to planting lima beans in 38-cm rows from the standpoint of both weed control and harvest efficiency. Furthermore, 38-cm rows make cultivation difficult.

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1998 NORTHEASTERN WEED SCIENCE SOCIETY STUDENT CONTEST

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ABSTRACT

The 1998 NEWSS Collegiate Weed Contest was held on August 4 at the University of Delaware's Research & Education Center in Georgetown, DE. Nine universities were represented by 20 undergraduate and 34 graduate students that participated in the contest at both the team and individual levels. This year's winners were:

Undergraduate Teams

1st place - University of Guelph - Kevin Ego, Christy Hoepting, Don McLean
2nd place - Ohio State University- Max Martin, Mark Peters, Brian Timmerman, Aaron Wray
3rd place - SUNY, Cobleskill - Keith Martin, Brad Rauch

Graduate Teams

1st place - Virginia Tech - Kevin Bradley, Steve King, Ivan Morozov, Dan Poston
2nd place - North Carolina State University - Shawn Askew, Andy Bailey, John Isgrigg, Andrew McRae
3rd place - Virginia Tech - Greg Armel, Wendy Pline, Rob Richardson, Peter Sforza
4th place - Penn State University - Melissa Bravo, Steve Dadio, Wade Esbenshade, Steve Josimovich

Undergraduate Individuals

1st place - Kevin Ego, University of Guelph
2nd place - Brian Timmerman, Ohio State University
2nd place - Katherine Campbell, University of Guelph
3rd place - Brad Rauch, SUNY Cobleskill

Graduate Individuals

1st place - Shawn Askew, North Carolina State University
2nd place - Kevin Bradley, Virginia Tech
3rd place - Dan Poston, Virginia Tech

Mark VanGessel was this year's contest chairman. Coordinators for the contest included Gary Schnappinger (sprayer calibration), Bradley Majek (weed ID), Quintin Johnson (herbicide ID), Mark VanGessel and Mark Isaacs (farmer problem), Jeffrey Derr (photography), David Mayonado (score keeper, awards), and Jay Windsor, Ward Harris, and Victor Green (local arrangements) The University of Delaware and the NEWSS would like to thank the many companies that contributed their financial support for the contest.

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WEED MANAGEMENT IN SOYBEAN WITH COMBINATIONS OF PPI HERBICIDES AND CLORANSULAM-METHYL POST.

S. D. Askew, W. A. Bailey, J. W. Wilcut, and V. B. Langston[1]

ABSTRACT

Field studies were conducted at Rocky Mount, NC in 1995 and 1996, Lewiston, NC in 1995, and Clayton, NC in 1996 to investigate weed control, soybean response, and soybean yield as influenced by herbicide systems that used PPI and POST herbicides. Herbicide systems evaluated included a factorial arrangement of PPI and POST herbicide options in a RCB with three replications of each treatment. PPI herbicide options included 1) Treflan at 0.75 lb ai/ac, 2) Treflan plus Broadstrike at 0.063 lb ai/ac, 3) Treflan plus Scepter at 0. 125 lb ai/ac, or 4) Treflan plus Canopy at 0.38 lb ai/ac. POST herbicide options were 1) none, 2) Classic at 0.012 lb ai/ac, 3) FirstRate at 0.016 lb ai/ha, or 4) Storm at 0.75 lb ai/ac. All POST herbicides were applied with a NIS at 0.25% (v/v). Herbicides were applied in a volume of 16.7 GPA at 24 PSI. Soybean varieties included Hartz 6686'and Holladay' at Lewiston and Rocky Mount in 1995, respectively, and Pioneer 9583' at both locations in 1996.

Soybean injury from PPI herbicides alone was minimal at all locations. Classic POST injured soybean at least 10% when evaluated 1 WAT. Storm and Classic were more injurious to soybean than FirstRate when used in conjunction with PPI broadleaf-controlling herbicides. Scepter, Broadstrike, and Canopy controlled pitted morningglory (Ipomoea lacunosa) 48, 56, and 58%, respectively when evaluated late season. Treflan PPI fb (followed by) Classic or FirstRate controlled pitted morningglory 98 and 96%, respectively. Broadstrike, Scepter, and Canopy controlled prickly sida (Sida spinosa) 98, 90, and 93%, respectively. Storm was more effective controlling prickly sida POST than Classic or FirstRate. Broadstrike and Canopy PPI were effective controlling common ragweed(Ambrosia artemisiifolia) while Scepter was ineffective. All POST herbicides provided effective control of common ragweed. Classic, FirstRate, and Storm POST controlled yellow nutsedge (Cyperus escatulentus) 86, 81, and 72 %, respectively.

Soybean yields were improved when broadleaf-controlling PPI herbicides were used in conjunction with Treflan. There were no differences in soybean yield when Treflan was used with a broadleaf-controlling herbicide treatment and followed with a POST herbicide treatment.

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EVALUATION OF WEED CONTROL AND PRODUCTIVITY ON FIELD GROWN CUT FLOWERS

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INTRODUCTION

A set of studies was established in the summer of 1998 to determine the tolerance of field grown cut flower species to specific preemergence herbicides, the effectiveness of weed control by those materials, and to determine if productivity of cut flowers is affected either by the herbicides or by colored mulches.

METHODS AND MATERIALS

The first study was conducted at the Penn State University Horticulture Research Farm at Rock Springs, PA. Four commercially grown cut flower species were used in this experiment: celosia (*Celosia argentea* L. 'Red Rocket'), sunflower (*Helianthus annuus* L. 'Schmitz Gold'), cosmos (*Cosmos bipinnatus* Cav. 'Red Qis'), and strawflower (*Helichrysum bracteatum* (Venten.) Andr. 'Choice Mix'). Treatments consisted of a control, the preemergence herbicide treatments listed in Table 1; and silver, red, and white plastic mulch. They were replicated three times for each species, with six or ten plants per rep depending on the species. All plots were in raised beds. There were four beds, each about 80 feet long by 30 inches wide. An eight-foot grass walkway separated the beds. A randomized complete block design was used, with each treatment by species block measuring 3 ft by 30 in. There was an extra one-foot between treatments within the bed.

The sunflowers, cosmos and strawflowers were planted on June 12, and the celosia was planted on June 24. All beds were hand weeded before herbicide applications on July 2. Conditions at the time of application were clear and sunny with 3 to 5 mph winds. The air temperature was 80° F and the soil temperature was 69° F. Time of application was 9:00 to 10:00 am. Prodiamine and napropamide were applied over-the-top with a CO_2 test plot sprayer at 30 psi through an 8004E nozzle at 35 gallons per acre. An Acme Spread Rite[2] applicator was used for the OH-2[3] treatments. Approximately 1 week after treatment (WAT) the foliage of the control and herbicide treated plants was examined and evaluated. Other evaluations included injury and plant quality ratings at 4 WAT and the harvesting and measurement of the flower number, length, and weight at 4, 7 and 11 WAT.

The second study was conducted at McCreight's Wholesale Florist, Washington Boro, PA, a commercial field grown cut flower producer. The site had been plowed and disked. Plants were transplanted on: May 12, statice (*Limonium perezii* (Stapf) F.T. Hubb. 'Seafoam Statice'); May 22, celosia (*Celosia argentea* L. 'Crested Cockscomb'); and May 26, feather kale (*Brassica oleracea* L. *var acephala* 'Glockner Today'), and zinnia (*Zinnia elegans* Jacq. 'Cherry Ruffle'). A randomized complete block design was used. Celosia, kale, and statice plots were approximately 3 ft by 8.5 ft, with five plants in each plot. The zinnia plots were 3 ft by 6 ft and contained four plants per plot.

On May 27, 1998 the treatments in Table 2 were applied with a CO_2 test plot at 30 psi through an 8004E nozzle in the equivalent of 35 gallons per acre. The conditions at the time of application were 85-90° F with a slight breeze of 3 to 9 mph. At the time of application the plants were the following heights: zinnia, 3 to 6 in; celosia, 4 to 8 in; feather kale, 3 to 5 in; and statice, 6

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[2] Acme Spred-Rite G, pbi/Gordon Corporation, Kansas City, MO.

[3] Scotts® OH-2™ Ornamental Herbicide, The Scotts Company, Scottslawn Road, Marysville, OH.

to 12 in. Weed control data, plant quality and herbicide injury ratings were collected on June 25 (4 WAT) and July 21 (8 WAT).

RESULTS AND DISCUSSION

Experiment 1. One WAT sunflowers were not affected by OH-2, napropamide caused slight injury, but prodiamine caused serious injury (Table 1). The newly expanded leaves at the time of application had chlorotic spots with a necrotic spot in the center. Prodiamine is not labeled for use on sunflowers and this may be the reason. Cosmos was not damaged by any of the herbicides even though it is not on the label of any of the herbicides. Strawflowers and Celosia had a fair amount of deformed leaves, but the damage was observed on the controls also, so it could not be correlated to any of the herbicide treatments.

At 4 WAT all of the treatments provided excellent weed control in the cosmos and strawflower (Table 3). Weed control in the sunflowers was very good to excellent. Only the silver and red mulch plots had statistically more weeds than the control, 6.7 and 5.7% weed cover, respectively. Weed species present in these plots included large crabgrass (*Digitaria sanguinalis* (L.) Scop.), common chickweed (*Stellaria media* (L.) Vill.), giant foxtail (*Setaria faberi* Herrm.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarter (*Chenopodium album* L.), black nightshade (*Solanum nigrum* L.), common dandelion (*Taraxacum officinale* Weber in Wiggers), purslane (*Portulaca oleracea* L.), yellow woodsorrel (*Oxalis stricta* L.), and Canada thistle (*Cirsium arvense* (L.) Scop.). Weeds were growing through the planting holes in the plastic mulch treatments in the sunflowers only. In the celosia all of the treatments provided excellent weed control except the prodiamine, in which there was 31% weed cover. Weeds in these plots included large crabgrass, purslane, oxalis, shepherds-purse (*Capsella bursa-pastoris* (L.) Medicus), mouseear chickweed (*Cerastium vulgatum* L.) scarlet pimpernel (*Anagallis arvensis* L), and Virginia copperleaf (*Acalypha virginica* L).

At 4 WAT the quality ratings for the cosmos and strawflower were all uniformly high, and the injury ratings low, regardless of treatment. The napropamide, prodiamine, and OH-2, with and without mulch caused slight injury to the sunflower, but did not result in lower quality ratings. In the celosia, the prodiamine and OH-2, with and without mulch, caused moderate injury that resulted in lower quality ratings for the injured plants.

The number and weight of primary and secondary sunflowers harvested were not affected by any of the treatments (Table 4). The average length of the primary inflorescences was shorter in the prodiamine and the silver and white mulch treatments.

The number, average length, and total weight of cosmos flowers harvested were not affected by any of the treatments.

The number and weight of strawflowers harvested were not affected by any of the treatments, but the average length of the inflorescences was shorter in the napropamide treatment. Though there was considerable variation in the number and total weight of flowers cut, it did not turn out to be statistically significant. This may have been because there was a great deal of variation in the productivity of each plot that may have masked differences between treatments.

OH-2 with mulch was the only treatment that reduced the number and total weight of celosia flowers harvested. Average stem length was not affected.

In summary, except for OH-2 with mulch on celosia, when compared to the weeded control none of the herbicide or mulch treatments affected the harvested number or weight of any of the flowers.

Experiment 2. At 4 WAT all of the herbicide treated plots had significantly less weed cover than the untreated control plots (Table 2). Both rates of oryzalin, napropamide and pendimethalin; and OH-2 without mulch; provided excellent weed control. The high rate of prodiamine and the OH-2 with mulch provided good control. The low rate of prodiamine and both rates of trifluralin provided moderate to poor weed control. Giant foxtail seedlings, and hairy galinsoga (*Galinsoga ciliata* (Raf.) Blake.) were the predominant weeds in these plots.

Though there was variability between species, at 8 WAT the oryzalin and napropamide treatments were still providing better overall weed control than the other treatments. The high rate of oryzalin consistently provided excellent control while the low rate provided good control. With a few exceptions the other treatments did not provide an acceptable level of control. Because the statice plots were heavily infested with Canada thistle, the cooperator hand weeded the area to reduce seed production and spread of this noxious weed; therefore, this species was not included in the 8 WAT evaluation.

At 4 WAT the pendimethalin at 4 lbs. ai/A injured all of the plants, and at the 2 lb.ai/A rate injured all but the zinnia (Table 5). Oryzalin did not injure any of the plants compared to the control except for slight injury to celosia when applied at the 4 lb. ai/A rate (Table 5). Both rates of napropamide injured the celosia, and the high rate slightly injured the zinnia. The OH-2 without mulch caused slight injury to the celosia and zinnia; and with mulch slightly injured the statice. Neither prodiamine nor trifluralin caused any injury to any of the plants at 4 WAT.

At 8 WAT the pendimethalin still caused more injury than any of the other treatments (Table 5). Celosia, kale, and zinnia treated with the high rate, and kale treated with the low rate, exhibited injury symptoms. Zinnia treated with the high rate of oryzalin or trifluralin, and celosia treated with the high rate of prodiamine, were slightly injured. The oryzalin, prodiamine, and triflualin treatments did not injure any of the other plants. None of the plants treated with either rate of napropamide exhibited injury symptoms 8 WAT. OH-2 with mulch slightly injured statice, and OH-2 without mulch slightly injured zinnia.

At 4 WAT pendimethalin at the high rate reduced the plant quality of all of the species tested, and the low rate reduced the quality of all except the zinnia. None of the other treatments reduced the quality of the kale, statice, or zinnia except the OH-2 without mulch, which affected the zinnia. However, the quality of the celosia was reduced by the OH-2 without mulch, the high rate of oryzalin, and both rates of napropamide and prodiamine.

At 8 WAT, the high rate of pendimethalin reduced the quality of all of the plants except the statice. The low rate affected only the kale. The high rate of oryzalin reduced the quality of celosia and zinnia and the high rate of prodiamine reduced the quality of celosia.

In summary, pendimethalin provided excellent early season weed control, but poor late season control. It consistently caused injury at 4 lbs ai/A and sometimes at the 2 lbs ai/A rate. Oryzalin provided good to excellent weed control, but slightly injured celosia and zinnia when applied at 4 lbs. ai/A. Napropamide provided excellent early season weed control marginally acceptable weed control later in the season. Though it caused some injury to celosia early in the season when applied at the high rate, no injury to any of the plants was observed later in the season. Prodiamine and trifluralin were the overall safest of the herbicides, but they provided the weakest weed control. OH-2 was very effective when placed on the soil surface, but was less effective when placed on an organic mulch. The organic mulch was designed to keep the OH-2 particles from splashing on to the crop plant and injuring the plants. OH-2 tended to be safer placed on a mulch than on the soil surface, but statice was slightly injured even when a mulch was used.

Table 1. Herbicide treatments were applied on sunflower, strawflower, celosia and cosmos on July 2, 1998. The percentage of leaves that appeared either deformed or damaged were recorded one week after treatment.

Treatment	(lbs. ai/A)	Sunflower	Strawflower	Celosia	Cosmos
No Chemical (control)	-	0	12	8	0
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	3	2	10	12	0
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	3	0	10	25	0
Napropamide 50WP	4	13	33	12	3
Prodiamine 65WDG	1	50	17	10	0

Table 2. Weed control in field grown cut flowers. Values represent the percent of the soil covered by weeds averaged over all four species rated 4 WAT, and the percent of soil covered by weeds averaged over three reps for celosia, kale and zinnias, rated 8 WAT.

	Rate	4 WAT	8 WAT [1/]		
Treatment	Lbs/A	Average	Celosia	Kale	Zinnia
Control	0	86.7 a	100.0	100.0 a	100.0
Oryzalin 4AS	2	1.7 f	45.7 bc	21.7 cd	13.7 bc
Oryzalin 4AS	4	0.3 f	15.0 cd	6.7 d	7.0 c
Napropamide 50WP	3	7.0 def	91.0 a	33.3 cd	27.0 bc
Napropamide 50WP	6	7.6 def	40.0 bcd	53.3 c	3.3 c
Prodiamine 65WDG	0.65	34.4 b	90.0 a	100.0 a	38.3 abc
Prodiamine 65 WDG	1.5	17.1 cde	87.3 a	100.0 a	30.0 bc
Pendimethalin 60WDG	2	4.3 ef	91.7 a	75.0 ab	45.0 abc
Pendimethalin 60WDG	4	1.5 f	46.7 bc	60.0 abc	23.3 bc
Trifluralin 5G	2	32.8 b	99.3 a	93.3 ab	43.3 abc
Trifluralin 5G	4	26.8 bc	98.3 a	90.0 ab	56.7 ab
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	3	18.9 cd	75.0 ab	95.0 a	80.0 a
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	3	0.2 f	7.5 d	87.5 ab	55.0 ab

[1/] Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Table 3. Weed control, quality and injury of sunflower, cosmos, strawflower, and celosia treated with herbicides or colored mulches, rated 4 WAT. Percent weed coverage is the percent of the soil covered by weeds. Quality represents the vigor and freedom from damage of the crop; 1 = dead and 10 = excellent condition. Injury represents the amount of chlorosis or necrosis on the plant; 1 = no injury and 10 = dead.

	Sunflower			Strawflower			Celosia [1/]			Cosmos		
Treatment	% Weed Coverage	Quality	Injury	% Weed Coverage	Quality	Injury	% Weed Coverage	Quality	Injury	% Weed Coverage	Quality	Injury
Weeded Control	0 c	10.0 a	1.0 c	0.0 a	10.0 a	1.0 a	0.0 a	10.0 a	1.0 b	0.0 a	10.0 a	1.0 a
Silver Mulch	6.7 a	10.0 a	1.0 c	0.0 a	10.0 a	1.0 a	0.3 a	9.7 a	1.0 b	0.7 a	10.0 a	1.0 a
Red Mulch	5.7 ab	10.0 a	1.0 c	0.0 a	10.0 a	1.0 a	0.0 a	10.0 a	1.0 b	2.3 a	10.0 a	1.0 a
White Mulch	0.3 c	9.3 a	1.0 c	0.3 a	10.0 a	1.0 a	3.3 a	10.0 a	1.0 b	0.3 a	10.0 a	1.0 a
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	1.0 c	10.0 a	2.0 b	0.3 a	9.0 a	1.3 a	5.0 a	6.3 b	4.7 a	1.7 a	10.0 a	1.0 a
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	2.0 bc	9.7 a	2.7 a	0.3 a	10.0 a	1.0 a	5.7 a	7.7 b	3.3 a	0.7 a	9.7 a	1.0 a
Napropamide 50WP	4.0 abc	10.0 a	1.7 b	1.7 a	9.0 a	1.3 a	7.0 a	9.3 a	1.3 b	2.3 a	8.7 a	2.3 a
Prodiamine 65WDG	2.0 bc	9.3 a	3.0 a	1.0 a	9.0 a	1.7 a	31.0 b	7.3 b	3.7 a	1.7 a	10.0 a	1.0 a

1/ Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Table 4. Effect of herbicides and mulches on the average length and total number and weight of primary inflorescences of sunflowers, and all inflorescences of strawflowers, celosia and cosmos over three reps. Flowers were harvested on July 30, August 20, and September 15, 1998 (4, 7 and 11 WAT).

	Sunflower			Strawflowers			Celosia			Cosmos		
Treatment	# of Flowers	Average Length (in.)	Total Weight (gm.)	# of Flowers	Average Length (in.)	Total Weight (gm.)	# of Flowers	Average Length (in.)	Total Weight (gm.)	# of Flowers	Average Length (in.)	Total Weight (gm.)
Primary or Terminal Inflorescence												
Weeded Control	8	26.2	4652	37	23.3	1986	36.7	19.6	2971	118	18.6	2518
Silver Mulch	9	23.3	4317	58	22.7	2698	46.0	20.4	4674	155	19.0	3202
Red Mulch	8	26.6	4513	56	23.6	2622	46.3	19.2	4124	194	20.5	4407
White Mulch	9.3	22.3	3475	68	22.0	2444	40.3	21.3	3659	176	19.2	3517
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	8	27.5	3691	42	23.5	1866	18.0	18.8	1520	128	18.9	2801
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	7	24.8	3315	51	23.2	2333	30.3	18.5	2203	133	20.3	3294
Napropamide 50WP	8	24.4	4075	39	18.2	1559	41.7	18.0	3130	97	18.8	2778
Prodiamine 65WDG	8.3	21.0	3169	55	21.8	2442	24.7	18.7	2429	157	18.5	3475
Significance of F	NS	*	NS	NS	**	NS	*	NS	**	NS	NS	NS
LSD at 0.05		2.7			1.6		18.3		1368			

Table 5. Plant injury for celosia, kale, statice, and zinnia rated on June 25 (4 WAT),and on July 21, 1998 (8 WAT). A value of 1 = no injury and a value of 10 = dead.

		Celosia		Kale		Statice		Zinnia [1/]	
Treatment	lbs./A	4 WAT	8 WAT	4 WAT	8 WAT	4 WAT	8 WAT	4 WAT	8 WAT
Control	0	1.3 de	1.4 cd	1.0 b	1.0 b	1.0 b	1.0 b	1.0 e	1.2 e
Oryzalin 4AS	2	1.3 de	2.1 cd	1.1 b	1.1 b	1.0 b	1.5 b	1.0 e	1.4 de
Oryzalin 4AS	4	2.8 bc	2.4 bc	1.1 b	1.1 b	1.0 b	1.6 b	2.1 c	2.8 b
Napropamide 50WP	3	3.0 bc	1.5 cd	1.0 b	1.0 b	1.1 b	1.9 b	1.5 cde	1.0 e
Napropamide 50WP	6	3.4 b	1.5 cd	1.0 b	1.1 b	1.0 b	2.1 b	1.7 cd	1.0 e
Prodiamine 65WDG	0.65	2.2 cd	2.3 cd	1.0 b	1.3 b	1.1 b	1.1 b	1.0 e	1.0 e
Prodiamine 65WDG	1.5	2.2 cd	3.5 b	1.0 b	1.0 b	1.0 b	1.2 b	1.4 de	1.2 e
Pendimethalin 60WDG	2	3.7 b	2.6 bc	3.5 a	5.2 a	1.5 a	1.3 b	1.3 de	1.6 de
Pendimethalin 60WDG	4	5.7 a	4.7 a	4.1 a	4.6 a	1.7 a	1.4 b	4.2 a	3.6 a
Trifluralin 5G	2	1.0 e	1.8 cd	1.0 b	1.0 b	1.1 b	1.6 b	1.0 e	1.5 de
Trifluralin 5G	4	1.0 e	1.1 d	1.0 b	1.3 b	1.0 b	1.2 b	1.0 e	2.0 cd
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	3	1.3 de	1.4 cd	1.2 b	1.0 b	1.6 a	3.5 a	1.0 e	1.0 e
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	3	2.7 bc	1.8 cd	1.7 b	1.0 b	1.0 b	1.0 b	3.2 b	2.4 bc

1/ Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Table 6. Plant quality for celosia, kale, statice and zinnia rated on June 25 (4 WAT) and July 21, 1998 (8 WAT). A value of 1 = dead and a value of 10 = top quality.

		Celosia		Kale		Statice		Zinnia [1/]	
Treatment	lbs./A	4 WAT	8 WAT	4 WAT	8 WAT	4 WAT	8 WAT	4 WAT	8 WAT
Control	0	9.5 a	9.2 abc	10.0 a	10.0 a	9.6 abc	8.7 a	9.2 abc	9.6 ab
Oryzalin 4AS	2	8.7 ab	8.5 abcd	9.2 a	9.9 a	9.8 a	9.5 a	9.2 abc	9.5 ab
Oryzalin 4AS	4	7.5 cd	7.8 cd	9.7 a	9.9 a	9.8 a	9.3 a	8.7 c	8.6 cd
Napropamide 50WP	3	8.0 bc	9.3 abc	10.0 a	10.0 a	9.9 a	9.1 a	9.5 ab	9.9 a
Napropamide 50WP	6	6.9 de	9.1 abc	9.9 a	9.9 a	9.7 a	9.1 a	8.9 bc	10.0 a
Prodiamine 65WDG	0.65	8.4 bc	8.4 abcd	9.8 a	9.7 a	9.7 a	9.7 a	9.6 ab	10.0 a
Prodiamine 65WDG	1.5	8.0 bc	7.5 d	9.7 a	10.0 a	9.7 a	9.5 a	9.3 abc	9.8 ab
Pendimethalin 60WDG	2	6.5 e	8.1 bcd	7.3 b	7.5 b	9.2 bc	9.5 a	9.2 abc	9.4 ab
Pendimethalin 60WDG	4	5.5 f	5.5 e	6.8 b	5.7 c	9.1 c	9.7 a	7.5 d	8.1 d
Trifluralin 5G	2	9.3 a	9.6 ab	9.9 a	10.0 a	9.6 abc	9.2 a	9.7 a	9.0 bc
Trifluralin 5G	4	9.5 a	9.7 a	9.9 a	9.7 a	9.9 a	9.7 a	9.4 ab	9.0 bc
(OH-2) Oxyfluorfen + Pendimethalin (mulch)	3	9.6 a	9.3 abc	9.9 a	10.0 a	9.5 abc	7.5 b	9.5 ab	10.0 a
(OH-2) Oxyfluorfen + Pendimethalin (no mulch)	3	6.9 de	8.6 abcd	9.8 a	10.0 a	10.0 a	9.9 a	7.8 d	8.4 cd

1/ Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

THE ABSENCE OF *HRP* GENES IN DELETERIOUS RHIZOBACTERIA IDENTIFIED AS WEED BIOLOGICAL CONTROL AGENTS

J.D. Weaver[1], S.H. Hutcheson[2], R.J. Kremer[3], A.C. Kennedy[4], and J. Lydon[5]

Deleterious rhizobacteria (DRB) identified as potential biological control agents of weeds were characterized using LOPAT analysis and screened for the presence of *hrp* gene clusters using PCR analysis and a radiolabeled probe containing the Hrp type I gene cluster from *Pseudomonas syringae* pv. *syringae* 61 (Pss61). The LOPAT results for most of the 12 DRB strains tested were the same or similar to those of their previously assigned species. Two of the DRB strains, *P. syrinage* 2V19 and 3366, induced a hypersensitive response in tobacco leaves. Amplification products were produced from reactions with DNA from all five of the *P. syringae* pathovars tested and one or more of the four sets of primers designed from the Hrp genes part of the Hrp type I gene cluster of Pss61. The only amplification product of the correct size produced in reactions with the Hrp/Hrc primers and DNA from the DRB strains was produced with DNA from *P. syringae* 2V19 and the HrcC primers. However, the amplified product did not anneal with pHIR11, a plasmid that contains the Hrp gene cluster. Furthermore, while fragments of *EcoRI* digested DNA from *P. syringae* pathovars annealed to the correct-sized radiolabeled PCR products from amplifications with Pss61 DNA and HrpL and HrcN, fragments for *EcoRI* digests of DNA from *P. syrinage* 2V19, 3366, and 8-1 failed to do so. The results demonstrate that pathogenicity genes common to plant and animal pathogens are absent from DRB that have biological activity on weed species.

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WEED CONTROL IN CORN WITH *S*-METOLACHLOR

D.B. Vitolo, M.G. Schnappinger, R. E. Schmenk, B. S. Manley, and C.A.S. Pearson [1]

ABSTRACT

S-metolachlor (CGA-77102), the S-chiral isomer of metolachlor, is a new acetamide herbicide developed by Novartis Crop Protection for preemergence grass and broadleaf weed control in corn (*Zea mays* L.). S-metolachlor will be marketed in various formulations and herbicide pre-pack combinations under the Dual MAGNUM™, Dual II MAGNUM™, Dual II MAGNUM SI™, Bicep Lite II MAGNUM™ and Bicep II MAGNUM™ trade names. Metolachlor is a mixture of isomers, and these isomers, depending on their configurations, can be grouped into R- and S- forms. The majority of the herbicidal activity of metolachlor comes from the S-isomer, while the R- isomer is relatively inactive. Synthesis technology has allowed for the selective production of the active isomer, resulting in an equivalency of S-metolachlor to metolachlor of 0.65:1.

Replicated field trials were conducted in New York, Maryland, Pennsylvania, Ohio and Indiana in 1997 and 1998 to evaluate Dual MAGNUM and Bicep II MAGNUM brand herbicides. Efficacy and duration of activity across soil types was very good to excellent on yellow nutsedge (*Cyperus esculentus* L.), giant foxtail (*Setaria faberi* Herrm.), barnyardgrass (*Echinochloa crus-galli* (L) Beauv.), and a wide range of broadleaf weeds.

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DISTRIBUTION OF GRANULAR HERBICIDES IN CONTAINER NURSERIES

R. E. Wooten, J. C. Neal, J. Darden, C. Adkins, M. Parker, and C. Lauderdale*

Each year nurserymen report poor or lack of weed control from preemergence herbicides labeled for the control of the target weeds. One potential reason for product performance failures is inaccurate or non-uniform application of the herbicide. This test was conducted in order to document the accuracy and uniformity of granular herbicide applications in commercial nurseries. A cooperative study was established at 6 commercial nursery sites. Five common preemergence herbicides were applied by the cooperating grower with or without the assistance of the local county extension agent. The herbicides included Scotts OH2 (oxyfluorfen + pendimethalin) @ 3 lb ai/A, Ronstar (oxadiazon) @ 3 lb ai/A, Snapshot (isoxaben + trifluralin) @ 5 lb ai/A, Regal OO (oxyfluorfen + oxadiazon) @ 3 lb ai/A, and Regalkade G (prodiamine) @ 0.75 lb ai/A. Treatments were not replicated at each nursery, rather large blocks were treated to facilitate actual grower conditions. The size of each treatment varied at each nursery – the smallest being about 30 ft by 40 ft and the largest about 30ft. by 250 ft. In each treatment, six-1 ft^2 catch pans were randomly placed throughout the block of plants. After application, the captured granules in each pan were bagged and later weighed.

When catch-pan weights were averaged, not a single grower-applied treatment was within $\pm$10% of the target application dose (Figure 1). When weights from individual catch-pans within a block are compared, the results varied between herbicide treatments and locations. At one site there was approximately a four-fold difference in amounts captured within the OH2-treated block, with the actual dose varying from 87% to 366% of target rate (Figure 2). Out of the six catch-pans in that block, only two contained an amount with $\pm$10% of the target rate. At another site, none of the samples exceeded the desired rate, but the range was from 27-90% of target. In general, the herbicides that were applied at higher doses of product (more granules per area) tended to have more accurate applications than products applied at less than 150 lb product per acre.

Although, the data from this experiment do not contain direct comparisons between herbicide dose and percent weed control, it can be assumed that lower than labeled rates would provide less weed control, and that nurserymen applying herbicides at greater than twice the labeled rate risk crop injury.. These data clearly demonstrate that regardless of the herbicide chosen, nurserymen need to improve the accuracy and precision of herbicide applications.

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Figure 1. Average dose of Scotts OH2 herbicide (expressed as a percent of the target rate) applied by nurserymen at six cooperating nursery sites.

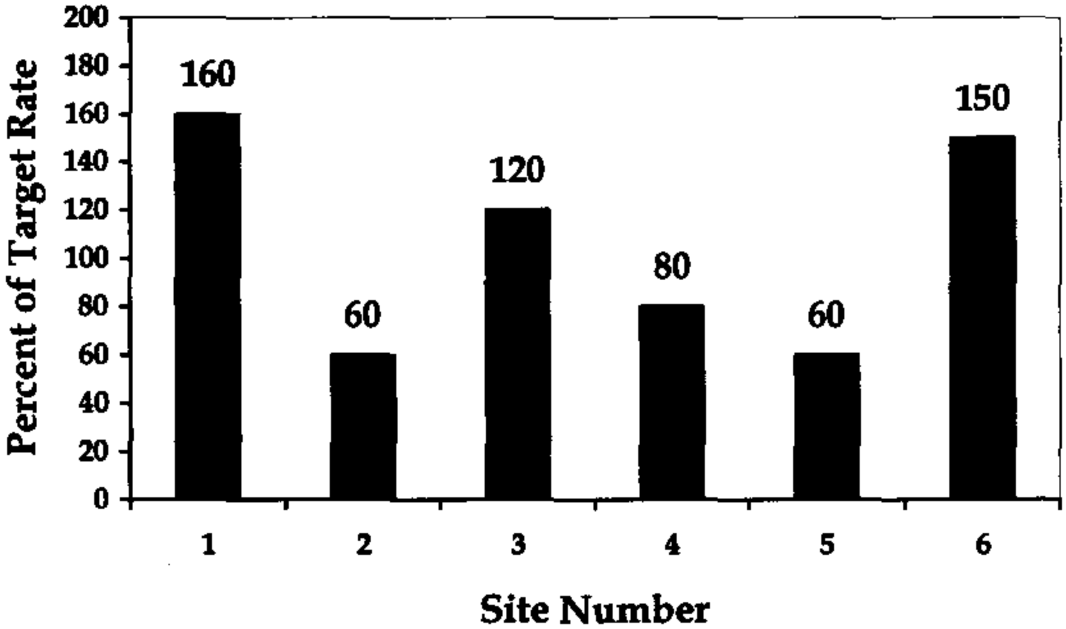
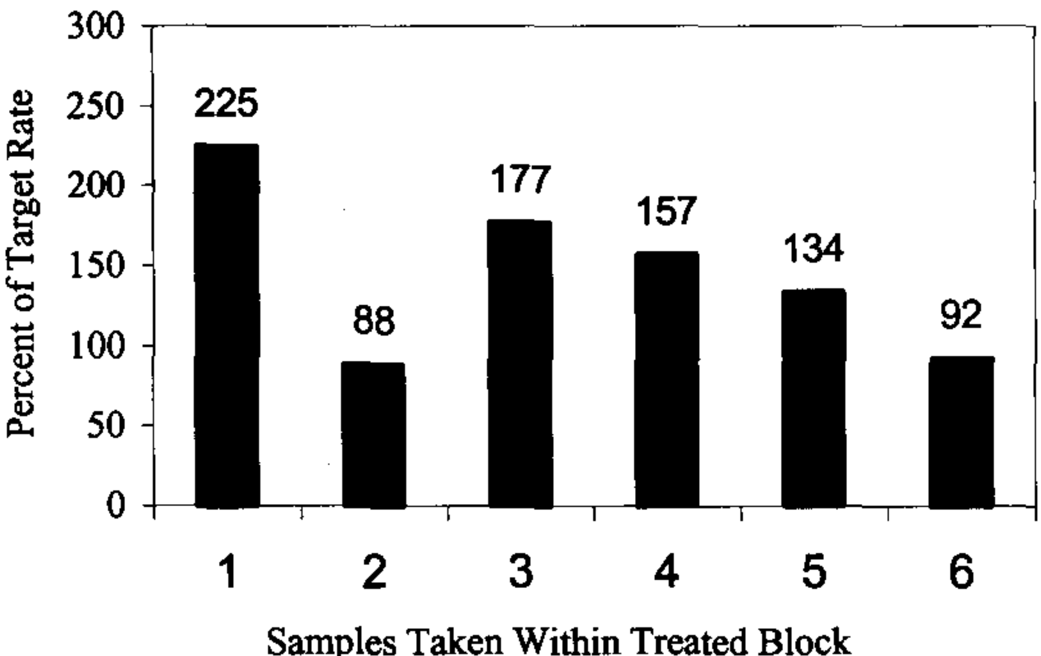


Figure 2. Herbicide distribution within a treated block at cooperator site number 1. Data are expressed as a percent of the target rate. Each column represents a single square foot collection pan within the OH2-treated block.



SURVEY FOR NATURAL ENEMIES OF AN EXOTIC WEED, MILE-A-MINUTE (Polygonum perfoliatum L.)

Y. Wu[1]*, R. C. Reardon[2], J-Q Ding[3], J. G. Fredericks[4], and M. R. Gale[5]

ABSTRACT

Mile-a-minute (Polygonum perfoliatum L.), an accidentally introduced annual vine from Asia, has been aggressively spreading from its central spot in York County, Pennsylvania. Mile-a-minute outcompetes native plant species for their habitats and impacts reforestation, wildlife restoration, and recreation areas in the Eastern United States. According to the literature and herbarium records this weed has a broad range in China, south to Guangdong Province in tropical and subtropical zone; and north to Heilongjing Province in frigid-temperate zone. Mile-a-minute weed has a potential to greatly extend its range in the United States.

A cooperative project, sponsored by USDA Forest Service, Forest Health Technology Enterprise Team, was initiated in 1996, to survey and identify native and exotic natural enemies for biological control of mile-a-minute weed. Surveys and collections for arthropods and plant pathogens were conducted both in the Eastern United States and in China. With the cooperation of several State Departments of Agriculture the surveys are being conducted in the areas containing mile-a-minute weed in Maryland, Pennsylvania, Virginia, Delaware, and West Virginia. The survey areas in China include Liaoning and Jilin Provinces in the Northeastern area, Inner-Mongolia, Hebei, Beijing and Tianjin Provinces in Northern China, Henan, and Shandong Provinces in Central China, and Zhejinang and Fujian Provinces in Sounthern China.

Preliminary field data and laboratory tests demonstrated that three insect species collected from China, a inch worm, a flower-feeding bug, and a weevil, impact mile-a-minute weed and posses a narrow host range. Further host range tests are being conducted at the USDA ARS quarantine facility in Newark, Delaware. Intensive laboratory tests are being conducted on the effectiveness of plant pathogens collected from the weed at the USDA ARS quarantine facility in Frederick, Maryland.

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ACCUMULATION DYNAMICS OF TRICLOPYR ESTER IN LEAF PACKS AND EFFECTS ON DETRITIVOROUS INSECTS.

D. G. Thompson[1], D. P. Kreutzweiser, B. Staznik, and J. A. Shepherd[2]

ABSTRACT

Previous field studies have demonstrated that residues of the herbicide, triclopyr butoxy ethyl ester (TBEE), can accumulate in submerged leaf material of aquatic systems at concentrations up to 20 times the maximum aqueous concentrations. Accumulated TBEE residues may pose a risk of adverse effects to Detritivorous invertebrates inhabiting and utilizing natural leaf packs. We examined the dynamics of TBEE accumulation and persistence in leaf material of laboratory and outdoor aquatic systems, and determined the ecological significance of this in terms of effects on detritivorous invertebrates and organic matter processing. Accumulations of TBEE in leaf packs of laboratory lentic microcosms was up to 80 X aqueous concentrations, and residues persisted for 4-5 d. Leaf material of flow-through microcosms accumulated TBEE at a much higher rate (up to 1000 X aqueous concentrations), but residues were cleared by 48-72 h. Accumulation and persistence in flow-through units were dependent on depth and velocity of water, and exposure duration. Accumulated TBEE was less in outdoor stream channels than in laboratory flow-through units. Despite accumulations of TBEE in leaf packs at up to 90 mg/g in systems treated at or near expected environmental concentrations, there was no significant mortality of detritivorous insects and no significant reductions in leaf consumption. Significant mortality and reduced feeding occurred only in systems treated at concentrations well above (up to 10 X) expected environmental concentrations.

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EFFECT OF ISOXAFLUTOLE ON PIGMENT BIOSYNTHESIS OF CUCUMBER (*Cucumis sativus* L.) COTYLEDON SYSTEM

Sanjay Kushwaha and Prasanta C. Bhowmik[1]

ABSTRACT

Isoxaflutole (5- cyclopropyl -4-(2-methylsulphonyl-4-trifluromethylbenzoyl) isoxazole) is a new herbicide for preemergence broad-spectrum weed control in corn. It produces bleaching symptoms in susceptible species. In the present study, the effect of isoxaflutole on chlorophyll (Chl) and carotenoid (Car) biosynthesis was investigated in cucumber (*Cucumis sativus* L.) cotyledon system. When the etiolated tissue was incubated with isoxaflutole for 24 h and exposed to the light for 48 h, there was reduction in chlorophyll a, chlorophyll b and carotenoid pigment levels. Increase in the isoxaflutole concentration beyond 5 mM resulted in greater reduction in Chl and Car pigments. Similarly, increasing the light intensity from 60 to 180 μmol m^{-2} s^{-1} resulted in greater reduction in Chl and Car pigments. Exogenously supplied δ-Aminolevulinic acid did not reverse the isoxaflutole- reduced chlorophyll synthesis, whereas an exogenously supplied homogentisic acid lactone was able to reverse the isoxaflutole-reduced pigments. It suggests that isoxaflutole did not inhibit chlorophyll synthesis directly. However, it is possible that isoxaflutole acts via disruption of carotenoid by inhibiting hydroxyphenyl pyruvate dioxygenase (HPPD) activity required for the conversion of *p*-hydroxyphenyl pyruvate to plastoquinone, a cofactor in carotenoid biosynthesis pathway.

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Absorption and Translocation of Prosulfuron and Primisulfuron Combinations with Dicamba by Hemp Dogbane (*Apocynum cannabinum*)

Pablo A. Kálnay, Scott Glenn, and W. H Phillips, II.

ABSTRACT

Absorption and translocation of Exceed, a pre-packed mix of prosulfuron and primisulfuron, and dicamba in hemp dogbane were studied in the greenhouse. The experiment was designed as a completely random design with four reps. The experiment was replicated The plants were grown in the greenhouse from horizontal 8-inch root segments and thinned to 1 shoot per pot. Herbicides were applied when the hemp dogbane was 10 to 14 inches tall. The treatments consisted of 0.031 lb ai/A of Exceed applied alone and in combination with 0.125 lb ai/A of dicamba, and the same rate of dicamba applied alone. All applications were conducted with a CO_2-driven sprayer table with a 8004E flat fan nozzle delivering 19.7 G/A. A strip of tape 1/4 inch wide was placed on the uppermost fully expanded leaf of each plant before spraying. ^{14}C-labeled prosulfuron, primisulfuron, or dicamba was applied to that leaf spot with a micro syringe following spraying. The plants were harvested 1 and 5 days after treatment (DAT), separated into plant parts and freeze-dried. Plant parts were combusted using a biological oxidizer, trapping the CO_2 in liquid scintillation cocktail and analyzed. Absorption of prosulfuron increased 24.9% when applied in combination with dicamba compared to Exceed applied alone 1 DAT. There was also increased translocation of prosulfuron to the lower leaves and shoots when Exceed was applied in combination with dicamba compared to the sulfonylurea mix applied alone 1 DAT. There were no differences in translocation to the upper leaves or different root segments 1 DAT of prosulfuron when Exceed was applied alone compared to the combination with dicamba. Absorption of prosulfuron for the Exceed/dicamba combination was also 34.6% higher than Exceed applied alone 5 DAT. Translocation of prosulfuron to the lower leaves and shoots for the Exceed/dicamba combination was 186% higher than Exceed applied alone. There were no differences in absorption or translocation of primisulfuron for the Exceed/dicamba combination 1 or 5 DAT compared to Exceed applied alone. There were no differences in absorption of dicamba for Exceed/dicamba combinations compared to dicamba applied alone. There was a trend of increased dicamba translocation for the Exceed/dicamba combination to upper leaves 1 DAT (44.2%) and to upper and lower leaves 5 DAT (71 and 89%, respectively) compared to dicamba applied alone. However, there was great variability for the ^{14}C-labeled dicamba treatments.

INFLUENCE OF EDAPHIC FACTORS ON ISOXAFLUTOLE ACTIVITY IN SOIL

S. Mitra, P. C. Bhowmik, and B. Xing[1]

ABSTRACT

Isoxaflutole is a pre-emergence corn herbicides which controls both grass and broad leaf weeds. Experiments were performed in the laboratory to study the adsorption of isoxaflutole in five different soils (Moorehead, MN; East Monroe, CO; Ellendale, MN; South Deerfield, MA; and Chelsea, MI) using the batch equilibration technique. Total initial isoxaflutole concentrations for each soils were 0.05, 0.15, 0.3. 0.8, 1.5, 2.0 and 4.0 $\mu g\ ml^{-1}$. Analysis of ^{14}C-ring labeled isoxaflutole was performed using liquid scintillation counting, and sorption data were fitted to the Freundlich model.

Isotherms for isoxaflutole in all the soils were nonlinear as indicated by the exponent (N = 0.930 to 0.998), indicating differential distribution of site energies in the various soils. The Freundlich sorption coefficient ranged from 0.646 to 50.00 ($\mu g^{1-N}\ g^{-N}\ ml^{N}$). Multiple regression of the adsorption constant, K_F against selected soil properties indicated that organic matter content was the best single predictor of isoxaflutole adsorption (r^2 = 0.999), followed by soil pH (r^2 = 0.954). Clay content of the soils did not have a high correlation with K_F values (r^2 = 0.453), while the adsorption of isoxaflutole was not influenced by the Ca concentration in the soil solution. The regression between K_F values and soil organic matter indicated that isoxaflutole adsorption increased with an increase in organic matter content of soils. Adsorption of isoxaflutole decreased as the soil pH increased from 4.5 to 8.5, which was depicted by the reduction of K_F values.

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EFFECT OF EMERGENCE DATE AND CORN COMPETITION ON BURCUCUMBER FECUNDITY

W.R. Esbenshade and W.S. Curran[1]

ABSTRACT

Burcucumber (Sicyos angulatus L.) is an annual climbing vine that produces multiple flushes of seedlings from mid-May to September in agronomic crops. Due to its prolonged germination period, control of burcucumber has been difficult. The effect of emergence date on burcucumber's overall growth and seed production is not fully known.

An experiment examining the effect of burcucumber emergence date and corn (Zea mays L.) competition on burcucumber fecundity was conducted in 1997 and 1998. Burcucumber seedlings were established on approximately 10 day intervals starting in late May through mid-August in corn and a non-crop environment. Measurements including leaf number, vine length, flowering period, overall plant biomass, seed number, and seed viability were determined.

Burcucumber plants in a non competitive environment experienced tremendous growth producing 700 g of dry matter and 4500 seeds per plant in 1997 and 600 g of dry matter and 1740 seeds per plant in 1998. Plant dry matter was greatest in the first establishment date (May 23) in both years and decreased for the establishment dates thereafter. Seed production peaked 21 days after the initial establishment (June 13). Although seed numbers were drastically reduced in comparison to the earlier establishments, plants established as late as 70 days after the initial establishment (August 5) were still able to produce seed. Burcucumber plants grown in corn only produced a fraction of the dry matter and seed of the plants in a non-crop environment in both years of this study. In most cases, burcucumber growth was reduced to about 5% of the growth of non-crop environment grown plants due to the competition by the crop. Although the growth and seed production of burcucumber grown in corn was drastically reduced, plants emerging as late as 50 days after the initial establishment (July 14) were still able to produce seed.

In summary, emergence date plays a vital role in the growth and development of burcucumber. Burcucumber exhibits substantial growth when grown without the competition of a crop. Burcucumber is capable of producing seed even when emerging as late as Aug. 5 in a non-crop environment. Crop competition greatly reduces the growth and seed production potential of burcucumber. No burcucumber seed was produced in a corn crop if burcucumber emerged after mid July.

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Using Herbicide-Resistant Corn Hybrids to Establish an Alfalfa Cover Crop

N. Gift[1], R.R. Hahn, and J. Mt. Pleasant

ABSTRACT

Though alfalfa (*Medicago sativa* L.) has been used as a cover crop in corn (*Zea mays* L.) in research for several decades, weed control has been prohibitively difficult to manage in this system. With the introduction of herbicide-resistant corn varieties, there is potential for coordinating planting dates of alfalfa and corn while maintaining sufficient levels of weed control. This was the first of a series of planned studies on the potential for managing an alfalfa cover crop in corn.

A leafhopper resistant alfalfa variety was planted immediately before imidazolinone- (IR), glufosinate- (GR), and sethoxydim-resistant (SR) corn varieties in three separate experiments. Corn was planted on May 18, 1998. In each experiment, a randomized complete block design with four replications was used. Treatments included corn only (treated with metolachlor and atrazine), alfalfa only (treated with sethoxydim and 2,4-DB), a weedy check, and various herbicides, each applied both mid- and late-postemergence (MPO and LPO). Response variables included weed control ratings, alfalfa tolerance, alfalfa stand, and corn silage yield. Preemergence herbicide treatments were applied on May 22 with a backpack sprayer. MPO herbicide treatments were applied to IR corn on June 19 and to SR and GR corn on June 25.

LPO herbicide treatments were applied on July 3. Visual weed ratings of all plots were taken three times for each experiment. GR and SR corn was rated on July 6, 14, and 27. IR corn was rated on July 10, 17, and 27. Alfalfa plant counts were taken on September 16-18 in three quadrats (30" x 12") per plot. IR corn was harvested as silage on September 24, and GR and SR corn was harvested on September 25. Data were analyzed using analysis of variance with orthogonal contrasts and Bonferroni-corrected least significant differences.

Corn yields were highly variable, and there were no significant yield differences among herbicide treatments in SR or GR corn. In IR corn, MPO treatments yielded higher than LPO treatments, but there were no differences among yields of the various herbicide treatments. Alfalfa stands, however, were generally greater in LPO treatments than MPO treatments in IR corn, and there were significant differences between herbicides. Particularly promising treatments for future examination in IR corn included chloransulam-methyl MPO, imazamox MPO and LPO, primisulfuron MPO, and halosulfuron MPO, all of which resulted in relatively high corn silage yields (17976-19397 kg/ha)and high alfalfa stand counts (228-249 plants/m^2). Average alfalfa stands in GR corn treatments were far lower than in the best IR corn herbicide treatments (103 plants/m^2). Sethoxydim and bromoxynil (MPO and LPO) is most promising SR treatment, with alfalfa counts of 226 and 203 plants/m^2, and corn silage yields of 23996 and 19071 kg/ha.

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EFFICACY OF GLYPHOSATE TANK MIX PROGRAMS IN ROUNDUP READY® SOYBEAN

D. H. Poston, H. P. Wilson, T. E. Hines, G. R. Armel, and R. J. Richardson[1]

ABSTRACT

Since the introduction of Roundup Ready ® soybean (Glycine max L. Merr.), much emphasis has been placed on developing herbicide mixtures that broaden the weed spectrum and add soil residual activity to postemergence glyphosate applications. Field studies were conducted in 1996, 1997, and 1998 in Painter, VA to evaluate the efficacy of glyphosate combined with various herbicides and manganese fertilizers.

In 1996, glyphosate was applied alone at rates of 0.38, 0.5, and 0.63 lb ai/A or in combination with 0.004, 0.005, 0.008, or 0.012 lb ai/A chlorimuron. Glyphosate alone at any use rate generally provided 80 % or higher control of smooth pigweed (Amaranthus hybridus L.), common lambsquarters (Chenopodium album L.), jimsonweed (Datura stramonium L.) and large crabgrass (Digitaria sanguinalis L. Scop.) 4 WAT and the addition of chlorimuron failed to improve control. Glyphosate applied at 0.38 and 0.5, and 0.63 lb/A provided 62, 73, and 81 % control of morningglory species, respectively. Improvements in morningglory (Ipomoea spp.) control ratings were generally observed with the addition of chlorimuron. Soybean yield was similar for all treatments.

In 1997, glyphosate was applied alone (0.75 lb/A) or in combination with acifluorfen (0.25 lb ai/A), acifluorfen + bentazon (0.5 or 0.75 lb ai/A), dimethenamid (0.75 lb ai/A), or imazethapyr (0.06 lb ai/A). Herbicide applications were made under moist conditions to small actively growing weeds. Reduced control of common ragweed (Ambrosia artemisiifolia L.) 5 WAT was observed when glyphosate (0.75 lb/A) was mixed with acifluorfen (0.25 lb/A), acifluorfen + bentazon (0.17 + 0.33 lb/A), and imazethapyr (0.063 lb/A). Similar reductions in the control of jimsonweed were observed. Control of smooth pigweed 5WAT was greater with all tank mixes than with glyphosate alone. Annual grass control was greatest 5 WAT when dimethenamid (0.75 lb/A) was included in glyphosate applications.

In a separate 1997 study, glyphosate was applied alone (0.075 lb/A) or in combination with fomesafen (0.38 lb ai/A), acifluorfen (0.38 lb/A), or 2,4-DB (0.03 lb ai/A). Unlike the previous study, herbicide applications were made under dry field conditions. Significantly greater control of morningglory was observed with mixtures compared to glyphosate alone. In contrast, annual grass control ratings were significantly less with mixture compared to glyphosate alone. Control of common lambsquarters was similar with all treatments.

In 1998, cloransulam was evaluated in mixtures with glyphosate. Season-long control of common ragweed, smooth pigweed, annual grasses, morningglory, and common lambsquarters was observed with all combinations. Pre-harvest morningglory control ratings were generally higher with mixtures than with glyphosate alone.

The addition of lignin-based or chelated manganese fertilizers (4 % v/v) to postemergence glyphosate (1.0 lb ai/A) applications significantly reduced annual grass control 4 WAT in 1997 and 1998. Reduced control of several other broadleaf weeds was also observed. The magnitude of reductions in glyphosate activity was greatest with lignin-based manganese.

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WEED MANAGEMENT PROGRAMS IN SOYBEAN WITH CLORANSULAM

G. R. Armel, H. P. Wilson, T. E. Hines, D. H. Poston, and R. J. Richardson[1]

ABSTRACT

Field studies were conducted in 1996, 1997, and 1998 in Painter, VA to evaluate the performance of cloransulam as a preemergence and postemergence herbicide in soybean (Glycine max L. Merr.).

In 1996, cloransulam (0.016 lb ai/A) applied postemergence following preplant incorporated applications of trifluralin (0.5 lb ai/A) or trifluralin + flumetsulam (0.91 lb ai/A) provided excellent control (> 90%) of annual morningglory (Ipomoea spp.), smooth pigweed (Amaranthus hybridus L.), jimsonweed (Datura stramonium L.), common ragweed (Ambrosia artemisiifolia L.), and large crabgrass (Digitaria sanguinalis L. Scop.) 4 WAT. Control of smooth pigweed by postemergence applications of cloransulam was unusually high in 1996 and may have been due in part to exceptionally good growing conditions, excellent performance preplant incorporated herbicides, and timely herbicide applications. Control of all weed species evaluated was generally less when cloransulam alone was applied preplant incorporated at a rate of 0.039 lb/A. The addition of 0.006 lb ai/A flumetsulam to postemergence cloransulam treatments did not improve weed control; soybean injury was generally higher in treatments containing flumetsulam. Postemergence applications of acifluorfen provided weed control similar to postemergence applications of cloransulam 4 WAT. In a separate study, cloransulam (0.016 lb/A) applied postemergence following preemergence applications of metolachlor (1.46 lb ai/A) or metolachlor + flumetsulam (1.93 lb ai/A) provided 87% or greater control 4 WAT of morningglory, smooth pigweed, jimsonweed, common ragweed, large crabgrass, and common lambsquarters (Chenopodium album L.). In both studies, higher soybean yields occurred in herbicide-treated plots than in the untreated control. However, no significant differences in soybean yield occurred between herbicide treatments.

In 1997, cloransulam applied postemergence at 0.016 lb/A following preemergence applications of trifluralin, trifluralin + flumetsulam, metolachlor, or metolachlor + flumetsulam provided good (80 to 89%) to excellent control of all weed species evaluated 4 WAT. Preemergence applications of metolachlor (1.46 lb/A) followed by postemergence applications of acifluorfen (0.375 lb ai/A) provided 75% control of common lambsquarters 4 WAT. In contrast, all treatments containing cloransulam provided at least 87% control of common lambsquarters 4 WAT.

In 1998, preemergence applications of cloransulam generally provided excellent season-long control of common ragweed, common lambsquarters, and smooth pigweed. Morningglory control was 85 to 95% 5 WAT when cloransulam was applied preemergence at rates of 0.023, 0.031, 0.039, and 0.046 lb/A, respectively. Excellent late-season control of morningglory was also observed.

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EFFICACY OF PREEMERGENCE WEED MANAGEMENT PROGRAMS IN SOYBEAN WITH DICLOSULAM

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ABSTRACT

Field studies were conducted in 1996, 1997, and 1998 in Painter, VA to evaluate diclosulam as a preemergence herbicide in soybean (Glycine max L. Merr.).

In 1996, trifluralin (0.5 lb ai/A) in combination with 0.008, 0.016, 0.024, 0.031, and 0.046 lb ai/A diclosulam provided 78, 85, 88, 83, and 87 % control of annual morningglory (Ipomoea spp.) 3.5 WAT, respectively. The same herbicide treatments gave 70, 73, 78, 88, and 98 % control of annual morningglory 9 WAT, respectively. Excellent control (>90 %) of common ragweed (Ambrosia artemisiifolia L.), smooth pigweed (Amaranthus hybridus L.), and jimsonweed (Datura stramonium L.) was observed 3.5 WAT. Trifluralin (0.5 lb/A) in combination with diclosulam applied at rates of 0.016 lb/A or greater provided 88% or greater control of jimsonweed 9 WAT. Trifluralin (0.5 lb/A) in combination with diclosulam applied at rates of at least 0.031 lbs/ac generally provided greater control of morningglory, common ragweed, and jimsonweed 9 WAT compared to combinations of trifluralin with chlorimuron + metribuzin, metribuzin, or flumetsulam. When applied in combination with metolachlor (1.46 lb ai/A), diclosulam controlled of common ragweed, smooth pigweed, and large crabgrass (Digitaria sanguinalis L. Scop.) 3.5 and 9 WAT. Metolachlor applied in combination diclosulam generally gave greater control of morningglory, common ragweed, and jimsonweed 9 WAT than metolachlor applied in combination with imazaquin, chlorimuron + metribuzin, metribuzin, or flumetsulam.

In 1997, diclosulam applied at rates of 0.023 or 0.031 lb/A and in combination with either trifluralin or metolachlor gave greater control 3.5 WAT of morningglory and common ragweed than combinations of flumetsulam with either trifluralin or metolachlor. Significantly greater control of large crabgrass and jimsonweed was also observed in treatments containing trifluralin + diclosulam compared to treatments containing trifluralin + flumetsulam.

In 1998, diclosulam applied alone or in combination with cloransulam or flumetsulam provided 89% or greater control 2 WAT of morningglory, common ragweed, and common lambsquarters (Chenopodium album L.). Visual injury ratings of 10 and 11%, respectively, were observed when diclosulam was applied at 0.016 lb/A and in combination with either 0.031 or 0.039 lb ai/A cloransulam. Less than 10% visual injury was recorded with all other treatments in the study. Excellent late season (10 WAT) control of smooth pigweed, common lambsquarters, common ragweed, and morningglory was observed when diclosulam was applied alone at 0.023 lb/A. All combinations of diclosulam and cloransulam produced similar results.

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THE CONTROL OF COMMON LAMBSQUARTERS IN CORN WITH FOUR SOIL-APPLIED HERBICIDES

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ABSTRACT

Common lambsquarters (Chenopodium album) occurs frequently in agronomic cropping systems. In Pennsylvania, triazine resistant and susceptible common lambsquarters can be found in corn fields. Several new corn herbicides may prove effective as preemergence herbicides in the control of triazine resistant and susceptible common lambsquarters in corn.

Field and greenhouse studies examined the performance of four herbicides on the control of common lambsquarters in 1998. The herbicide field performance trials compared three rates (1/3x, 2/3x, 1x) of flumetsulam, isoxaflutole, pendimethalin, and rimsulfuron as a preemergence treatment. A single rate of atrazine was used to determine triazine resistance. The field experiment had four replications conducted at two locations in Centre County. The soil type at both locations was a silty clay loam with less than 3% organic matter. Common lambsquarters control was evaluated through visual estimates of control, weed densities and by harvesting above ground weed biomass in August. The greenhouse herbicide performance screen compared the same herbicides at 1/6, 1/3, and 2/3x rates. Weed density and biomass measurements were taken three weeks after application. The greenhouse experiment had four replications and was repeated.

Rainfall during the 1998 growing season approached the seasonal average. However, following the application of the preemergence herbicides, almost three weeks passed without appreciable rainfall. This lack of rainfall reduced the performance of all the herbicides. At the Irvin location, common lambsquarters appeared to be a mixed population of triazine resistant and triazine susceptible. Three weeks after application pendimethalin, flumetsulam, atrazine, isoxaflutole, and rimsulfuron provided 81%, 61%, 59%, 58%, and 8% control based on lambsquarters density. By mid July, common lambsquarters control (based on density) was less than 50% with all herbicides. By the end of August, pendimethalin, isoxaflutole, atrazine, flumetsulam, and rimsulfuron provided 66%, 50%, 43% 35% and 2% control of common lambsquarters according to above-ground biomass. At the Hort location, common lambsquarters appeared to be triazine susceptible. Three weeks after application atrazine, isoxaflutole, rimsulfuron, pendimethalin, and flumetsulam provided 100%, 82%, 64%, 60%, and 25% control based on weed density. By mid July, control with atrazine was near perfect, isoxaflutole provided 81% control, and all other treatments were less than 50% based on weed density. Weed biomass in August indicated atrazine, isoxaflutole, pendimethalin, rimsulfuron, and flumetsulam provided 99%, 75%, 52%, 34%, and 8% control of common lambsquarters.

The preliminary analysis of the greenhouse experiment suggests that ample moisture greatly improves the performance of all herbicides. The greenhouse experiment showed that isoxaflutole, flumetsulam, and pendimethalin were similar and provided good common lambsquarters control. Rimsulfuron was less effective than the other three herbicides, especially at lower than the full rate.

In summary, pendimethalin and isoxaflutole provided the best control of common lambsquarters across locations. Atrazine was better than all other herbicides on triazine susceptible common lambsquarters. Rimsulfuron was the least effective common herbicide for common lambsquarters control in both the field and greenhouse experiments.

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USE OF A CHLOROPHYLL METER TO ASSESS HERBICIDE INJURY AND PREDICT CROP RESPONSE

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INTRODUCTION

For many years, weed scientists have evaluated crop injury as an integral component of herbicide efficacy studies. While data such as percent injury or stunting are informative, their use for predicting yield reduction is often only moderately effective. Serious injury early in plant development can slow growth and development for the rest of the growing season. However, because plants are small, it is often difficult to rate degree of stunting. Other tools such as a chlorophyll meter (Minolta SPAD 502) may be useful at assessing herbicide damage to plants. The small hand held chlorophyll meter provides a non-destructive estimate of the chlorophyll content of plants. Leaf chlorophyll content can be related to plant nutritional status, and as such the meter has been used successfully to assess nitrogen (N) status of corn (Jemison and Lytle, 1996; Piekielek and Fox, 1992), potatoes (Minotti et al., 1994; Honeycutt, 1998), and other crops (Turner and Jund, 1989). However, many other factors can affect leaf chlorophyll such as temperature, nutrient deficiencies (magnesium, sulfur, and others), and plant injury. Most researchers have found better predictive success when they normalize readings (compare plants from unfertilized sites to a highly fertilized N plot) to reduce the variation from other sources.

While the chlorophyll meter has been used successfully to predict crop nutrient response, to date, little or no research has been conducted using the meter to assess degree of herbicide injury and subsequent loss in yield. This use has practical implications. If a producer or consultant could quickly assess herbicide damage and be able to predict that losses may be 20 percent or greater early in the growing season, a decision could be made to plant additional feed at that time. Therefore, the objectives of this work were to determine if herbicide injury could be detected using a chlorophyll meter, and whether SPAD readings taken early in plant development could more accurately predict crop response than standard injury estimates.

MATERIALS AND METHODS

Experiments were conducted in 1997 and 1998 at the Sustainable Agriculture Experiment Station in Stillwater, Maine. The experiments were corn herbicide evaluations comparing recommended rates of several herbicides and standard tank mix combinations to above-label rate treatments included to increase chance of seeing injury. Data was also collected from another herbicide trial conducted on a potato field in Corinna, Maine. The corn herbicides were all preemergence products. The potato herbicides were a mixture of pre and postemergence products. All product rates and tank-mix combinations are presented in Table 1.

Corn (*Zea mays* L.) was planted May 22, 1997 and May 17, 1998. Soil used in both years was a Lamoine silt loam with 5.2 and 5.6% organic matter. Treatments were applied on May 23, 1997 and May 21, 1998. Potatoes were planted April 27, 1998 and preemergence treatments were applied May 1st and postemergence treatments on May 16th. Herbicides were applied by hand using a backpack sprayer at a rate of 20 gallons/minute and pressure at 30 lbs/in^2

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through 8002ES nozzles. Percent injury and degree of corn stunting was rated at the two, three, and fifth leaf stage of development. Injury was rated as the number of plants in the two center rows exhibiting chlorosis. Stunting was assessed as a percentage relative to hand-weeded corn. Plant height was measured at the fifth leaf stage of development. Potato injury was assessed five days following postemergence application at 25 days after emergence. Twenty SPAD measurements were collected from each plot, and these were taken from the last fully expanded leaf. So, with V-2 corn, readings were taken on the second leaf in the middle of the leaf avoiding the midrib. Relative SPAD is the average SPAD from a treated plot divided by the average SPAD from the hand-weeded control. Relative yield is the yield of a treated plot divided by the hand-weeded control.

The experimental design used in all studies was a randomized complete block with four replications. Linear regression, stepwise multiple regression, and Cate-Nelson graphs were the analytical methods used to determine which variables could be used to predict yield response (Systat 7.0; Cate and Nelson, 1965).

RESULTS AND DISCUSSION

Environmental conditions significantly affected plant response to the applied herbicides. In the corn trial conducted in 1997, no rain fell on the experimental site for 15 days following application. As a result, we found no injury with any treatment in 1997. Therefore, no data will be presented. In 1998, the corn study received slightly over 3 inches of steady gentle rain over a 2-day period. The moisture allowed herbicides to activate and the percolating water carried the compounds near the germinating plant causing varying levels of injury. Chlorosis was more severe with above-label rates. In the potato study, early rainfall allowed good activation of Matrix and good effectiveness as a preemergence herbicide. No injury was noted before postemergence treatments were applied. Postemergence injury symptoms were visible for approximately a week.

While there were significant treatment differences in 1998 with both injury and stunting, injury ratings were only moderately effective in predicting crop response (Figures 1). Stunting ratings were less effective ($r^2 = 0.26$). The poor predictability (less than 50% of the variation in yield could be attributed to these variables) is hardly unexpected since these measurements were taken at the V-2 stage of growth. The predictive ability of SPAD values was slightly higher than stunting or injury variables (r2 = 0.48). Using stepwise multiple regression, plant height at the V-5 growth stage was the best variable to predict yield ($r^2 = 0.62$). While statistically significant, percent injury, stunting and V-2 stage SPAD values did not improve the predictive model.

However, using a Cate-Nelson approach, we found a much better predictive relationship. Using critical levels of 75% relative SPAD (mean SPAD value of treated plot divided by that of the hand-weeded plot) and 90% relative yield, we found 11/14 points (80%) fell in the lower left and upper right quadrants. The utility of using relative values is that data from other experiments can also be plotted on the same graph to see if those critical. When we combined the second site-year data from the potato experiment, the predictive relationship remained consistent showing further strength in the testing procedure (Figure 2).

This Cate-Nelson analysis is useful in separating data into groups. A crop consultant visiting a corn field exhibiting herbicide injury is concerned aboutd being able to predict whether that crop injury will significantly limit yield. If so, recommendations could be made to plant more corn for feed. The reason this analytical method is more robust than standard regression analysis is that decisions are made based on critical levels. In N research, if soil nitrate levels are 30 mg/kg or 50 mg/kg, yield will likely not be limited due to N. Similarly, plants at the V-2 stage of growth can take some level of injury and grow out of it. It is more important to determine the point where they may not. We are less concerned about the tightness of the fit around the regression line.

CONCLUSIONS

Use of a chlorophyll meter to predict crop response to herbicide injury appears to be more effective than standard assessment of injury or stunting. While plant height at the V-5 growth stage was highly correlated to corn yield, the relationship was not as effective as using a Cate-Nelson approach. While these data are preliminary in nature (due in part to the difficulty in getting appropriate conditions to see this type of injury in a research setting), results are promising.

Table 1. Herbicide Products and Application Rates

Crop	Selected Products	Application rates (lbs ai/ac)
Corn	Isoxaflutole	0.039
Corn	Isoxaflutole	0.052
Corn	Isoxaflutole	0.079
Corn	Isoxaflutole	0.118
Corn	Isoxaflutole + Acetochlor	0.046 + 0.77
Corn	Isoxaflutole + Acetochlor	0.052 + 0.875
Corn	Isoxaflutole + Atrazine	0.052 + 1.5
Corn	Isoxaflutole + Acetochlor + Atrazine	0.52 + 0.875 + 1.5
Corn	Isoxaflutole + Metolachlor	0.039 + 0.64
Corn	Isoxaflutole + Metolachlor	0.039 + 1.28
Corn	Thiafluamide + Metribuzin	0.61 + 1.26
Corn	Isoxaflutole + Thiafluamide	0.094 + 0.45
Corn	Flumetsulam + Metolachlor	0.07 + 2.1
Potato – pre	Rimsulfuron + Metribuzin	0.026 + 0.375
Potato – pre	Rimsulfuron + Metribuzin	0.039 + 0.375
Potato – pre	Rimsulfuron + Metribuzin	0.026 + 0.75
Potato – pre	Rimsulfuron + Metribuzin	0.039 + 0.75
Potato – post	Rimsulfuron + Metribuzin	0.026 + 0.375
Potato – post	Rimsulfuron + Metribuzin	0.033 + 0.375
Potato – post	Rimsulfuron + Metribuzin	0.039 + 0.375

Figure 1. Relationship of Corn V-2 Injury to Corn Silage Yield – 1998.

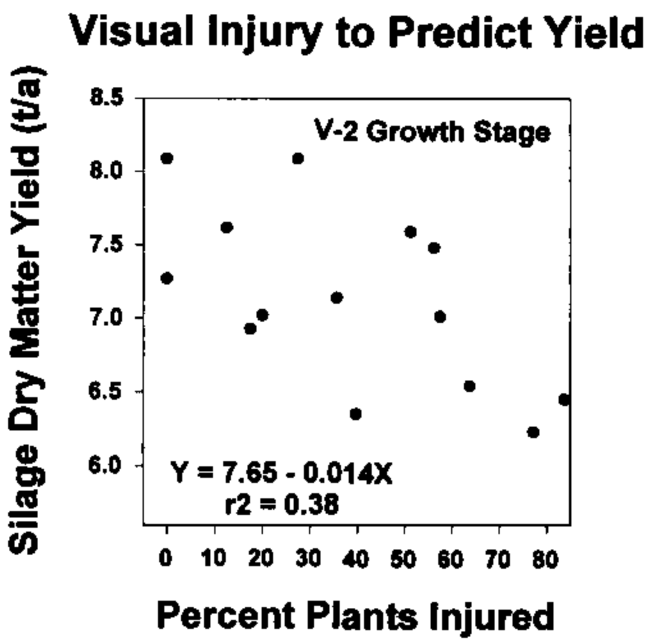
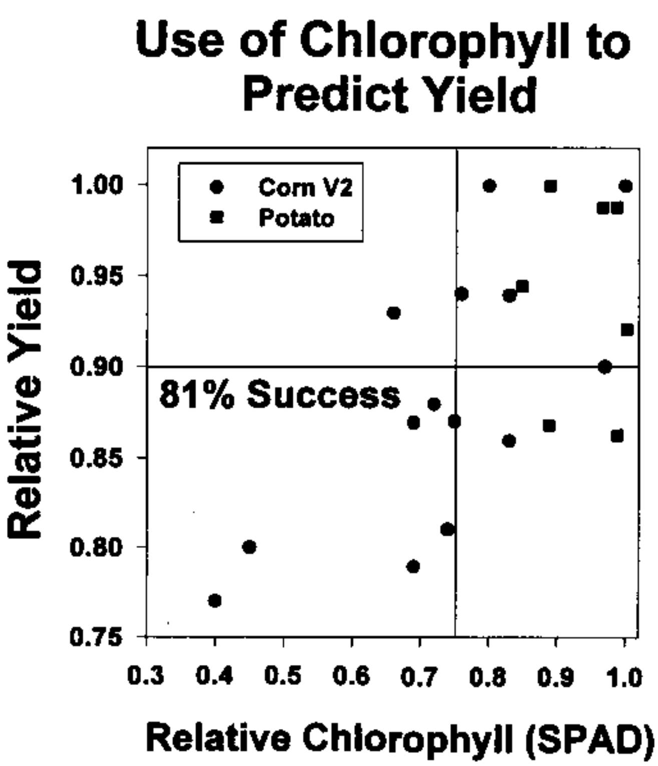


Figure 2. Relative SPAD values to Yield of Potato and Corn - 1998



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INFLUENCE OF CULTURAL PRACTICES ON THE EFFICACY OF FALL GLYPHOSATE APPLICATIONS

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ABSTRACT

Fall herbicide applications are considered the most effective timing in reducing perennial weed populations. Fall applications to fields planted with soybeans (Glycine max L.) need to be sprayed prior to crop harvest. No information is available on the interaction of soybean cultural practices and effectiveness of fall glyphosate applications. Field studies were conducted 1996 through 1999 at four locations to evaluate the efficacy of fall glyphosate applications on horsenettle (Solanum carolinense) and Canada thistle (Cirsium arvense). Two locations were infested with horsenettle and two locations with Canada thistle. The studies were designed as a 3 by 3 factorial in a randomized complete block design with four replications to investigate the interactions of row spacings and soybean maturities on the effectiveness of spray penetration through the crop canopy and weed control. Row spacing consisted of narrow (7.5 or 10 inches), medium (10 or 15 inches) or wide (30 inches) rows. Soybean maturities included an early-maturing (group 4.0), normal-maturing (group 4.6 or 4.9), or late-maturing (group 5.5) variety. Varieties at three of the four locations were Asgrow 4045, Asgrow 4922, and Asgrow 5547. In 1998 at one location, Asgrow 4922 was substituted by Asgrow 4601. At all four locations, a postemergence herbicide was used for annual weed control approximately four weeks after planting. Spray penetration of glyphosate through the crop canopy was measured using four water sensitive cards per plot placed directly between the crop rows. Two cards were placed on the ground and two cards were placed mid-canopy, approximately two-thirds the average height of the crop. At the time of the fall glyphosate application, the early-maturing variety showed greater than 90 percent leaf drop, the normal-maturing variety was beginning leaf drop, and the late-maturing variety was not senescing.

Glyphosate applications of 2.0 lbs ai/A, were made with a CO_2 backpack sprayer in a spray volume of 25 GPA at 20 psi using XR11003 spray tips. Spray penetration through the canopy was visually assessed by the percentage of spray coverage on the card. Weed control was determined by plant shoot counts in the fall and spring and percent visual ratings in the spring.

Maturity influenced spray coverage at ground and mid-canopy samples at all locations. Coverage on the ground was best with the early-maturing variety and least with the late-maturing variety. Results of the normal-maturing variety were inconsistent. At two locations, row spacing influenced coverage at ground level. Greater coverage was found on the ground with the wide rows compared to the narrow rows. Overall row spacing, however, had little impact on coverage at mid-canopy. The effectiveness of the fall application on weed control was inconsistent throughout the four locations. Due to inconsistency, more evaluations are needed to identify the benefits of fall glyphosate applications.

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HERBICIDE IMPACT ON CORN EMERGENCE VIGOR

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ABSTRACT

This is the second year of a two-year replicated study conducted in Eastern New York to evaluate the effect of selected preemergent herbicides on corn (*Zea mays* L.) emergence vigor. Varieties are ranked according to their emergence rate. Growers often believe earlier emergence is desirable to avoid seed disorders associated with cold and moist soil conditions common in the spring in New York State. Selecting corn varieties based on the impact of selected herbicide(s) is (are) rare.

Four corn varieties of equal maturity length from two different companies (company A & B) were selected; two with fast and two with slow emergence vigor ratings. Four herbicides including flumetsulam plus metolachlor, pendimethalin, acetochlor, and atrazine were applied at the labeled and twice-labeled rates. The soil temperature was 57 degrees at planting and 62 degrees at the time of treatment. Soil moisture remained near field capacity from planting to spraying. Plant population, phytotoxicity (Table 1 and 2), and yield (Table 3) was evaluated.

Data evaluation for both years showed only pendimethalin at twice the labeled rate with one slow emerging variety in 1998 to significantly influence harvest population <u>between</u> treatments or within varieties. Similar phytotoxicity evaluations were recorded in both years. The labeled and twice-labeled rates of flumetsulam plus metolachlor caused significant phytotoxicity between treatments for each emergence vigor ranking. This occurred for both companies through 6 weeks after treatment (WAT). One slower emergence variety displayed significant phytotoxicity at the labeled and twice labeled rate whereas the other slower emergence variety produced significant phytotoxicity at only the twice-labeled rate of pendimethalin through 6 WAT. Acetochlor and atrazine caused no phytotoxicity throughout the second year of the study.

Evaluations <u>within</u> varieties showed the labeled and twice-labeled rates of flumetsulam plus metolachlor produced significant phytotoxicity at the labeled rate for company A and at both rates for company B through 4 WAT. Pendimethalin produced phytotoxicity within company A's varieties at the labeled rate but significance was lost at the twice-labeled rate for both companies through 4 WAT. The 1997 results were similar.

The labeled rate of all treatments improved yield significantly in 1997 and notably in 1998 when compared to the check for company A. In 1997 and 1998, company B varieties produced notable yield improvement with the faster to emerge varieties. Although not statistically significant, yields were equal or better for the slower emerging varieties treated at the labeled rates for company A in 1997 and for company B in both years when compared to the check. Lower phytotoxicity did not benefit nor did higher phytotoxicity reduce yield either year.

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Table 1

Phytotoxicity at 2, 4, and 6 Weeks After Treatment of 80-Day Corn Rated as Slow vs. Fast to Emerge Comparing Between the X and 2 X Rates of Commonly Selected Herbicides

Treatment	Company A											
	Slow to Emerge						Fast To Emerge					
	1997			1998			1997			1998		
	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT
Flumet'/Met (x)*	22.6	22.0[s]	6.20	8.00[s]	8.80[s]	8.00[s]	28.6	22.0[s]	6.20	6.00[s]	6.80[s]	4.60[s]
Pendimeth' (x)**	23.0	20.0[s]	0.00	3.60[s]	2.00	0.80	24.6	25.0[s]	0.00	0.00	0.40	0.80
Acetachlor (x)	26.0	11.0[s]	0.00	0.20[s]	0.00	0.40	27.0	10.0[s]	0.00	0.00	0.00	0.00
Flumet'/Met (2x)	27.2	28.0[s]	46.0[s]	8.40[s]	20.0[s]	22.0[s]	28.4	27.0[s]	38.0[s]	8.00[s]	14.8[s]	11.4[s]
Pendimet' (2x)	23.0	26.0[s]	22.0[s]	9.00[s]	1.20	0.80	25.0	23.0[s]	36.0[s]	2.00	0.40	0.40
Acetachlor (2x)	29.0	6.00	0.00	1.80	1.00	2.00	28.0	6.00	0.00	1.60	0.40	0.00
Atrazine (x)	30.0	1.00	0.00	0.00	0.00	0.00	30.0	1.00	0.00	0.00	0.00	0.00
Hand Weeded	-----	----	------	0.00	0.00	0.00	-----	-----	-----	0.00	0.00	0.00
LSD[s]	3.18	5.88	16.2	3.26	4.31	4.75	3.98	5.31	17.2	3.07	5.10	4.12

* Flumetsulam + Metolachlor ** Pendimethalin [s] significant @ 5%

Table 2

Phytotoxicity at 2, 4, and 6 Weeks After Treatment of 80-Day Corn Rated as Slow vs. Fast to Emerge Comparing Between the X and 2 X Rates of Commonly Selected Herbicides

Treatment	Company B											
	Slow to Emerge						Fast To Emerge					
	1997			1998			1997			1998		
	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT	2WAT	4WAT	6WAT
Flumet'/Met (x)*	29.0	22.0[s]	6.60	5.00[s]	1.80	1.40	35.8	25.0[s]	6.60	8.00[s]	4.80[s]	1.80[s]
Pendimeth' (x)**	30.0	22.0[s]	0.00	1.20	0.00	0.00	37.0	19.0[s]	0.00	0.60	0.00	0.00
Acetachlor (x)	31.6	10.0[s]	0.00	0.00	0.00	0.00	36.0	11.0[s]	0.00	0.20	0.00	0.00
Flumet'/Met (2x)	32.6	26.0[s]	46.0[s]	6.20[s]	8.80[s]	9.40[s]	36.6	25.0[s]	46.0[s]	9.00[s]	18.0[s]	13.0[s]
Pendimet' (2x)	29.0	23.0[s]	28.0[s]	0.60	0.40	0.00	34.6	22.0	36.0[s]	4.40[s]	0.40	0.40
Acetachlor (2x)	32.8	6.00	0.00	0.00	0.40	0.40	39.0	6.00	0.00	0.00	0.40	0.40
Atrazine (x)	34.0	1.00	0.00	0.00	0.00	0.00	38.6	2.00	0.00	0.00	0.00	0.00
Hand Weeded	-----	-----	------	0.00	0.00	0.00	-----	-----	-----	0.00	0.00	0.00
LSD[s]	5.71	4.66	17.2	3.64	2.02	2.36	5.12	5.46	15.3	3.01	2.78	2.71

* Flumetsulam + Metolachlor ** Pendimethalin [s] significant @ 5%

Table 3

The Yield (Bu/A) of 80-Day Corn Rated as Slow vs. Fast to Emerge from Two Different Companies Comparing Between the X and 2X Rates of Commonly Selected Herbicides

Treatment	Company A				COMPANY B			
	Slow to Emerge		Fast to Emerge		Slow to Emerge		Fast to Emerge	
	1997	1998	1997	1998	1997	1998	1997	1998
Flumet'+Metola' (X)*	144	128	154[s]	134	146[s]	184	134[s]	167
Pendimethalin (X)	124	148	124[s]	152	109	186	101	177
Acetachlor (X)	148	127	102[s]	140	103	164	103	167
Flumet'+Metola' (2X)	97	114[s]	135[s]	137	104	172	73	143
Pendimethalin (2X)	73	132	99	137	91	167	66	165
Acetachlor (2X)	123	125[s]	131[s]	135	107[s]	187	95	145
Atrazine (X)	107	124[s]	81	154	71	166	61	165
Hand Weeded Check		158		132		166		155
LSD	45.4	29.0	19.7	28.7	36.0	39.3	47.6	25.9

* Flumetsulam + Metolachlor [s] Significant @ 5%

COMPETITIVE CONTROL OF ANNUAL WEEDS WITH A CROWNVETCH LIVING MULCH AND COMPANION SEEDING OF SOYBEAN IN NO-TILL CORN

N. L. Hartwig[1]

ABSTRACT

In previous research, crownvetch (Coronilla varia) when used as a perennial living mulch and suppressed sufficiently to prevent competition with a companion corn (Zea mays L.) crop, did not contribute anything to annual weed control. In this experiment,'P3B81 STS' soybean (Glysine max L.) was drilled as a 2° cover crop into established crownvetch just before corn planting to see if there was an improvement in weed control over crownvetch alone when treated with lower rates of herbicides that are at least somewhat selective for both crownvetch and soybean. With the latest corn silage harvesting equipment, a mixture of corn, soybean and crownvetch could all be harvested together which might improve the overall yield and quality of the corn silage.

To identify weed suppressive potentials of the different covers as well as the potential for reducing herbicide inputs, the following weed control treatments were randomly assigned to 12 plots within each cover crop block. Weeds were controlled with 1/4 X, 1/2X, and 1X application rates (levels) of the following late preplant broadcast applied herbicide treatments. The soybean and corn were planted two and five days after herbicide application when crownvetch was 4-12".

1. May 15, '98 - rimsulfuron + thifensulfuron methyl (Basis®) plus imazethapyr + imazapyr (Lightning®)[1] @ 0.0125 + 0.056 #ai/A*
2. May 15, '98 - rimsulfuron + thifensulfuron methyl (Basis®) plus isoxaflutole (Balance®) + metolachlor (Dual II®)[1] @ 0.0125 + 0.07 + 1.95 #ai/A*
3. May 15, '98 - rimsulfuron + thifensulfuron methyl (Basis®) plus atrazine + imazethapyr (Contour®) + metolachlor (Dual II®)[1] @ 0.0125 + 0.5 + 0.0625 + 1.95 #ai/A*
4. May 15, '98 - rimsulfuron + thifensulfuron methyl (Basis®) plus imazethapyr (Pursuit®) plus metolachlor (Dual II®)[1] @ 0.0125 + 0.0625 + 1.95* (* = 1X rates)

[1] Chaser® (NIS @ 0.25% v/v + UAN @ 1.5% v/v) included with all the above treatments.

In 1998 it was dry during the last two weeks of May with limited rainfall into early June. The rest of the growing season was good with limited but adequate rainfall.

The soil was a Hagerstown Silt Loam (Typic Hapludult) with a pH of 6.8. All treatments were applied with a tractor mounted small plot sprayer with XR80015 flat fan nozzles at 26 psi in 10, 20 and 40 gal/A of water. 'Pioneer 35A19 IR' (104 day) corn was planted in 15 by 25 ft. plots with a six row no-till planter in 30 in. rows on May 20, 1998 with 100 lb/A of 10-30-10 fertilizer in the row. Imidazolinone resistant corn was planted since imazethapyr (Pursuit) was a component of most of the treatments. Urea @ 160 lb N/A was applied broadcast at corn planting time.

There was a good stand of soybean in the crownvetch by late June. Control of both annual grasses and broadleaf's was generally significantly reduced at lower herbicide rates without a cover crop but was generally >98% even at the lowest herbicide rates with crownvetch and with or without soybean (Table 1). The competitive control of these weeds, however, came with an unacceptable reduction in corn yield. The highest corn silage yield was 27 T/A where Lightning was used at the highest rate without a cover crop and virtually all other treatments had yields significantly less than this. Previous research suggests that cover crop growth that exceeds 500 lb/A of dry matter by the end of the summer will result in significant corn yield reductions and it would appear that this is true for soybean as well as crownvetch.

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Table 1. Effect of 3 cover crops, 4 herbicide mixtures and 3 herbicide rates, when averaged over 4 replications. n = 4

					<------7/3/1998------							><------8/3,4/1998------				><--7/30/1998-->		9/24
					CV	2° CC	AnGR	CHEAL	AMARE	ABUTH	TAROF	CV	2° CC	AnGR	AnBLV	Corn Silage (65% H2O)		
Treat.	Cover	Herbicide	Herb.	n	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	<-----Dry Wt. Yield-----			----->	Ht.	Pop.	Yield
No.	Crop	Treatment	Rate	plots	%	%	%	%	%	%	%	lb/A	lb/A	lb/A	lb/A	cm	plants/A	Ton/A
1	None	Basis + Lightning*	1/4X	4	100.0	.	97.0	97.8	96.8	96.3	98.8	.	.	483	1063	158	24176	19.7
2	None	Basis + Lightning*	1/2X	4	99.5	.	90.0	98.8	98.5	97.5	98.0	108	.	505	252	174	24103	19.9
3	None	Basis + Lightning*	1X	4	100.0	.	99.3	97.5	100.0	99.3	99.7	.	.	296	183	185	25192	27.0
4	None	Basis + Balance + Dual II*	1/4X	4	100.0	.	93.3	96.3	66.3	95.0	93.0	.	.	478	2849	153	24684	15.3
5	None	Basis + Balance + Dual II*	1/2X	4	100.0	.	98.0	98.8	90.0	98.3	96.0	.	.	697	1724	169	24539	18.8
6	None	Basis + Balance + Dual II*	1X	4	100.0	.	99.5	76.3	97.5	99.3	99.3	.	.	44	673	191	25192	24.5
7	None	Basis + Contour + Dual II*	1/4X	4	99.2	.	98.5	98.5	99.8	99.8	86.3	461	.	99	440	131	21054	12.3
8	None	Basis + Contour + Dual II*	1/2X	4	98.0	.	99.8	99.8	99.5	99.0	95.0	1492	.	314	114	180	24539	23.0
9	None	Basis + Contour + Dual II*	1X	4	100.0	.	99.8	100.0	100.0	100.0	99.5	.	.	28	0	191	25192	26.6
10	None	Basis + Pursuit + Dual II*	1/4X	4	99.0	.	99.0	98.0	99.8	99.3	77.5	824	.	428	233	160	23523	18.0
11	None	Basis + Pursuit + Dual II*	1/2X	4	100.0	.	99.5	99.3	100.0	99.8	86.8	.	.	50	282	170	23813	20.9
12	None	Basis + Pursuit + Dual II*	1X	4	100.0	.	99.8	100.0	100.0	100.0	98.8	.	.	2	30	194	25918	25.4
.	None (Average)			48	99.6a	.	97.8b	96.7b	95.7b	98.6b	93.8b	576c	.	285a	653a	172a	24356a	21.0a
13	Crownvetch (CV)	Basis + Lightning*	1/4X	4	38.8	.	99.8	99.5	99.5	99.3	99.0	2414	.	0	148	118	17424	10.8
14	Crownvetch (CV)	Basis + Lightning*	1/2X	4	54.3	.	98.8	99.0	99.5	98.8	100.0	3067	.	143	247	141	23522	15.6
15	Crownvetch (CV)	Basis + Lightning*	1X	4	76.5	.	99.3	99.8	99.5	99.8	100.0	1889	.	22	25	173	23232	21.2
16	Crownvetch (CV)	Basis + Balance + Dual II*	1/4X	4	40.0	.	93.5	99.5	92.0	98.8	98.8	1987	.	708	653	136	21780	14.9
17	Crownvetch (CV)	Basis + Balance + Dual II*	1/2X	4	75.8	.	99.0	99.0	95.5	98.8	98.3	2905	.	285	485	136	21344	15.4
18	Crownvetch (CV)	Basis + Balance + Dual II*	1X	4	91.3	.	99.0	99.8	99.3	99.0	99.3	2056	.	60	84	171	23522	22.7
19	Crownvetch (CV)	Basis + Contour + Dual II*	1/4X	4	2.5	.	100.0	100.0	100.0	100.0	100.0	6669	.	0	0	99	10091	8.1
20	Crownvetch (CV)	Basis + Contour + Dual II*	1/2X	4	7.5	.	100.0	100.0	100.0	100.0	100.0	4785	.	0	0	116	15537	12.5
21	Crownvetch (CV)	Basis + Contour + Dual II*	1X	4	27.5	.	97.5	100.0	100.0	100.0	100.0	3425	.	0	0	143	23668	19.9
22	Crownvetch (CV)	Basis + Pursuit + Dual II*	1/4X	4	11.3	.	100.0	100.0	100.0	100.0	97.0	4240	.	0	84	104	16771	10.7
23	Crownvetch (CV)	Basis + Pursuit + Dual II*	1/2X	4	23.8	.	100.0	100.0	100.0	100.0	98.3	3018	.	0	0	133	20110	13.6
24	Crownvetch (CV)	Basis + Pursuit + Dual II*	1X	4	65.0	.	100.0	100.0	100.0	99.8	99.3	1973	.	0	0	160	23038	19.3
.	Crownvetch (CV) (Average)			48	42.8c	.	98.9ab	99.7ab	98.8a	99.5a	99.0a	3202a	.	102b	144b	135b	19940c	15.3b
37	CV+Soybeans	Basis + Lightning*	1/4X	4	38.8	56.3	98.3	100.0	98.8	100.0	100.0	2203	952	159	74	114	17715	10.7
38	CV+Soybeans	Basis + Lightning*	1/2X	4	66.3	32.5	100.0	100.0	100.0	100.0	100.0	1359	1422	132	5	138	22579	12.5
39	CV+Soybeans	Basis + Lightning*	1X	4	89.3	13.8	99.8	100.0	100.0	100.0	100.0	780	2101	0	0	161	24684	17.1
40	CV+Soybeans	Basis + Balance + Dual II*	1/4X	4	43.8	52.5	98.8	99.8	98.5	99.5	100.0	903	612	71	139	119	19602	6.8
41	CV+Soybeans	Basis + Balance + Dual II*	1/2X	4	75.5	33.8	99.5	99.8	95.0	99.3	99.3	1192	1682	187	178	145	23886	15.5
42	CV+Soybeans	Basis + Balance + Dual II*	1X	4	96.3	7.5	100.0	99.8	97.8	100.0	99.0	162	1791	0	178	170	25047	17.1
43	CV+Soybeans	Basis + Contour + Dual II*	1/4X	4	8.8	91.3	100.0	100.0	100.0	100.0	97.3	3562	403	0	0	111	17424	10.1
44	CV+Soybeans	Basis + Contour + Dual II*	1/2X	4	37.5	68.8	100.0	100.0	100.0	100.0	100.0	2301	969	0	0	128	21490	12.7
45	CV+Soybeans	Basis + Contour + Dual II*	1X	4	50.0	32.5	100.0	100.0	100.0	100.0	99.7	1831	1208	0	25	145	23522	14.9
46	CV+Soybeans	Basis + Pursuit + Dual II*	1/4X	4	35.0	88.8	99.3	100.0	100.0	100.0	94.3	2390	734	0	0	105	16190	7.8
47	CV+Soybeans	Basis + Pursuit + Dual II*	1/2X	4	53.8	27.5	100.0	100.0	100.0	100.0	98.3	2993	801	0	0	136	23522	13.3
48	CV+Soybeans	Basis + Pursuit + Dual II*	1X	4	67.5	17.5	100.0	100.0	100.0	100.0	99.5	2248	1258	0	0	145	24975	14.0
.	CV+Soybeans (Average)			48	55.2b	43.5	99.6a	99.9a	99.2a	99.9a	98.9a	1827b	1161	46b	50b	134b	21650b	12.7c
		Treatment Signific.level (P)			0.9358	0.5842	0.6259	0.5570	0.0001	0.2584	0.7350	0.3574	0.6259	0.5822	0.0156	0.2981	0.2576	0.2409

* Includes Chaser (NIS @ 0.25% v/v + UAN @ 1.5% v/v)

CONTROL OF YELLOW NUTSEDGE: A THREE-YEAR SUMMARY

John Jemison and Mary Wiedenhoeft[1]

ABSTRACT

Yellow nutsedge continues to be a problem for corn producers in the Northeast. Spreading through nutlets and rhizomes, nutsedge is easily carried to other fields on tractors and tillage implements. Early season competition from nutsedge can be severe. Growers are searching for effective control measures to minimize nutsedge impact.

The study described below, conducted at the Sustainable Agriculture Research Farm in Stillwater, ME, was a comparison of application timing (pre-plant incorporation, preemergence, and postemergence) and product effectiveness (metolachlor, bentazon, and halosulfuron) to control nutsedge. Weeds in this study were yellow nutsedge, mustard, and lambsquarters. Specific herbicide rates and timings are provided in Table 1. We included hand-weeded and herbicide free control plots in the studies. Each herbicide treatment was applied with a backpack sprayer through 8002 VS nozzles at 20 gpa and 30 psi. Weed ratings were made one week following postemergence application, and weed biomass was sampled at canopy closure. Corn silage was harvested by hand at maturity.

Environmental conditions during the 3-yr period strongly influenced herbicide effectiveness and corn yields. In 1996 we had above average rainfall for June and July, and generally cooler than average temperatures. In 1997, we had a 17-day rain-free period following preemergence applications. There was above average rain for June and July followed by a drought in August that resulted in lower than average yields. In 1998, we had above average rain in June and above average temperatures and timely precipitation for nearly optimal growing conditions. As a result, we found significant year by herbicide interactions with ratings, weed biomass and corn yields. In all three years, incorporating metolachlor provided consistently better nutsedge control than a preemergence spray (Figure 1). Incorporating the herbicide into the biologically active zone helped control nutsedge and other weeds early, allowing the corn to get established with less competition. However, corn yields benefited from incorporation only one year out of three (Figure 2). Nutsedge control with metolachlor was significantly better than bentazon applied postemergence in all three years, but corn yields were not significantly improved (Figure 1 and 2). Halosulfuron applied early postemergence provided consistently effective nutsedge control and controlled other weeds present. In other treatments where nutsedge control was over 90%, we found statistically equivalent yields.

From an economic perspective, if annual grass pressure is not an issue (as it was in this study), atrazine preemergence and halosulfuron applied early postemergence appear to provide consistent nutsedge control and good silage yields at the lowest cost. However, two spray applications have to be made with this approach. If triazine resistance is not an issue and annual grass pressure is high, metolachlor and atrazine preplant incorporated may be the best alternative. Preemergence metolachlor will be effective as long as there is sufficient rainfall to move the product into the biologically active zone where nutlets are germinating and emerging.

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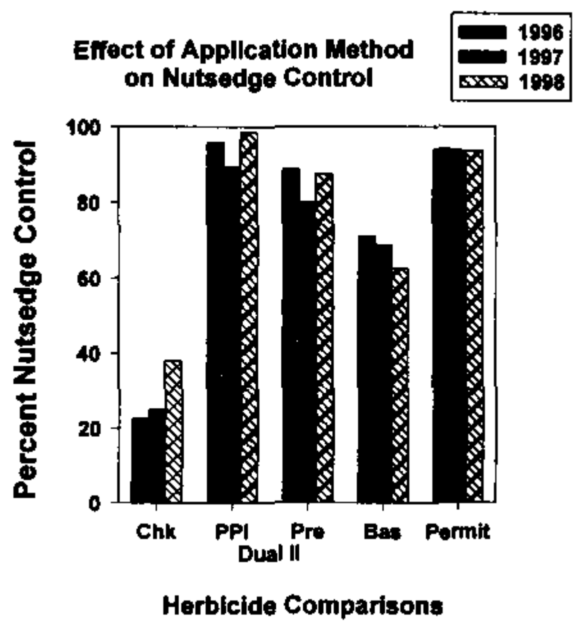
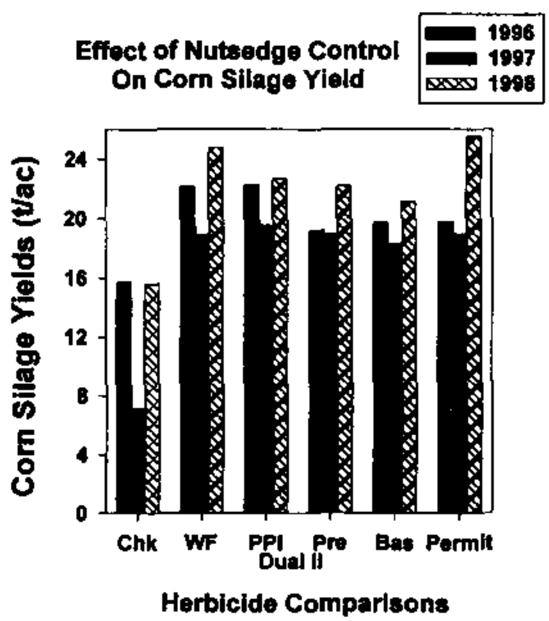
Table 1. Herbicide Application Timing, Application Rate, and Cost.

Application Timing	**Herbicide**	**Application Rate (lb ai ac^{-1})**	**Producer Cost ($)**
Preplant Incorporation	Metolachlor + Atrazine	2.44 + 2.0	$32.11 + $7.00* **$39.11**
Preemergence	Metolachlor + Atrazine	2.44 + 2.0	**$32.11**
Pre + Postemergence	Atrazine + Bentazon	2.0 + 1.95	$7.86 + $26.80 **$34.66**
Postemergence	Nicosulfuron + Halosulfuron	0.03 + 0.047	$20.60 + $14.24 **$34.84**
Pre + Postemergence	Atrazine + Halosulfuron	2.0 + 0.047	$7.86 + $14.24 **$22.10**

* Estimated cost of preplant incorporation

Figure 1 and 2. Effect of Application Method on Nutsedge Control and Corn Silage Yields





TRICLOPYR AND GLYPHOSATE EFFICACY ON ASPEN AS AFFECTED BY DROP CONCENTRATION, DROP NUMBER AND DROP SIZE

R. A. Campbell[1], J. Huang[1] and S. Liu[2]

ABSTRACT

Reports in the literature on the effects of spray volume, drop size and drop number on efficacy of herbicides are inconsistent. One reason for the inconsistency is that most studies examined only one of the variables. In fact, the variables are interrelated so that the role of each can only be determined by testing combinations of a range of each of the variables. Trembling aspen (*Populus tremuloides* Michx.) resprouts if only top-killed so root kill is essential in order to control it effectively. By the same token, research on the role of application parameters on efficacy requires a bioassay which measures root kill. Our aspen bioassay fills this need. Experiments were conducted in the greenhouse using aspen plants grown from seed. When the plants reached 100 cm, they were cut off near ground level. They were treated when shoots resprouted from cut stumps had regrown to about 35 cm in height and had seventeen to twenty-one leaves. Three weeks following treatment, the plants were again cut off. Four weeks later, the regrowth was measured.

As greenhouse-grown plants are more sensitive to herbicide than field-grown plants, the bioassay can be conducted either by spraying the entire plant with a much lower than operational concentration or by using an operational concentration but only treating a single leaf. The glyphosate (Vision) experiments were conducted using the first method while the triclopyr ester (Release) experiments were conducted using the second method. Parameter range for the glyphosate experiments: spray volume = 15 to 120 L/ha; droplet diameter = 326 to 1684 microns; ae rate = 0.03 to 0.15 kg/ha. Parameter range for the triclopyr ester experiments: spray concentration = 0.25 to 3.9 kg ae/ha; droplet number = 20 to 160 per plant; droplet diameter = 269 to 1359 microns.

For glyphosate, efficacy greatly increased as spray volume decreased from 120 to 15 L/ha (i.e., as droplet concentration increased). Droplet size did not have an effect. For triclopyr, droplet concentration did not have an effect but efficacy greatly increased as droplet number increased from 20 to 160 per plant. High efficacy was obtained with high concentration droplets (i.e., low spray volume) if the droplet size was decreased to maintain a high droplet number.

These studies suggest that different strategies are required to optimize application parameters for these two herbicides.

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EFFECT OF PRE-SPRAY DEW ON RETENTION AND SUBSEQUENT EFFICACY OF GLYPHOSATE ON ASPEN AND RASPBERRY

R. A. Campbell and J. A. Studens[1]

ABSTRACT

BLOWOFF. Using an artificial dew chamber, target plants of trembling aspen (*Populus tremuloides* Michx.) and wild red raspberry [*Rubus idaeus* L. ssp. *Melanolasius* (Dieck) Focke] were coated uniformly with artificial dew which had a pebbled or beaded appearance similar to that of natural dew. Once sufficient dew had formed, two lower and two upper leaves were removed to derive an estimate of dew deposit. Immediately after dew deposition, dyed herbicide spray-mix was applied (2.0 kg ae glyphosate as Vision in 30 L/ha + 0.5 % w/v Errio Acid Red) to each plant using a cart-mounted sprayer fitted with a controlled droplet applicator head. Plants were then exposed to air movement of a fixed speed (3.6 km/h). Spray deposits blown off the foliage were collected on Coroplast sheets positioned around the base of the plant stems and quantified colorimetrically. Overall loss of active ingredient from a treated plant by blowoff of dew had a positive exponential relationship to the proportion of the total foliar dew occurring on leaves holding greater than 0.1 ml of dew. The relationship appears to be independent of plant species. The latter variable is a function of both the degree of dew accumulation and the area of the leaf surface available for collecting dew. For example, a branch of mature aspen leaves had a much greater rate of dew deposited on its foliage (555 L/ha of leaf surface) than a branch of juvenile aspen leaves (303 L/ha of leaf surface) and yet the degree of blowoff from juvenile aspen seedlings was greater (11.2 % vs 0.6 %) because they were comprised of significantly larger leaves than the mature growth form (avg. 48.8 sq cm vs. 11.6 sq cm).

EFFICACY. Trembling aspen and wild red raspberry were grown in the greenhouse for four months prior to treatment. Following dew deposition, glyphosate (as Vision) spray mixes were applied either: a) to a single mid-crown leaf using an acoustic mono-sized-droplet generator, or b) broadcast using the cart sprayer; depending upon the concentration of the spray-mix being tested (as greenhouse-grown plants are more sensitive to glyphosate than field plants, the bioassay can be conducted either by spraying the entire plant with a much lower than operational concentration or by using an operational concentration but only treating a single leaf). Deposits were allowed to dry down passively to minimize runoff. Plants were cut to ground level or slightly above, three weeks after treatment. Resprouted foliage was removed and weighed three weeks after cutting. Losses in efficacy of up to 35% were found to occur when applications were made to dew-covered foliage. In view of the fact that earlier research found a decrease in glyphosate efficacy with increasing spray volume, the loss in efficacy noted in these experiments is likely the result of dilution of the deposited spray droplets when they coalesced with dew beads on the leaf surface. The fact that the dew vs no dew curves of application rate vs efficacy were parallel suggests that one could compensate for dew under operational conditions by increasing the ae rate per ha.

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NEWLY DEVELOPED BRUSH-SAW MOUNTED APPLICATOR FOR VEGETATION CONTROL PRODUCTS

Len Lanteigne[1], Doug Pitt[2], Aboud Mubareka[3] and Tim O'Brien[4]

ABSTRACT

Competition from red maple (*Acer rubrum* L.), white birch (*Betula papyrifera* Marsh.), sugar maple (*Acer saccharum* Marsh.) and other fast-growing broadleaf species is a major problem endemic to conifer regeneration following harvest in Canada's east-coast forest region and elsewhere. This competition results in crop tree mortality, reduced growth, delays in harvesting time, increased costs related to forest management, and decreases in annual allowable cut. Manual removal has been used as an alternative to broadcast applications of chemical herbicides for conifer release but this method may result in prolific re-sprouting of woody and herbaceous species.

The SPROUT-LESS applicator consists of a cup (herbicide container) and gasket that mounts under the saw blade. The design capitalizes on the fact that a brush-saw blade vibrates slightly when cutting and spins smoothly otherwise. During cutting (vibration), the gasket releases a minute quantity of concentrated herbicide (undiluted or slightly diluted) directly onto the stump surface. When the blade spins freely (before and after cutting) no herbicide is released, minimizing the chemical burden on the environment and worker exposure. The device does not alter the ergonomics of the saw; there are no cumbersome external bottles or tubes. This device could offer forest and right-of-way managers increased efficiency in manual vegetation removal applications. The device also offers the potential to dramatically reduce the volume of herbicide needed, while eliminating the risks associated with conventional herbicide use (worker exposure, off-target deposition, etc.).

Two studies were conducted in the Maritime Provinces during 1996-98 to evaluate the silvicultural efficacy of cut-stump applications of RELEASE and VISION herbicides through the SPROUT-LESS delivery system. Results one-year post-treatment for red maple indicate that there was a reduction in the number of sprouts by 76%, reduction in stem and crown volume by 93%; clump mortality was 45% and pre-treatment density was reduced by 65%. Statistical analysis for the study involving sugar maple and white birch has not been completed but visual estimates indicate that there is similar control of sprouting.

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THE FALLINGSNOW ECOSYSTEM PROJECT: ENVIRONMENTAL CONSEQUENCES OF CONIFER RELEASE ALTERNATIVES

R. A. Lautenschlager[1], Robert G. Wagner[2], and F. Wayne Bell[3]

ABSTRACT

Conifer release with herbicides is effective and efficient, and therefore it is the tending practice most commonly used in northern North American forests. Increased public concern about chemical use in the environment, however, has raised questions about the political and environmental sustainability of this practice. In 1993, with funding from the Ontario government and help from: the Ontario Ministry of Natural Resources, Canadian Forest Service, colleges, universities, and private contractors, we initiated an integrated, operational scale study (60 Km south of Thunder Bay, Ontario) designed to document abiotic and biotic changes following alternative conifer release treatments to boreal mixed wood spruce plantations. Data was collected before treatment in 1993 and after treatment from 1994 to 1998 on four 40 to 70 ha blocks containing cutting (brushsaw or Silvana Selective), herbicide [Release®(a.i. triclopyr) or Vision®(a.i. glyphosate)], untreated (check), and unharvested (adjacent mature aspen/spruce stand) treatments.

The following results have been observed to date: (1) Soil Nutrients, Mircoclimate, N mineralization, and Foliar Nutrients - no loss of N, NH4+, NO3-, K, Ca during the first two growing seasons after treatment; near-ground solar radiation increases led to higher near-ground and soil temperatures, higher soil moisture, and reduced relative humidity on released plots; soil N turnover and NO3- production increased following cutting and were greatest following the Vision® treatment; and spruce foliar N was greater in herbicide treated plots during the first growing season after treatment; (2) Below-ground Fungi - species richness and community structure of check (77 species) and Vision® plots (81 species) were similar, forest harvesting increased fungal community richness and diversity; (3) Vegetation - 438 above-ground spp. were identified, cutting and herbicide treatments reduced deciduous tree cover dramatically, but shrubs were reduced much more by herbicide than cutting treatments, plant diversity indices were relatively unaffected by the conifer release alternatives tested but herbicide treated plots consistently had the highest species richness, spruce volume growth increased the most following herbicide release; (4) Insects - in the soil were abundant 83,750 and 175,000 collembola and mites respectively/m2, with greatest densities in the unharvested forest, carabid beetle species richness and diversity increased after clearcutting and again after conifer release, defoliating insect populations did not increase following any of the conifer release alternatives tested; (5) Terrestrial Gastropods - potentially the most significant contributor of animal biomass and energy in the study area, were relatively more common in cutover plantations than unharvested forest plots, but they were unaffected by the conifer release treatments; (6) Amphibians and Reptiles - only spring peepers, wood frogs and garter snakes were relatively common across our upland study blocks and their populations were unaffected by the release treatments; (7) Small Mammals - population responses were species specific, of the eight common species live-trapped and released, red-backed vole populations only were reduced significantly during the first growing season after treatment; (8) Songbirds - hardwood foliage dependent spp. (parulid warblers, vireos, and thrushes) were more common in untreated, while seed eating spp. (sparrows and finches) were more abundant in herbicide treated plots; (8) Moose - winter use of all blocks and plots (treated or check) decreased during the first and second winters after release but has increased gradually

since, digestible dry matter of aspen was five to 11 percent greater on released than check plots two growing seasons after release, but not different for two other species examined.

Results to date indicate that there are minimal differences among the herbicide and cutting alternatives tested, and that the initial differences observed between released and untreated plots for some components are no longer common, suggesting that in the short-term, conifer release, regardless of the alternative used, is relatively inconsequential for most environmental components found in regenerating northern forests.

Table 1. Block and treatment plot size (in hectares) of the Fallingsnow Ecosystem Project.

	Blocks				
	1	2	3	4	Total
Treatment					
Brushsaw	6.0	4.7	12.4	4.4	27.5
Silvana Selective	8.4	6.7	10.4	8.1	33.6
Release®	4.9	6.5	8.1	9.3	28.8
Vision®	9.9	6.5	10.4	5.3	32.1
Check	8.1	3.3	10.5	5.0	26.9
Unharvested	9.0	8.0	10.0	7.0	34.0
Total	46.3	35.7	61.8	39.1	182.9

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SECOND-SEASON EFFICACY RESULTS OF *Chondrostereum purpureum* APPLICATIONS ON TARGET HARDWOOD SPECIES IN EASTERN CANADA

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ABSTRACT

Chondrostereum purpureum [(Pers. ex Fr.) Pouzar] is an indigenous fungal pathogen that infects woody plants through fresh cambial wounds. Applied to cut stems as a biocontrol agent, living fungal mycelium may potentially reduce resprouting of woody plants following manual weeding. To test this hypothesis and generate efficacy data in support of registration and use of this fungus, experiments were conducted in Ontario and New Brunswick in 1995, as part of a national initiative. Installations focused on speckled alder [*Alnus rugosa* (Du Roi) Spreng], red maple (*Acer rubrum* L.), and aspen (*Populus tremuloides* Michx.). Principle treatments applied between July 26-29 consisted of two formulations crossed with two fungal isolates (BC-2139, ON-JAM6). Stump treatment with triclopyr (Release®), blank formulations, and cutting only (no treatment) were used as controls. Two growing seasons after treatment, fungal treatments exhibited the highest efficacy on alder, with the JAM6 and 2139 isolates providing 50% and 75%, respectively, reductions in resprout size, number, and vigor over untreated controls. Formulation had no apparent influence on these trends. Subtle fungal effects were observed on red maple, however these were not deemed to be of silvicultural significance. Despite successful infection, aspen stems resprouted and suckered vigorously following all fungal treatments at the Ontario site. In contrast, New Brunswick aspen, treated during a drought, succumbed to cutting only. No resprouting was observed in any of the triclopyr-treated plots. Results suggest that *Chondrostereum purpureum* may provide acceptable control of some woody species, however, efficacy appears variable and may depend on factors such as pre-treatment plant vigor, weather conditions at the time of treatment, and virulence of the isolate in relation to the target species.

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CONSTRUCTING VEGETATION MAPS FROM LARGE-SCALE AERIAL PHOTOGRAPHY

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ABSTRACT

Stereoscopic photo-interpretation and digital spectral classification methods were compared for the construction of detailed vegetation maps of four young spruce plantations (age 5 to 9). Complete block coverage was obtained with 1:5,000-scale, 23-cm format, normal-colour photographs acquired during peak growing season. Additionally, large-scale (1:500 nominal), 70-mm format sample coverage was obtained for 160 10 x 10 m plots located throughout the four areas. On 1:5,000-scale photographs, blocks were stereoscopically stratified into areas (> 25 m2) of uniform vegetation. A random selection of half of the sample plots (80) were then used as "training sites" to calibrate the assessment of strata on the 1:5,000 photographs. Percent cover was evaluated for tall shrub (> 2 m), mid shrub (0.5 - 2 m), low shrub (< 0.5 m), dead shrub, conifer, grass, fern, other herbaceous species, bare ground and slash. Remaining sample plots were used to verify the accuracy of the final map product. In a parallel analysis, 1:5,000 photo negatives were scanned at 56-micron resolution and converted to positive digital images. These were then spectrally grouped on the basis of an iterative statistical clustering, followed by maximum likelihood classification. Results suggest that, with stereo photo interpretation, reliable estimates of cover (± 5 to 10 %) in broad shrub and herbaceous classes can be obtained. Estimates of less abundant components (low shrub, grass, ferns, conifer, bare ground and slash, ± 2 to 5 % cover) may be precise enough for some investigations. High spectral variability, caused by factors such as mixed species complexes, vertical structure, topography, and bi-directional reflectance (e.g., sunlit vs. shaded crowns), reduced the spectral separability of classes on digital images. Spectral classification may need to be augmented by pattern-, shape-, and texture-recognition algorithms before automated image classification is feasible in the context applied.

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FATE AND IMPACT OF PHOSPHINOTHRICIN-BASED HERBICIDES IN A NORTHERN AQUATIC ECOSYSTEM.

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ABSTRACT

The fate and impacts of two phosphinothricin-based herbicides were assessed using in situ mesocosms deployed in a small northern lake. The experimental lake is considered typical of lentic ecosystems most at risk of contamination via accidental over spray or off-target drift. Objectives of the study were to quantify initial test concentrations in a concentration-response design, track the aqueous fate of the active ingredient and parent compounds in the two highest treatment levels and to assess the impacts and potential risk for phytoplankton and zooplankton communities exposed to differential exposure regimes. The experimental design allowed direct comparison of these aspects for bialaphos a natural tripeptide compound derived from *Streptomyces* spp. and the synthetic product glufosinate-ammonium, both of which contain phosphinothricin as the active ingredient. Both compounds dissipated slowly following linear kinetics and generated significant concentration-dependant reductions in dissolved oxygen, phytoplankton and zooplankton abundance. At the expected environmental concentration of 1 ppm differential sensitivity and recovery of planktonic species was noted. Recovery of planktonic species was more rapid in the bialaphos treated enclosures than the glufosinate-ammonium treated enclosures.

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COMPARATIVE FATE AND PERSISTENCE OF GLYPHOSATE AND TRICLOPYR HERBICIDES IN SOIL OF AN ACADIAN FOREST REGENERATION SITE

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ABSTRACT

The fate and persistence of glyphosate following application of three different formulations (VISION, TOUCHDOWN, and MON14420) as well as triclopyr (RELEASE) were compared following applications at maximal label rates to a typical forest regeneration site of eastern New Brunswick. The experiment involved a randomized complete block design with pre-treatment crown volume index (low, medium or high) of hardwoods as the blocking variable. Pooled samples (4 subsamples per experimental unit) of litter, humus and mineral soil layers were obtained on eleven discrete sampling dates from the time of study initiation through to time of freeze-up. Samples were extracted and analyzed using validated HPLC or GLC-ECD analytical techniques for glyphosate and triclopyr, respectively. Results confirmed that none of the compounds were susceptible to leaching with the majority of herbicide residues being retained in the litter and humus layers and little residue reaching the mineral soil layer. Transient increases in residues between 3 and 7 days after treatment were attributed to washoff with rain and dew or with leaf fall and was observed for all treatments. Glyphosate residues in both litter and humus layers dissipated rapidly following curvilinear kinetics with overall mean times to 50% dissipation (DT50) of 10.3 +/- 1.24 and 12.0 +/- 0.85 days, respectively. Brush density had little effect (<26%) on variant in DT50 values. Differences in persistence estimates among the three glyphosate formulations in both litter (range 10.3 to 14.9 days) and humus (range 10.1 to 10.8 days) were not significantly different ($p < 0.05$). Results suggest that product formulations did not substantially influence soil persistence or residue behaviour of the active ingredient glyphosate acid. Triclopyr residues were more variable and dissipated following more linear kinetics resulting in substantially greater persistence estimates.

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CRITICAL PERIOD OF INTERSPECIFIC COMPETITION FOR NORTHERN CONIFERS ASSOCIATED WITH HERBACEOUS VEGETATION

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ABSTRACT

We examined the temporal effects of interspecific competition from herbaceous vegetation on seedlings of jack pine (*Pinus banksiana* Lamb.), red pine (*Pinus resinosa* Ait.), eastern white pine (*Pinus strobus* L.), and black spruce (*Picea mariana* (Mill.) B.S.P.) during the first five years after planting. Using critical-period analysis, which defines the time period when interspecific competition reduces tree growth, we found similarities and differences in responses among tree species. Declines in stem volume index with increasing duration of competition after planting (expressed by weed-infested curves) were similar among species. In contrast, gains in stem volume index associated with increasing duration of vegetation control (as expressed by weed-free curves) differed among species. Critical periods for stem volume index were shorter for intolerant jack and red pine (1 and 2 yrs after planting) than for more tolerant white pine and black spruce (1 to 3 yrs for spruce and 1 to 4 yrs for white pine). Absolute stem volume growth was greater and relative declines from continuous association with herbaceous vegetation were less (85, 81, 78, and 67% for white pine, black spruce, red pine, and jack pine, respectively) for the intolerant species. The time of equal interference occurred between 1 and 2 yrs after planting for all species. Height / stem diameter ratio decreased with increasing yrs of vegetation control in a similar manner for all species. Survival was not reduced and height was variable among treatments for all species.

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PUBLIC PERCEPTIONS OF RISK AND ACCEPTABILITY OF FOREST VEGETATION MANAGEMENT ALTERNATIVES IN ONTARIO

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ABSTRACT

We examined public perceptions of risk and acceptability for 9 alternatives to controlling forest vegetation in Ontario ($N = 2{,}301$) in the fall of 1994. The proportion of respondents indicating whether an alternative was 1) difficult to control, 2) potentially catastrophic, 3) a problem for future generations, and 4) a personal worry determined perceptions of risk for each vegetation management alternative. Ranking of alternatives from highest to lowest perceived risk was: aerially-applied herbicides > biological control > ground-applied herbicides > mulches > prescribed fire > heavy equipment > cover cropping > manual cutting > grazing animals. Public acceptance was lowest for aerially-applied herbicides (18%) followed by ground-applied herbicides (37%), biological control (57%), prescribed fire (57%), mulches (65%), heavy equipment (72%), cover cropping (80%), grazing animals (82%), and manual cutting (89%). Public acceptability of various agents for biological control differed depending on the proposed agent. Natural plant toxins were viewed as most acceptable (73%) followed by microorganisms (42%), genetically-engineered organisms (39%), and viruses (21%). We found a strong correlation between a risk perception index and acceptability of the alternatives for the general public ($r > 2 = 0.84$) and those in timber-dependent communities ($r\ 2\ = 0.89$). Our results suggest that stronger public support can probably be achieved for forest vegetation management programs that include non-herbicide alternatives.

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BIOLOGICAL CONTROL OF WEEDS: THE EUROPEAN LINK IN THE USDA-ARS.

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ABSTRACT

The USDA-ARS European Biological Control Laboratory (EBCL), one of three ARS overseas laboratories, is located in Montpellier, France, with satellite stations in Greece and Italy. These are within or near the native distributions of many major weed and insect pests of the United States (U.S.). Over 50% of the major weed pests in the U.S. are introduced from Eurasia, and one factor contributing to their pest status is that they have, at most, only limited pressure from diseases and insects that attack them in their native habitats. Biological control is one strategy to manage these weeds and insects.

The EBCL is an important component in developing foreign biological control agents for weed control in the U.S., and there are many examples of cooperation with the EBCL resulting in successful biological weed control. The EBCL serves for the collection and study of potential agents, many of which are selected and shipped to state and federal cooperators in the U.S. The EBCL also is visited by cooperating scientists, who work directly with EBCL scientists on their projects.

EBCL scientists and their cooperators collect throughout Eurasia. Specimens are processed in Montpellier under permit from French regulatory authorities, and shipping to North American cooperators is under permit from U.S. authorities. In addition to discovery of new organisms, research on candidates includes tests of target damage, limited host range studies, and candidate identification. Candidates selected by performance in preliminary tests are shipped to cooperators in the U. S., where evaluation is completed and permits for release are acquired. In some cases, EBCL scientists or visitors ship unknowns directly to designated containment labs in the U.S. for evaluation.

Cooperative projects involve several labs in the U. S., Canada, and Europe, primarily with insect natural enemies. More recently, development of foreign plant pathogens for weed control has been pursued with two ARS labs, the Northern Plains Agricultural Research Laboratory (NPARL) in Sidney, Montana (A. J. Caesar), and the Foreign Disease-Weed Science Research Unit (FDWSRU) in Frederick, Maryland (W. L. Bruckart and S. M. Yang). Cooperation with the NPARL is on pathogens of leafy spurge (*Euphorbia esula*) and hoary cress (*Cardaria draba*). Research at the FDWSRU concerns evaluation of candidate agents in a greenhouse facility designed for containment of foreign microbial plant pathogens. Projects with the FDWSRU currently include evaluation of *Uromyces salsolae* from Russian thistle (*Salsola* spp.), and *Cercosporella acroptili* from Russian knapweed (*Acroptilon repens*).

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PRELIMINARY SURVEY RESULTS OF PATHOGENS ON PROBLEM WEEDS FOR THE NORTHEAST

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ABSTRACT

Plant pathogens used as bioherbicides have potential to be important components of integrated weed management programs in minor crops. In the Northeast, many growers are faced with increased urban encroachment and non-agricultural neighbors who are concerned about pesticide usage. Biological weed management offers a tool that can be very effective and has wide-spread support. Before biocontrol programs utilizing pathogens can be implemented, suitable candidates must be found and studied. The results reported here are findings from the first year of an intensive program to identify pathogens of weeds that have potential for use as bioherbicides. The main target weeds in this survey are problems in cranberry production: Poison-ivy (Toxicodendron radicans (L.) Ktze.), briars (Smilax spp.), brambles (Rubus spp.), and slender-leaved goldenrod (Solidago tenuifolia L.). Other weeds surveyed included common lambsquarters (Chenopodium album L.), Canada goldenrod (S. canadensis L.), white champion (Silene alba (Mill.) E. H. L. Krause), and pigweed (Amaranthus spp.) Symptomatic tissue was collected from naturally occurring weed populations. Isolations were made using sterile techniques and preliminary identifications were made. Experiments to complete Koch's postulates for an isolate from poison-ivy were initiated. Isolates obtained from brambles were determined to be the same organism as one that causes fruit rot of cranberry.

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PROMOTING LEVELS OF BACTERIA-BASED WEED CONTROL THROUGH THE USE OF ORGANOSILICONES

John C. Porter, T. A. Bewick, Frank L. Caruso, and Dana Warrick[1]

ABSTRACT

Pathogenic bacteria enter plants passively. This often occurs when the bacteria are suspended in water and enter through stomates and hydathodes. Silwet L-77 has been used successfully as an adjuvant for the bacterial bioherbicide Pseudomonas syringae pv tagetis (PST) ((Helmers) Young, Dye, and Wilkie) in controlling several weeds from the family Asteraceae. Experiments were conducted to determine whether the host range of this pathogen could be increased by using Silwet 408 or Silwet 806 as adjuvants. Silwet L-77 was included for comparison. Experiments were conducted in a greenhouse as a randomized complete block with four replications in a 4 x 4 x 3 factorial. Factors were bacterial concentration (0, 10^7, 10^8 and 10^9 cells per ml), adjuvant concentration (0, 0.1, 0.2 and 0.5 % v/v) and adjuvant type. Target weeds were devils beggarticks (Bidens frondosa L.), slender-leaved goldenrod (Solidago tenuifolia Pursh.), common ragweed (Ambrosia artemisiifolia L.) and dandelion (Taraxacum officinale Weber in Wiggers). Visual estimates of weed injury were made every 3 to 4 days for four weeks. Within one week after treatment, plants of each species showed symptoms characteristic of infection by PST. Many outgrew the symptoms one to two weeks later. At four weeks after treatment, all shoots were harvested and dry weight determined. At their highest concentrations, all three organosilicones had a significant impact on increasing common ragweed control but only Silwet L-77 and Silwet 806 did on increasing slender-leaved goldenrod control. None of them had an effect on increasing dandelion or devils beggarticks control.

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BIOLOGICAL CONTROL OF PURPLE LOOSESTRIFE (*Lythrum salicaria* L.) IN CONNECTICUT WETLANDS

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ABSTRACT

Purple loosestrife, *Lythrum salicaria* L. (Lythraceae), is an invasive non-native plant from Eurasia that was introduced into North America almost 200 years ago. The largest occurrences of this species are found in wetlands in the northeastern U.S. Purple loosestrife aggressively outcompetes and displaces native wetland vegetation such as cattail, sedge, and bulrush. Accompanied by this significant loss of native plant diversity, few species of wildlife are supported and valuable natural resources in wetland ecosystems are destroyed. The rapid spread of purple loosestrife may encroach on croplands, hay meadows and forage pastures, thus having a measured impact on agriculture. Purple loosestrife quickly overtakes and dominates disturbed areas, which may impede or prevent successful wetland creation, enhancement and restoration. Purple loosestrife is officially recognized as a noxious weed in at least 18 states, where its importation and distribution are prohibited. Biological control is recommended as a sustainable management strategy to reduce populations of this invasive plant.

Galerucella calmariensis L. and *Galerucella pusilla* Duftschmidt (Coleoptera: Chrysomelidae) are two leaf-feeding beetles from Europe that were approved by the U.S. Department of Agriculture (USDA) in 1992 as purple loosestrife biological control agents. The beetles are host-specific, feeding only on purple loosestrife leaves and stems but not on native wetland plants. Distributional surveys conducted in Connecticut from 1995 through 1997 documented monocultures of purple loosestrife in every county statewide. More than 200 wetland locations in Connecticut have been documented with purple loosestrife infestations.

Biological control activities in Connecticut began in 1996 with the introduction of *Galerucella* beetles by the author into three wetland sites. To date, 36,500 beetles have been released at ten locations throughout the state. Monitoring of each release site began with collection of baseline ecological data prior to the introduction of the biological control agents, followed by site visits between May and September to coincide with key developmental stages of purple loosestrife and the beetles.

Results from 1997 suggest that *Galerucella* beetles are becoming established in the state following their initial release in July 1996, and they are beginning to cause localized feeding damage to purple loosestrife in several wetlands. *Galerucella* feeding injury negatively affected purple loosestrife plant height and inflorescence development. Associated plant species diversity was inversely related to purple loosestrife stem density. Connecticut results complement findings from other states and Canada, where beetles initially released in ten states and six Canadian provinces in 1992 and 1993 became established within several years. The wetland sites will continue to be monitored for five to ten years to document interactions occurring between the biological control agents and the target host plant, purple loosestrife.

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CONTROL OF *POA ANNUA* WITH *XANTHOMONAS CAMPESTRIS* PV. *POANNUA* – EUP PROGRESS REPORT

T. E. Vrabel, J. M. Doyle and D. A. Odelson [1]

ABSTRACT

Annual bluegrass (*Poa annua* L.) is a widespread serious weed species of golf turf. Several years ago strains of the bacteria *Xanthomonas campestris* pv. *poannua* were identified as causing a bacterial wilt of annual bluegrass and were evaluated as a biocontrol agent. While shown to be effective in controlling annual bluegrass, commercialization of *Xanthomonas campestris* pv. *poannua* had been halted by the lack of success in developing a stable and viable dry formulation of the bacteria that could be commercialized.

Eco Soil Systems, Inc. is developing for commercialization a strain of *Xanthomonas campestris* pv. *poannua* that is marketed as a liquid formulation containing active bacteria in high concentrations. This product has the flexibility of being marketed as a packaged material delivered directly to the end user or, in the near future, increased at the application site in conjunction with the BioJect™ on site fermentation system.

In the fall of 1998, Eco Soil Systems, Inc. initiated an EUP program to commercially evaluate the effectiveness of *Xanthomonas campestris* pv. *poannua* for the management of annual bluegrass in golf and athletic turf. The program consists of a series of four to six fall applications followed by a similar number of applications in the spring. The objective of this program is to cause significant levels of infection in annual bluegrass plants which would weaken them and make them more susceptible to mortality caused by cold stress over the winter, and by heat and drought stress in the early summer. Over 150 golf courses are participating in this EUP program.

Leaf tissue analysis of *Poa annua* plants sampled from treated golf courses shows a 95 % infection success rate. Initial infection symptoms are seen as an etiolation of seed stalks and stems that is followed by subsequent chlorosis and thinning of the affected plants. Infection and symptoms occurred in both the annual (*P. annua* ssp. *annua*) and perennial (*P. annua* ssp. *reptans*) annual bluegrass subspecies. Desirable species such as creeping bentgrass (*Agrostis palustris* Huds.) and velvet bentgrass (*Agrostis canina* L.) are not affected by *Xanthomonas campestris* pv. *Poannua* regardless of growth stage.

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THE USE OF COLLETOTRICHUM GLOEOSPORIOIDES TO CONTROL SWAMP DODDER (CUSCUTA GRONOVII WILLD.)

Jane S. Mika and Frank L. Caruso[1]

ABSTRACT

Swamp dodder (Cuscuta gronovii Willd.) is a serious pest In Massachusetts cranberry bogs and can reduce yield by as much as 25 %. In the summer of 1996 several isolates of Colletotrichum acutatum J.H. Simmonds and C. gloeosporioides (Penz.) Penz. & Sacc. in Penz. were cultured from diseased dodder from a commercial cranberry bog in Wareham, MA . Investigations were initiated to determine whether these fungi could be used as mycoherbicides. Three isolates of C. acutatum were used in pathogenic studies by inoculating dodder growing on alfalfa. Inoculum was prepared by streaking mycleium onto potato dextrose agar (PDA) and incubating the plates under 24 hr light incandescent light at 24C for 4 - 6 days. The conidia were suspended in sterile distilled water to a concentration of 10^7 conidia/ml. The post-attachment dodder was sprayed with conidia till runoff. The plants were placed in bell jars for 48 hours. Two days after removing the plants from high humidity, significant damage (>70%) was observed on all plants. Symptoms included black lesions usually at branching and desiccated tendrils. Lesions were excised and plated on PDA. Colletotrichum acutatum was recovered from 85 - 100% of the dodder segments.

In October, 1996, dodder seeds were collected from three bogs. It was observed that the seeds differed remarkably in both in size and coloration. In general, darker seeds, which often were covered with fine hyphae, germinated at 30-40%. The mean rate for dodder seed germination is approximately 10% . Seeds from all bogs were then subjected to a 'Blotter Test' to determine seed health (infection). Regression analysis on the seeds from one bog indicated a significant relationship between germination and the presence of Colletotrichum gloeosporioides .

Both C. gloeosporioides and C. acutatum isolates from dodder and rotted cranberry fruit were used to inoculate both green (unripe) and ripe cranberries to determine whether the dodder isolates caused fruit rot. Typical symptoms were an area of softened tissue surrounding the stem end of the fruit. Of all isolates, the C. gloeosporioides from dodder seed caused the least fruit rot (0 to 7%). Ripe fruit was not infected by either species.

Several pathogenicity experiments indicated that C. gloeosporioides was more virulent than C. acutatum on swamp dodder. The addition of unrefined corn oil to the conidial inoculum increased the pathogenicity of both species.

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The Effect of Fall Applied Preemergence Herbicides on Spring Overseeding

Dr. T. L. Watschke and J. A. Borger[1]

ABSTRACT

These studies were conducted on a mixed stand of tall fescue (Festuca arundinacea Schreb), fine fescue (Festuca spp), perennial ryegrass (Lolium perenne L.) and Kentucky bluegrass (Poa pratensis L.) at the Landscape Management Research Center, Penn State University, University Park, Pa. The objective of these studies was to asses the ability to over seed an area in the spring that had preemergence herbicides applied in the prior fall. Each study was a randomize complete block design with three replications and a plot size of three feet by five feet. All of the treatments were applied on Oct 17, 1997 using a three foot CO_2 powered boom sprayer calibrated to deliver 80 gpa using two, flat fan, 6504 nozzles at 30 psi. Granular treatments were applied with a shaker jar. Glyphosate was applied at 5 lbs ai/A on Oct 21, 1997 to each test site to simulate winterkill.

On April 6, 1998, three test sites were prepared by making three passes using 3/4" hollow core aerification and two passes with a verticutting unit. The first test site was seeded with Midnight Kentucky bluegrass at 2.5 lbs/M. The second test site was seeded with a three way blend of perennial ryegrass consisting of 32% Express, 32% Cutter and 32% Edge at 5 lbs/M. The third test site was seeded with 0.5 lb/M DF1 creeping bentgrass (Agrostis palustris Huds.) using a 10 to 1 ratio of greens grade Milorginite to bentgrass seed. All seeding was accomplished using a 2.5 foot drop seeder. In addition to the preemergence and seeding, the test sites received 1 lb N/M from a 19-26-5 starter fertilizer at seeding. The seedbeds were maintained until the final rating on June 24, 1998.

All treatments tended to delay seedling germination and development in the Midnight Kentucky bluegrass study. A final rating of percent ground cover revealed that prodiamine 65WDG at 0.65, 0.75, 1.0 lb ai/A and oxidiazion 2G at 3 lb ai/A significantly decreased turf density as compared to the untreated check. Dithiopyr 1EC at 0.5 lb ai/A and oxidiazion 2G at 2 lb ai/A did not significantly differ from the untreated check, but were numerically lower. The untreated check had 85% cover on June 24, 1998.

When perennial ryegrass was used, all treatments tended to delay seedling germination and development. The final rating of percent ground cover taken on June 24, 1998, revealed that prodiamine 65WDG at 0.65, 0.75 and 1.0 lb ai/A treated areas significantly decreased the turf stand when compared to the untreated check (95%). Dithiopyr 1EC at 0.5, oxidiazion 2G at 2 and 3 lb ai/A did not significantly differ from the untreated check, but was numerically lower.

The third turfgrass established, DF1 creeping bentgrass, produced results similar to that of the Midnight Kentucky bluegrass in germination and seedling development. All treatments were significantly lower than the untreated check (91.7%) when rated on June 24, 1998.

The results for perennial ryegrass and the creeping bentgrass were consistent with previous findings from research conducted at Penn State University.

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DIVOT RECOVERY OF 'TIFWAY' BERMUDAGRASS TREATED WITH TRINEXAPAC-ETHYL AND PACLOBUTRAZOL

Matthew J. Fagerness and Fred H. Yelverton[1]

ABSTRACT

Trinexapac-ethyl (TE) and paclobutrazol (PB) are two plant growth regulators, which can effectively suppress vertical shoot growth in many turfgrass species. Both inhibit biosynthesis of gibberellic acid (GA) but TE is foliar absorbed with only a 2-day half-life in soil while PB is root absorbed and has a 200-day half-life in the soil. Both growth regulators can effectively suppress shoot growth for 4-6 weeks after application. Concerns with use of either plant growth regulator often focus on their impact on lateral development of affected turfgrass species. 'Tifway' bermudagrass [*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* (Burtt-Davy)] is frequently found on golf course fairways and tees in transition zone or southern regions of the United States. Because divots are a common form of mechanical disturbance in either fairways or tees, the effects of TE and PB on recovery rates for divots made in 'Tifway' bermudagrass are a relevant concern for many golf course superintendents. An experiment was conducted in the summer of 1998 to evaluate the effects of TE and PB on patterns of divot recovery in established 'Tifway' bermudagrass maintained under golf course fairway conditions. Applications of TE and PB were made once, twice, or three times during summer at label recommended rates (0.11 kg a.i./ha and 0.56 kg a.i./ha, respectively). Divots were made biweekly throughout the summer, using a custom-built divot maker, to evaluate effects of TE and PB on divot recovery both during and after periods of growth suppression. Assessment of divot recovery was conducted on a biweekly basis and constituted measurements of percent grow-in using a counting grid and shoot counts for shoots originating from rhizome nodes. Turfgrass quality was assessed biweekly as a standard measurement to ensure TE and PB were affecting growth as would be expected. Divot recovery in nontreated turf required 4-6 weeks, with maximum recovery occurring between two and four weeks after divots were made. Results showed little, if any, detrimental effect of TE on recovery rates of divots during the period of growth inhibition. However, results also suggested that divot recovery may be enhanced during periods following growth inhibition when growth resurgence in 'Tifway' bermudagrass is not uncommon. PB showed the tendency to delay recovery of divots, especially in turf where PB was continuously applied. The emergence of shoots from rhizome nodes was also reduced in PB-treated divots, suggesting that PB activity in soil may affect rhizome development in 'Tifway' bermudagrass.

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MANAGEMENT OF FALSE GREEN KYLLINGA IN COOL SEASON TURF WITH POSTEMERGENCE HERBICIDES

John Isgrigg III and Fred H. Yelverton[1]

ABSTRACT

Field experiments were conducted in 1997 and 1998 at the Great Smokies Resort in Asheville, NC, to evaluate the effects of postemergence (POST) herbicide applications on false green kyllinga (*Kyllinga gracillima* Miq.) in cool season turfgrass species. Herbicides were applied POST in a randomized complete block design to 5 by 10 foot plots at 32.5 GPA. Herbicide treatments were halosulfuron at 0.62 lbs. ai/a, either as a single application or followed by a four week sequential application, alone or in combination with MSMA at 1 or 1.5 lbs ai/a. MSMA treatments were initial applications of 1 or 1.5 lbs. ai/a followed by a one week sequential treatment at the initial application rate. Bentazon + 1% crop oil v/v was applied at 1 lb ai/a alone or in a tankmix with MSMA at 1 or 1.5 lbs. ai/a. All bentazon treatments received a 1 lb ai sequential bentazon application seven days after initial treatment. The sites were mixed bentgrass-Kentucky bluegrass-perennial ryegrass fairways mowed at 0.5 inches. Rainfall was normal in 1997 but conditions were extremely dry in 1998.

In 1997, bentazon applications controlled kyllinga > 96%. Kyllinga was controlled >85% with halosulfuron and halosulfuron plus MSMA at any rate 6WAT. Treatments containing bentazon were the only applications which adequately controlled false green kyllinga in 1998. Kyllinga control was >92% 6WAT with bentazon alone or in combination with MSMA at 1.5 lbs. No significant turfgrass phytotoxicity was observed in any year. Turf quality declines were due to phytotoxicity imparted by treatments on heavy kyllinga infestations.

Halosulfuron adequately controlled false green kyllinga in a year with abundant moisture. However, under drought conditions control was reduced. Bentazon applications resulted in good to excellent control in both years.

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Pre/Post Crabgrass Control at Two Stages of Growth in 1998

Dr. T. L. Watschke and J. A. Borger[1]

ABSTRACT

Two experiments were conducted in 1998 to evaluate the control of smooth crabgrass after emergence into a mature Midnight Kentucky bluegrass stand (Poa pratensis L.) maintained at 7/8 inches using a triplex reel mower. The objective of the experiment was to asses efficacy of selected herbicides at two stages of crabgrass growth (prior to and after tillering). Treatments in the pre-tillering experiment were applied on June 16, 1998, with the MSMA treatment being reapplied on June 29, 1998. Treatments were applied using a three ft. hand held CO_2 powered boom sprayer with two 6504 flat fan nozzles calibrated to deliver 40 gpa at 30 psi.

Only the dithiopyr 1EC plus fenoxaprop extra 0.57EW at 0.5 lb ai/A and 0.09 lb ai/A, respectively, exceeded the level of acceptability of 85% control (92%). The remaining treatments that fell below the level of acceptability were pendimethalin plus fenoxaprop 3.09EC at 1.54 lb ai/A (80%) and 2.06 lb ai/A (82%), fenoxaprop extra 0.57EW at 0.06 lb ai/A (53%) and 0.09 lb ai/A (73%), dithiopyr 1EC at 0.25 lb ai/A (82%) and 0.5 lb ai/A (73%), dithiopyr 0.25G at 0.25 lb ai/A (67%) and 0.5 lb ai/A (82%), MSMA 6L (2 applications at 2.0 lb ai/A) (67%), fenoxaprop 1EC at 0.12 lb ai/A (58%).

The treatments in the experiment conducted on tillering crabgrass were applied on July 8, 1998, with the same methodology as the prior experiment. Fenoxaprop 1EC at 0.18 lb ai/A was the only treatment that met or exceeded the 85% level of acceptability (90%). The other treatments in the experiment were pendimethalin plus fenoxaprop 3.09EC at 2.06 lb ai/A (58%) and 3.09 lb ai/A (80%), fenoxaprop extra 0.57EW at 0.06 lb ai/A (65%) and 0.09 lb ai/A (70%), and 0.12 lb ai/A (78%) and 0.18 lb ai/A (78%).

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Preemergence Control of Smooth Crabgrass with Spring and Fall Herbicide Applications

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ABSTRACT

This study was conducted on a mature stand of perennial ryegrass (Lolium perenne L.) at the Landscape Management Research Center, Penn State University, University Park, Pa. The objective of the study was to determine the control of smooth crabgrass comparing fall versus spring applications of prodiamine and dithiopyr. All of the fall treatments were applied on Oct 17, 1997, while the spring treatments were applied on April 16, 1998, using a three foot CO_2 powered boom sprayer calibrated to deliver 80 gpa using two, flat fan, 6504 nozzles at 30 psi. Granular treatments were applied using a shaker jar. On May 6, 1998, the treatments that did not have any nitrogen applied with the herbicide received 0.5 lbs N/M from a 46-0-0 (urea) and 0.5 lbs N/M from a 31-0-0 (IBDU) fertilizer using a 3-ft. drop spreader. After each application of treatments and fertilizer, the test site received 0.5" of water. Germination of the crabgrass was first observed in bare soil areas on April 17, 1998. The morning of April 18, 1998 a heavy frost occurred and the crabgrass that had germinated was killed. Germination of crabgrass was again observed on April 27, 1998, in both bare soil and turfgrass cover locations. The test area was maintained at 7/8" using a triplex reel mower returning the clippings to the site.

None of the treatments applied only in the fall controlled at the acceptable level (85%). However, dithiopyr 0.164G at 0.5 lb ai/A and prodiamine 65WDG at 1.0 lb ai/A controlled crabgrass only slightly below the acceptable level (83% and 80% control). Prodiamine 65WDG 0.75 lb ai/A and at 0.65 lb ai/A provided 75% and 70% control respectively.

Treatments that were applied both fall and spring provided the best control. Prodiamine 65WDG at 0.65 lb ai/A fall followed by 0.38 lb ai/A spring (92%) and 0.75 lb ai/A fall followed by 0.38 lb ai/A spring (90%) were the two most efficacious treatments. When prodiamine 65WDG was applied in the fall at 0.75 lb ai/A but the sequential spring application rate was reduced to 0.25 lb ai/A or with a fall application rate of 0.65 lb ai/A followed by a spring rate of 0.25 lb ai/A the level was found to be 83%. A fall – spring application of dithiopyr 0.164G at 0.25 lb ai/A and 0.125 lb ai/A provided 87% control.

Spring only applications of dithiopyr 0.164G at 0.38 lb ai/A (90%) and the 1EC formulation at 0.5 lb ai/A provided acceptable control (85%). When the rate of dithiopyr 0.164G was reduced to 0.125 lb ai/A control was reduced (63%). A spring application of prodiamine 65WDG at a rate of 0.75 lb ai/A exceeded the level of control of the fall application but still only provided 78% control.

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ROOT GROWTH OF CREEPING BENTGRASS AND ANNUAL BLUEGRASS IN RESPONSE TO VARIOUS ROOT ZONE TEMPERATURES

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ABSTRACT

Cool-season turfgrass and weed species growing on putting greens in North Carolina experience maximum root growth in the spring and fall. During stressful summer periods, root mass often decreases. This trend would seem to hold true for both creeping bentgrass and annual bluegrass, which is considered a weed in the transition zone. Field observations, however, suggest that annual bluegrass is more sensitive to high summer temperatures. The purpose of this study was to elaborate on these field observations by determining the root-zone temperature responses for the two turfgrass species and evaluating whether the responses could contribute to their competitive interactions. 'Penncross' creeping bentgrass (*Agrostis palustris* Huds.) and annual bluegrass (*Poa annua* ssp. *annua*) seeds were germinated in a cup with a cloth bottom held above a nutrient solution at 22 C. After 16 days, plants were randomly assigned to seven chambers with nutrient solution temperatures continuously maintained at 14, 18, 22, 26, 30, 34, and 38 C. The nutrient solution temperatures encompass the range of soil root-zone temperatures encountered in sandy soils during growing seasons in North Carolina. Plants were exposed to the temperature treatments for 16 days; nutrient levels, pH, daylength, and irradiance were held constant. Shoot extension was measured daily and root lengths were measured every two days. Clippings were collected every three days, and fresh weights were measured. At the conclusion of the experiment, roots were collected, and fresh and dry weights were measured. Annual bluegrass was able to produce longer roots than creeping bentgrass at all seven root-zone temperatures, but creeping bentgrass produced roots with greater biomass. However, the temperature response curves for the species were similar with growth optima occurring in the 20 – 22 C range. Both species were very sensitive to temperatures above 30 C. Clearly, high soil temperatures in summer months can have direct adverse effects on root growth of both species. Nonetheless, we found no evidence that greater sensitivity of annual bluegrass to high root-zone temperatures contributes to its decline during the summer season.

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EFFECTS OF TRINEXAPAC-ETHYL ON LATE-SEASON DEVELOPMENT AND COLD HARDINESS OF 'TIFWAY' BERMUDAGRASS

Matthew J. Fagerness and Fred H. Yelverton[1]

ABSTRACT

Trinexapac-ethyl (TE) is the most frequently used plant growth regulator on bermudagrass fairways in the transition zone or southern regions of the United States. TE inhibits the biosynthesis of gibberellic acid (GA) and commonly suppresses vertical shoot growth for 4-6 weeks after application. Applications of TE are confined to periods of maximum bermudagrass growth, usually between June and September in the transition zone. Residual effects of TE applications made during summer or early fall to aid in overseeding on patterns of fall dormancy and winter hardiness of bermudagrass are unknown. TE was applied at 0.11 kg a.i./ha to established 'Tifway' bermudagrass [*Cynodon dactylon* (L.) Pers. x *Cynodon transvaalensis* (Burtt-Davy)] once, twice, or three times during the summer of 1997 and 1998 at four-week intervals. An additional application of TE in late September to previously nontreated turf was also made in each year to simulate applications made to assist in overseeding. It was postulated that these different seasonal application regimes could impact a) when 'Tifway' bermudagrass becomes fully dormant, b) the winter hardiness of this species, and c) the overall ecological fitness of 'Tifway' bermudagrass. Shoot biomass and visual quality data were collected throughout the growing season. Assessments of root biomass, shoot density, and ability to recover from exposure to three freezing temperatures (-5 C, -10 C, and –15 C) were made following the September application of TE. Results from both seasons demonstrated that continuous applications of TE during the summer were necessary to adequately maintain growth inhibition and enhancement of turfgrass quality over the period of maximum bermudagrass growth. Visual quality was maintained later into the fall in turf treated continuously during the summer with TE. Root biomass of 'Tifway' bermudagrass was unaffected by the seasonal application patterns of TE. Shoot density measurements were enhanced in turf treated continuously throughout the summer, presumably due to the occurrence of post inhibition growth enhancement at a time when conditions were unfavorable for active growth. TE was not found to have any impact on winter hardiness of 'Tifway' bermudagrass. Applications of TE in late September negatively influenced visual quality and shoot density in 1997; these effects were less dramatic in 1998, indicating a relationship between TE activity and ambient environmental conditions before, during, and after the time of application(s).

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EFFECTS OF PLANT GROWTH REGULATORS ON GERMINATION AND GROWTH OF ANNUAL BLUEGRASS AND CREEPING BENTGRASS

John Isgrigg III and Fred H. Yelverton[1]

ABSTRACT

Greenhouse experiments were conducted in 1998 to evaluate the effects of paclobutrazol and trinexapac-ethyl on germination and seedling growth of annual bluegrass (*Poa annua* L. var. annua) and 'Penncross' creeping bentgrass (*Agrostis palustris* Huds.). The experiments were arranged in a complete factorial design with the following treatments: two plant growth regulators (PGRs), two soils, two species and seven application timings. An 80:20 sand/peat mix or a loamy sand (89:8:3 sand:silt:clay) soil were placed in four-inch square pots and planted with 30 seeds of either species then treated with one of three rates of the two PGRs at one of seven timings. Paclobutrazol was applied at 0.25, 0.375 and 0.5 lbs ai/a and trinexapac-ethyl at 0.046, 0.1 and 0.146 lbs ai/a. Application timings were three, two or one week prior to planting (PRE), at planting (AP) or one, two or three weeks after planting (POST). Emerged seedlings were harvested six weeks after planting and evaluated for: germination ten days after planting and at harvest, mean shoot length and dry biomass and mean root length and dry biomass. PGRs were applied in a spray chamber calibrated to deliver 50 GPA. Data were analyzed using the GLM procedure, means were separated with Fishers Protected LSD at a 95% confidence level.

PGR main effects were significant with paclobutrazol, at any rate, inhibiting mean shoot biomass, mean shoot length, mean shoot count, and mean root biomass. Treatments with trinexapac-ethyl reduced mean shoot length. Timing impacted germination, mean shoot length and biomass, and mean root length and biomass. Species main effect differences were observed with respect to germination, mean shoot length and biomass, and mean root length and biomass. PGR by TIMING interactions were observed with respect to germination and mean root biomass while a PGR by SPECIES interaction was significant for germination.

Paclobutrazol inhibited seedling growth, germination and shoot and root biomass of both species tested. Annual bluegrass was more affected by paclobutrazol applications than was creeping bentgrass. Trinexapac-ethyl affected shoot length only. These studies suggest paclobutrazol may be used to inhibit annual bluegrass germination and seedling growth in bentgrass putting greens. Trinexapac-ethyl is viewed to be moderately safe on putting greens recently seeded or reseeded with creeping bentgrass.

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CONTROL OF WIRESTEM MUHLY IN HERBICIDE RESISTANT CORN

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ABSTRACT

Wirestem muhly (Muhlenbergia frondosa (Poir.) Fernald) is a warm season, perennial grass species that is a problem in conservation tillage systems. Effective programs are limited for managing wirestem muhly using traditional corn hybrids in conservation tillage systems. The following demonstrations were designed to evaluate wirestem muhly control using several herbicides in herbicide resistant corn (Zea mays L.) hybrids.

In 1997 and 1998, field demonstrations were conducted in central Pennsylvania in a no-till area with an established wirestem muhly population. In 1997, Poast Protected/SR corn was planted in the entire trial area in early May and followed with a burndown/PRE treatment for annual weed control. Postemergence herbicide treatments included Poast Plus (sethoxydim), Accent (nicosulfuron), and Basis Gold (nicosulfuron + rimsulfuron + atrazine) at different rates, timings, and in combinations. Appropriate adjuvants were included where necessary. A randomized complete block design (10 by 100 feet) with two replications was used in this study. In 1998, three herbicide resistant corn hybrids (Poast Protected/SR, Roundup Ready, and Liberty Link/GR) were strip-planted in the trial area during mid-May and a burndown/PRE treatment applied for annual weed control. The primary postemergence herbicide treatments included Liberty (glufosinate), Poast Plus, and Roundup Ultra (glyphosate) at different rates and timings. The primary treatments were applied in combinations with and compared to other standard corn herbicides. Appropriate adjuvants were included where necessary. A nonreplicated strip design (15 by 90 feet) was used in the demonstration. In both years, the herbicides were applied with a CO_2-backpack sprayer when wirestem muhly was 10 to 12 inches tall (POST1) and 15 to 18 inches tall (POST2). Treatments were evaluated visually.

End of season results from the studies showed that in 1997, Poast Plus treatments provided 60% to 70% control with a single application and the same treatments provided 75% to 95% control in 1998. A split application of Poast Plus provided greater than 90% control of wirestem muhly. Accent provided no more than 80% control as either a single application or a split treatment. Basis Gold only slightly suppressed wirestem muhly growth (30% control). The single Liberty application provided 40% control of wirestem muhly, whereas the split treatment provided 77% control. Roundup Ultra provided excellent initial control (100%) of wirestem muhly. However, by the end-of-season, wirestem muhly control was 75% to 85%, probably due to the emergence of new shoots. Tank mixing Accent, Basis Gold, or atrazine with the primary herbicide treatments did not increase the level of wirestem muhly control. In some tank mix treatments antagonism was observed, namely, Basis Gold plus Poast Plus and Roundup Ultra plus atrazine.

In summary, these strip trials show that wirestem muhly can be more effectively managed with certain herbicides in herbicide resistant corn hybrids as compared to traditional corn herbicides. As noted in these studies and from previous research conducted at Penn State University, herbicide application timing and perhaps split treatments are necessary for effective wirestem muhly control. Herbicide resistant crops with an appropriate herbicide treatment should be an excellent alternative for managing wirestem muhly in corn in areas where tillage is not feasible.

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WEED CONTROL SYSTEMS IN ROUNDUP READY® CORN

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ABSTRACT

Roundup Ready® corn (*Zea mays*) was grown commercially for the first time in 1998. A survey of users indicated that 96% of growers were satisfied and offered very favorable impressions of Roundup Ready corn. The survey also indicated that 98% of growers were satisfied with crop safety and overall control of weeds with the Roundup Ready system.

Field trials were conducted in 1998 to further evaluate weed control systems in Roundup Ready corn. Systems evaluated in both conventional and no-till corn were preemergence followed by postemergence and postemergence only weed control programs. Residual herbicides, such as Harness® Xtra (acetochlor/atrazine), were applied at ½, ¾, and full labeled use rates preemergence followed by Roundup® Ultra™ (glyphosate) at 24-32 ounces/acre (0.56-0.75 LB ae/A) postemergence, and in tank mixtures with 24-32 ounces/acre Roundup Ultra early postemergence. In general, reduced residual herbicide rates applied in a program with Roundup Ultra provided good season-long weed control with good consistency of control across trials. Sequential postemergence applications of only Roundup Ultra at 32 ounces/acre followed by 24 ounces/acre also provided good and consistent season-long weed control. Sequential applications of Roundup Ultra provided more consistent season-long control than a single postemergence application of Roundup Ultra in Roundup Ready corn.

Results support the use of reduced residual herbicide rates (50-75% of labeled rates) applied preemergence or in early postemergence tank mixtures with Roundup Ultra in Roundup Ready corn weed control systems. Early postemergence applications should be made before weeds are greater than 4 inches tall to minimize competition to the crop. Roundup Ultra is labeled for postemergence applications to Roundup Ready corn from emergence through the V8 stage (8 leaves with collars) or until corn height reaches 30 inches, whichever comes first. The maximum use rate of 32 ounces/acre Roundup Ultra can be applied in any single application with a maximum of 64 ounces/acre of Roundup Ultra that can be applied in-crop (excluding pre-harvest application) in Roundup Ready corn.

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FACTORS AFFECTING SILAGE AND GRAIN YIELDS WITH GLUFOSINATE- AND GLYPHOSATE- RESISTANT CORN

R. R. Hahn and P. J. Stachowski[1]

ABSTRACT

Field experiments were established near Aurora, NY in 1998 to evaluate the effect of residual herbicide rates with glyphosate on grain corn (*Zea mays* L.) yields and to evaluate the effect of application timing of glufosinate and glyphosate treatments on corn silage yields. To evaluate the effect of residual herbicide rates, corn 'DK493RR' was planted May 20. A preemergence (PRE) standard treatment of 2.2 lb ai/A of metolachlor/atrazine plus 1 lb ai/A of pendimethalin was applied on May 21. Applications of 1 lb ai/A of glyphosate alone and in combinations with 1, 1.5, or 2 lb ai/A of alachlor or with 1.5, 2.25, or 3 lb ai/A of alachlor/atrazine were applied on June 24 when corn was at the V5 stage and annual weeds were less than 4 inches tall. Separate experiments were established to evaluate the effect of application timing of glufosinate and glyphosate treatments on corn silage yields. Corn, 'DK493GR' and 'DK493RR', was planted in separate experiments on June 9 in a field with heavy pressure from common ragweed (*Ambrosia artemisiifolia* L.) and other annual weeds. In each, a PRE standard of 2.25 lb/A of metolachlor/atrazine plus 1.5 lb/A of pendimethalin was applied. Applications of 0.26 lb ai/A of glufosinate plus 0.75 lb ai/A of atrazine and 3 lb/A of ammonium sulfate or 1 lb/A of glyphosate plus 0.75 lb/A of atrazine were applied early, mid, and late postemergence (EPOST, MPOST, LPOST). EPOST applications were made on July 2 when corn was in the V4-5 stage and common ragweed was 2 inches tall.

With moderate weed pressure, there were no significant differences in grain corn yield between the PRE standard and MPOST glyphosate treatments. Yield for the PRE standard was 141 bu/A while 1 lb/A of glyphosate alone yielded 144 bu/A. Grain corn yields for the glyphosate plus 1/2x, 3/4x and x rates of alachlor averaged 147 bu/A while yields for the glyphosate plus 1/2x, 3/4x, and x rates of alachlor/atrazine averaged 141 bu/A. The untreated check yielded 130 bu/A. Application timing of glufosinate plus atrazine or glyphosate plus atrazine treatments had a significant impact on corn silage yields. With heavy annual ragweed pressure, all glufosinate plus atrazine treatments resulted in reduced yields compared with the PRE standard. The EPOST, MPOST, and LPOST applications of this combination yielded 18.4, 17.5, and 15.3 T/A respectively compared with 23.5 T/A for the PRE standard and 13.3 T/A for the untreated check. While the MPOST and LPOST applications of glyphosate plus atrazine resulted in significant yield loss compared with the PRE standard, the EPOST application resulted in a similar yield to the PRE standard. The EPOST glyphosate plus atrazine treatment yielded 19.2 T/A compared with 20.3 T/A from the PRE standard while the MPOST and LPOST applications yielded 16.7 and 15.9 T/A respectively. The untreated check produced 12.7 T/A of corn silage.

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THE EFFECTS OF PRE-EMERGENCE AND POST-EMERGENCE HERBICIDES ON THE GROWTH OF TRANSGENIC AND NON-TRANSGENIC SOYBEANS

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ABSTRACT

The development and use of herbicide-resistant crops (HRC's) is a new tool that growers can use as they seek better management of weeds in their farming operation. In corn, imazethapyr-resistant (IR) and imazethapyr-tolerant (IT) corn were the first commercial herbicide-resistant corn hybrids that were developed through nonclassical breeding methods. Following in the footsteps of these hybrids were the commercialization of sethoxydim-resistant (SR) and glufosinate-resistant (GR) corn hybrids.

In soybeans, DuPont developed a sulfonylurea-tolerant soybean (STS soybean) that provides a greater margin of safety for post-emergence applications of the sulfonylurea herbicides *thifensulfuron* and chlorimuron. Recently, soybean lines have been developed with resistance to glyphosate applied topically. These two genetic traits (STS and glyphosate-resistance) have also been stacked together in soybeans to allow for topical applications of all three herbicides without fear of injury.

Much interest is generated in the use of these HRC's by allowing growers the opportunity to manage hard to control weeds, providing them a wide window of application, and no worry about rainfall to activiate soil applied herbicides. Yet, researchers across the country have found that some HRC's seem to be more sensitive to environmental stress. Whether stress from other herbicides applied to these crops will cause a reduction in plant growth and development is uncertain. The goals of this research were to compare standard herbicide programs to topical applications of glyphosate and compare their effects on soybean biomass.

Research was performed in 1998 at the University of Maryland Beltsville Facility. Three different group IV soybeans were compared; Stressland, Pioneer 9492 (glyphosate-resistant), and Asgrow 4501 (stacked - STS + glyphosate-resistant). Herbicide programs examined included the following: metolachlor applied pre-emergence, metribuzin + chlorimuron applied pre-emergence, metolachlor + metribuzin + chlorimuron applied pre-emergence, glyphosate applied post-emergence and an untreated control. Biomass samples of above ground plant parts were collected periodically throughout the season. Plant height, fresh weight and leaf area were recorded. At maturity, the number of pods per plant and seeds per pod were obtained.

Within each soybean variety, preliminary data would indicate that few differences exist between treatments. It did not appear that any of the pre-emergence herbicides or the glyphosate alone application provided a reduction in biomass or leaf area. The untreated control plots provided the least amount of biomass due to weed interference for most of the growing season.

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CHLORANSULAM EFFICACY AND CROP TOLERANCE IN CONVENTIONAL AND GLYPHOSATE-RESISTANT SOYBEANS

M.J. VanGessel, Q. Johnson, and V. Langston[1]

ABSTRACT

Chloransulam (FirstRate), a newly registered herbicide from Dow AgroSciences, has been tested by the University of Delaware's program over the past three years to determine the best fit for soybeans (Glycine max L.) grown on the Delmarva peninsula. Chloransulam has been tested for its crop safety with a number of soybean varieties, range of effectiveness on various weed species, and compatibility with glyphosate (Roundup Ultra) for use with glyphosate-resistant (Roundup Ready) soybeans. Although chloransulam has both foliar and soil activity, only POST studies will be discussed. Studies were all conducted as small plot, replicated trials. Many of the treatments are a subset of a larger study involving other herbicides and/or rates. Unless stated, chloransulam treatments are compared to the appropriate standard treatments using Dunnett's t-test. The standard rate of chloransulam in these studies is 0.016 lbs ai/A.

Varietal sensitivity was evaluated in 1997 and 1998. Varieties used both years were Manokin, Hutcheson, Stressland, DeKalb 420, and Pioneer 9552. Additional varieties in 1997 were Delsoy 4710, Hoffman 7403, and Asgrow 4401, while in 1998, Asgrow 4601, Pioneer 93B82, and TS 474 were planted. Visual injury in 1997 was up to 16% with a 2X rate (0.032 lbs ai/A). In both years, injury at the 1X was less than 10%. Chlorophyll reflectance measured within 7 days of application was not different from the untreated check for any treatment. Yields in 1997 of plots treated chloransulam were similar to highest yielding treatments in the study. There was no difference observed between the varieties tested in either year.

Five studies examined the effectiveness of chloransulam alone and in combination with other POST herbicides. Common ragweed control was ≥95% at all five studies. Morningglory species (Ipomoea spp.) were present in four of the studies and chloransulam alone provide ≥95% control in two studies and >80% control in the other two studies. The combinations of chloransulam with flumetsulam (Python), thifensulfuron (Pinnacle), or aciflurifen (Blazer) did not improve control over chloransulam alone.

Chloransulam did not provide control of smooth pigweed (Amaranthus hybridus L.) or common lambsquarters (Chenopodium album L.). For improved smooth pigweed

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control, the addition of acifluorfen or thifensulfuron increased level of control to ≥90%. Results with flumetsulam were not consistent. For improved common lambsquarters control, the addition of thifensulfuron improved control >80%. Results with acifluorfen or flumetsulam were not consistent for improved common lambsquarters control.

Ten studies were conducted to evaluate improve control of chloransulam in combination with glyphosate compared to glyphosate alone when treating glyphosate-resistant soybeans. In 6 studies, there was no additional weed control with the tankmixture compared to glyphosate alone. Chloransulam improved common ragweed (Ambrosia artemisiifolia L.) control in 3 studies compared to the results with glyphosate alone. Likewise, morningglory species was improved in 2 studies.

In one study that evaluated a variety of tank mix partners with glyphosate, chloransulam in combination with glyphosate was as good as chlorimuron (Classic) for control of common ragweed. However, imazethapyr (Pursuit) in combination with glyphosate improved common lambsquarters control compared to glyphosate alone or in combination with chloransulam.

In a factorial study of glyphosate applied in 10 or 25 g/A, with or without a surfactant, or with or without chloransulam. In 1997, common ragweed and ivyleaf morningglory [Ipomoea hederacea (L.) Jacq.] control was improved when chloransulam was included with glyphosate. Similarly, in 1998, ivyleaf morningglory control was improved with the combination of chloransulam and glyphosate compared to glyphosate alone.

Reduced grass control was observed with chloransulam was tank-mixed with fluazifop plus fenoxaprop (Fusion) or sethoxydim (Poast Plus), compared to the POST graminicides alone.

Chloransulam will provide a useful herbicide for soybean weed management in Delmarva. The crop tolerance is good to excellent and it is a nice complement to glyphosate on glyphosate-resistant soybeans. Chloransulam will need to be tankmixed for adequate control of common lambsquarters and smooth pigweed. Thifensulfuron plus chloransulam does provide a consistent level of control of these weed species

TIMING AND TANK MIXES FOR ROUNDUP READY SOYBEANS

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ABSTRACT

Roundup Ready soybeans were planted without preemergence herbicides in each of the past four years. Postemergence applications of 0.75 lb ai/a glyphosate were sprayed two, three, four, five, or six weeks after planting. Two weeks after planting, the soybeans were at the unifoliate leaf stage, and the weeds were one inch tall or less. Three weeks after planting, the soybeans were at the first trifoliate leaf stage, and the weeds were one to two inches. Four weeks after planting, the soybeans were at the two to three trifoliate leaf stage, and the weeds were two to four inches tall. Five weeks after planting, the soybeans were at the three to four trifoliate leaf stage, and the weeds were four to six inches tall. Six weeks after planting, the soybeans were at the four to six trifoliate leaf stage, and the weeds were six to twelve inches tall. The postemergence glyphosate spray at all the application timings except the six-week timing each year controlled emerged weeds. The six-week timing spray controlled the larger weeds, but smaller weeds survived. The dense weed canopies, which developed in the six weeks since planting, shielded smaller weeds from the spray and resulted in less effective weed control. Weed control and soybean yields at the end of the season varied from year to year. Weed control and yields were reduced when the postemergence spray was applied before week four during years when moisture was available for additional weed germination after the application and before the soybean canopy closed. Soybean yields were also reduced when the postemergence sprays were applied after the fourth week during years when extended periods of hot and dry weather occurred after the weeds were controlled. Weeds that were controlled before reaching four inches in height in dry years did not reduce soybean yields. When weeds were allowed to grow with the soybeans until they exceeded four inches in height, yields were reduced when water was a limiting factor for the rest of the growing season. During years when rainfall was not limited, soybean yields were only reduced when applications were delayed until six weeks after planting when weed control was reduced due to shielding by the weed canopy. Tank mixing residual herbicides with glyphosate improved the consistency of weed control when the postemergence spray was applied earlier than four weeks after planting.

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POTENTIAL HERBICIDES FOR USE IN LIMA BEAN PRODUCTION

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ABSTRACT

Herbicides currently labeled for use in lima beans (*Phaseolus lunatus* L.) do not consistently control weed species commonly found in production fields. Recently developed soybean herbicides control many of these troublesome weeds, but tolerance to lima beans is not known. Three experiments were conducted to evaluate the potential of new herbicides for lima bean tolerance. Studies were conducted in DE, 1996 to 1998, and NC, 1997 and 1998. The first study examined soil-applied herbicides. The herbicides evaluated were: chloransulam (FirstRate) at 0.01, 0.02, 0.03, and 0.04 lb ai/A; flumetsulam plus metolachlor (Broadstrike+Dual) at 1.2, 1.4, 1.7, and 1.9 lb ai/A; sulfentrazone (Authority) at 0.1, 0.15, 0.2, and 0.25 lbs ai/A; lactofen (Cobra) at 0.2 and 0.25 lb ai/A; and imazethapyr (Pursuit) plus metolachor (Dual) at 0.05 and 1.5 lb ai/A, respectively. A weedy check was also included. Lima bean injury, five to six weeks after emergence, was lowest for Pursuit plus Dual (the standard). Injury from all four rates of FirstRate was consistently lower than the other herbicides evaluated. Crop safety with Broadstrike+Dual ranged from 0 to 18% depending on location and rate. Injury from Authority ranged from 3 to 30% at NC in 1997 and up to 75% at DE in 1998. Cobra treatments caused unacceptable levels of lima bean injury. Yields were reflective of crop injury and weed control. Yields with FirstRate were more consistent than the other herbicides examined.

The second study examined POST herbicides, all applied when the crop was at the first to second trifoliolate stage. The herbicides evaluated were: FirstRate, bentazon (Basagran), Pursuit, and imazamox (Raptor). A weedy check was also included. FirstRate resulted in 0 to 13% crop injury and Raptor resulted in 3 to 25% injury depending rate and location. Increased crop safety from tank-mixtures of Basagran plus Pursuit (1 and 0.05 lbs ai/A, respectively) was not observed compared to use of these herbicides alone. Some safening was observed with Basagran plus Raptor (1 and 0.03 lbs ai/A, respectively) but this was not consistent for all locations. Yields were reflective of crop injury and weed control.

Varietal sensitivity to Authority, applied PRE, and POST applications of FirstRate, Raptor, Pursuit and Basagran was tested. Sacramento Valley Milling Company's M-15, F1072, M-408; Harris-Moran Seed Company's Packers; Ben Fish Seed Company Concentrated Fordhook and 8-78; and Musser Seed Company's Eastland were treated. No differences were detected among the varieties tested.

There is potential for soybean herbicides to increase weed management options for lima bean growers. These options will provide broader spectrum of broadleaf weed control than what is currently available, with good crop safety.

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IMPACT OF WEED DENSITY AND POD ROT ON LIMA BEAN YIELD AND QUALITY

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ABSTRACT

Integrated pest management for lima beans (Phaseolus lunatus L.) is challenging due to limited availability of pesticides and lack of understanding of multiple pest complexes. Basic understanding of weed thresholds in lima beans is needed as well as multiple pest interactions. Field experiments were conducted at University of Delaware's Warrington Farm, Harbeson, DE in 1997 and at 2 locations at University of Delaware's Research and Education Center, Georgetown, DE in 1998 to determine the impact of weed density and pod rot (Rhizoctonia solani kuhn.) on lima bean yield and quality.

Lima bean variety, 'Maffei-15', was used for all studies. The experimental design was a randomized complete block with treatments arranged as a three-factor factorial, with four replications. The factors were weed species {common cocklebur [Xanthium strumarium L.], jimsonweed [Datura stramonium L.], or ivy leaf morningglory [Ipomea hederacea L. [Jacq.]} and weed densities (0, 6, 9, or 18 plants per 9 m of row) in an additive design. Third factor was pod rot infestation (inoculated or non-inoculated). Three additional plots per replication were planted with each of the weed species at a density of 6 per row with no lima beans. Plots were inoculated with Rhizoctonia at mid-flowering stage of lima beans. All the plots were kept weed-free except for the weeds of interest throughout the crop growth season. Only common cocklebur was evaluated in 1997 as other weed species had poor emergence.

Parameters evaluated were lima bean height 65 days after planting, yield, percent marketable beans, marketable yield, 200 bean weight, number of plump and flat pods, number of pods with 1, 2, 3, or 4 beans, dry pods, pod rot infested pods, insect damaged pods, and flecked pods. In addition, a random sample of 200 beans was evaluated for pod rot and insect damage.

In 1997 and 1998, lima bean height, yield, number of flat and dry pods, flecking, pod rot infestation and insect damage on both pods and beans did not differ among treatments. Lima bean yield was greatest from plots where no weeds were planted. Yield was similar for all weed densities and species. Various yield attributes were influenced by weed species, density, or their interactions depending on the specific attribute.

The weed densities chosen in this study may have been relatively high and lower weed densities are needed to examine species by yield interaction, especially in a less competitive crop such as lima beans. Also, 1998 was conducive for pod rot disease and plots not inoculated with pod rot fungus may have been naturally infested, thus no differences between inoculated and non-inoculated plots.

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MODELING INTERFERENCE OF REDROOT PIGWEED, LARGE CRABGRASS AND SMALLFLOWER GALINSOGA IN PEPPER

Rongwei Fu[1] and Richard A. Ashley[2]

ABSTRACT

Field experiments were conducted to determine the influence of emergence time and density of redroot pigweed, large crabgrass and smallflower galinsoga on the yield loss of bell pepper. Selected weed densities up to 32 plants m^{-1} were established within 15cm on either side of the crop row separately for each weed species.The effects of two emergence times - weed seedlings emerged right after transplanting of pepper and weed seedlings emerged after two more weeks - were studied. Both weed density and emergence time relative to pepper transplanting affected the magnitude of yield loss. Yield loss ranged from 25% to 97.7% for early emerged large crabgrass, and 0.5% to 61.4% for late emerged large crabgrass within the range of established seedling densities. Yield loss due to redroot pigweed ranged from 7.3% to 65.9% for early emerged seedlings, and from 0.4% to 41.2% for late emerged seedlings. Early emerged smallflower galinsoga caused up to 54.8% of yield loss, while the late emerged seedlings didn't seem to have much influence on yield loss. The results of this study are important in the development of an integrated weed management strategy for pepper.

INTRODUCTION

Study of the interference between weeds and crops will be of help in understanding the underlying process in weed competition and to develop effective control strategies in integrated weed management (IWM) systems. During the development of IWM systems, a lot of efforts have been made to reduce the use of herbicides while maintaining the maximum profit margin. Economic action thresholds have rapidly gained acceptance as one of the most important concepts in integrated weed management, where profits of the crop production, instead of the pure weed control effects, are addressed. It forms the basis of the present theory on decision making (10). The knowledge of interference, typically the response of crop yield to different weed infestations, acts as the defining part to determine the economic thresholds.

Peppers *Capsicum annuum* L. are a high value crop and essential to the profitability of vegetable producers in Connecticut and the whole northeast area (1992 Census of Agriculture). Wholesale gross returns for an acre of peppers range from \$4800 to \$16000/acre for intensively managed production using hybrid plants, plastic mulch, raised beds and trickle irrigation with liquid fertilizer. Weeds are managed by a combination of cultivation, plastic mulches, herbicides and fumigants. Weed control often breaks down completely as harvesting begins and fruit laden plants block passage between rows. Current herbicide use represents a large proportion of the total pesticide use. Peppers are vulnerable to weed competition, but not much information is available to help growers make decisions about weed control. Few studies reported weed interference in peppers (7, 8, 9, 12), and none of these studies proceeded with a modeling approach to describe the interference, which could be used effectively in weed management decision making.

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Redroot pigweed *Armaranthus retroflexus* L., large crabgrass *Digitaria sanguinalis* (L) Scop. and smallflower galinsoga *Galinsoga ciliata* L., are three important weeds in the agricultural fields in the northeast area. The first two species are among the dominant weeds in the fields, and the last one is troublesome in that the seeds of smallflower galinsoga have no typical period of dormancy, and the seedlings will emerge throughout the growing season. This makes it difficult to make decisions about whether or not to control the seedlings in the field. The time of weed emergence relative to crop as well as weed densities are two important factors influencing weed interference (2, 5). The objective of this study is to model the relationship between pepper yield response and these three weed species under different densities and different emergence times.

MATERIALS AND METHODS

EXPERIMENTAL PROCEDURES

The experiments were conducted in the research station of Department of Plant Science, University of Connecticut at Mansfield, CT. The soil type is Woodbridge fine sandy loam with 57.1% sand, 9.9% clay and 33% silt. Boynton Bell pepper seeds were planted in the greenhouse on April 17^{th}, 1998 and the seedlings were transplanted to the field on May 29^{th}. Weeds within the crop row (a 15cm band on each side of the crop row) are the target weeds of this study. Naturally established weeds were used and studies of the effects of redroot pigweed, large crabgrass and smallflower galinsoga on pepper yield were considered as three individual experiments.

The experimental design was a randomized complete block design with four replicates. Plots consisted of two rows 3.1m long with 1m between rows. Treatments consisted of two times of weed emergence and seven weed densities. Earlier time of weed emergence corresponded to those weeds emerging right after transplanting, and the later time of weed emergence after two more weeks. Two weeks after the pepper seedlings had been transplanted, half of the field was cultivated and hand hoed to remove the weeds emerged after transplanting. New weed seedlings were then allowed to emerge.

Naturally established weeds were identified and thinned to the desired densities of 0, 1, 2, 4, 8, 16, 32 seedlings per meter of row for the three weed species. For each density, the desired number of weeds was chosen randomly from the weeds present in the specified area. These seven weed densities were set up for each weed emergence time, and the different populations were established by June 25^{th} for the earlier time and July 9^{th} for the later time. The undesired weeds between the treatments were controlled by cultivation, hand hoeing and herbicides. Weeds emerged within the crop row after the treatments had been established were removed by hand hoeing. Plots were checked every week to maintain the desired weed densities.

The peppers were harvested every two weeks beginning On August 21^{th}, 1998. Fresh weight of marketable fruits were recorded and accumulated as the total yield.

STATISTICAL ANALYSIS

Data will be analyzed by the nonlinear regression given by Cousens (4) to characterize the relationship between yield loss and weed pressure.

$$Y_L = ID / (e^{CT} + ID/A) \qquad [1]$$

where Y_L is the percent yield loss; D is the density of weeds m^{-1} of crop row; T is the time of weeds emergence relative to the crop in growing degree days (GDD) (base temperature 9.7°C; 11); and I, A, and C are nonlinear regression coefficients. Parameter I is the percent yield loss per unit weed density as $D \to 0$, A is the asymptotic yield loss as $D \to \infty$, and C is the rate at which slope (I) decreases exponentially as T becomes larger. The larger the value of C, the more competitive the crop is against the late emerging weeds. The ratio of I/A is a measure of weed intraspecific competition (3).

Observed yield could be expressed as:

$$Y = Y_{WF}(1 - Y_L) \qquad [2]$$

where Y is the observed yield, Y_{WF} is the weed-free yield and Y_L is the percentage yield loss as in model 1. Therefore, Y_{WF} could be considered as an additional parameter that could be estimated with each data set from all data records rather than just from weed-free control plots.

The model parameter estimates will be determined using a nonlinear curve fitting method (1). A test for lack of fit of the hyperbolic model will be performed by partitioning the residual sum of squares into error for lack of fit and pure experimental error (6). If an F-test value for lack of fit sums of squares is not significant at the 5% level, the nonlinear model is appropriate.

RESULTS AND DISCUSSION

Based on the test for lack of fit, the hyperbolic regression model provided a satisfactory fit for all three yield data sets from the interference of the three weed species, but the results from the later establishment of smallflower galinsoga have some data points which deviated from the fitted line (Figure 3).

Both weed densities and time of emergence have great effects on the pepper fruit yield. Later emerging weeds caused less yield reduction than earlier emerging weeds. Figure 1 shows the effects of large crabgrass interference on the fruit yield. Seedlings emerged right after transplanting could cause a large proportion of yield reduction even under very low densities. For example, 1 large crabgrass m^{-1} emerged right after transplanting resulted in 25% yield loss while only 0.5% yield loss was observed when the same number of seedlings emerged after two more weeks. Under high densities such as 16 seedlings m^{-1} and 32 seedlings m^{-1}, the yield

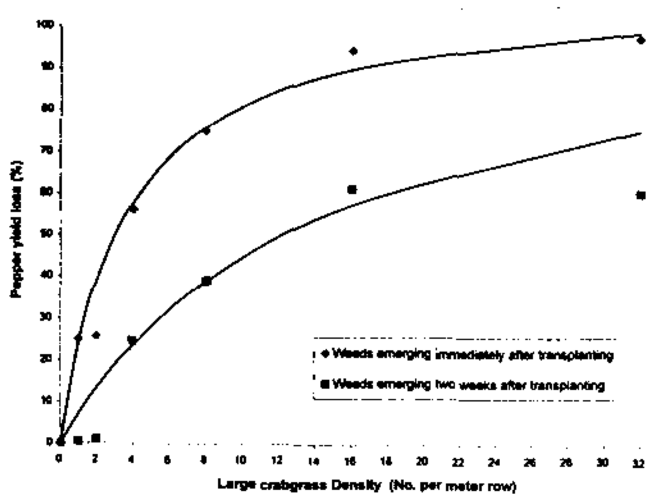

Figure 1. Percent pepper yield loss as a functin of large crabgrass density and time of crabgrass emergence. Points represent mean observed values, and the lines represent the fitting equation.

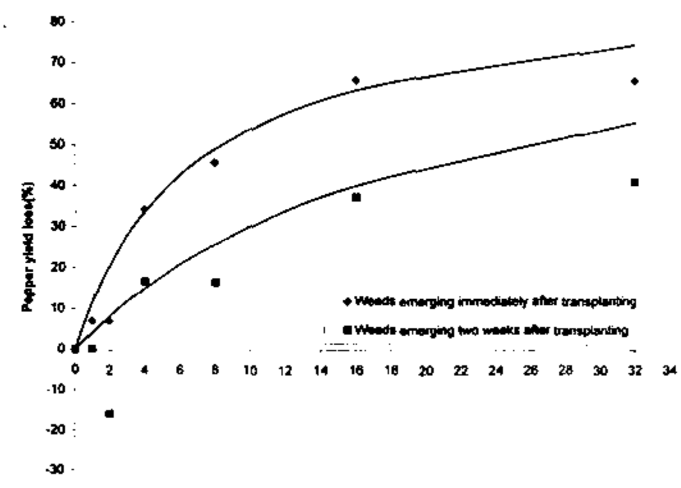

Figure 2. Percent pepper yield loss as a function of redroot pigweed density and time of pigweed emergence. Points represent mean observed values and the lines represent the fitted equation

reductions were up to 94.5% and 97.7% respectively for the earlier time, and 60.7% and 61.4% for the later time. These results showed that large crabgrass was a strong competitor for bell peppers.

The effects of redroot pigweed interference on the pepper fruit yield were shown in Figure 2. For seedlings emerged right after transplanting, low densities such as 1 and 2 seedlings m^{-1} caused a 7.3% of yield reduction. The percentage of yield reduction increased to 65.9 % and 65.7% when the seedling density increased to 16 m^{-1} and 32 m^{-1}. Similar to the results of large crabgrass, the yield reduction percentages remained rather stable under higher weed densities, maybe due to the intraspecific competition within weeds and the death of some seedlings. Low densities of redroot pigweed emerged two weeks after transplanting didn't have much influence on the yield reduction.

Results from the interference of smallflower galinsoga had a less satisfactory fit for the equation than the results from large crabgrass and redroot pigweed (Figure 3). Seedlings emerged right after transplanting seemed to have great effects on yield reduction under low densities, and 1 seedling m^{-1} caused a 22.7% yield reduction. The effects on yield reduction remained fairly stable (from 22.7% to 29.5%) when the weed density increased from 1 seedling m^{-1} to 8 seedlings m^{-1}. The yield reductions were more than 50% under higher densities. The pepper yields under the later time seedlings showed large variation, but no obvious trend of yield reduction was observed when the weed densities increased. Statistical analysis on this data set showed no significant difference on the mean yield. The later emerged weeds had no significant effect on pepper yield.

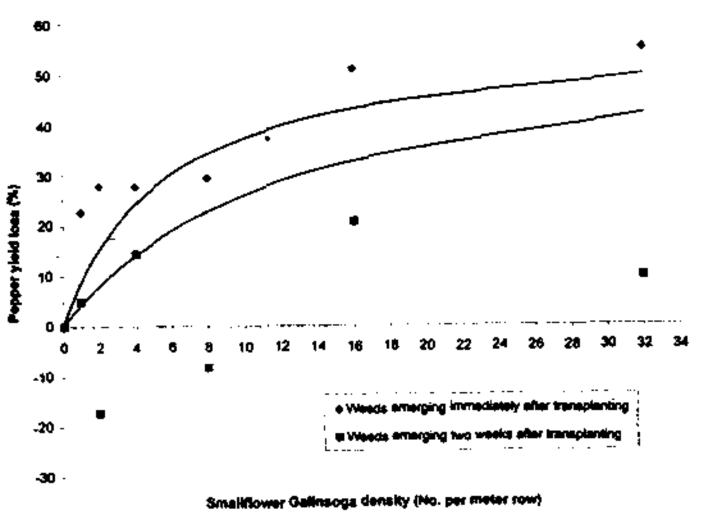

Figure 3. Percent pepper yield loss as a function of smallflower galinsoga density and time of smallflower galinsoga emergence. Points represent mean observed values and the lines represent the fitted equation.

Table 1. Observed weed-free pepper fruit yields and parameter estimates (± S.E.) of the nonlinear regression model.

Weed Species	Observed mean Weed-free yield	Parameter Estimates[a] Y_{WF}	A	I	C
	Kg ha⁻	Kg ha⁻	%	%	
Redroot pigweed	22302(780)	22827(621)	89.9(8.2)	13.45(2.9)	0.007(0.001)
Large Crabgrass	22190(812)	21537(446)	98.4(4.3)	30.37(3.4)	0.01(0.002)
Smallflower Galinsoga	34409(1168)	32433(1593)	58.1(8.9)	10.50(9.0)	0.006(0.005)

[a] Y_{WF} represents predicted weed-free yield, A is the asymptotic yield loss at high weed densities, I is the yield loss as weed density approaches 0, and C is the rate at which I decreases exponentially as relative time of weed emergence increases.

Table 1 showed the observed weed-free yields and the estimates of the parameters of the model. The estimated weed-free pepper yield values (Y_{WF}) didn't differ from the observed weed-free yield for each weed species, but varied from species to species. So the weed-free yield was influenced by the specific weed species, which was an unwanted situation. Some careful work is needed to eliminate these effects, so the results from the different species could be interpreted on the same basis. If the weed-free yields were all on the same level, the reduction rate of yield from different species could be altered.

The asymptotic yield loss at high weed densities, parameter *A*, represents the maximum yield loss. The estimated values ranged from 58.1% to 98.4% for the three weed species, agreeing with the observed maximum yield loss. The estimates of *I*, the yield loss as weed density approaches 0, were 13.5%, 30.4% and 10.5% for redroot pigweed, large crabgrass and smallflower galinsoga respectively. These *I* values were unexpectedly high as yield loss would approach 0 when no weeds were in the fields. The larger value of *C* represents more competitive ability of the crop against later emerged weeds. The estimated values of *C* did not accurately reflect the actual situation, where it seemed that the pepper had stronger competitive ability against late emerging smallflower galinsoga, but in that case the estimated value of C is smallest.

More data are needed to get good estimates of model parameters. With more data gathered, these results have the potential to be used as the basis for weed management decisions. These results could be combined to characterize the multiple weed species in the field with careful adjustments. They could be incorporated into calculations of economic thresholds and used in the development of economic decision rules for individual species or multispecies. These rules can assist pepper growers with the implementation of cost-effective strategies for weed control.

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LONG ISLAND POTATO VINE DESICCATION RESULTS – 1998

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ABSTRACT

There are few registered potato (*Solanum tuberosum* L.) vine desiccation options available to growers in the Northeastern US. Diquat and endothall (Desicate II) are the only currently available materials in New York. The manufacturer of Desicate II suggests that the effectiveness can be enhanced by use of surfactants and ammonium sulfate. The objective of an experiment conducted in 1998 was to determine the effect of: various combinations of the new endothall formulation with surfactants and ammonium sulfate; single versus split applications of endothall; and the standard diquat.

The experiment was conducted at the Long Island Horticultural Research Laboratory in Riverhead, New York. 'Allegany' potatoes were planted on April 29, 1998 and standard production practices were employed except for nitrogen rate. The nitrogen rate at planting was 100 lb/A and the sidedress rate was 120 lb/A, providing a total of 220 lb N/A.

Vine desiccation treatments were applied with a hand-held boom, $C0_2$ pressurized sprayer applying 50 gal/A at 38 psi. Treatments evaluated were: endothall at 1.0 ai lb/A applied on 26 August, 1998 alone, or in combination with 1pt/A LI 700 surfactant and 5 lb/A of ammonium sulfate or 1 pt of LI 700 and 2 pt/A Quest; endothall at 0.5 lbs ai/A on 26 August, 1998 in combination with 1 pt/A of LI 700 and 5 lb/A ammonium sulfate followed by the same materials or diquat at 0.25 lb ai/A plus 1 pt/A Latron AG 98 on 4 September, 1998; a split application of diquat at 0.25 lb ai/A plus 1 pt/A Latron AG 98 applied on 26 August and 4 September, 1998. The experiment was designed as a complete randomized block with four replications. Plots were two-34 inch rows by 20'. Desiccation ratings on leaves and stem are based on a scale of 0 to 10. The 0 rating is equivalent to no desiccation, 10 indicates 100% desiccation. Ratings were collected on 26 August; 4, 9, 18 September. A twenty-five tuber sample was collected from each plot on 16 October. Specific gravity and vascular discoloration data were collected on 21 October. Tubers were cut approximately 1/4 inch from stem attachment and vascular discoloration was classified as: none, slight, moderate or severe.

Two days after application vine desiccation ratings from all chemical treatments were significantly different from those of the unsprayed control. The 1.0 lb/A endothall treatment without ammonium sulfate and the 0.5 lb/A endothall treatments had the lowest desiccation ratings of the chemical treatments. Very little stem desiccation was noted at the first evaluation. Nine days after the first application, all chemical treatments had ratings of 9 or higher on leaves and 5 or higher on stems and were significantly different from the control. Fifteen days after the first application there was no significant differences between the chemical treatments in stem desiccation but all were significantly higher than the unsprayed plots. The most complete stem desiccation was in plots receiving the split applications of diquat or endothall at 0.5 lb/A with the surfactant and ammonium sulfate; and the one application of endothall at 1.0 lb/A with surfactant and ammonium sulfate.

No differences in specific gravity and vascular discoloration between treatments were noted.

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Table 1. The effect of seven vine desiccation treatments of leaf and stem desiccation of 'Allegany' potatoes. Riverhead, N Y 1998.

					Leaves				Stems			
Chemical	Rate/A	Additives	Rate/A	Date	8/28	9/4	9/9	9/18	8/28	9/4	9/9	9/18
endothall	1.0 lb	LI 700 Am Sulfate	1 pt 5 lbs	8/26	9.3	9.8	10.0	10.0	1.0	6.8	8.3	10.0
endothall	0.5 lb	LI 700 Am Sulfate	1 pt 5 lbs	8/26,9/4	6.8	9.3	10.0	10.0	0.8	5.3	8.3	9.8
endothall	1.0 lb			8/26	6.8	9.8	10.0	10.0	0.8	5.5	7.3	9.8
endothall diquat	1.0 lb 0.25 lb	LI 700 Am Sulfate AG 98	1 pt 5 lbs 1 pt	8/26 9/4	7.5	9.3	10.0	10.0	1.0	5.0	7.8	10.0
diquat	0.25 lb	AG 98	1 pt	8/26,9/4	8.5	9.0	10.0	10.0	0.8	6.5	9.0	10.0
endothall	1.0 lb	Quest LI 700	2 pt 1 pt	8/26	8.8	9.5	10.0	10.0	1.0	6.0	7.3	9.5
Control					2.5	4.0	6.3	10.0	0.5	2.0	3.5	9.3
Fisher's protected LSD (0.05)					*2*	*ns*	*1.1*	*1.7*	*1*	*1.8*		*ns*

Leaf & stem desiccation ratings based on a scale of 1 to 10: 1 = no desiccation, 10 = 100% desiccation.
AG 98 = Latron AG 98 is a non-ionic surfactant.

Table 2. The effect of seven vine desiccation treatments on specific gravity and vascular discoloration of 'Allegany' potatoes. Riverhead, N Y 1998.

					Specific	% of tubers with vascular disc.			
Chemical	Rate/A	Additives	Rate/A	Date	Gravity	None	Slight	Mod.	Severe
endothall	1.0 lb	LI 700 Am Sulfate	1 pt 5 lbs	8/26	78	63	23	12	2
endothall	0.5 lb	LI 700 Am Sulfate	1 pt 5 lbs	8/26,9/4	78	72	21	7	0
endothall	1.0 lb			8/26	77	61	27	10	2
endothall diquat	1.0 lb 0.25 lb	LI 700 Am Sulfate AG 98	1 pt 5 lbs 1 pt	8/26 9/4	75	61	25	12	2
diquat	0.25 lb	AG 98	1 pt	8/26,9/4	77	63	24	8	5
endothall	1.0 lb	Quest LI 700	2 pt 1 pt	8/26	76	58	21	18	3
Control					79	64	21	15	0
Fisher's protected LSD (0.05)					*ns*	*ns*	*ns*	*ns*	*ns*

EVALUATING NEW HERBICIDES IN ENGLISH PEAS

R. R. Bellinder, M. Arsenovic, and A. J. Miller[1]

ABSTRACT

Flufenacet/metribuzin (0.42, 0.55 lb ai/A, PRE), halosulfuron (0.032, 0.064 lb PRE), sulfentrazone (0.093, 0.125 lb PRE or POST), cloransulam (0.016 lb POST, 0.032 lb PRE), flumetsulam (0.045 lb PRE), imazethapyr (0.032, 0.046 PRE; 0.032 lb POST), and imazamox (0.032 lb POST) were applied to English peas, variety "Bolero" in 3 on-farm trials in western New York in 1998. Additionally, selected treatments were used in a trial conducted at the H.C. Thompson Vegetable Research Farm in Freeville, NY. Pendimethalin (0.75 lb PRE) and bentazon + MCPB (0.5 + 0.5 lb POST) were used as the chemical standards for comparison. Pea planting dates ranged from 4/18 to 4/30 and PRE treatments were applied 0, 5, and 12 days after planting (DAP). POST treatments were applied between 20 and 26 DAP. Phytotoxicity evaluations were made 14 to 21 days after treatment (DAT), (PRE treatments), 5 to 14 DAT (POST treatments), and 40 and 60 DAP (all treatments). Whole plant biomass (dry wt) was collected in three of the four trials between 66 and 70 DAP. Less than 10% early injury was observed with sulfentrazone (0.093, 0.125 PRE); imazethapyr (0.032 POST), and imazamox (0.032 POST). Injury increased (>10<20%) with flufenacet/metribuzin (both rates), flumetsulam, imazethapyr (both rates PRE), sulfentrazone (0.125 POST), and pendimethalin. At 14-21 DAT, injury greater than 20% occurred with halosulfuron at both rates (23%), sulfentrazone (0.125 POST--32%), and cloransulam (0.016 POST--95%; 0.032 PRE--61%). By 60 DAP, only flumetsulam, cloransulam (PRE & POST) caused injury greater than 20%. When herbicides were applied preemergence to peas 12 DAP, injury tended to be greater than when applied 0 and 5 DAP. Whole plant biomass data was variable with few statistically significant differences. Significant yield reductions occurred with cloransulam, both PRE and POST and flumetsulam (one of three trials). Higher rates of flufenacet/metribuzin, halosulfuron, and sulfentrazone (0.125 POST) tended to depress yields, but not significantly. Due to early season precipitation and abnormally cold temperatures in early June, pendimethalin (PRE) injured peas and yields in the on-farm trials were often lower than those of the other herbicides.

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MANAGING RYE COVER CROPS FOR REDUCED TILLAGE PUMPKINS

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ABSTRACT

Due to the lack of registered herbicides in conventionally-grown pumpkins, controlling weeds is challenging. Interest in no-tillage (NT) or reduced tillage pumpkin production has increased in recent years and questions have arisen concerning the best way to handle the rye residues before planting pumpkins. To address this question, four strategies: NT straw-removed; discing; NT standing rye; and strip-till (6 in. band) were compared to conventional tillage (CT) in 1997 and 1998. Each strategy was used with and without ethalfluralin (1.33 lb ai/A PRE). All plot preparations occurred between 5/5 and 6/22 in both years. Glyphosate (1.0 lb ai/A) was applied to CT treatments on 5/5-8, the rye was mowed 5/12 and was plowed down 5/13-5/22. It was applied to the remaining treatments on 5/14-5/20. In 1997, straw-removed plots were mowed (4 in. height) and straw was removed, and disced and strip-till treatments were established 7 days before planting, on 6/16. In 1998, NT straw-removed, disced, and strip-till treatments were mowed on 5/26 and straw was removed on 5/27. Disced and strip-till treatments were established on the day of planting, 6/22. Paraquat (0.5 lb ai/A) was applied to the entire trial after planting in both years. Following emergence counts, plants were thinned to an in-row spacing of 2.5 ft. Weed counts were taken in early July in both years and paraquat was applied subsequently as a directed spray to all plots in 1997. In 1998, in herbicide treatments where soil disturbance occurred, a single in-row handweeding was coupled with between-row paraquat applications. Pumpkin emergence in standing rye was significantly lower than all other treatments (16 vs 45 plants) in 1997. Emergence was not affected by rye management strategy in 1998. Hairy galinsoga (*Galinsoga ciliata*) and redroot pigweed (*Amaranthus retroflexus*) were the predominant weed species in both years, constituting 31 and 69% of the population, respectively, in 1997. This proportion changed with site and in 1998, these weed populations were 12 and 88%, with hairy galinsoga numbers being 2.7 times greater (avg. 37 vs 99/0.5m^2) than in 1997. Weed control in both years was variable. Ethalfluralin reduced but did not eliminate redroot pigweed and had no affect on hairy galinsoga. Thus, only slight differences occurred between herbicide and non-herbicide treatments. Soil disturbance had a greater impact on weed numbers but was not consistent between years. In 1997, weed numbers were higher with strip tillage, and lower with NT standing rye than all other treatments, including CT. Weed numbers in 1998 tended to increase with amount of tillage, with NT standing rye < strip-till = NT straw-removed < discing < CT. Although there was a trend toward increased yields with the use of ethalfluralin in 1997, compared to CT + ethalfluralin, yields differed significantly only in the case of NT straw-removed and strip-till, both without ethalfluralin. In 1998, slightly greater numerical differences occurred in the paired treatments. Without ethalfluralin, NT straw-removed, discing, and NT standing rye all yielded less than CT + ethalfluralin but were equivalent to CT alone. Yields with CT + ethalfluralin were highest in both years and weed suppression by the rye residues, with the exception of when left undisturbed, was variable between years.

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THE USE OF BRUSH HOE AND S TINE CULTIVATORS IN HERB PRODUCTION

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Abstract

Weed control options in herb production are extremely limited. Hand weeding and mechanical cultivation are the primary means of controlling weeds. New innovative cultivation equipment has shown promise in large seeded vegetables and some transplanted crops. The objective of experiments conducted in 1998 was to determine if some innovative equipment would be useful in the production of herbs.

Following some preliminary work in 1997, two experiments were conducted at the Long Island Horticultural Research Laboratory in Riverhead, New York in 1998. The equipment evaluated was a Rabe Werk S tine cultivator, a Bartschi-FOBRO AG brush hoe and standard sweep type cultivator. Single and multiple cultivation treatments were included in the complete randomized block design experiments. Treatments were replicated four times. Plot size was one-4 row bed (68") by 40 feet. Yield and weed weight data were collected from a 4-foot section of two center rows of each plot. Weed ratings were taken for weed control between and within rows. Crop plants, dill (*Anethum graveolens* 'Bouquet') and basil (*Ocimum basilicum* 'Large Leaf'), were planted with Planet Jr. seeders set at #29.

The first use of the equipment was to take place on 17 July 1998 when the crops were easily "rowed" and few weeds were emerged. Unfortunately only the S tine equipment was used prior to a rain that prevented the use of the other equipment. On 21 July 1998 when both crops had first true leaves, all the equipment was used including the S tine cultivator. On 30 July 1998 when dill was one inch tall and basil was 2 inches tall, the third use of S tine and the second use of the brush hoe and the standard cultivator took place. The standard cultivator plots were hand-weeded four times. An unweeded, not cultivated treatment was included in both experiments. The primary weeds in the experiments were purslane (*Portulaca oleracea* L.) and lambsquarters (*Chenopodium album* L.).

The impact of weed control on yield of both crops is clearly visible in Tables 1 and 2. The most effective treatment was the combination of standard cultivation plus hand weeding. The no cultivation control produced the lowest yields. The amount of purslane within rows in the unweeded control was relatively light compared to the "new" cultivation equipment, indicating the weeds between rows surpressed weeds within rows. The data indicate that hand weeding is needed with these crops regardless on the type of equipment is used. The S tine cultivator however provides some challenges to use in small seeded crops since early use improves control and the emerging crop plants are vulnerable to the tines close to the rows.

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Table 1. The effect of Brush hoe, S tine and sweep type cultivating treatments on weed control and dill yield. Riverhead, N Y 1998.

Cultivation Treatments	Yield (lb/plot)	Weed Ratings on 7/30		Purslane (lb/plot)	
		Within row	Between row	Within row	Between row
No Cultivation Control	0.7	1.0	1.8	0.9	1.5
Brush Hoe, 7/21	2.0	0.0	9.3	1.8	0.5
Brush Hoe, 7/21,7/30	3.0	0.0	9.0	0.9	0.6
Rabe Werk, 7/17, 7/21	2.7	0.0	7.0	1.7	0.6
Rabe Werk, 7/17, 7/21, 7/30	2.5	0.5	6.8	0.8	0.6
Cultivation, 7/21, 7/30 + weeding	4.2	6.0	7.0	0.0	0.0
Fisher's Protected LSD (0.05)	*1.4*	*1.5*	*1.3*	*0.7*	*0.7*

Table 2. The effect of Brush hoe, S tine and sweep type cultivating treatments on weed control and basil yield. Riverhead, N Y 1998.

Cultivation Treatments	Yield (lb/plot)	Weed Ratings on 7/30		Purslane (lb/plot)	
		Within row	Between row	Within row	Between row
No Cultivation Control	1.3	0.3	0.5	0.6	1.1
Brush Hoe, 7/21	2.7	0.0	8.5	1.8	0.2
Brush Hoe, 7/21,7/30	2.8	0.3	7.8	1.4	0.1
Rabe Werk, 7/17, 7/21	3.3	2.8	6.8	1.1	0.3
Rabe Werk, 7/17, 7/21, 7/30	2.9	0.0	6.8	1.4	0.3
Cultivation, 7/21, 7/30 + weeding	5.9	7.3	8.5	0.0	0.0
Fisher's Protected LSD (0.05)	*1.4*	*1.2*	*3.8*	*0.7*	*0.5*

Weed ratings are based on a scale of 0 to 10; 0 = no control, 10 = 100% control.
Plot size for yield is 2 center rows (14.5 in. apart) by 4 ft.
Within row plot size is 2 center rows (3.5 in) by 4 ft and between row plot size is 11 in. by 4 ft.

FLUROXYPYR EFFICACY AND PHYTOTOXICITY IN SPINACH

B. A. Majek and A. O. Ayeni[1]

ABSTRACT

Fluroxypyr is a new postemergence broadleaf weed herbicide with registration anticipated soon in corn and small grains. Many winter annual broadleaf weeds are susceptible or moderately susceptible to fluroxypyr, including common chickweed (Stellaria media (L.) Vill.), henbit (Lamium amplexicaule L.), catchweed bedstraw (Galium aparine L.) and shepherd's purse (Capsella bursa-pastoris (L.) Medik.). Common lambsquarters (Chenopodium album L.) is not susceptible to fluroxypyr. The use rate of fluroxypyr is expected to range between 0.06 and 0.19 lb ae/a. Postemergence applications to spring and fall seeded spinach indicated that safety to the crop was marginal. Little or no injury was observed when 0.06 lb ae/a was applied to spinach with five to seven true leaves in the spring. Higher rates resulted in slight to moderate typical growth regulator herbicide injury symptoms. The highest rate evaluated, 0.38 lb ae/a, reduced the yield of spring spinach. Slight to moderate injury was observed at all rates applied to fall seeded spinach sprayed at the two to three leaf stage of growth. Symptoms were similar to those observed on the larger spring seeded crop treated at higher rates. Additional research is needed to determine the lowest rates of fluroxypyr that are effective for the control of the winter annual weeds in spinach, and the factors that influence crop injury, including the results of late fall or early winter applications to dormant spinach.

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COMMON WEED MANAGEMENT PROBLEMS FACING NEW ENGLAND VEGETABLE AND SMALL FRUIT GROWERS

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ABSTRACT

New England vegetable and small fruit growers face many weed control challenges not all that dissimilar to other Northeastern production areas. The most common of these are described below. In some cases, lack of weed control is related to education problems which have been created by problems in Extension staffing and mailing practices. Others are attributable to problems in the registration process which include Industry concerns as well as regulatory issues.

Most of the vegetable acreage in New England is planted to sweet corn (Zea mays L.). The most common herbicide used in this crop is a formulated mix of atrazine and metolachlor. The New England Vegetable Management Guide recommends a maximum of 1 lb a.i/acre of atrazine. When growers reduce the rate of the prepack to lower the rate of atrazine applied, the rate of metolachlor is also reduced and the result is, most commonly, unacceptable levels of Fall panicum (Panicum dichotomiflorum). A second problem in sweet corn involves proper application and activation of herbicides under Spring-applied row covers. Incorporation of herbicides, which would eliminate much of the problem, is not practiced by many growers due to problems with performance with discing equipment in the area's glacial soils.

Adequate control of quackgrass (Elytrigia repens) is also a common problem. Fortunately, adequate control of this weed can be achieved with a Fall application of glyphosate. Education and convincing growers to spend money to apply herbicides in the absence of a crop remains a problem.

Many fruiting vegetables in New England are planted on strips of plastic mulch. Control of weeds both in the planting holes and between the strips is a common problem. Education issues combined with a lack of effective registered herbicides are problems which persist.

The most common problem weeds in strawberry (Frageria spp.) are yellow wood sorrel (Oxalis sp.) and field pansy (Viola tricolor). Section 18 exemptions have been received in several New England states over the past 3 years. Grower unwillingness to participate in use surveys have resulted in reductions in the number of Section 18's granted over the past year.

STRAWBERRY TOLERANCE TO METOLACHLOR

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Abstract

Strawberries have suddenly become *de rigueur* for dinning in the mid-Atlantic area, particularly for a 2-month period in the spring. Strawberry demand has caused an increase in newly-planted acreage, and stimulated the adaptation of technology for annual plantings on plastic mulch for early production. However, DCPA herbicide, which was used for over 30 years on newly-planted strawberries and after renovation, was discontinued in 1995. An alternative herbicide to replace DCPA is needed. Currently, napropamide herbicide may be used at planting and in dormancy, but not after renovation. Four varieties of strawberries (*Fragaria* x *ananassa* Duch.) Earliglow, Allstar, Jewel, and Honeoye were planted on April 14, 1998 in a Norfolk loamy sand, 0.6% OM, pH 6.3. Preemergence S-metolachlor was applied broadcast over newly-planted strawberries on April 15, 1998, at 1.2 and 2.4 lb ai/A and repeated at 60 days after the first application. A standard treatment of napropamide 1.0 lb ai/A at planting plus terbacil 0.075 lb ai/A postemergence 60 days after planting was non-injurious and provided a weed-free control for the S-metolachlor treatments. A hand-weeded control was also maintained in the study. All plots were cultivated and hoed and irrigated as needed. The plot size was 24 by 20 feet with one row of each variety with two additional rows on the plot edges to provide a buffer. The treated area was 20 by 20 feet applied to the four varieties. The row width was 4 feet with plants spaced 24 inches in the row. The treatments were replicated four times. Fertilizer was top-dressed over the row on May 6 and June 9 in the amounts as follows: N=43 and 34, P=none, K=55 and 44, B=0.25 and 0.20, S=13 and 11, and Mg=7 and 5 lb/A, respectively. On July 28, additional fertilizer was top-dressed over the row as follows: N=34, P=28, K=26, B=0.2, S=9, and Mg=5 lb/A. At 30 days after planting and treatment, S-metolachlor at 1.2 and 2.4 lb ai/A caused 25 and 40 percent growth reduction of strawberries, respectively. However, the repeated S-metolachlor application at 60 days after the first application did not affect strawberry growth nor cause foliar symptoms. At 120 days after planting, the two applications of S-metolachlor at 1.2 lb ai/A did not affect plant size. However, two applications of 2.4 lb ai/A S-metolachlor caused a greater than 50% growth reduction of strawberries. The S-metolachlor rate tested, 1.2 lb ai/A, was 26% greater than the labeled rate for the soil type; therefore, strawberry injury risk would be less at the labeled rates. Strawberry daughter-plant production was unaffected by S-metolachlor, 1.2 lb ai/A or by napropamide 1.0 lb ai/A+ terbacil 0.075 lb ai/A; however, S-metolachlor, 2.4 lb ai/A reduced daughter plant production. Strawberry variety tolerance differences were not observed. Other studies have shown metolachlor 1.0 lb ai/A at planting and 2.0 lb ai/A broadcast after strawberry establishment were non-injurious. Preliminary data suggest yield is not affected by metolachlor. Metolachlor or S-metolachlor appear to be efficacious for newly-planted strawberries; however, reduced rates and multiple applications during the year of establishment appear to reduce potential injury risk.

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EVALUATION OF RAKING AS A MEANS OF MECHANICAL CONTROL OF DODDER (Cuscuta gronovii L.) IN CRANBERRY

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ABSTRACT

Preemergence control of dodder in cranberry plantings with chemical herbicides is often incomplete. There are no post-emergence treatments currently available to cranberry growers. Mature dodder often completely covers the cranberry canopy. Traditionally, growers have raked dodder vines from the crop in order to reduce dodder seed production and increase yield. However, no empirical evidence showing the efficacy of this method in achieving these goals currently exists. A field experiment was conducted in 1997 and 1998 to determine whether physical removal by raking was an effective way to control dodder, reduce dodder seed production, and increase cranberry yield. The experiment was arranged as a randomized complete block with three replications. Dodder was raked at flowering, seed set, or a combination of the two timings. Dodder seed was collected, weighed, and counted. Cranberry fruit was harvested, and the presence of fruit rot, the number of sound and infected fruit, and the anthocyanin content of sound fruit determined. Analysis of variance showed that, while raking reduced the area covered by dodder vines, it did not significantly reduce dodder seed production or affect anthocyanin production by the fruit. However, it did reduce cranberry fruit yield.

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CRANBERRY TOLERANCE TO SEVERAL HERBICIDES

B. A. Majek and A. O. Ayeni[1]

ABSTRACT

Extensive greenhouse screening identified several new herbicides with potentially low phytotoxicity when applied to established cranberries. These herbicides were evaluated in cranberry bogs at Rutgers Blueberry/Cranberry Research and Extension Center in 1998. Herbicides were applied to dormant cranberries in late April, less than one week after winter flood was removed, or in the middle of June when the cranberries were in bloom and growing rapidly. Treatments applied in late April to dormant cranberries included isoxaflutole at 0.14 lb ai/a, clomazone at 0.5 lb ai/a, asulam at 4.0 lb ai/a, quinclorac at 0.5 lb ai/a, rimsulfuron at 0.03 lb ai/a, and thiflusulfuron at 0.06 lb ai/a. June treatments to actively growing cranberries in bloom included asulam at 4.0 lb ai/a, chlorimuron at 0.02 lb ai/a, nicosulfuron at 0.06 lb ai/a, quinclorac at 0.5 lb ai/a, rimsulfuron at 0.03 lb ai/a, tribenuron-methyl at 0.004 lb ai/a, and thiflusulfuron at 0.06 lb ai/a. Isoxaflutole caused very slight marginal whitening of new foliage for a few weeks after application. Less than ten percent of the new foliage was affected and recovery was rapid. Asulam caused the cranberries to exhibit a slight to moderate subtle change in the color of the foliage that appeared in the new growth and lasted for about two months after application. The foliage treated with asulam appeared tanner in color than untreated cranberries. The color difference was clearly noticeable next to untreated cranberries, but would be more difficult to recognize if the entire bog were treated. No other symptoms were observed, and the cranberries recovered by late summer. Chlorimuron caused cranberry foliage to exhibit slight temporary chlorosis, which appeared about a week after the June application. Recovery was rapid and complete. All the herbicides screened on cranberries were also evaluated for the control of three serious weeds in cranberries, roundleaf greenbriar (Smilax rotundifolia L.), prickly dewberry (Rubus flagellaris L.), and yellow loosestrife (Lysimachia terrestris (L.) BSP.). Only one herbicide, asulam, was effective for the control one weed, yellow loosestrife, when applied in early July.

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GRASS CONTROL ALTERNATIVES FOR WILD BLUEBERRIES

D.E. Yarborough and T.M. Hess [1]

ABSTRACT

Annual grasses such as, witch grass *(Panicum capillare)* and bentgrass *(Agrostis capillaris)* have been increasing in Maine's wild blueberry *Vaccinium angustifolium* fields. Growers rely on a single preemergence application of hexazinone for most of their weed suppression, and have been using lower rates to prevent this herbicide from leaching into the groundwater. This treatment has not been adequate to control these grasses, because they germinate later in the season and there is not enough herbicide residue to control them. In order to asses the effect of rate and timing of preemergence and postemergence herbicide applications, a trial was established in the summer of 1996 in a wild blueberry field in Wesley, ME that was inundated with bentgrass to the point where the field was unharvestable. Treatments applied pre-emergence, on May 30, 1997 were hexazinone as Velpar DF® at 1.3 or 2.7 lb/a, terbacil as Sinbar 80 WP® at 2 or 3 lb/a, or simazine as Princip 4L® at 2 or 4 qt/ac. Postemergence treatments applied on July 23, 1997 consisted of hexazinone as Pronone MG® at 10 or 20 lb/a, sethoxydim as Poast® at 1.5 or 2.5 pt/a or clethodim as Prism® at 13 or 17 oz/ac, and an untreated control. Each treatment was replicated 4 times in a randomized complete block design and evaluated for grass and broadleaf weed, and blueberry cover in September1997 and June 1998. Plots treated preemergence had better control of broadleaf weeds, while those treated postemergence had better control of grass weeds. Weed pressure actually increased with the preemergence treatment at the high rate vs. the low rate because of suppression of broadleaf weeds and release of grasses. Results indicate that clethodim was as effective as sethoxydim at controlling grasses and that the granular hexazinone had better grass control at the higher rate but less control at the lower rate than the preemergence treatments. Increasing the rate of preemergence herbicides were not effective in suppressing the grasses, but they may be controlled with properly timed post-emergence applications of sethoxydim or clethodim.

In a second study, established at Blueberry Hill Farm Experiment Station in Jonesboro, ME, pendimethalin as Prowl® was applied on May 28,1998 at 0, 1.4, 2.8, 5.6 or 11.2 pints product/a with 4 replications. Pendimethalin provided good control of witch grass and some broadleaf weeds, including blue toadflax (*Linaria canadensis)*. This herbicide is not registered for wild blueberries, but would provide an alternate method to control these grasses preemergence, and should be perused for registration.

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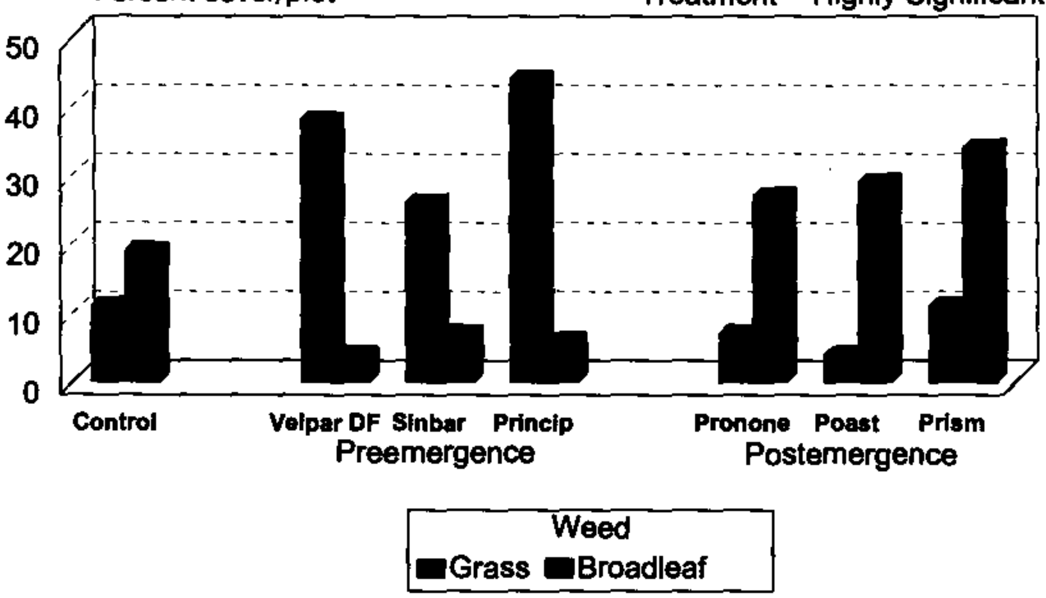
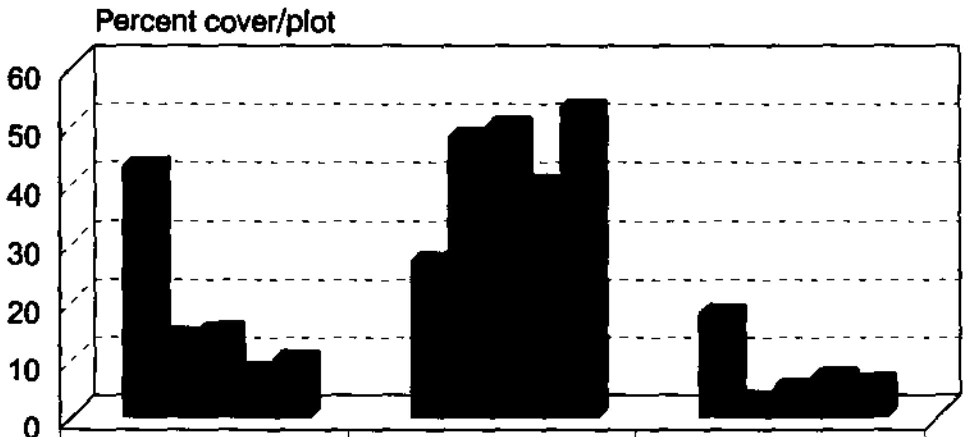
Effect of treatment and timing on grass and broadleaf weeds



Effect of pendimethalin on wild blueberry and weeds



	Broadleaf	Wild blueberry	Grass
Control	43	27	18
1.4 pts/a	14	48	3
2.8 pts/a	15	50	5
5.6 pts/a	8	40	7
11.2 pts/a	10	53	6

All rates are in product/acre

Non-native vascular flora at Ellis Island, New York

Richard Stalter[1]

ABSTRACT

Ellis Island, the site of the United States' largest immigration center, is a 27.5 acre (11.1 hectare) island in New York Harbor. Six collecting trips were made to the study area in the fall, 1997, and in the spring and summer, 1998. More than 500 specimens form the basis for this study. The vascular flora of Ellis Island consists of 181 species within 130 genera and 57 families. One hundred two or 56.3% of the flora are not native to this region. Twenty-three families are comprised exclusively of non-native species while 19 families contain all native species. Families containing large numbers of non-native species are the Poaceae (15 species), Rosaceae (9 species), and Asteraceae (8 species). The largest families in the flora are the Asteraceae (26 species), Poaceae (20 species), and Rosaceae (16 species). Species of foreign origin are a major component of the natural vegetation.

INTRODUCTION

Ellis Island was a 3.0 acre island in New York harbor, when owned by Samuel Ellis, a New Jersey farmer, in 1785. Ellis's descendants sold it to the United States government in 1808 for $10, 000. During the Civil War, the government used the site as a munitions depot. The United States government created an immigration facility consisting of a main building and boiler house at a cost of $280,000, which opened on January 1, 1892, with the arrival of three passenger ships with a total of 700 passengers[2]. The original main building was destroyed by fire on June 15, 1897, and a new immigration station, of French Renaissance design, costing $1,500,000, was opened on December 17, 1900.

The island was enlarged to its present size by landfill, possibly from ballast from ships coming into the harbor, and later with soil very likely from the construction of the New York City Subway system (Farrugio 1997 pers. communication). In 1902, a hospital was opened on adjoining Island Number 2, and an additional landfill created Island Number 3 in 1906.

Between 1892 and 1954, twelve million immigrants passed through Ellis Island. Ellis Island was declared a National Monument in 1965, and is currently administered by the National Park Service. In 1996, 1,567,366 people visited the site; 11,258,014 people have visited this site since it was opened as a tourist attraction in 1990.

The objectives of the present study are to identify the vascular flora at Ellis Island, and to compare the native and non-native plants at Ellis Island with those found at Little Beach Island, NJ; Assateague Island, VA; Fisherman Island, VA; The Outer Banks of North Carolina; and Fort Sumter, SC.

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METHODS

Six collecting trips were made to the study area beginning September 18, 1997, and terminating on July 17, 1998. Objectives for each trip included the collection of voucher specimens and accumulation of information on abundance and apparent habitat preference for each species.

More than 500 specimens form the basis for this study. Taxonomically problematic specimens were sent to various experts for annotation; experts consulted include Ihsan Al-Shehbaz (Brassicaceae), Steven Clemants (Amaranthaceae, Chenopodiaceae and Juncaceae), Eric Lamont (Asteraceae), Robert Meyer (Poaceae), Richard Mitchell (Polygonaceae), James Montgomery (ferns), Charles Sheviak (Orchidaceae), and Gordon Tucker (Cyperaceae). A complete set of voucher specimens has been deposited at the National Park Service herbarium at Ellis Island, NY, and partial duplicate sets have been deposited in the herbaria of the experts above. Accession numbers will be assigned by the National Park Service to the primary set of specimens at the herbarium at Ellis Island, and will be available upon request from the National Park Service. Nomenclature primarily follows that of Gleason and Cronquist[1], and Kartesz[3].

RESULTS AND DISCUSSION

The vascular flora of Ellis Island consists of 181 species within 130 genera and 51 families. The major families include the Asteraceae (26 species) and Poaceae (20 species); over 25% of the species comprising the total flora are contained in these two families. One hundred two species, 56.3% of the flora, are not native to the region. A summary and a comparison of the frequencies of native and non-native vascular plants at Ellis Island with that found in four additional coastal sites is listed in Table 1. The percentage of non-native plants at the four coastal sites is low, ranging from 20.2% at uninhabited Little Beach Island, New Jersey[4], to 27.9% at a major tourist attraction, Fort Sumter National Monument, South Carolina[6]. Most of the non-native plants at Fisherman Island, Virginia grow along the disturbed roadside right-of-way[8].

The number of non-native species at Ellis Island is significantly higher than those reported for New York State (Table 2). Not surprisingly, the number of non-native plant families at Ellis Island, 40.3%, is higher than the number of native plant families, 37% (Table 3). The percentage of non-native plant families at Ellis Island may be higher than the percentage of non-native plant families at similar coastal and/or disturbed sites with more than 150 taxa in New York State.

Human influence at the Ellis Island Visitor's Center, the three acre north side of the island, is considerable; over 1,500,000 people visit the site each year. Access to the remaining 24 acres is restricted to park personnel and scientific researchers. Nonetheless, the seldom visited southern portion of the island has a large number of non-native plants. Some such as Petunia violacea and Yucca filamentosa have probably persisted here for many years. Other species including the highly invasive Ailanthus altissima, Alliaria petiolata and Artemisia vulgaris are unwelcome new immigrants to Ellis Island.

Most of the non-native plants are of European origin. One woody exception, Ailanthus altissima, is a native plant of Asia. Most non-native plants at Ellis Island today were well established in the United States before Ellis Island opened as an immigration facility in 1892[9]. Did immigrants contribute to the present-day non-native flora of Ellis

Island? Probably! However, the precise contribution of the Ellis Island immigrants to the present non-native flora at the island never can be determined accurately.

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Table 1. Frequencies of plant species as native versus non-native species from Ellis Island, NY; Little Beach Island, NJ[4]; Fisherman Island, VA[5]; Outer Banks, NC[7] and Fort Sumter, SC[6].

	Ellis I., NY	Little B. I., NJ	Fisherman I., VA	Outer Banks, NC	Ft. Sumter SC
Native Species	79	63	173	586	49
Non-Native Species	102	16	49	155	19
% Non-Native Species	56.3	20.2	22.1	20.9	27.9
Total Species	181	79	222	741	68

Table 2. Numbers and frequencies of plant species grouped as native versus non-native species from Ellis Island, NY and New York State.

	Ellis Island, NY	New York State
Native Species	79 (43.7%)	2,435 (67.1%)
Non-native Species	102 (56.3%)	1,192 (32.9%)
Total Species	181 (100%)	3,627 (100%)

Table 3. Frequency and number of plant families as native versus non-native families at Ellis Island, NY.

Family Status	Frequency and Number of Families
Native	19 (33.3%)
Non-native	23 (40.3%)
Both	15 (26.3%)

AN ERADICATION PROGRAM FOR GIANT HOGWEED IN NORTHWESTERN PENNSYLVANIA

Bryan W. Brendley[1], Carley R. Kalac[1], Gary L. Clement[2], Will Mountain[3] and Mike Zeller[3]

ABSTRACT

Giant hogweed (*Heracleum mantegazzianum*) is an invasive, non-native, herbaceous weed commonly reaching heights of three meters or more. Giant hogweed is a designated Federal noxious weed due to the fact that varied glycosides within its sap can lead to severe chemical burns on human skin. In 1995 it was noted that Erie County and environs had hogweed in approximately ten locations. A survey program coupled with intensive media promotions led to the identification of over seventy confirmed sites in Northwestern Pennsylvania. In the spring of 1998, the USDA (APHIS, PPQ) organized a Giant Hogweed eradication team. This team has systematically tracked down hogweed sites and treated stands of hogweed in two stages: first, flowers were removed mechanically before seed set, and second, a mixture of Thinvert RTU 93% + Garlon 4 5% + Transline 2% was applied to vegetative foliage. We believe that after numerous rechecks and reapplications, all ninety-two of the known hogweed sites have been brought under control. Stands will continue to be checked and retreated early in spring of 1999 for germination of seeds already in the soil.

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COMPARISON OF SPRING-APPLIED HERBICIDES FOR CONTROL OF GIANT KNOTWEED DURING ROADSIDE RENOVATION

A. E. Gover, J. M. Johnson and L. J. Kuhns[1/]

ABSTRACT

As part of an ongoing research project funded by the Pennsylvania Department of Transportation, two field trials were established to evaluate the efficacy of various herbicide combinations for the control of giant knotweed (*Polygonum sachalinense* F.Schmidt ex Maxim.). The herbicide combinations were evaluated as part of a renovation scheme calling for spring primary treatments, with follow-up treatments and seeding of a grass mixture occurring in late summer. Giant knotweed, and Japanese knotweed (*Polygonum cuspidatum* Sieb. & Zucc.), are herbaceous, perennial species, growing in dense colonies reaching heights of 3 m. When growing close to the road, these species cause reduction of sight distance and damage the road surface by growing up through the asphalt at the road edge. Applications made in the spring before plants reach their full height are less difficult.

The trials were established on April 30, 1998, in Doylestown, PA, on a north-facing fill slope; and May 14, 1998, near Leechburg, PA, on a fill shoulder above the east bank of the Kiskiminetas River. The herbicides included in the ten combinations were clopyralid, dicamba, glyphosate, imazameth, imazapyr, and picloram (Table 1). Treatments at the Doylestown site were applied using a CO_2-powered, hand-held boom sprayer, equipped with Spraying Systems XR 8002 VS flat fan tips. The mixtures were applied at 187 l/ha at 172 kPa to 3.7 by 6.1 m plots arranged in a randomized complete block design with three replications. Giant knotweed ranged from just emerging to 1 m in height, with an average canopy height of 0.5 to 0.7 m. Treatments at the Leechburg site were applied using a CO_2-powered, hand-held sprayer with a two-nozzle swivel valve equipped with a Spraying Systems 1504 flat fan and a #5500 Adjustable ConeJet with an X-6 tip. The plots were 14 m long, while the depth varied from 3 to 5 m. The experimental design was a randomized complete block with two replications. At treatment, the knotweed was 1.5 to 2 m high. At Doylestown, visual ratings of percent necrosis were taken May 28, and percent control and cover were taken August 31. At Leechburg, ratings were taken July 2 for percent control, and September 1 for percent control and cover. Immediately following the second rating, both sites were oversprayed with glyphosate plus picloram, at 3.3 plus 0.28 kg/ha. A mixture of hard fescue (*Festuca brevipila* Tracey), creeping red fescue (*Festuca rubra* ssp *rubra* L.), and annual ryegrass (*Lolium multiflorum* Lam.) was overseeded at Doylestown on September 14, and Leechburg on September 15.

There was no significant difference between any of the treatments at the Leechburg site. Percent control of giant knotweed on September 1 ranged from 70 to 100 percent, and percent ground cover ranged from 1 to 19 percent. At the Doylestown site, the glyphosate-based treatments provided 59 to 76 percent control on August 31, while the treatments with growth-hormone type herbicides as the primary ingredient provided 86 to 99 percent control. Ground cover ratings ranged from 32 to 80 percent. Common pokeweed (*Phytolacca americana* L.) was the predominant species colonizing the study area. Other species included giant foxtail (*Setaria faberi* Herrm.), American burnweed (*Erechtites hieraciifolia* (L.) Raf. ex DC.), and crownvetch (*Coronilla varia* L).

The true effectiveness of these treatments in a renovation program cannot be determined until the final data is collected in 1999. However, the positive results provided by several of the treatments at both sites, at two different growth stages, indicates that roadside managers may have several options in the management of giant knotweed.

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Table 1. Summary of first season response of giant knotweed to herbicide treatments applied April 30, 1998, in Doylestown, PA, and May 14, 1998, in Leechburg, PA. All ratings were taken visually. Values for the Doylestown site are a mean of three replications. Values for the Leechburg site are a mean of two replications.

Product	Application Rate	Doylestown May 28 Necrosis	Doylestown Aug 31 Control	Doylestown Aug 31 Cover	Leechburg Jul 2 Control	Leechburg Sep 1 Control	Leechburg Sep 1 Cover
	(kg/ha)	(			%		)
dicamba clopyralid	3.4 0.21	97	88	80	73	82	19
dicamba clopyralid	2.2 0.32	96	95	80	83	96	5
picloram clopyralid	1.1 0.21	98	99	32	73	92	7
glyphosate clopyralid	3.4 0.21	52	75	56	55	72	7
glyphosate picloram	3.4 0.56	88	76	60	93	98	6
glyphosate imazapyr	3.4 0.28	62	60	73	70	96	3
glyphosate imazameth	3.4 0.21	63	59	70	45	70	18
clopyralid imazapyr	0.32 0.28	59	86	48	60	96	4
picloram imazapyr	0.56 0.28	83	88	65	97	99	1
dicamba picloram	1.7 0.56	86	86	55	100	100	2
C.V.		29	18	21	26	13	113
Significance Level (p)		0.13	0.05	0.005	0.19	0.21	0.39
LSD (p=0.05)		n.s.	25	22	n.s.	n.s.	n.s.

BIOLOGY AND MANAGEMENT OF MICROSTEGIUM, A RELATIVELY UNRESEARCHED TURF WEED

Jeffrey F. Derr[1]

ABSTRACT

Microstegium vimineum [(Trin.) A. Camus], referred to as Japanese stilt grass and as annual jewgrass, is a summer annual. It has become an important weed in Virginia and other northeastern and southern states. It grows in disturbed areas, along streambanks, in forests, and other areas, and is shade tolerant. Experiments were conducted to determine the germination pattern for this weed, as well as control using selected preemergence and postemergence herbicides.

Microstegium seed was planted the last week of February, 1998 at a field site in Virginia Beach. It germinated the last week of March, slightly in advance of smooth crabgrass. On April 9, Microstegium was in the cotyledon to two-leaf stage, while smooth crabgrass was only in the cotyledon stage. Onset of colder weather the second week of April apparently caused the decline in stand observed on April 16. Microstegium plants began flowering in the second week of October in Virginia Beach.

A field site was treated with preemergence herbicides commonly used for crabgrass control in turf. Granular formulations of benefin, benefin plus trifluralin, and oxadiazon were used, while sprayable formulations of bensulide, dithiopyr, oryzalin, pendimethalin, prodiamine and siduron were evaluated. When Microstegium seed was planted 30 days after application, all preemergence herbicides evaluated controlled this weed over 80% based on shoot fresh weight reduction. Benefin at 3.0 lb ai/A, benefin plus trifluralin at 3.0 lb/A, dithiopyr emulsifiable concentrate at 0.5 lb/A, pendimethalin at 3.0 lb ai/A, and siduron at 10 lb/A did not provide acceptable control at 90 DAT. At that time, bensulide at 10.0 lb/A, oryzalin at 3.0 lb/A, oxadiazon at 3.0 lb/A, and prodiamine at 0.75 lb/A all reduced Microstegium shoot fresh weight by over 75%.

For postemergence control, Microstegium was grown in 4-inch pots containing pine bark. Plants were 4 inches tall with no tillers when treated. Based on shoot fresh weight reduction, fenoxaprop at 0.06 lb/A gave excellent control and MSMA at 2.0 lb/A provided approximately 75% control. Dithiopyr at 0.5 lb/A and quinclorac at 0.75 lb/A applied postemergence did not control Microstegium.

Microstegium appears to germinate slightly earlier than smooth crabgrass yet flowers later. Microstegium can be controlled preemergence using available crabgrass herbicides for turf. Postemergence control can be obtained using certain crabgrass herbicides.

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PREEMERGENCE CONTROL OF SMOOTH CRABGRASS IN 1998

T. L. Watschke and J. A. Borger[1]

ABSTRACT

A thirty treatment study was conducted at the Landscape Management Research Center at The Pennsylvania State University on a mature stand of predominately Midnight Kentucky bluegrass (Poa pratensis L.). The objective of the study was to compare experimental materials with commercial standards for the preemergence control of smooth crabgrass. Various treatments were applied on April 16 and 23 using a three-foot hand-held CO_2 powered boom sprayer with two 6504 flat fan nozzles calibrated to deliver 80 gpa at 30 psi. Granular treatments were applied using a shaker jar. Germination was first noticed in the study site on April 27, 1998. On May 16, 1998, those treatments that were not applied with fertilizer carrier, were fertilized with 0.5 lbs N/M from urea and 0.5 lbs N/M from IBDU which was subsequently irrigated with approximately 0.5 inches of water. The study area was maintained at 0.75 inches with a triplex reel mower with the clippings returned and irrigation was supplied when needed to prevent wilting. Control was rated on August 11, 1998. Of the 30 treatments in the study, 8 provided acceptable control (80% or greater). Two provided outstanding control (95%), dithiopyr 40 WP at 0.5 lbs ai/A, and the EC formulation applied at the same rate. Others providing acceptable control were bensulide 4EC at a rate of 7.3 oz/M, a bensulide split at 7.3 oz/M followed eight weeks later with 3.65 oz/M, dithiopyr 1.06 MEC, oxadiazon 2G, prodiamine 65WDG, and dithiopyr 40 WP at lower rates.

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MOSS CONTROL IN GOLF COURSE GREENS

R. B. Taylorson [1]

ABSTRACT

Three experiments were conducted at the Spring Valley Country Club in Sharon, MA on a velvet bentgrass (Agrostis canina) nursery maintained at 3/16 inches. The intensity of moss (Bryum argenteum) infestations was variable from plot to plot and within plots but was ubiquitously present. Plots were five feet wide by five feet long with a two foot untreated strip between plots. Soils were a sand mix. Spray treatments were applied with a backpack sprayer in 96 GPA and granulars by a Gandy drop spreader. Ratings of moss control were on a scale of 0-10 with 10 being complete control and 0 no control. Turf injury ratings were also on a 0-10 scale with 10 being perfect tolerance and 0 complete kill.

In experiment I, aqueous solutions of CuSO4, ZnSO4 and FeSO4 were applied at 2,4 and 8oz/M, (NH4)2SO4 at 19, 36 and 58 oz/M and Fe(NH4)2SO4 at 10 and 20 oz/M. All products were reagent grade. There were four applications at monthly intervals beginning on May 19. In addition, a single application of technical dichlorophen (2,2'-Dihydroxy-5,5'-Dichlorodiphenylmethane) at 7 oz/M prepared in 1% (v/v) NaOH applied once on June 17 was made. There were six replicates. Plots were rated bi-weekly and after 16 weeks only (NH4)2SO4 at the higher rates and dichlorophen gave acceptable (>7.0) levels of control. No significant injury was observed with any treatment.

In experiment II, the proprietary quaternary ammonium compounds Barquat, Bardac and Hyamine 1622 were applied 3X in 0.25, 0.5 and 1.0% solutions at monthly intervals beginning June 2. In addition, Demoss was applied in 3 and 4% solutions (v/v). There were four replications. The final observations (12 WAT) indicated only Hyamine at the highest rates gave acceptable control. However, all of the quaternary ammoniums produced obvious temporary injury at the high rate, particularly Bardac and Hyamine.

In experiment III, single applications of Dimension at 0.38 lb ai/A either alone or combined with Demoss at 3%, FeSO4 at 8 oz/M, or Fe (NH4)SO4 at 20 oz/M were applied on July 15. Also three granulars designated at S-8299, S-8301 and S-7204 were applied at 80 oz/M to prewetted turf. Dichlorophen at 3.5 oz/M dissolved in 1% NaOH was applied on July 28. On September 16, 8 WAT, only dichlorophen and S-7024 gave acceptable levels of control. The granulars produced a rapid but temporary blackening of the turf.

In all the experiments, achieving statistical significance among treatments was complicated by high within treatment variability. Mostly, this relates to variations in moss density and the resulting difficulty in rating control. These results however, do suggest several approaches to the moss control problem.

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SEEDHEAD SUPPRESSION OF ANNUAL BLUEGRASS ON A PUTTING GREEN

T. L. Watschke and J. A. Borger[1]

ABSTRACT

This study was conducted on a mixed stand of creeping bentgrass (Agrostis stolonifera) and Poa annua at the Penn State Blue Golf Course in State College, PA. The objective of the study was to evaluate selected growth regulators, with and without additional adjuvants, for the seedhead suppression of Poa annua. All of the treatments were applied on March 31, and, in some cases, April 7 and April 14, 1998 using a three-foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two 6504 nozzles at 30 psi. The turf was maintained using practices for irrigation, mowing, and fertilization that would be typical for a green. The green did not receive any aerification/topdressing prior to or during the study. Phytotoxicity ratings taken on April 27, 1998 revealed that those treatments that had follow-up applications of seaweed cocktail (2 WAT) caused significant injury when compared to untreated turf. Turf that received all other treatments was rated to be not different from untreated turf. When seedhead suppression was rated on May 5, 1998, several of the treatments caused good suppression (> 80%). Turf treated with follow-up applications of seaweed cocktail had the greatest seedhead suppression (93%), although phytotoxicity was unacceptable. Mefluidide Lite at 40 oz/A suppressed seedheads by 70%. By adding MacroSorb Foliar at 2 oz/M at the time of application followed by the same rate of MacroSorb Foliar one and two weeks later, seedhead suppression was increased to 82%. The addition of Surf-Side 37 at 2 oz/M at the time of Mefluidide Lite application followed by another 2 oz/M application of Surf-Side 37 two weeks later increased seedhead suppression to 88%. When the rate of Mefluidide Lite was reduced to 20 oz/A, additions of MacroSorb Foliar did not improve seedhead suppression to an acceptable level. When seedhead suppression was rated on May 15, 1998, Mefluidide Lite with Surf-Side 37 and Mefluidide Lite with seaweed cocktail were the only two treatments that suppressed seedheads by more than 80%. Mefluidide Lite alone at 40 oz/A suppressed seedheads by 37% by May 15, 1998. Clearly, the efficacy and longevity of seedhead suppression can be enhanced by adjuvants.

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MANAGEMENT OF SILVERY THREAD MOSS (*Bryum argenteum*)
IN BENTGRASS GREENS

F. H. Yelverton, J. Isgrigg, III, and J. Hinton[1]

ABSTRACT

Silvery thread moss problems in creeping bentgrass (*Agrostis palustris* Huds.) putting greens are becoming more of a problem in the US. There are over 9,500 species of mosses but the predominant species found in bentgrass greens is silvery thread moss. Optimum moss habitats have traditionally been thought to be moist, shady sites with high soil acidity. The presence of these lower plants in bentgrass greens remains somewhat of a mystery. However, moss invasion is usually worse in areas of the putting surface that tend to get scalped. Therefore, it is logical to think that a gradual trend to lower mowing heights may be playing a vital role in the increase of moss in bentgrass putting greens. Recent changes in fungicide use may also have contributed to more moss. The increase in moss populations has coincided with discontinued use of mercury-based fungicides. Trials were initiated at two golf courses in western NC with high moss populations in bentgrass greens. Treatments included experimental iron formulations (0-0-0-30% Fe, 4-0-0-18% Fe, 0-0-0-40% Fe, and 6-0-0-11% Fe), Ultra Dawn dishwashing soap (3.2% v/v solution), the mercury-based fungicide PMAS (30 ml/100 m^2), ammonium sulfate (1 kg product/100 m^2), and the same treatments applied in combination with 1.7 kg ai/ha of oxadiazon. PMAS applied 3 times at 1 wk intervals provided 91% control of silvery thread moss 3 wk after initial application (WAIT) but control dropped to 53% 8 WAIT. Ultra Dawn applied 3 times at 1 wk intervals provided 45% and 26% control 3 and 8 WAIT, respectively. The experimental Fe formulations provided varying levels of moss control. The 4-0-0-18% Fe formulation provided the most suppression. Two applications at 4 wk intervals provided 78% and 85% suppression 3 WAIT at two locations. Control 8 WAIT at each location was 26% and 94%, respectively. One application of 1.7 kg ai/ha of oxadiazon generally enhanced moss control. The addition of oxadiazon with the iron formulations enhanced control for all formulations to >74% control at one location and >55% control at the other location 8 WAIT. The addition of oxadiazon with 2 applications of 4-0-0-18% Fe provided 88% control of moss at both locations 8 WAIT. It appeared that enhanced control with this iron formulation was due in part to bentgrass growth stimulation with nitrogen.

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DIFFERENTIAL RESPONSE OF LARGE CRABGRASS AND GOOSEGRASS TO QUINCLORAC

Joseph Zawierucha [1] and Donald Penner [2]

ABSTRACT

Quinclorac herbicide from BASF is currently registered in the United States for use in rice (*Oryza sativa* L.) and is on registration tract for use in turfgrass. The spectrum of weed control with quinclorac includes annual grasses and several key broadleaf weeds. Quinclorac exhibits both preemergence and postemergence activity on susceptible weed species. Two major weedy grass species in both warm and cool season turfgrass include large crabgrass (*Digitaria sanguinalis* [L.] Scop.) and goosegrass (*Eleusine indica* [L.] Gaertn.). Previous studies have found that large crabgrass is very sensitive to quinclorac, while goosegrass has been found to be quite tolerant.

Past research has also demonstrated that quinclorac requires the use of an effective adjuvant to maximize foliar activity. Several greenhouse experiments were conducted to evaluate selected commercial and experimental adjuvants for their effectiveness and selectivity in turfgrass. Large crabgrass and goosegrass were used as indicator species for efficacy. Applications were made at the 1-2 tiller stage of the weeds. GR_{50} values were calculated to quantify and compare the efficacy of the adjuvants. For large crabgrass, GR_{50} values ranged from 46 to 98 g ha^{-1} depending on adjuvant. For goosegrass, no adjuvant was found to provide sufficient control to allow for a GR_{50} calculation within a commercial use rate range. Further studies were conducted with goosegrass to evaluate the effects of growth stage and the impact of both foliar and soil uptake of quinclorac on resultant control. Quinclorac was applied @ 1,2,4,8, and 16 kg ha^{-1} to goosegrass as a preemergence treatment, 1-2 leaf stage, 4-5 leaf stage, and 1-2 tiller stage with and without a vermiculite soil barrier. Results showed that across growth stages, the soil activity of quinclorac tended to increase control; however, commercial performance could not be achieved within the perspective labeled use rate at any growth stage.

Absorption, translocation, and metabolism studies using ^{14}C-quinclorac were also conducted with the two grass species. For these experiments, plants were maintained in vials containing Hoagland's solution and were continually aerated. Results from the absorption studies showed that after an eighty-hour exposure time, that both species had absorbed approximately equal amounts of applied ^{14}C- quinclorac (27% and 22%), respectively for large crabgrass and goosegrass. The translocation results showed that 95% of the absorbed ^{14}C-quinclorac remained in the treated leaf for large crabgrass after 80 hr. However, only 58% of the absorbed ^{14}C remained in the treated leaf of goosegrass. Nutrient vials did not contain any appreciable amounts of ^{14}C-quinclorac that may have been exudated by either species. Results of the metabolism studies showed that neither the susceptible species (crabgrass) nor the tolerant species (goosegrass) was able to metabolize the parent quinclorac herbicide. The data indicate that target site differences may contribute to selectivity.

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BOX-PLOTS: A SIMPLE TOOL FOR EVALUATING BIOLOGICAL PERFORMANCE DATA

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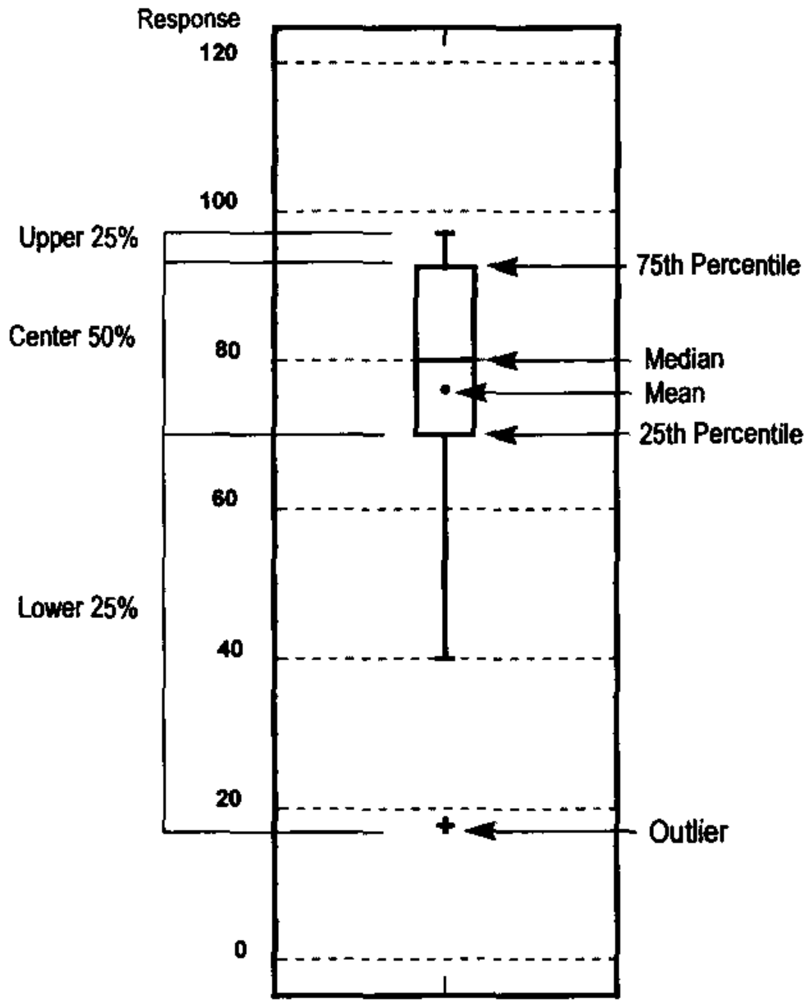
Box-plots are a statistical tool developed by Tukey for the graphical presentation of a data set. A single box-plot examines the distribution of the data in terms of location, symmetry, spread and outliers. Box-plots for each treatment in an experiment, plotted together on the same graph, allow the researcher to make comparisons of performance, consistency and practical significance of the treatments. Box-plots provide much of the same information as a means comparison test, with added information on consistency. They do not test statistical significance. Statistical analysis of data across trials requires great effort and manipulation of the data. Box-plots show the variability across replicates as well as across trials, allowing the researcher to make practical decisions based on similar information provided from complex analyses. A box-plot is a simple tool which delivers a lot of information. Enough information is provided to make practical decisions regarding treatments in performance trials with minimal time and effort in data analysis. Researchers with many trials, who can not afford the time for detailed analysis of each trial, find box-plots very beneficial.



SPRAY DRIFT TASK FORCE IMPACT ON THE APPLICATOR COMMUNITY

Dave Valcore[1]

ABSTRACT

The Spray Drift Task Force (SDTF) is a joint venture of 38 crop protectant manufactures (registrants) to develop spray drift deposition data for all major use patterns, formulations and active ingredients (crop protectants) that are applied outdoors. The SDTF has conducted over 400 field drift trials and over 4000 atomization trials under strict US Environmental Protection Agency (EPA) Good Laboratory Practices guidelines. The major use patterns covered were: airblast, ground row crop, aerial, and overhead chemigation.

A generic database was developed to study the major variables and the effects of tank-mix physical properties on spray drift. A result of this research has been a cooperative research agreement between EPA and the SDTF to develop a spray drift model (AgDrift®) and consideration of a national standard for categorizing spray quality by drop-size range. EPA review of the data and validation of the AgDrift model is nearly complete. Both the spray quality standard and the AgDrift model will be introduced in the near future. The expected label and regulatory impact will include topics such as: buffer zones, label upgrades and the addition of spray quality size range requirements.

Another outcome of the SDTF has been the creation of the National Coalition on Drift Minimization. This group brings together a large range of public and private stakeholders to facilitate applicator training, sort through regulation and labeling issues, and foster Best Management Principles and technologies.

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MAXIMIZING HERBICIDE PERFORMANCE WITH ADJUVANTS

Donald Penner[1]

ABSTRACT

Adjuvants can be defined as substances added to a pesticide formulation or to the spray tank to enhance the activity of the active ingredient or to improve the application characteristics. Adjuvants can be classified according to use as modifiers, utility, and activator adjuvants. The latter include adjuvants that enhance herbicide absorption. Adjuvants can also be classified by charge as anionic, cationic, zwitterions, and nonionic. Most of the adjuvants used to increase herbicide absorption are nonionic. Adjuvants may also be classified into chemical classes. Examples are alkyl phenolethoxylates, linear alcohol ethoxylates, alkyl glycosides, phosphate esters, cationic tallowamines, organosilicones, crop oil concentrates, esterfied seed oils, and saponified seed oils.

A frequently asked question is which adjuvant do I need with my postemergence herbicide to maximize performance. The preponderance of evidence supports the concept that a particular adjuvant has to be matched to specific herbicides, weed species, and environmental conditions. Thus, no one adjuvant can be expected to maximize the performance of all postemergence herbicides on all weeds under all conditions.

Cations such as Ca, Mg, and Fe in hard water can reduce efficacy of anionic herbicides. Adjuvants such as diammonium sulfate are often referred to as water conditioners. The ammonium from diammonium sulfate or ammonium nitrate out compete the cations in the hard water to form salts of the weakly anionic herbicides. The ammonium salts appear to be absorbed in preference to the Ca, Mg, or Fe salts of the herbicides. Numerous adjuvants now contain several components, one or more of which may be considered a water conditioner.

The shift from preemergence to more postemergence herbicides has contributed to the enhanced interest in adjuvant efficacy, specification, and discovery.

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SITE-SPECIFIC WEED MANAGEMENT: TRANSCENDING SPATIAL SCALES.

David A. Mortensen[1]

ABSTRACT

Precision agriculture has been popularized as an enabling suite of technologies applied to improve integrated crop management at the sub-whole field spatial scale. This limited view however excludes many possible applications of these enabling technologies and existing knowledge about cropping systems. The increased availability of geospatial and information technologies in crop management will enable agriculturalists to address management questions from a wide range of spatial scales. At the sub-whole field scale, spatial information about landscape form and function coupled with soil, crop performance and pest distribution data can be used to guide efficient use of field visitation time and precision in order to most accurately characterize a field. Such spatial information may then be used to help better assess the performance of an integrated crop production approach, guide deployment of integrated weed management practices and to redistribute and regulate herbicide applications. At a larger spatial scale, we may soon find farmers cooperatively sharing data from on-farm experimentation that when coupled with landscape and climate data can be used to define inference spaces or agronomic decision domains for particular crop husbandry or resource management practices. The potential to create locally derived recommendations from locally collected data is a fascinating prospect. Such a vision of the future may see individual farm fields become the experimental unit with applied researchers and extension specialists engaged in a facilitation role. In such a role, agronomic meaning would be extracted from multi-site, agronomically similar experimental environments. The potential for studying cropping systems performance through a landscape perspective will be reviewed from the sub-whole field to watershed spatial scales with a particular emphasis placed on the potential contributions of such an approach to integrated weed management.

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SPIDER SPRAY TRAC MULTI-BOOM SMALL PLOT SPRAYER

P. J. Stachowski and R. R. Hahn[1]

ABSTRACT

The objective was to design and fabricate a multi-boom, small plot sprayer for weed science research in field crops that could be operated by one person. The sprayer needed to apply herbicide treatments preplant incorporated, preemergence, or postemergence in a variety of row crops, forage mixes, and small grains with minimum wheel traffic in 10 by 25 ft plots and with alleys between treatments of 5 ft or less. In addition, the unit had to be easily transportable and had to accommodate variable row spacings along with variable crop and weed heights. Use of compressed air as the propellant was required to obtain very high precision of treatment application. Multiple spray tanks and booms were desired to prevent cross-contamination between treatments. Finally, boom design had to allow for the addition of shields to minimize cross-contamination in adjacent plots under sub-optimal spraying conditions.

A sprayer was developed in cooperation with, and fabricated by R&D Sprayers, Inc., Opelousas, LA using a Spider Spray Trac from West Texas Lee Company, Idalou, TX. The Spider Spray Trac is a hydraulically driven, four-wheel drive, articulated unit with a water cooled 25 horsepower diesel engine. A wheel-mounted digital speedometer indicates ground speed. Wheel spacing from 72 to 120 inches on center of tires is infinitely adjustable from the driver's seat via hydraulic rams. Ground clearance of the unit is manually adjustable from 15 to 40 inches. Twenty spray booms with six diaphragm check valve nozzle bodies at 20-inch spacings are mounted to the front of the unit. Spray boom height is adjusted by manually setting the position of mount and fine-tuned with a hydraulic cylinder. Air is supplied by an engine driven Emglo model K56A air compressor. Compressed air travels through a regulator to manifolds and finally to 20, 4 L stainless steel tanks (one for each boom) that contain the spray mixtures. A panel of 20 labeled, on/off, ball valves controls the individual spray booms. Each tank has a third fitting which allows air agitation of the spray mixture and for depressurizing the tanks. In addition, two, 3 gal tanks are plumbed to wash and rinse hoses and spray booms.

After treatments are mixed, each boom is primed. The diaphragm check valve nozzle bodies allow for nearly instantaneous correct pressure and flow from tips as well as drip-free stops. The sprayer is driven through columns of plots, usually eight, without stopping before individual plots. This allows the unit to move at a uniform speed through each entire plot. A mounted clipboard provides a list of treatments to be applied for each column of plots. As the appropriate boom approaches the designated plot, it is turned on and the boom from the previous treatment turned off. Front mounting of booms facilitates changing from one treatment to another within a 5 ft alley. Spray tanks are allowed to depressurize and agitate while the unit is positioned for the next column of plots.

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LOW VOLUME AERIAL AND GROUND APPLICATION USING THE THINVERT APPLICATION SYSTEM

R. R. Johnson[1]

ABSTRACT

Invert or water-in-oil emulsions have been used as carriers for the application of herbicides since the mid 1950's. The thick, mayonnaise-like droplets have been used to apply phenoxy herbicides to utility rights-of-way, roadsides, and drainage ditchbanks. Limitations of the thick invert systems were that special pumps, large diameter hoses, and special mixing equipment were required to handle the materials, spray droplets were very large, spray volumes were high, and applications were often non-uniform across the treated area.

In 1989 we began development of the THINVERT® Application System, which uses a thin invert emulsion as a carrier, and a series of unique spray nozzles, which will produce small, uniform droplets with a narrow droplet size spectrum, and which may be mixed using conventional pumps, hoses, and application equipment. Since that beginning, experimental, demonstration, and commercial applications using the system have been made to highway, railroad, and utility rights-of-way, industrial sites, croplands, forests, and aquatic marginal sites in the United States and Canada. The application system uses a spray fluid containing an outer oil phase of non-phytotoxic oil, emulsifiers, and surfactants surrounding an inner water phase. Herbicides applied with the system may be in the oil phase or the water phase, depending on their solubilities. The unique spray nozzles contain from five to 144 or more small triangular spray orifices, which may vary in depth from .003" to .015". Each orifice produces a straight stream of spray fluid which breaks up into small uniform spray droplets. These droplets will vary in size depending on the size of the orifice, the spray pressure, and the forward speed of the spray platform. Spray droplets from a given orifice size are unusually uniform in diameter. Since the droplets are small and uniform, with few fine particles, spray volumes may be reduced while adequate spray coverage is maintained. In addition, since the spray droplets have an outer surface of oil, droplet shrinkage of aerial sprays from evaporation is minimized. Typical volume for ground applied sprays is three to five gal/A, while aerial applications are made at spray volumes of one to four gal/A. Commercial ground applications have been made to roadsides in PA, DE, and NY, to utility rights-of-way and turf in most states in the Northeast, and for noxious weed control on railroad rights-of-way in the western US. Aerial applications have been made for forest site preparation in ME, VA, and AL, weed control in winter wheat in DE, Melaleuca control in FL, and for insect control in sugarcane in LA.

Current and future development programs with the application system include: trials with fixed wing aircraft, compatibility trials with additional pesticides at reduced spray volumes, and trials with more economical formulation or application technology.

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COMPARISON OF HERBICIDE-TOLERANT SOYBEAN WEED MANAGEMENT PROGRAMS

M.J. VanGessel and Q. Johnson[1]

ABSTRACT

There have been a limited number of studies examining the differences between the various herbicide-tolerant soybean varieties and their respective herbicide programs. Most studies have compared a single genetically-modified variety with a standard herbicide program. Studies were conducted from 1996 to 1998 to determine differences among standard, Roundup Ready, Liberty Link, and STS weed control programs. Standard soybean varieties were treated with Storm (aciflurofen and bentazon) plus Pinnacle (thifensulfuron) plus graminicide at first or third trifoliolate stage, and Cobra (lactofen) plus graminicide was applied at the fifth trifoliolate stage. Genetically modified soybean varieties were treated with the respective POST herbicides sprayed at first, third, or fifth trifoliolate. All herbicide programs included a soil-applied treatment of Canopy (chlorimuron and metribuzin) plus Dual (metolachlor) followed by the respective POST herbicide applied at the third trifoliolate stage.

In 1996, weed control was excellent for all treatments except Liberty (glufosinate) applied at the first trifoliolate stage. In 1997 at both locations, herbicide applications at the fifth trifoliolate stage resulted in poorer weed control than the other applications. In 1998 at Georgetown DE, ivyleaf morningglory [Ipomoea hederacea (L.) Jacq.] control was better with Liberty Link and STS soybean weed management programs than Roundup Ready and conventional herbicide programs. Common ragweed (Ambrosia artemisiifolia L.) control was better with Liberty Link, STS, or Roundup Ready weed management programs compared to a conventional herbicide program. Fall panicum (Panicum dichotomiflorum L.) control was >85% for all treatments except Roundup Ready or STS herbicide programs applied at first trifoliolate stage or conventional herbicide program at third trifoliolate stage. In 1998 at Knowles Corner DE, morningglory (Ipomoea spp.) control was >85% when a soil-applied herbicide was used regardless of the POST herbicides, STS herbicide program applied at first trifoliolate, or Liberty applied at fifth trifoliolate.

In order to compare yields, the soil-applied followed by an application at the third trifoliate stage was considered the base-line yield (100) for the respective variety. Yield of the other three treatments for the given variety were determined based on the base-line yield. In 1996, yields were lower when herbicide application was delayed to the fifth trifoliolate stage compared to earlier applications. In 1997 at Georgetown DE, yields were best when plots received a soil-applied herbicide application followed by a POST herbicide. In 1997 at Felton DE, yields were best with the treatments receiving a Roundup-Ready herbicide program

Herbicide-resistant soybeans have a place in the Mid-Atlantic region. Noting the weeds needed to be controlled is most critical in herbicide selection.

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BAY FOE 5043 & METRIBUZIN SOIL-APPLIED: EARLY-SEASON WEED CONTROL IN POSTEMERGENCE PROGRAMS, INCLUDING TRANSGENIC SOYBEANS

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ABSTRACT

Postemergence weed control can be difficult due to various constrictions on the window of application opportunities. Unfavorable weather patterns, intense weed pressure, multiple weed flushes, multilayered weed canopies, rapidly closing crop canopies and other factors can all inhibit the ability to deliver an adequate postemergence application at the proper timing. These barriers do not account for insensitive weed species or stages, nor required retreatments. BAY FOE 5043 & metribuzin (1:1.5 ratio) is a new soil-applied herbicide being offered by Bayer Corporation to provide activity on many grasses and broadleaf weeds in soybeans. Field tests were conducted throughout the United States in 1997 and 1998 to evaluate and demonstrate the utility of BAY FOE 5043 & metribuzin soil-applied used in conjunction with a planned postemergence herbicide program. At 0.38 to 0.72 kg ai/ha, it provided weed control for the first four to six weeks after application. This early season weed control reduced the severity of weed competition with the crop, and allowed for a wider application window prior to the planned postemergence herbicide application. It also assisted in maintaining remaining weeds or newly emerging weeds at a more uniform height and canopy density, which allows for more complete spray coverage and potentially improved control with the postemergence herbicides.

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[1]Bayer Corporation, State College, PA, Kansas City, MO, Kansas City, MO, and Atlanta, GA, respectively.

1998 ISOXAFLUTOLE PERFORMANCE IN NORTHEASTERN U.S. UNIVERSITY FIELD TRIALS

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ABSTRACT

Isoxaflutole (Balance) is a newly registered preemergence corn herbicide from Rhone-Poulence Ag Company that is effective for controlling some grassy and many broadleaf weed species. Balance has not yet received registration in the northeast, but research continues to optimize use rates for varying soil type. In 1998, four northeastern universities conducted similar trials that examined varying rates of Balance in combination with other herbicides. The Pennsylvania State University (PA), University of Massachusetts (MA), University of Connecticut (CT) and University of Maine (ME) completed these protocols. Upon analysis it was determined that the textural class of the soils where the studies were conducted were either silty clay or silt loam. Balance, Harness and Atrazine were applied in combinations at varying rates to small field plots and treatments were replicated three times. Weed species common to all locations included, common lambsquarters, giant or yellow foxtail, common ragweed and pigweed. Weed control and crop injury were assessed throughout the season by a visual rating system.

Crop injury was evident only at the ME location. Early season ratings at this site indicated 13 to 64 % corn injury. This rating reflected percent bleaching and although the bleaching was severe, the crop recovered and end of season silage yields showed no significant difference. Crop injury at this site was probably due to herbicide movement to the crop seed zone caused by 3 inches of rainfall received three days after herbicide application. End of season ratings at the PA, ME and MA locations indicated excellent (90-100 %) control of lambsquarters, pigweed and ragweed regardless of Balance rate. Balance + Harness combinations offered good to excellent (85-100 %) foxtail control at the ME and MA locations. Foxtail control in PA was poor to good (77-90 %); this lack of control was probably due to the excessive rainfall (> 3 inches in one week) immediately following herbicide application and loss of residual activity. Foxtail control improved as the rate of Harness was increased from 0.6 to 0.9 lb ai/A for all locations.

Balance herbicide is an excellent product for controlling troublesome weeds such as common lambsquarters. Research needs to contiue to examine the injury potential of Balance on certain soils or under different environmental conditions before this product is widely used in the northeast. However, Balance should be a good compliment for managing weeds in the northeast.

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TECHNICAL OVERVIEW OF ZA1296, A NEW CORN HERBICIDE FROM ZENECA

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ABSTRACT

ZA1296 (2-[4-methylsulfonyl-2-nitrobenzoyl]-1,3-cyclohexanedione) is an experimental triketone (2-benzoylcyclohexane-1,3-diones) herbicide being developed for the preemergence and postemergence corn (*Zea mays* L.) herbicide market. ZA1296 provides control of all the major broadleaf weeds, while providing the producer with application flexibility, excellent crop tolerance, and residual weed control.

The proposed common name for ZA1296 is mesotrione. The molecular target for ZA1296 is the enzyme p-hydroxyphenylpyruvate dioxygenase (HPPD). This enzyme is involved in the pathway that converts the amino acid tyrosine to plastiquinone. ZA1296 is structurally similar to the substrate p-hydroxyphenylpyruvate and acts by competitive inhibition, the result is the blockage of carotenoid synthesis. Corn is naturally tolerant to ZA1296 because of its ability to rapidly metabolize ZA1296.

Weeds are expected to have low potential to develop resistance to ZA1296 because there are few HPPD inhibitors on the market and mutagenized *Arabidopsis* populations have yielded no mutants resistant to ZA1296. Similar *Arabidopsis* populations have shown frequent mutations for ALS resistance.

ZA1296 has a favorable environmental profile. ZA1296 is not a carcinogen and has no detectable residues at harvest. ZA1296 presents negligible risks to mammals, birds and aquatic species. The adsorption coefficient of ZA1296 varies over a wide range (Kd 0.1-5.0 L Kg^{-1}) according to the pH of the soil, with adsorption decreasing as soil pH increases.

ZA1296 applied preemergence will primarily be used in combination with acetochlor to provide broad spectrum control of all of the major broadleaf and grass weeds in corn. Postemergence ZA1296 provides broad spectrum control of all the major broadleaved weeds and some grasses as well as providing residual control of later-germinating weeds.

[1] ZENECA Ag Products, Dover, DE.
[2] ZENECA Ag Products, Richmond, CA.

ZA1296: A VERSATILE PREEMERGENCE AND POSTEMERGENCE BROADLEAF HERBICIDE FOR CORN.

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ABSTRACT

ZA1296 (2-[4-methylsulfonyl-2-nitrobenzoyl]-1,3-cyclohexanedione) is a new herbicide being developed by Zeneca Ag Products for preemergence and postemergence broadleaf weed control in corn (Zea mays L.).

For broad spectrum preemergence weed control, a premix of ZA1296 and acetochlor is under development. This premix has been evaluated for several years in conventional, reduced tillage, and no-till fields with excellent results. ZA1296/acetochlor provides control of many important weeds, including velvetleaf (Abutilon theophrasti Medicus), pigweeds and waterhemps (Amaranthus sp.), common lambsquarters (Chenopodium album L.), common ragweed (Ambrosia artemisiifolia L.), kochia [Kochia scoparia (L.)Schrad.], common sunflower (Helianthus annuus L.), jimsonweed (Datura stramonium L.), nightshade (Solanum sp.), smartweed (Polygonum sp.), giant foxtail (Setaria faberi Herrm.), green foxtail [Setaria viridis (L.)Beauv.], yellow foxtail [Setaria glauca (L.)Beauv.], barnyardgrass [Echinochloa crus-galli (L.)Beauv.], large crabgrass [Digitaria sanguinalis (L.)Scop.], fall panicum (Panicum dichotomiflorum Michx.), and several other species.

ZA1296 has also been extensively tested as a postemergence herbicide. For optimum postemergence herbicide performance, the addition of crop oil concentrate, alone or with UAN fertilizer, is recommended. ZA1296 controls velvetleaf, common cocklebur (Xanthium strumarium L.), pigweeds, waterhemps, common lambsquarters, common ragweed, jimsonweed, nightshade, common sunflower, smartweed, and several other common broadleaf weeds. Broad spectrum grass and broadleaf weed control can be attained by preemergence applications of acetochlor or other grass herbicides followed by ZA1296 applied postemergence, or by a postemergence tank-mix of ZA1296 with a postemergence grass herbicide.

Corn exhibits excellent tolerance to both preemergence and postemergence applications of ZA1296.

[1]Zeneca Ag Products, Richmond, CA. *Pub98-19*

WEED CONTROL PROGRAMS IN CORN WITH SPIRIT™ HERBICIDE

R. E. Schmenk, D. B. Vitolo, M.G. Schnappinger, B. S. Manley, C. A. S. Pearson and S. L. Pyle [1]

ABSTRACT

Spirit 57 WG is a pre-packaged mixture containing a 3:1 ratio of primisulfuron to prosulfuron. Developed by Novartis Crop Protection, Inc. as a postemergence weed control option in corn, Spirit provides central corn belt producers residual activity and the opportunity to rotate to soybeans the following growing season. Trials were conducted throughout Midwestern and Northeastern states in 1998 to define application timing, tank mix and adjuvant partners, as well as programs including soil applied herbicides for optimal crop safety and efficacy. An early or mid postemergence application of Spirit at 1.0 oz/A provided very good to excellent velvetleaf (*Abutilon theophrasti* Medic.), common lambsquarters (*Chenopodium Album* (L.)), pigweed (*Amaranthus* spp.) and ivyleaf morningglory (*Ipomoea hederacea* (L.) Jacq.) control. Crop safety was very good at either postemergence timing. A soil application of *s*-metolachlor or *s*-metolachlor + atrazine followed by Spirit provided excellent broad spectrum control of grass and broadleaf weeds across several environments.

1/ R&D Scientist, R&D Station Manager, R&D Senior Scientist, R&D Scientist, R&D Regional Manager and Technical Manager, respectively, Novartis Crop Protection, Inc., Canonsburg, PA 15317

WEED CONTROL IN CORN WITH PRE-PACKAGE MIXTURES OF FLUMETSULAM + *S*-METOLACHLOR AND ATRAZINE

M.G. Schnappinger, D. B. Vitolo, R. E. Schmenk, B. S. Manley, and C. A. S. Pearson [1]

ABSTRACT

Flumetsulam has been very effective in controlling triazine resistant lambsquarters (*Chenopodium album* L.), velvetleaf (*Abutilon theophrasti* Medik.), and pigweed species (*Amaranthus* spp.) in corn (*Zea mays* L.). Application rates of flumetsulam used in the past (0.044-0.063 lbs ai/A) have given excellent weed control but resulted in occasional crop phytotoxicity. In 1997 and 1998, trials were conducted where the flumetsulam application rates varied from 0.039-0.045 lbs. ai/A. To provide for broadspectrum grass and weed control, it was necessary to apply adequate rates of *s*-metolachlor and atrazine. This was accomplished by either tank mixing flumetsulam + *s*-metolachlor + benoxacor 7.6L with *s*-metolachlor + atrazine + benoxacor (5.5L), flumetsulam 75WG with *s*-metolachlor + atrazine + benoxacor (6.0L), or by applying a prepackage mix of flumetsulam + *s*-metolachlor + atrazine + benoxacor (4.59L). In trials conducted throughout the Northeastern states, the various tank mix and prepackage strategies provided very good to excellent control of the triazine resistant broadleaf weeds as well as other weeds present. Crop selectivity was excellent in all cases.

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NEW MANAGEMENT SYSTEMS FOR CONTROL OF TRIAZINE-RESISTANT COMMON LAMBSQUARTERS (*Chenopodium album* L.) IN NO-TILL CORN

H. Menbere* and R. L. Ritter

ABSTRACT

Triazine-resistant (TR) common lambsquarters continues to plague farmers throughout the mid-Atlantic region. It is estimated that this plant can now be located in every county in Maryland. Its spread is due to several factors; use of pre-emergence herbicide programs that do not control this pest, lack of control of weed escapes, little to no cultivation, spreading of manure contaminated with weed seed and custom combining that allows for seed dispersal in contaminated equipment as well.

Preemergence control of TR common lambsquarters is limited to a number of products. Pendimethalin can provide good control, but has been inconsistent in Maryland and has limitations in no-tillage systems due to injury when corn is planted shallow. Acetochlor may provide early-season suppression, but usually a post-emergence application is required later in the growing season. Flumetsulam and flumetsulam combinations have provided best preemergence control, but under cool, wet growing conditions, corn injury may occur.

Excellent postemergence control can be obtained with dicamba, dicamba + atrazine, or combinations of dicamba with either primisulfuron or primisulfuron + prosulfuron.

Over the past 2 years, two new herbicides have been examined for their preemergence activity against TR common lambsquarters. Isoxaflutole and rimsulfuron + thifensulfuron have provided good season-long weed control when used at recommended rates. Yet, under cool, wet conditions, corn injury may occur.

New post-emergence corn herbicides under study that have provided good control include BAS 662, carfentrazone and combinations of pyridate with dicamba or primisulfuron + prosulfuron.

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Activity of Rimsulfuron Combinations in No-Tillage Corn

W. Phillips II, S. Glenn, and P. A. Kalnay[1]

Experiments were conducted in 1998 to evaluate triazine-resistant lambsquarters (*Chenopodium album* L.) (CHEAL) and giant foxtail (*Setaria faberii* L.) (SETFA) control in no-till corn with preemergence (PRE) and postemergence (POST) applications of Basis. Basis was applied PRE or POST at 0.015 or 0.023 lbs ai/A alone or in combination with 2.7 lbs/A Bicep II Magnum. All plots were also treated with 0.5 lbs/A paraquat at planting (May 9). The experiment was conducted at Washington County, Maryland and was arranged as a RCB with 3 replications. Basis applied PRE alone at 0.015 and 0.023 lbs/A produced 82 and 87% CHEAL control and 78 and 87% SETFA control 3 weeks after treatment (WAT). Control of SETFA declined 6 WAT with 0.015 lbs/A Basis (53%) compared to 3 WAT. Greater SETFA control was observed with 0.023 lbs/A Basis compared to 0.015 lbs/A. Tank mixtures of Basis with Bicep II Magnum increased CHEAL and SETFA control 6 WAT compared to Basis applied PRE alone. CHEAL and SETFA control ranged from 90 to 92% and 85 to 90%, respectively. There was no difference in control of these weeds between tank mixtures with 0.015 and 0.023 lbs/A Basis. Postemergence applications of 0.015 and 0.023 lbs/A Basis controlled CHEAL (83 and 95%) and SETFA (65 and 92%) 6 WAT. Tank mixtures of 0.015 lbs/A Basis with Bicep II Magnum applied POST improved CHEAL (93%) and SETFA (85%) control compared to 0.015 lbs/A Basis applied alone. Postemergence applications Basis and Basis combinations controlled CHEAL and SETFA as well or better than PRE applications .

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WEED CONTROL IN FIELD GROWN AND CONTAINERIZED ORNAMENTALS WITH THIAZOPYR.

Mark Czarnota[1], Dr. Robert McNiel[2], Jacob Barney[3], Dr. Leslie A. Weston[4]

ABSTRACT

The experimental preemergent herbicide thiazopyr (Rohm and Haas) was evaluated for weed control in six field grown ground covers and five container grown ornamentals. In addition, tolerance of these ornamentals to thiazopyr was evaluated.

In May of 1997 at the University of Kentucky's Horticultural Research Farm, six plant species: including daylily (*Hemerocallis* species), hosta (*Hosta plantaginea (Lam.) Aschers.)*, ajuga (*Ajuga repens L.*), English ivy (*Hedera helix L.*), common periwinkle (*Vinca minor L.*), and wintercreeper (*Euonymus fortunei*) were transplanted into a cultivated test plot. Treatments were subsequently applied on May 21, 1997. At the exact same location in 1998, this test was repeated with treatments applied May 15. In June of 1998, plugs of: Japanese barberry (*Berberis thunbergii atropurpurea* 'Crimson Pygmy'), purple coneflower (*Echinacea purpurpea*), creeping juniper (*Juniperus horizontalis* 'Blue Chip'), bush cinquefoil (*Potentilla fruticosa*), and black-eyed susan (*Rudbeckia hirta pulcherrima*) were potted into a bark based media, and allowed to mature for approximately three weeks. On July 20, a 1/4 of a teaspoon of a weed seed mix containing barnyardgrass (*Echinochloa crus-galli* (L.) Beauv.) , large crabgrass (*Digitaria sanguinalis* (L.) Scop.), ivyleaf morningglory (*Ipomoea hederacea* (L.) Jacq.), and portulaca (*Portulaca oleracea* L.) was applied to each pot. Treatments were then applied immediately after seeding. In all tests, sprayables were applied with a CO_2 pressurized backpack sprayer using 8004 spray tips calibrated to deliver 26 GPA. In the field studies, granulars were applied with a drop spreader calibrated to deliver the required amount of active ingredient. In the containerized studies, granulars were applied using a shaker jar containing the appropriate amount of product. All test were designed as a randomized complete block with either 3 or 4 replicates.

All treatments were rated visually both for weed control, and injury to the ground covers. Weed control ratings were on a 0-100 scale (0=no control, 100=complete control). Injury ratings were taken on a 0-100 scale (0=no injury, 100=completely dead plant). All data was subjected to analysis of variance, and means were separated using Duncan's New Multiple Range test with α=0.05.

The most common weeds found in the field studies included: yellow nutsedge *(Cyperus esculentus* L.), ladysthumb (*Polygonum persicaria*), ivyleaf and pitted morningglories (*Ipomoea hederace* and *lacunosa*), and hairy galinsoga (*Galinsoga ciliata*). During 1997 and 1998, the 0.5 lb ai/A (pounds active ingredient/ Acre) rate of thiazopyr (all formulations) provided poor control of yellow nutsedge (48.3% over both years) at 8 weeks after treatment (WAT). However, control of ladysthumb, morningglories, and galinsoga at 8 WAT was acceptable (all ~80%) . The formulations containing 1.0 lb ai/A of thiazopyr provided good control of yellow nutsedge in 1997 (83.3% overall), and minimal control in 1998 (57.0% overall). However, control of ladysthumb, morningglories, and galinsoga was consistently good with no ratings below 78.3% during both years. In 1997 and 1998, injury to English ivy, periwinkle, and winter creeper was minimal if noticeable at all, in most treatments. The granular combinations that contained oxyflurofen resulting in the most injury.

In the container study, all formulations of thiazopyr provided good to excellent control of ivyleaf morningglory, large crabgrass and barnyardgrass at 4 WAT. The control of portulaca at 4 WAT was good to excellent with the 1.0 lb ai/A of thiazopyr (all ratings >75%), but ratings with the 0.5 lb ai/A did not exceed 76.3% at 4 WAT. Injury was not evident with the juniper, barberry, or potentilla, but was evident in the herbaceous black-eyed susan and purple coneflower at 1 and 2 WAT. However by 4 WAT, injury had dissipated to near 0 by 4 WAT.

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EVALUATION OF FABRIC DISCS, MULCHES, AND HERBICIDES FOR PREVENTING WEEDS IN CONTAINERS

Todd L. Mervosh and Timothy M. Abbey[1]

ABSTRACT

A study was initiated in 1998 at the Valley Laboratory (Windsor, CT) and a commercial nursery (Madison, CT) to compare the efficacy of fabric discs, mulches, and herbicide treatments for management of weeds in nursery containers. Plants, potted in 2-gallon (9"-diameter) containers in early May 1998, consist of evergreen azalea (*Rhododendron* 'Girard's Pleasant White') and winterberry holly (*Ilex verticillata* 'Winter Red') at Windsor, and deciduous azalea (*R. poukhanense* 'Compacta') and winterberry holly (*I. verticillata* 'Red Sprite') at Madison. Plots consisting of three containers of each species were arranged in a randomized complete block design with four replicates per treatment. Immediately prior to applying treatments on May 13, mixtures of sand with seed of common groundsel (*Senecio vulgaris* L.) at Windsor and with birdseye pearlwort (*Sagina procumbens* L.) at Madison were applied to the potting mix surface in all containers. The following treatments were applied: untreated check, sprayable herbicide [isoxaben (0.75 lb/A) + pendimethalin (3 lb/A)], granular herbicide [Ornamental Herbicide 2 (2 lb/A oxyfluorfen + 1 lb/A pendimethalin)], fabric disc with copper-coated underside (Geodisc), pine bark mulch (3/4" layer), cocoa hull mulch (3/4" layer), and corn gluten meal (650 lb/A, 3.0 g per container). Granular herbicide was applied with a calibrated auger-fed drop spreader, and herbicide spray was applied in 25 gal/A of water with a CO_2-pressurized backpack sprayer. Herbicide and corn gluten meal treatments were applied again on August 14 at Windsor and August 20 at Madison. Because of plant injury from the first application, the sprayable herbicide was changed to isoxaben (0.75 lb/A) + oryzalin (2 lb/A).

The sprayable herbicide injured both azalea and holly at Windsor and caused minor injury to azalea at Madison. By 6 weeks after initial treatment (WAT), vigor of holly treated with the granular herbicide was reduced at Windsor. At 13 WAT, leaf discoloration on azalea at Madison was observed in containers mulched with cocoa hulls. At Windsor, vigor of both species in containers mulched with pine bark was reduced slightly. Weed control was evaluated at 6 and 13 WAT. At Windsor, weeds were counted upon removal and weighed. At 6 WAT, treatments provided the following control of common groundsel: sprayable herbicide (>99%), granular herbicide (85%), fabric disc (96%), cocoa hull (57%), pine bark (35%), corn gluten meal (0%). At 13 WAT, the following weed control ratings were taken: sprayable herbicide (70%), granular herbicide (38%), fabric disc (67%), cocoa hull (51%), pine bark (57%), corn gluten meal (32%). At Madison, pearlwort density was quantified by estimating percent surface area covered by the weed; all other weeds were counted and removed. Cocoa hull and fabric disc treatments provided the best prevention of red maple (*Acer rubrum* L.) seedlings. Percent area covered by pearlwort at 13 WAT was the following: untreated check (75%), sprayable herbicide (0.2%), granular herbicide (20%), fabric disc (2%), cocoa hull (0.3%), pine bark (3%), corn gluten meal (69%). Pearlwort in all containers was killed with a directed spray of glufosinate-ammonium at 13 WAT prior to the second treatment application.

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HERBICIDE TOLERANCES OF CONTAINER-GROWN HERBACEOUS ORNAMENTALS

Todd L. Mervosh and John F. Ahrens[1]

ABSTRACT

The herbicides 2,4-D, ethanol and isopropanol amine salts (Formula 40) at 0.5, 1.0, and 2.0 lb ai/A, isoxaben (Gallery) at 0.5, 1.0, and 2.0 lb ai/A, prodiamine (Factor) at 0.75, 1.5, and 3.0 lb ai/A, and a combination of isoxaben (0.5 lb ai/A) plus prodiamine (1.5 lb ai/A) were sprayed over containers of herbaceous perennials on June 8 or 9, 1998, within a month of planting, at a spray volume of 30 gal/A. Isoxaben and 2,4-D were applied over three ornamental grasses: blue fescue (*Festuca ovina* 'Elijah Blue') in 1-gallon containers, dwarf fountain grass (*Pennisetum alopecuroides* 'Hameln') and ribbon grass (*Phalaris arundinacea* 'Picta') in 2-gallon containers, all grown in a mix of 65% bark, 30% peat, 5% sand. Isoxaben, prodiamine, and isoxaben plus prodiamine were applied over columbine (*Aquilegia* 'Dragon Fly') in quart containers, false spirea (*Astilbe x aren* 'Gloria Purpurea') and yarrow (*Achillea* 'Cloth of Gold') in 1-gallon containers. All were grown in a mix of 50% peat and 50% pine bark. Plots contained three or four plants per species, and treatments were replicated four times in randomized complete blocks. Irrigation was applied soon after isoxaben and prodiamine treatments, but was delayed for 24 hr after 2,4-D treatments. Weeds were sparse and thus were not evaluated. Visual injury was rated at 1 month and plant vigor was rated at 3 months after treatment.

Neither 2,4-D nor isoxaben injured or reduced vigor of the grasses as compared with the untreated checks. Both isoxaben and prodiamine applied at the low and middle rates, and the combination of isoxaben plus prodiamine caused no injury to yarrow, columbine or false spirea. Isoxaben at 2.0 lb/A injured all three of these ornamentals at 1 month, but yarrow and false spirea recovered by 3 months after treatment. Prodiamine at 3.0 lb/A caused slight to moderate injury to columbine and false spirea but not to yarrow. Columbine grew variably poor even in untreated plots.

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IR-4 ORNAMENTAL RESEARCH FOR 1998[1]

J. Ray Frank[2]

ABSTRACT

The IR-4 Ornamental Research Program has been active for 21 years. Data has been developed for obtaining over 5400 national label registrations for pesticides to be used for nursery, floral, forestry and turf production. Data has also been developed to provide pesticides for use in the commercial landscape, interior plantscapes and tissue culture.

Over 450 ornamental research trials were conducted in 1998 including 185 on herbicides and plant growth regulators. These trials were conducted in 11 states by twelve weed scientists on the following herbicides:

Atrazine	Dithiopyr	Oxadiazon
Bentazon	Fluazifop	Oxyfluorfen + Oryzalin
Clethodim	Halosulfuron	Oxyfluorfen + Pendimethalin
2,4-D Amine	Isoxaben	Pendimethalin
2,4-D Ester	Napropamide	Prodiamine
Dicamba	Oryzalin	Trifluralin

1 New Jersey Agriculture Experiment Stations, Publication No. A27200-35-98 supported by State, U.S. Hatch Act and other U.S. Department of Agricultural funds.

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WEED MANAGEMENT IN CONTAINER-GROWN FALL-FLOWERING ORNAMENTALS

Andrew Senesac[1]

ABSTRACT

Commercial growers of container-grown fall-flowering ornamental crops, such as chrysanthemum, pansy and ornamental crucifers, usually begin growing the crop outdoors in early summer, for sale in the fall. Although the plants are usually grown in soilless media, the containers often become infested with weeds during the growing season. Preemergence herbicides sprayed over the top of container-grown herbaceous ornamentals can often cause injury. Although several herbicides are available in granular form, they too have the potential to injure if small granules are caught in leaf axils. The use of paper mulch pellets, impregnated with herbicides, may offer a safe means of delivering effective herbicides.

Several replicated trials were conducted at the Long Island Horticultural Research Laboratory to examine ornamental tolerance to preemergence herbicides.

Chrysanthemum (*Dendranthema* x *grandiflorum*) 'Lisa', 'Linda', and 'Jennifer'; *Viola x wittrockiana* 'Bingo Blue with Blotch' and 'Crystal Bowl Yellow'; *Aster dumosus X Aster novi-belgii* 'Jenny'; *Aster novi-belgii* 'Celeste'; and *Brassica oleracea* 'Osaka' Red were treated with single applications of the following herbicides: prodiamine 65 WDG(1.5 lbs./a a.i), oryzalin 4AS (2.0 lbs./a), dithiopyr 1EC at (0.5 lbs./a) and pendimethalin 60 WDG and 2G (2.0 lbs./a). Each of the sprayable formulations was applied with CO_2 backpack sprayer directly over the top of the plants. The spray treatments were also applied to paper pellets at the same rate per acre. The pellets were thoroughly mixed and applied to the surface of the pots at the rate of 150 lbs/1,000 sq ft. The plants were harvested eight weeks after treatment.

The results indicate that prodiamine, when applied by spray or pellets was the best tolerated treatment by all species. Dithiopyr when sprayed, caused significant injury to all plants. This treatment was considerably safened however, when dithiopyr was applied on paper pellets. Pendimethalin spray injured all plants except for two chrysanthemum cultivars, 'Lisa' and 'Linda'. This herbicide was also safened when applied as 2G or on pellets. These data suggest that while some preemergence herbicides may be fairly well tolerated when applied as sprays, a greater degree of safety can be obtained if the herbicides are delivered as granules or on paper pellets.

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BITTERCRESS (*CARDAMINE FLEXUOSA*) CONTROL IN CONTAINER PRODUCTION

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ABSTRACT

Flexuous bittercress (*Cardamine flexuosa* With.) is similar in appearance to hairy bittercress (*Cardamine hirsuta* L.), a common winter annual weed in nursery production. Flexuous bittercress has a much-branched, zigzag stem and the stems are often hairy. It appears to lack a rosette when flowering, and the capsules diverge at a 45° angle from the stem. Hairy bittercress has a more erect, straight and often unbranched stem, and the stem is glabrous. The fruit of hairy bittercress are strictly erect. Container experiments were used to evaluate preemergence and postemergence control of flexuous bittercress.

Eight-inch pots were filled with pine bark and then treated with common nursery preemergence herbicides. Established plants of flexuous bittercress were placed adjacent to these plots, allowing seed to fall into the treated bark. At five weeks after treatment, there were 144 flexuous bittercress plants per plot in untreated pots. Less than 5 plants per plot were observed in pots treated with isoxaben at 0.75 lb ai/A, oxyfluorfen at 2.0 lb/A, and oxyfluorfen plus oryzalin at 3.0 lb/A. Less than twenty plants per plot were seen in pots treated with oxyfluorfen plus pendimethalin at 3.0 lb/A, oxyfluorfen plus oxadiazon at 3.0 lb/A, isoxaben plus trifluralin at 3.75 lb/A, and oxadiazon applied at 3.0 lb/A. Approximately 75 plants per plot were found in pots treated with oryzalin at 3.0 lb/A and pendimethalin at 3.0 lb/A, with 117 plants per plot in pots treated with prodiamine at 0.75 lb/A. At two months after treatment, isoxaben, oxyfluorfen, oxyfluorfen plus oryzalin, oxyfluorfen plus oxadiazon, and isoxaben plus trifluralin provided over 90% control of this weed. Oryzalin, oxadiazon, and pendimethalin provided fair to good (75 to 83%) control of flexuous bittercress. Prodiamine at 1.0 lb/A did not control this bittercress species at 2 MAT.

For postemergence control, flexuous bittercress was grown in pots containing pine bark. It was treated when 5 inches tall. A nonionic surfactant was added to all treatments. At 24 days after treatment (DAT), oxyfluorfen at 1.0 lb/A and sulfentrazone at 0.375 lb/A completely controlled this species. Bentazon at 1.0 lb/A and oxadiazon wettable powder at 3.0 lb/A controlled flexuous bittercress approximately 95%. Halosulfuron at 0.03 lb/A provided slower effects, as 75% control was seen at 24 DAT, while 98% control was seen at 38 DAT. Isoxaben at 0.75 lb/A provided approximately 50% control at both 24 and 38 DAT. Clopyralid at 0.25 lb/A did not control flexuous bittercress. Flexuous bittercress can be controlled preemergence and postemergence using selected nursery herbicides.

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AN EVALUATION OF SULPHOSATE AND FOUR GLYPHOSATE FORMULATIONS ON CONIFERS

Larry J. Kuhns and Tracey Harpster [1]

INTRODUCTION

Though glyphosate is generally considered to be a nonselective herbicide, Christmas tree growers have long known that under certain conditions they could contact the lower branches of their trees with the herbicide Roundup[2] without causing injury to them. Species, time of application, rate of application, surfactant, method of application (directed versus over-the-top), and pruning wounds are all factors affecting conifer tolerance to glyphosate.

Because Roundup was widely used by Christmas tree growers, they were very concerned when the basic producer of Roundup changed the formulation so that it contained a more active surfactant. The new product was marketed under the names Roundup Pro and Roundup Ultra[3]. This change increased its herbicidal activity and raised the possibility that it could damage trees if applied in the same way as Roundup had been. In addition to Roundup and Roundup Pro two other glyphosate formulations are labeled for use in Christmas trees. Accord[4] has no surfactant, but the label recommends the addition of one prior to application. Glyfos[5] is a generic form of glyphosate that is supposedly comparable to Roundup. Sulfosate is marketed under the trade name Touchdown[6]. It is a nonselective, postemergence, translocated herbicide similar to glyphosate. To determine the tolerance of the major Christmas tree species grown in the northeast to these glyphosate formulations, and sulfosate, a set of studies was established.

METHODS AND MATERIALS

The studies were conducted at four different sites in Pennsylvania – 1) Kuhns Tree Farm in State College, 2) The Penn State University Horticulture Research Farm in Rock Springs, 3) Shellhammer's Christmas Tree Farm in Breinigsville, and 4) Strathmeyer Forests, Inc. in Dover. All four sites contained Douglas Fir (*Pseudotsuga menzesii* (Mirb) Franco). Three of the sites contained Fraser Fir (*Abies fraseri* (Pursh) Poir), Colorado Spruce (*Picea pungens* Engelm.), and Eastern White Pine (*Pinus strobus* L.). Canaan fir (*Abies balsamea phanerolepis* Fern.), White Fir (*Abies concolor* (Gord. & Glend.), and Canadian Hemlock (*Tsuga canadenses* (L.) Carriére) were present on individual sites. Trees at the Kuhns and Strathmeyer sites were 2-2 transplants planted in spring, 1994. Trees at the Horticulture Research Farm were 2-2 transplants planted in spring, 1996. The age of the trees at the Shellhammer site was not recorded.

Treatments and dates of application are presented in Table 1. Rates were lower at the Kuhns Tree Farm site in 1997 because one quart per acre of Roundup had been applied by mistake to all of the trees in the study one week before the test treatments were applied. Applications were made with a CO_2 test plot sprayer at 30 psi through an OC04 nozzle. The system had an output equivalent to approximately 45 gallons per acre. Most trees in the study were 30 to 48 inches tall at the time of the first application. However, the trees at the Horticulture Research Farm were less than 24 inches tall; and the Canaan fir and white fir at Shellhammer's were about 60 inches tall. As

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[2] Roundup, isopropylamine salt of glyphosate, 3 lb. ae/gallon, Monsanto Company, St. Louis, MO 63167.

[3] Roundup Pro and Roundup Ultra, isopropylamine salt of glyphosate, 3 lb. ae/gallon, Monsanto Company, St. Louis, MO 63167.

[4] Accord Herbicide, isopropylamine salt of glyphosate, 3 lb. ae/gallon, Monsanto Company, St. Louis, MO 63167.

[5] Glyfos, isopropylamine salt of glyphosate, 3 lb. ae/gallon, Cheminova, Inc., Wayne, NJ 07470.

[6] Touchdown, trimethylphosphonic salt of sulfosate, 6 lb. ae/gallon, Zeneca, Wilmington, DE 19850.

a minimum, the lower 12 inches of both sides of the trees was contacted by the spray solution. One set of plants at the Horticulture Research Farm received over-the-top (OTT) applications with the same sprayer through an 8004E nozzle with an output of 27 GPA. There were five trees per plot, and each treatment was replicated three times at each site for each species. Trees were evaluated for injury in July of 1997 and injury and plant quality in July of 1998.

RESULTS

Hemlock. Though hemlock is clearly not a Christmas tree, it was included in the study because it is a plant that has a reputation for being especially sensitive to herbicide injury. Treatments were only applied one time, in fall, 1996, at 1 and 2 lbs. ai/A. In this study none of the treatments caused any damage to the trees. At the time the trees were rated all of them had a second flush of growth, including on branches at the base where the herbicides had been applied.

Canaan fir. Treatments were only applied one time, in fall, 1996, at 1 and 2 lbs. ai/A. Glyfos at 2 lbs. ai/A had a slightly, but significantly, higher injury rating than the other treatments. It was difficult to determine definitely, but it appeared the leaders on some of the trees treated with Glyphos at 2 lbs. ai/A were thinner than those on trees receiving the other treatments. The damage was not considered to be serious.

White fir. Treatments were only applied one time, in fall, 1996, at 1 and 2 lbs. ai/A. Roundup Pro, Glyfos, and Touchdown, all at 2 lbs. ai/A, caused higher, but insignificant, injury ratings than the other treatments. The injury noted was perceived to be a slight loss of apical dominance, resulting in weak leaders on some plants. The injury was not consistent throughout any of the plots.

Colorado Spruce. Treatments at the Horticulture Research Farm and the Strathmeyer site were applied once at rates of up to 3 and 2 lbs. ai/A, respectively. Treatments at the Kuhns site were applied three times in two years at rates up to 3 lbs. ai/A. In 1997 there was no injury evident at the Kuhns or Strathmeyer sites. In 1998, at the Kuhns site Roundup Pro at the high rate slightly injured some trees. The injury noted was perceived to be a slight loss of apical dominance, resulting in weak leaders on some plants. The injury was not consistent throughout the plots receiving this treatment. At the Horticulture Research Farm there were some treatments applied as directed sprays that had higher injury ratings than others, but they could not consistently be linked to a particular treatment. Strangely, the OTT applications had more consistently lower injury ratings than the directed sprays, though none of the differences were statistically different. Quality ratings taken at the Kuhns site and the Horticulture Research Farm were equally inconsistent. There was no strong relationship between the quality ratings and the injury ratings, indicating how slight the injury was.

Fraser fir. Treatments at the Kuhns and Shellhammer sites were applied at least twice at rates of up to 3 lbs. ai/A. Treatments at the Horticulture Research Farm were applied once at rates of up to 3 lbs. ai/A. At the Shellhammer site there was essentially no injury observed either year on any of the plants, and there was no difference in plant quality ratings. At the Kuhns site, in 1997, some branches sprayed with Touchdown, Glyfos, or Roundup Pro at 3 lbs. ai/A were light yellow and stunted. Touchdown had a significantly higher level of damage, but all injured trees were in the same block; no damage was observed in the other two blocks. None of the damage observed was considered to be commercially unacceptable. In 1998, there were some slight injury symptoms evident. The growth at the base of some of the trees was slightly stunted where it was contacted by the spray solution. Branch tips and needles in this area were slightly shorter. It was hard to tell if it was treatment related, but some of the leaders appeared to have a slight crook in them at the time of the evaluation. This did not last, as by the end of the season all of the leaders in the test area were straight. There was very little difference in the plant quality ratings at this site. At the Horticulture Research Farm, trees that were direct sprayed with the high rate of Glyfos had higher injury ratings than the controls. The plant quality rating for plants treated with the high rate of Glyfos were also lower than the control. For plants that were sprayed OTT there was no difference in their injury or plant quality ratings.

Douglas fir. Treatments at the Kuhns and Shellhammer sites were applied at least twice at rates of up to 3 lbs. ai/A. Treatments at the Strathmeyer site were applied once at rates up to 2 lbs. ai/A. Treatments at the Horticulture Research Farm were applied once at rates up to 3 lbs. ai/A. There was some injury to Douglas fir, but the treatments that caused injury were not consistent. In 1997 the high rate of Glyfos injured trees at the Kuhns site and the high rate of Accord plus X-77 [7] injured the trees at the Shellhammer site. None of the treatments injured the trees at the Strathmeyer site. Where injury occurred, some of the trees had leaders that were slightly stunted and thin, and the tips of the lower branches that were contacted by the spray were stunted or dead. In 1998, none of the trees at the Kuhns or Shellhammer sites showed any sign of injury. At the Horticulture Research Farm the high rate of Roundup Pro seriously injured the trees that had been sprayed OTT. The plant quality ratings for the trees receiving the OTT treatment were also lower than for any treatment. The more severe injury observed with this treatment was exhibited as stunted, light-green to yellow lateral growth, and stunted leaders.

White pine. Treatments at the Kuhns site were applied at least twice at rates of up to 3 lbs. ai/A, at the Strathmeyer site once at rates of up to 2 lbs. ai/A., and once at the Horticulture Research Farm at rates up to 3 lbs. ai/A. In 1997, at the Strathmeyer site, trees treated with both rates of Glyfos and the high rate of Accord plus X-77 had the highest injury ratings, though they were not significantly different from the control trees. Injury symptoms recorded included some yellowing of the foliage and slight loss of apical dominance, resulting in some trees with tufted growth rather than strong central leaders. Injury was greater at the Kuhns site. Both rates of Glyfos and Accord plus X-77, and the high rates of Roundup Pro and Touchdown, caused significant injury to the trees. The injury included some stunting of growth, yellowing of foliage, and loss of apical dominance, resulting in leaders that were thinner and weaker. In 1998 the trees at the Kuhns site showed very few signs of any injury. The trees had grown past the injury recorded the previous year. At the Horticulture Research Farm the pines that received the directed spray of Accord plus X-77 at the high rate caused some injury to the trees. When applied OTT, Roundup Pro at the high rate seriously injured or killed the pines (44% mortality). Quality ratings for trees in this treatment were obviously lower than those of any other treatment.

DISCUSSION

None of the trees at the Strathmeyer site exhibited signs of significant injury. This was a bit surprising since the trees at that site included white pine and hemlock, which have been found to be sensitive to Roundup in the past. Two possible reasons injury was not seen are the relatively low application rates and the late application date. The highest rate of application at this site was 2 lbs. ai/A. This is higher than would be recommended in a commercial planting, but not by much. The date of application, October 16, is about as late as Roundup applications are normally made in the northeastern part of the country. The plants were certainly fully hardened prior to application.

An overall view of the data in this study indicates that the risk of injuring trees with Roundup Pro is greater than with the old formulation of Roundup. However, in all cases in which Roundup Pro caused more injury than Roundup, the Roundup Pro was applied at 3 lbs. ai/A. This rate is double the rate that would be recommended for a use in which a significant part of the tree would be contacted with the spray solution. In carefully calibrated, directed spray applications at 1.5 lbs. ai/A or less, Roundup Pro should be safe for use around the species tested after their growth has fully hardened in the fall.

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[7] X-77 Spreader, Loveland Ind., Inc., Greeley CO 80632.

Also, at a few sites and on some species, the high rates of Glyfos, Touchdown, and Accord plus X-77 caused more injury than the old Roundup formulation. Except for the white pine, there was no consistent pattern to the injury produced. As with the Roundup Pro, if these products are applied properly they should be safe for use around the species tested.

As expected, white pine was the most sensitive of the species tested. The most consistent injury was produced at the Kuhns site, where the treatments had been applied in both the spring and fall of 1996. At the time of the 1997 evaluation plants treated with Roundup Pro, Glyfos, Accord plus X-77, and Touchdown all showed significant injury. Though glyphosate is broken down quickly in the soil by microorganisms, it is also known that it does not break down very quickly once in the plant. It is possible that the spring and fall applications combined to produce the injury seen in 1997. The risk of OTT applications was evident in the 1998 evaluation at the Horticulture Research Farm. The high rate of Roundup Pro lead to the death of over 40% of the treated plants.

Finally, there was a considerable amount of variation in the ratings with some of the sites and species. Within the same plots some trees would show some sign of injury, while others looked perfectly normal. It must be recognized that all Christmas tree species currently being produced are grown from seed. There is a tremendous amount of genetic variation within any planting. Differences in their time of budbreak are easy to see in the spring, with some plants breaking bud several weeks earlier than the latest to break bud in a planting. Though it would not be as readily apparent, there is no reason to believe that the development of the waxy cuticle on conifer needles that protects them from glyphosate could not develop at different, genetically controlled rates. In addition, there are significant differences in growth rate and quality of Christmas trees grown from seed. Though these differences should be accounted for through variation in the control plots, the variation can be so great in isolated areas that it could account for the small differences seen between some treatments.

Table 1. Treatments were applied in spring or fall of 1996 and 1997. Chemicals and rates of application are in pounds of active ingredient per acre (lbs. ai/A) applied at each location.

Treatment	Kuhns			Shellhammer		Strathmeyer	Hort Farm
	4/1196	9/20/96	9/26/97	9/19/96	9/16/97	10/16/96	9/24/97
Control							
Roundup	1	1.5	1	1	1.5	1	1.5
Roundup	2	3	2	2	3	2	3
Roundup Pro	1	1.5	1	1	1.5	1	1.5
Roundup Pro	2	3	2	2	3	2	3
Glyfos	-	1.5	1	1	1.5	1	1.5
Glyfos	-	3	2	2	3	2	1.5
Accord + X-77 (0.25% v/v)	1	1.5	1	1	1.5	1	1.5
Accord + X-77 (0.25% v/v)	2	3	2	2	3	2	3
Accord	2	3	2	1	1.5	1	3
Touchdown	1	1.5	1	1	1.5	-	-
Touchdown	2	3	2	2	3	-	-

Table 2. Plant injury ratings of Colorado spruce and Fraser fir evaluated in July of 1997 and 1998. Plant injury is the average of three reps, with five plants per rep, with 1 = no injury and 10 = dead. Treatments were applied in September or October of 1996 and 1997, as directed sprays (DS) to all trees except one set at the Horticulture Research Farm which had the treatments applied over-the-top (OTT). Treatments were also applied in April 1996 at Kuhns Tree Farm. Rates of application are listed as low or high. Low rates were 1 or 1.5 lb. ai/A; high rates were 2 or 3 lbs. ai/A. 1/

		Colorado Spruce					Fraser Fir					
		1997		1998			1997		1998			
Treatment	Rates	Kuhns	Strath.	Kuhns	Hort Farm		Kuhns	Shell.	Kuhns	Shell.	Hort Farm	
					DS	OTT					DS	OTT
Control		1.0 a	1.0 a	1.0 b	1.0 d	1.0 a	1.0 c	1.0 b	1.0 b	1.0 a	1.0 b	1.0 a
Roundup	Low	1.0 a	1.0 a	1.3 ab	1.8 abcd	1.9 a	1.0 c	1.0 b	1.1 b	1.0 a	1.5 b	1.7 a
Roundup	High	1.0 a	1.0 a	1.1 b	1.7 bcd	1.2 a	1.0 c	1.3 a	1.2 ab	1.0 a	1.8 b	1.8 a
Roundup Pro	Low	1.0 a	1.0 a	1.2 ab	2.2 abcd	1.2 a	1.0 c	1.0 b	1.4 ab	1.0 a	1.8 b	1.6 a
Roundup Pro	High	1.0 a	1.0 a	1.7 a	2.6 ab	2.3 a	2.3 b	1.0 b	1.7 ab	1.0 a	2.0 ab	1.8 a
Glyfos	Low	1.0 a	1.0 a	1.1 b	1.8 abcd	1.7 a	2.0 b	1.0 b	1.1 b	1.0 s	1.1 b	1.5 a
Glyfos	High	1.0 a	1.0 a	1.1 b	1.9 abcd	1.3 a	2.3 b	1.0 b	1.6 ab	1.0 a	2.9 a	1.6 a
Accord + X-77 (0.25% v/v)	Low	1.0 a	1.0 a	1.1 b	3.0 a	1.3 a	1.3 c	1.0 b	1.5 ab	1.0 a	1.3 b	1.6 a
Accord + X-77 (0.25% v/v)	High	1.0 a	1.0 a	1.3 ab	1.1 cd	1.8 a	1.0 c	1.0 b	1.9 a	1.0 a	1.4 b	1.7 a
Accord		1.0 a	1.0 a	1.4 ab	2.3 abc	1.7 a	1.0 c	1.0 b	1.5 ab	1.0 a	1.6 b	1.2 a
Touchdown	Low	1.0 a	1.0 a	1.2 ab	-	-	1.3 c	1.0 b	1.7 ab	1.0 a	-	-
Touchdown	High	1.0 a	1.0 a	1.4 ab	-	-	3.0 a	1.0 b	1.5 ab	1.1 a	-	-

1/ Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Table 3. Plant injury ratings of Douglas fir and white pine evaluated in July of 1997 and 1998. Plant injury is the average of three reps, with five plants per rep, with 1 = no injury and 10 = dead. Treatments were applied in September or October of 1996 and 1997, as directed sprays (DS) to all trees except one set at the Horticulture Research Farm which had the treatments applied over-the-top (OTT). Treatments were also applied in April 1996 at Kuhns Tree Farm. Rates of application are listed as low or high. Low rates were 1 or 1.5 lb. ai/A; high rates were 2 or 3 lbs. ai/A. [1/]

		Douglas Fir							White Pine				
		1997			1998				1997		1998		
Treatment	Rates	Kuhns	Shell.	Strath.	Kuhns	Shell.	Hort Farm		Kuhns	Strath.	Kuhns	Hort Farm	
							DS	OTT				DS	OTT
Control		1.0 b	1.0 b	1.0 a	1.0 a	1.0 a	2.7 a	2.2 bc	1.7 cd	1.0 a	1.5 a	1.0 c	1.4 c
Roundup	Low	1.0 b	1.0 b	1.0 a	1.3 a	1.0 a	1.8 a	3.2 bc	1.3 d	1.0 a	1.2 a	2.8 ab	2.3 bc
Roundup	High	1.0 b	1.0 b	1.0 a	1.0 a	1.0 a	2.4 a	3.3 b	3.7 bc	1.0 a	1.2 a	2.8 abc	2.4 bc
Roundup Pro	Low	1.3 b	1.0 b	1.0 a	1.0 a	1.0 a	2.2 a	2.5 bc	3.0 bcd	1.0 a	1.2 a	2.8 abc	4.1 bc
Roundup Pro	High	1.3 b	1.0 b	1.0 a	1.1 a	1.1 a	3.7 a	6.0 a	4.7 ab	1.0 a	1.2 a	1.8 abc	8.7 a
Glyfos	Low	1.0 b	1.0 b	1.0 a	1.1 a	1.0 a	3.2 a	3.0 bc	5.0 ab	1.7 a	1.0 a	1.7 bc	5.3 b
Glyfos	High	2.3 a	1.3 b	1.0 a	1.0 a	1.0 a	3.3 a	2.2 bc	6.7 a	1.7 a	1.0 a	2.2 abc	2.5 bc
Accord + X-77 (0.25% v/v)	Low	1.7 ab	1.0 b	1.0 a	1.0 a	1.2 a	2.5 a	2.3 bc	4.7 ab	1.3 a	1.2 a	2.0 abc	3.8 bc
Accord + X-77 (0.25% v/v)	High	1.7 ab	3.0 a	1.0 a	1.2 a	1.0 a	2.9 a	2.9 bc	4.0 b	1.7 a	1.2 a	3.5 a	3.7 bc
Accord		1.0 b	1.0 b	1.0 a	1.2 a	1.0 a	1.9 a	1.8 c	3.0 bcd	1.0 a	1.5 a	2.6 abc	3.8 bc
Touchdown	Low	1.0 b	1.0 b	1.0 a	1.2 a	1.0 a	-	-	3.3 bcd	1.3 a	1.3 a	-	-
Touchdown	High	1.0 b	1.0 b	1.0 a	1.0 a	1.2 a	-	-	4.3 b	1.0 a	1.3 a	-	-

[1/] Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Table 4. Plant quality ratings of conifers evaluated in July of 1998. Plant quality is the average of three reps, with five plants per rep, with 1 = dead and 10 = highest quality. Treatments were applied in September or October of 1996 and 1997, as directed sprays (DS) to all trees except one set at the Horticulture Research Farm which had the treatments applied over-the-top (OTT). Treatments were also applied in April 1996 at Kuhns Tree Farm. [1/]

		Colorado Spruce			Fraser Fir				Douglas Fir				Eastern White Pine		
Treatment	Rates	Kuhns	Hort Farm		Kuhns	Shell.	Hort Farm		Kuhns	Shell.	Hort Farm		Kuhns	Hort Farm	
			DS	OTT			DS	OTT			DS	OTT		DS	OTT
Control		9.6 a	9.2 ab	9.8 a	9.6 a	9.9 a	9.1 a	8.9 a	9.8 a	9.8 abc	7.9 a	8.1 ab	9.4 a	9.5 a	9.3 a
Roundup	Low	9.2 a	9.2 ab	8.8 a	9.5 a	10.0 a	9.2 a	8.8 a	9.6 a	9.9 ab	8.4 a	7.9 ab	9.4 a	7.5 a	8.8 a
Roundup	High	9.9 a	9.1 ab	9.5 a	9.6 a	10.0 a	9.0 a	8.8 a	10.0 a	9.8 abc	7.3 a	6.6 b	9.6 a	7.7 a	8.5 a
Roundup Pro	Low	9.6 a	8.8 ab	9.5 a	9.5 a	10.0 a	9.2 a	9.2 a	9.7 a	10.0 a	8.2 a	7.4 ab	9.8 a	8.3 a	6.7 a
Roundup Pro	High	9.0 a	8.6 ab	9.1 a	8.7 a	9.9 a	8.8 a	9.2 a	9.7 a	10.0 a	6.6 a	4.4 c	9.5 a	9.2 a	2.3 c
Glyfos	Low	9.8 a	9.2 ab	8.8 a	9.9 a	10.0 a	9.8 a	9.3 a	9.7 a	9.8 abc	7.4 a	7.5 ab	9.7 a	9.3 a	8.2 a
Glyfos	High	9.8 a	8.9 ab	9.1 a	9.1 a	9.9 a	7.4 b	9.3 a	8.9 b	9.5 bc	7.4 a	8.3 a	9.3 a	7.9 a	8.8 a
Accord + X-77 (0.25% v/v)	Low	9.6 a	8.0 b	9.5 a	8.7 a	9.8 a	9.5 a	9.2 a	10.0 a	9.7 abc	7.3 a	8.2 ab	9.4 a	8.8 a	7.2 a
Accord + X-77 (0.25% v/v)	High	9.6 a	9.6 a	9.2 a	8.6 a	9.9 a	9.4 a	9.1 a	9.8 a	9.7 abc	7.5 a	7.0 ab	9.2 a	7.7 a	7.6 a
Accord		9.2 a	8.7 ab	8.9 a	9.2 a	9.9 a	9.0 a	9.8 a	9.8 a	10.0 a	8.4 a	8.3 a	9.4 a	8.1 a	7.3 a
Touchdown	Low	9.7 a	-	-	9.1 a	9.9 a	-	-	9.8 a	9.8 abc	-	-	9.1 a	-	-
Touchdown	High	9.4 a	-	-	9.2 a	9.9 a	-	-	9.8 a	9.4 c	-	-	9.6 a	-	-

1/ Means within columns, followed by the same letter, do not differ at the 5% level of significance (DMRT)

Northeastern Weed Science Society

52nd annual meeting

January 6, 1998
Capital Hilton Hotel, Washington, D.C.

Presidential Address

Joseph C. Neal
North Carolina State University

CAN WE INFLUENCE THOSE WHO INFLUENCE US?

Despite popular myth, there are four things which we can count on – death, taxes, weeds and change. We all do what we can to thwart the first three, but are we doing anything to affect meaningful change – or, do we allow external influences to dictate change upon us? Change is ubiquitous in our lives and society. Much of that which changes only indirectly affects us. Only when imposed change directly impacts us do we generate the will to act upon that change. Too often by that time it is too late to alter the course of events which change our professional or personal activities or freedoms. We see evidence of this in legislative or regulatory action which are directed by emotional pleas rather than scientific reasoning. We see this in redirected funding or funding reductions which have forced academic research to respond more to politically driven funding priorities rather than justifiable needs. We also see this in corporate or academic downsizing and the nearly ubiquitous administrative mantra "we will do more with less." These and many other factors directly impact our directions, priorities, goals and activities. A case in point – the theme for this year's annual conference is the impact of legislation on weed science, with an emphasis on the Food Quality Protection Act. Such legislation and the related regulatory actions seem distant and immovable, yet such far-reaching issues really present avenues for action and opportunities to affect positive change.

So, how do we affect positive change in our professional lives? Individually we may feel our voices are not heard, and if heard, are not effective. We also often feel our collective voices are similarly unheard. Some of the keys to affecting positive change are to have well-focused goals, justifications for those goals, expected impacts, possible methods and alternatives, and be succinct. These issues must be expressed in manners which will be relevant and easily understood by the decision-makers and those to whom the decision-makers must be accountable. In agriculture we are often guilty of not expressing our agenda in terms that are relevant to the average legislator or voter. We tend to focus on the impact our actions may have on agriculture and agricultural productivity. Noble causes to be sure. But, with only 2% of the US population directly involved in agriculture, these goals are not directly relevant to the average citizen (and thereby, not particularly relevant to legislative or regulatory staff). While our goals may not need changing, how we justify and state those goals may improve our chances of being "heard."

Over the past year, I have had the opportunity to represent the Northeastern Weed Science Society in the Council on Agricultural Science and Technology - sponsored program entitled "Conversations on Change." The purpose of this program is to pursue an emerging vision that incorporates (a) new and dynamic relationships in food, fiber, natural and human resources; (b) rapidly evolving global agricultural systems; and (c) new opportunities for CAST member Societies to serve members, employers and the public. A coordinating team is working to identify, develop and bring opportunities for meaningful change to strengthen scientific societies. While being a results-oriented person, I have at times been frustrated with those in the program who seem to view dialog or process as an end unto itself. However, the dialog has yielded progress in several areas. I have been involved in a subgroup which is focusing on "outreach" – in its broadest sense. One of the issues the outreach group has grappled with is agricultural science's lack of understanding of the public's perspectives on agricultural issues. In an effort to better understand the public's views, we have proposed to conduct focus groups in several sites, the purposes of which are to not only understand the public's views but also to gauge the receptivity of the public to different messages about agriculture. As an end point, we hope to have a greater understanding of how to effectively communicate agricultural issues to the general public, legislators, and regulators. Several other initiatives are being developed by other subgroups. When complete, these initiatives will be shared with the CAST member Societies in forms which may be used to achieve the goals of the individual member Society.

Weed Science has been well represented in the Conversations on Change program. In fact, with delegates from each regional society and the national, weed science has greater representation than any other discipline. Furthermore, weed science appears to be one step ahead of most other professional societies in several areas. So what are we in the Northeastern Weed Science Society doing to affect meaningful change? First, we have forged or explored linkages. For example with the WSSA and other regional societies we cooperate on many programs such as the Congressional Science Fellow, AESOP, Washington liaison, and shared job postings. We have lead the weed science societies in developing "outreach" symposia such as those offered in conjunction with the Delmarva Agri Business group and the turf & ornamentals industries. Further, we are discussing the possibility of a concurrent meeting with the Northeastern branch of the American Society for Horticultural Science. Some linkages we need to further improve are those with USDA-ARS, state weed science organizations, state regulatory groups, and other non-traditional vegetation management groups. Secondly, our support and active involvement in the AESOP program has opened doors in Washington, D.C. with invited testimony by some of our members at congressional hearings. And, third, but perhaps the most compelling is our self-examination of our outreach mission. I thank Nate Hartwig and his committee for their work in this area. The proposals presented to the membership at this meeting regarding an "Education Coordinator's committee and responsibilities" are sure to stimulate discussion. But more importantly, this effort is sure to lead to better member service and service to our clients.

Whether individually or as a group, our voices can be heard and our opinions can influence those who have influence over us, if and only if we try. While we will not always get our way, if we are resolute in our efforts, and true to our convictions, we can affect change.

In closing, I thank you for allowing me the opportunity to serve as President and to be involved in the positive changes within the Northeastern Weed Science Society. And, I encourage each of you to look for an opportunity to contribute to positive change, wherever your convictions take you.

RISK ASSESSMENT OF FOREIGN PLANT PATHOGENS FOR BIOLOGICAL CONTROL OF WEEDS

William L. Bruckart and D. G. Luster[1]

ABSTRACT

One strategy currently being developed for weed management is classical biological control by foreign plant pathogens. Most of the major weed pests in North America are introduced plant species which are not infected by pathogens known from their sites of origin. Our approach is to acquire disease causing microorganisms which occur on these plants in their native areas through foreign exploration and cooperation with colleagues overseas. Test organisms are studied in the USDA-ARS, Foreign Disease-Weed Science Research Unit containment greenhouse and laboratory facility and judgments are made about risk and potential efficacy. Each test organism must be virulent (cause disease) on the target weed and it must be safe to use in North America. Risk is the product of hazard and exposure. For classical biological control agents, we assume that exposure will occur if introduction into the United States is permitted. Therefore, the strategy for classical biological control agents is to control hazard. Following demonstrated virulence of an accession, focus of research turns to identification of potential hazards to the North American agroecosystem. The risk assessment process involves several steps. Accessions capable of causing disease in preliminary studies that favor the pathogen are studied further for virulence, identification, and host specificity. Host specificity is preferred for organisms that will be introduced into the United States for biological control. In certain cases, there have been limited non-target infections occurring under our greenhouse conditions. Side-by-side qualitative and quantitative assessments comparing candidate foreign pathogens with known endemic pathogens of target and non-target plants enables us to clarify issues of potential risk and benefit. Examples of hazard identification and risk assessment are provided for *Puccinia* spp. being evaluated for biological control of musk thistle (*Carduus thoermeri*) and yellow starthistle (*Centaurea solstitialis*).

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A BIOHERBICIDE FOR DODDER: THE LONG AND WINDING ROAD

T. A. Bewick[1]

ABSTRACT

In 1984, apparent lesions were observed on swamp dodder growing in an uncultivated marsh near Berlin, WI. Isolations taken from these lesions produced two fungi. Koch's postulates were satisfied for each organism. A series of experiments was undertaken to demonstrate the these fungi had the potential to be developed into a bioherbicide for dodder control and the results of these experiments were published in 1987. In 1990, a patent for the use of one of the organisms was issued by the U.S. patent office. Development continued slowly due to the lack of industry interest. In 1994, United-Agri Products expressed a desire to continue development of a commercially viable product. In 1997, at a meeting with the EPA Biopesticide and Pollution Prevention Division, regulatory concerns were discussed. From the data requirements outlined for registration, it appears there will be a product available for the 1999 field season. Fifteen years from discovery to regulation is approximately the time-frame expected for chemical pesticides to make it through the regulatory process.

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EFFECTS OF ORGANOSILICATES AND HERBICIDES ON THE GROWTH RATE OF *PSEUDOMONAS SYRINGAE* PV. *TAGETIS*

J. C. Porter, T. A. Bewick, and F. L. Caruso[1]

ABSTRACT

Many bacterial species have the potential of being used as biocontrol agents of weeds as they are host-specific, virulent, and easy and inexpensive to mass produce. However, bacteria do not actively enter plants and infection rates are usually quite low when they are applied as sprays. If bacteria are applied in solutions containing organosilicates or herbicides, increased penetration by the bacterium might be achieved. Effective concentrations of organosilicates and herbicides may also have detrimental effects on the growth of the bacterium. The effects of the organosilicates LI-700, L-77, AS-408, and AS-1 and the herbicides glyphosate and 2,4-D (in the forms Roundup Ultra and Weedar 64, respectively) on the growth rate of *Pseudomonas syringae* pv. *tagetis*, a bacterium being examined as a potential biological control agent of many Asteraceae weeds, are discussed.

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Understanding The Competition

R.C. Ostrowski[1]

ABSTRACT

The use of microbes to control vegetation is considered by some to be an academic pursuit. We need only match the pathogen to the host, deliver the magic 10^6 colony forming units, and watch the weeds succumb to our brilliant epidemiology.

Those who have participated in the commercial pursuit of a biological product and its registration have been indoctrinated into the real world of production, packaging, registration, efficacy, economics, and the integrated utilization of the product.

How successful are we? And what are the underlying factors in this success ratio?

We believe the critical issues in bringing a product to market is tantamount to our ability to recognize our own strengths and weaknesses within our sphere of activity. Learning how our competion can complement these attributes and share in the development of the product may be the type of cooperation needed to bring these products to a commercial success. Federal and State agencies must participate in these endeavors not as competitors but as scientists whose interests are in improving the method of production of the given crop. Success should come with cooperation.

1) Mgr. Biotechnology, United Agri Products, Greeley, CO.

REGISTRATION OF BIOLOGICAL PESTICIDES IN THE U.S.

James J. Boland[1]

ABSTRACT

Biological pesticides include biochemicals, microbials, killed microbials and plant pesticides. The registration of biological pesticides is governed by the Federal Insecticide Fungicide and Rodenticide Act (FIFRA), the Federal Food Drug and Cosmetic Act (FFDCA) and the Food Quality Protection Act (FQPA). Registration activity for biological pesticides is the responsibility of the Biopesticides and Pollution Prevention Division within the Office of Pesticide Programs. Special rules, regulations and guidelines have lessened the cost of biological registrations and shortened review times. An overview of the biological pesticide registration process will be presented.

[1] Environmental Protection Specialist, USEPA, Office of Pesticide Programs, Biopesticides and Pollution Prevention Division, Washington DC

Extended Weed Control from Gallery* Applications

R. J. Keese and C. L. Forth[1]

Postemergence herbicide applications provide control of weeds present at the time of application. Preemergence treatments generally prevent weed seeds from germinating; Gallery* prevents germination and provides a barrier against further weed encroachment. Applications were made either in fall of 1995, or spring of 1997, to evaluate weed activity in small home lawns. Properties were in the Baltimore, MD area, and averaged 3,500 to 4,000 square feet. Weeds were identified prior to herbicide applications. Properties were divided into quadrants, where both the front and backyard were split in half. Each yard received an application of Trimec 959 (3.125 pt/A), and two quadrants received Trimec + Gallery* (1.0 lb/A).

Following the fall application, evaluations were made at 6, 7 and 8 months after application. The spring application was evaluated at 2, 3 and 4 months after application. Weeds evaluated for the study included dandelion (Taraxacum offficinale), plantains (Plantago sp.), white clover (Trifolium repens), spurge (Euphorbia sp.), oxalis (Oxalis sp.) and chickweed (Cerastium sp.). Binary logistic regression was used to test for the significance of treatment differences.

Fall applications of Gallery provide excellent broadleaf weed control the following spring and summer. Greater than 95% weed control was achieved with Gallery over the 8 month period. Trimec however, provided approximately 70% control over the course of the study. Binary logistic regression showed that Trimec was 27 times more likely to fail than was Gallery, with a p-value of 0.00. Spring evaluations were more difficult, since many existing weeds at application were not controlled by the Trimec (i.e. ground ivy and violets). Evaluations had to take into consideration that these weeds were not part of the study. Gallery again provided approximately 90% control, compared to 60% with Trimec. In this case, Trimec was 5 times more likely to fail, p-value = 0.00.

The benefits of extended control are many - fewer visits to retreat a site, fewer emerging weed complaints, more time to attend to other aspects of the lawncare business. Increased profitability can also be a benefit when new sales are being solicited rather than attending to callbacks.

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* Trademark of Dow AgroSciences

[1] Dow AgroSciences and TruGreen-ChemLawn

Table 1: Weed control with Trimec alone (3.125 pt/A) or Trimec + Gallery (1.0 lb/A).

	% Control	
Fall application 10/19/95	Trimec	Trimec + Gallery
6 MAT	71	100
7 MAT	62	96
8 MAT	70	95
Spring application 4/25/97		
2 MAT	54	86
3 MAT	77	94
4 MAT	58	91

EFFECTS OF SOIL RESIDUES OF DIURON SIMAZINE, AND TERBACIL ON NEWLY PLANTED APPLE AND PEACH TREES

Diane Hardison[1], Thomas Tworkoski[2], and Stephen Miller[2]

ABSTRACT

The residual herbicides, diuron, simazine, and terbacil have been applied repeatedly in fruit tree orchards to control weeds. Growers have questioned the effect of long term herbicide applications on growth of replanted trees. Previous studies indicate that these herbicides will not damage fruit trees. However, their toxicity will be affected by soil texture and organic matter. Long-term applications of diuron, simazine, and terbacil can reduce weed vegetation and, consequently, soil organic matter will decline with time. We have also found residues of these herbicides can persist years after application. The objective of this experiment was to determine if residues of diuron, simazine, and terbacil affect newly planted apple and peach trees.

The experiment was conducted at A.F.R.S. in Jefferson County, WV on Hagerstown silt loam. Eighteen weed control treatments were applied to plots (2 by 10 m) each May starting in 1981. Weed control treatments were diuron, simazine, and terbacil applied alone or in combination at rates of 0, 2, and 4 kg ha^{-1}. Additional weed control treatments were soil cultivation in spring, fall, spring plus fall, and none (control). In order to evaluate persistence of weed control treatments on fruit tree growth, plots were divided so that half the plot received a final treatment in 1995 and the other half in 1996. One 'Ace Spur Delicious' apple on M.7 rootstock and one 'Red Haven' peach on Lovell rootstock were planted in each plot half (subplot). Each plot was replicated four times. The experiment was a split plot design.

Results generally support previous work that repeated use of diuron, simazine, and terbacil at rates sufficient for acceptable weed control do not inhibit growth of fruit trees. The greatest branch and trunk diameter growth of peach trees occurred in plots treated with 4 kg ha^{-1} diuron plus 2 kg ha^{-1} simazine (57 cm and 9.1 mm, respectively). The least branch and trunk diameter growth occurred in plots that were fall cultivated only (20 cm and 0.8 mm, respectively). Like the peach trees, apple tree branches grew 45 cm in plots receiving 4 kg ha^{-1} diuron plus 2 kg ha^{-1} simazine and 23 cm in plots with fall cultivation only. Time of last weed control (1995 or 1996) did not affect fruit tree growth.

Weed abundance in June 1997 was affected by both type of weed control and time of last weed control. Weed abundance was greatest in plots tilled in both spring and fall (21% area covered) and least in plots receiving 2 kg ha^{-1} diuron or 4 kg ha^{-1} diuron plus 2 kg ha^{-1} terbacil (3% area covered). Overall, weed abundance was greater in plots with final weed control in 1995 than in 1996 (10% vs. 7%, respectively).

Our previous research demonstrated small, but persistent concentrations of diuron, simazine, and terbacil in soil after repeated annual applications. Although a second year of data is necessary, the results of the current experiment suggest that 15 annual applications of diuron, simazine, and terbacil did not adversely affect growth of newly planted peach and apple trees.

[1] Graduate Student, Hood College, Frederick, MD 21701

[2] Plant Physiologist and Research Horticulturist, Appalachian Fruit Research Station, USDA,ARS, Kearneysville, WV 25431

FACTORS THAT INFLUENCE CORN TOLERANCE TO FLUMETSULAM

Brian D. Olson and Ron Cordes[1]

ABSTRACT

Research and commercial experience have identified several environmental and cultural factors which can affect the tolerance of corn to soil applied flumetsulam. Some of these factors include; extended periods of cold soil temperatures (<50F), planting depth, soil organic matter, and certain soil insecticide treatments. To further study the effects of some of these factors on corn tolerance to flumetsulam a study was conducted in Waterloo, New York in 1996.

The herbicide treatments in the trial were setup as a 3 by 3 factorial study where flumetsulam applied at 0, 0.079 (1X) and 0.159 (2X) lb ai/A was combined with Dual™ (metolachlor at 2 lb/A), Dual II™ (metolachlor at 2 lb/A) and Surpass EC™ (acetochlor at 2 lb/A) for a total of nine treatments. Agway 266 corn was planted 30 May 1996 and the herbicide treatments were applied preemergence on 31 May 1996. Plot size was 10 by 30 ft plots each containing 4 rows of corn spaced 30 inches apart. Experimental design was a split-split plot with 4 replications. The treatments were applied with XR8003 flat fan spray tips in 20 GPA of spray solution on 31 May. The main plots were herbicide treatments, the sub-plots were planting depth (1 vs 2 in.) and the sub-sub plots were insecticide treatment (no insecticide vs terbufos). Terbufos (Counter 20CR™) was applied at the time of planting in-furrow at 1.2 oz/1000 ft. Corn tolerance was evaluated by measuring corn height of ten plants in each sub-plot on 20 June, 3 and 12 July and 20 August 1996.

When analyzed across all flumetsulam treatments, corn that was planted at a depth of 1 inch was significantly shorter than corn planted at a depth of 2 inches. These significant differences in plant height were observed at all evaluation dates except August 20. Also in the June and July evaluations, flumetsulam treated corn which received an application of terbufos was significantly shorter than corn that did not receive the insecticide treatment. For all evaluation dates, flumetsulam treated corn was significantly shorter than non-flumetsulam treated corn, however, the magnitude of the height differences were least when corn was planted 2 inches deep without terbufos and greatest when corn was planted 1 inch deep with terbufos. Differences in corn height were significant between some treatments on 20 August, but the differences were only 2-3 inches for corn 110 inches tall (2-3% difference in plant height), versus 4-6 inch differences for corn 30 inches tall on 3 July (13-20%).

The results of this research provide further validation of current use recommendations for minimizing the risk of corn injury form soil applied flumetsulam. Corn tolerance is significantly improved by deeper planting depth (>1.5 in.) and the exclusion of a terbufos insecticide treatment with flumetsulam. In addition to these two factors, the risk of corn injury from flumetsulam can be reduced by applying on soils with > 1.5% organic matter and delaying planting until the average soil temperature >50 F at the time of planting to promote good early season growth and vigor.

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[1] Field Development Scientist, Dow AgroSciences LLC, Geneva, NY 14456 and Product Development Manager, Dow AgroSciences LLC, Indianapolis, IN 46268.

52nd Annual Business Meeting of the NORTHEASTERN WEED SCIENCE SOCIETY Capitol Hilton, Washington, D.C. January 7, 1998

I. Call to Order

The 52nd Annual Business Meeting was called to order by Joseph Neal (President) at 4:15 PM on Wednesday, January 7, 1998.

II. Acceptance of Minutes

A motion was brought forward to accept the Minutes of the 51st Annual Business Meeting as written in Volume 52, Proceedings of the NORTHEASTERN WEED SCIENCE SOCIETY pages 148-152. The motion was seconded, and without any further discussion, the Minutes were unanimously approved by the membership.

III. Necrology Report

Joe Neal reported the death of Collins Veatch from the University of West Virginia.

IV. Executive Committee Reports

Joe Neal asked the membership to review the Annual Reports in the handout. He commented that he was pleased with the meeting facilities.

Officers:	Committees:
J. C. Neal, President	R. D. Sweet, CAST Representative
D. B. Vitolo, President-Elect	S. Glenn, Editor
A. R. Bonanno, Vice President	J. J. Baron, Legislative
A. F. Senesac, Secretary-Treasurer	J. F. Derr, Public Relations
T. E. Vrabel, Past President	R. J. Keese, Research Coordinator
	D. J. Mayonado, Sustaining Membership
	W. S. Curran, WSSA Representative

V. Secretary/Treasurer Update

Joe Neal reported that attendance at the 52nd Annual Meeting was 196, down from 211 last year. Hotel room nights were down from historical attendance. Comments were made regarding the Beltwide Conference and other conflicts that have decreased attendance.

Graduate Students participating in the Graduate Student Paper Contest were reminded to bring their receipts to the registration desk Thursday morning to receive their room reimbursement.

VI. Audit Committee Report

Grant Jordan was unable to audit the report due to the illness of Andy Senesac, Secretary/Treasurer.

VII. Archive Report

Tom Vrabel announced that he forwarded the archive information put together by Jeff Derr to Robin Bellinder, NEWSS Archivist. These will be stored in the Archive at the Department of Fruit and Vegetable Science, Cornell University, Ithaca, NY.

VIII. Awards

A. 1997 Collegiate Weed Contest

Tom Vrabel was called upon to review the Collegiate Weed Contest winners. He reported that attendance was very good for the contest at North Carolina State University.

Graduate team winners were: first place, Michigan State University; second place, Virginia Tech; and third place, University of Tennessee.

Undergraduate team winners were: first place, University of Guelph; second place, University of Guelph; and third place, Penn State University.

The individual winners were: first place, Brett Thorpe, Michigan State University; second place, Paul Vandergill, University of Guelph.

B. Graduate Student Paper Contest

Tom Vrabel acknowledged BASF for their support of the Student Paper Contest which provides monetary awards for first and second place winners. He asked Viv Harris of BASF to come forward to present the prizes. Third place winner was D. B. Lowe of Clemson University. Second place winner was Travis Frye of Penn State University. First place winner was Don Poston of Virginia Tech.

C. Research Poster Award

Second place was awarded to P. C. Bhowmik and J. A. Drohen, University of Massachusetts, Amherst. First place was awarded to L.J. Kuhns and T. Harpster, Penn State University.

D. Photo Contest

John Grande, Chair of the Photo Contest Judging Committee suggested that slides be scanned and printed for display at the meeting. He thanked committee members Betty Marose and Jim Saik.

Print Competition: No entries, no award.

Slide Competition:

1st prize, Joe Neal, North Carolina State University
2nd prize, Bill Curran, Penn State University
3rd prize, Tom Watschke, Penn State University

IX. Old Business

A. Washington Liaison Committee

Rich Bonanno presented the report he first presented in the General Session regarding the increase from part time to a full time AESOP position and the support of a Congressional Science Fellow. Doing both would cost an additional $7 to 10 per society member. A full time AESOP position only would cost an additional $3 to 5 per member. All the regional societies and WSSA are having these discussions. The NEWSS decision may affect the overall outcome of these discussions. We currently contribute $4000 to these two programs which cost $80,000.

A Congressional Science Fellow is a one year volunteer staff member positioned in a Congressman's or Senator's office; NEWSS funds contribute to the support of these individuals. AESOP allows us to interact and have impact on Congress; AESOP is solicited to offer expertise to the subcommittees.

A hand count was taken: 55 voted no, 65 voted yes to increase to full time AESOP position.

A second hand vote was taken: 16 voted yes, 65 voted no to support a Congressional Science Fellow.

B. Education Committee Recommendations

Joe Neal presented the three options discussed at the General Session regarding the education and outreach function of the Society. Option A was to revise the existing EC position from Research Coordinator to Research and Education Coordinator. Some of the responsibilities of this position would be farmed out to a paid position at the cost of approximately $300. Option B was to add a full time Education Coordinator to the EC and budget for web site development, etc. at a cost of $3000 to $5000. Option C is to maintain status quo. The EC is recommending Option A. President Neal opened the discussion to the floor. Ballets were passed out and collected. The results of the vote were: Option A-55 votes, Option B-6 votes, and Option C-4 votes. The EC will work on implementing Option A.

X. Presentation of Gavel

Joe Neal presented the gavel to incoming President David Vitolo. Dave thanked outgoing president Neal for his service to the Society and presented him with a plaque commemorating his service as president.

XI. New Business

A. Call for Resolutions

Tim Dutt, Chair of the Resolutions Committee, stated that no resolutions had been submitted to the Resolutions Committee in 1997. There were no resolutions from the floor.

B. Nominating Committee Report

Renee Keese, Chair of the Nominating Committee, thanked Nominating Committee members Ted Bean, Keith Brownell, John Hinz, and Gary Tuxhorn. The Committee presented Brian Olson to the membership as candidate for Vice President. President Vitolo asked if there were any nominations from the floor. With no new nominations, Dave Vitolo moved to close the nominations for Vice President; motion was seconded and carried.. Brian Olson was elected as Vice President of the Society by acclamation.

C. Election of 1998 Nominating Committee

Dave Vitolo named Gar Thomas as Chair and Nancy Cain as member of the 1998 Nominating Committee. He asked for nominations from the floor. Todd Mervosh, Paul Stachowski, and Andy Ackley were nominated from the floor. The motion to close nominations and approve the nominees was carried.

D. Designation of the 1998 Resolutions Committee

President Vitolo designated that the 1998 Resolutions Committee will be chaired by Paul Stachowski. He will select two other members.

E. Weed Contest - 1998

The 1998 Collegiate Weed Contest will be hosted by the University of Delaware on August 4, 1998 (travel date August 3). Mark VanGessel will Chair the Organizing Committee.

F. Meeting Site - 1999

President Vitolo announced that the 1999 Annual Meeting will be held January 4-7, 1999 at the Cambridge, Massachusetts Marriott.

G. Other New Business

A questionnaire was passed out to poll the membership regarding the starting date for the Annual Meetings for 2000 and 2001 and their proximity to New Years Day.

XII. Executive Committee for 1998

David Vitolo, NEWSS President, introduced the 1998 Executive Committee.

President-Elect, A. R. Bonanno; Vice President, B. D. Olson; Secretary/Treasurer, A. F. Senesac; Past President, J. C. Neal; CAST Representative, R. D. Sweet; Editor, S. Glenn; Legislative, J. J. Baron; Public Relations, J. F. Derr; Research and Education Coordinator, R. J. Keese; Sustaining Membership, D. J. Mayonado and WSSA Representative, W. S. Curran.

XIII. Adjournment

President Vitolo asked for a motion to adjourn the Annual Meeting. The membership motioned, seconded and unanimously approved to adjourn at 5:30 PM.

NEWSS Financial Statement for 1997

November 1, 1996-October 31,1997

INCOME:	
1997 Sustaining membership	$3,100.00
Membership	$3,500.00
Registration	$10,930.00
Proceedings	$5,580.00
NEWSS History	$365.00
Annual Meeting Awards	$300.00
Interest(all acts)	$1,691.22
Coffee Break Support	$1,400.00
Weed Contest	$4,440.00
Other Income	$310.00
Subtotal	$31,616.22
EXPENSE:	
Administration	$1,445.46
Annual Meeting	$9,529.06
Proceedings	$4,582.47
NEWSS NEWS	$2,813.30
Annual Meeting Awards	$1,266.88
Weed Contest	$2,747.54
Miscellaneous (includes WSSA Cong. Fellow and AESOP)	$6,090.36
Subtotal	$28,475.07
Total Income/Expense (1997)	$3,141.15
Balance Forwarded Savings Certificate Account (IDS Financial Services)	$16,083.15
Balance Forward Money Market Act (Compass Treasury Cash Series)	$20,083.06
Balance Forward Checking Account (North Fork Bank)	$4,807.42
TOTAL NET WORTH	**$44,115.38**
October 31,1997 Savings Certificate Account (IDS Financial Services)	$16,887.44
October 31,1997 Money Market Act (Compass Treasury Cash Series)	$15,879.27
October 31, 1997 Checking Account (North Fork Bank)	$11,348.67
TOTAL NET WORTH	**$44,115.38**

THE NORTHEASTERN WEED SCIENCE SOCIETY Checking Acount, Money Market Acount and Savings Certificate were reviewed by the undersigned and are in order.

Grant L Jordan

Joseph B. Sieczka

Executive Committee Reports of the NORTHEASTERN WEED SCIENCE SOCIETY
Presented at the 52nd Annual Business Meeting
Capital Hilton, Washington DC January 7, 1998

PRESIDENT
Joseph C. Neal

While 1997 has been a busy year, the major activity of the 1997 EC (of course) has been the logistics and business of developing the 1998 annual meeting. The theme for the conference is "the impact of legislation on weed science" – an appropriate theme considering the Washington, D.C. venue. Rich Bonanno, program chair, has done an excellent job in developing the program. I thank Rich, the section chairs and all of the executive committee for their hard work that has produced such a fine program. In addition to working on the program, many other initiatives were begun in 1997 including a dialog with other weed science societies on shared visions and opportunities, and an examination of our own outreach programs.

In July, 1997, representatives of all regional weed science societies, the WSSA, the Aquatic Plant Management Society, and the Canadian Expert Committee on Weeds met in Chicago to discuss shared opportunities. I applaud Cal Messersmith, president of WSSA, for his vision and commitment to this process, without which this dialog would not be happening. Although part of the agenda appeared to be a sales pitch for a WSSA Executive Vice President position, there was much more. Regional and national membership needs and perspectives as well as opportunities for collaboration and interaction were discussed. There was much agreement on some issues, not on others. However, there was general agreement that greater cooperation between weed science societies and other organizations interested in weed management was possible and should be pursued. WSSA continues to take the lead in this dialog and I expect to see evidence of this at the 1998 WSSA meeting and to hear more about this issue in 1998. At the 1997 annual meeting we announced an effort to evaluate the NEWSS's role in outreach education. I appointed Nate Hartwig to chair a committee to conduct this review. I am pleased to say that the report from the committee illustrated strong support for an outreach education mission and has made several specific recommendations The NEWSS EC reviewed the recommendations of the education committee with a close eye on the financial implications to the Society and membership and felt that the membership should also be presented with a less costly plan. The committee's recommendations and several options for implementation will be reported, discussed and voted upon at the 1998 meeting. The full text of the committee's report is included.

I have also had the opportunity to represent the NEWSS in the CAST "Conversations on Change" coordinating team workshops. The goal of this initiative, funded by the Kellogg Foundation, is to develop methods by which positive change in scientific societies may be facilitated. It was surprising to find that many scientific societies are experiencing many of the same problems and issues as the weed science Societies. There were clearly several areas in which scientific societies can cooperate, pool resources, and better serve members and society at large. It is hoped that the participants in this workshop will become "ambassadors of positive change" in their respective Societies and provide conduits for communication and shared resources. Lofty ideals, but well developed, gaining momentum and with a real chance of success. It is gratifying to note that the weed science Societies appear to be in the forefront of this process of meaningful change. I am particularly proud that the NEWSS is in a leadership position with the self-evaluation of our outreach education mission.

Last but not least, I thank the membership of the NEWSS for the opportunity to serve as president. It has been an enjoyable experience. I also thank the hard-working members of the Executive Committee for all they did to make my job as President an enjoyable and (I hope) a productive one.

PRESIDENT-ELECT
D. B. Vitolo

Activities

Hotels were visited in Boston (3), Cambridge (3), Philadelphia (1), and Baltimore (2) to view potential meeting sites and collect bids. Key selection criteria were cost to the Society and members, the facility, and the location. After considerable negotiations, the Cambridge Marriott was selected.

__1999 Annual Meeting__

The 1999 Annual Meeting will be held at the Cambridge Marriott. (we're going to party like it's 1999). Overlooking Boston and the Charles River, the Cambridge Marriott is adjacent to MIT, and across the street from the MIT -T station. For dining, several restaurants (including Legal Seafoods) and a Food Court are attached to the Cambridge Marriott, and Downtown Boston and Harvard Square are minutes away by T or taxi.

__Highlights:__

Rate:$79.00 + 4%/yr
Parking:Free
AV:Free
Reception: Free (with $1,500 food upgrade).
Board Meetings at conference rate (March, October 98)

Hospitality suites will require the services of a bartender ($75/1st 3 hrs, $25/each additional Hr) as per their interpretation of state law. Suites will run $150/day. We have the option of renewing the contract for the 2001 meeting for the same rates. The 2001 contract is awaiting our decision on meeting dates.

I would encourage the NEWSS to enter into 2-year agreements with hotels for three reasons:
1. Cost.
2. A reduction in work load for the President-elect.
3. A reduction in work for the VP as Program Chair.

VICE PRESIDENT
A. Richard Bonanno

The 1998 Annual Meeting plans for the NEWSS are highlighted by a new section and the most papers presented since 1989. Based on the arrival of Dr. Tom Bewick from Florida to the Massachusetts cranberry Experiment Station, a section on Biological Weed Management was created. This section has drawn papers largely from USDA researchers in the Washington DC area. A breakdown of 1998 papers is as follows:

14 Posters
37 Agronomy
15 Industrial, Forestry, & Conservation
18 Turf & Plant Growth Regulators
9 Ornamentals
11 Fruit & Vegetables
13 Biological Weed Control

There are a total of 117 papers being presented compared with 104 in 1997; however, only 8 graduate students are in the contest this year. The Graduate Student Contest numbers are down from 13 last year and 18 in 1996. It is not clear if numbers of students in school or the Washington, DC location is the reason. The topic for the General Symposium is the 1996 Food Quality Protection Act. Four topics will be presented including an Overview by Jerry Baron of IR-4, Section 18's by Pat Cimino of EPA, the Risk Cup by Steve Johnson of EPA, and Endocrine Disrupters by Janise McFarland of Novartis The featured speaker at the General Session is Ernest Delfosse, the new National Program Leader for Weed Science. The welcoming address will be given by Janet Anderson of EPA. This year, we ate not having an educational session on the last day due the DC location.

Since the 1999 Annual Meeting will be in Cambridge, it is likely that the 2000 Annual Meeting will be in either Washington, DC or Baltimore. The results of the last member survey indicated that Baltimore and Boston are the meeting sites most preferred.

SECRETARY-TREASURER

Andy Senesac

Attendence at the 1997 Annual Meeting in Newport, Rhode Island was 212 with an additional 7 attending the Special Turf and Ornamental Session. Total membership for 1997 was 248. In FY 1997, income exceeded expenses by $3,141.15 and the net worth of the NEWSS was $44,115.38.

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PAST PRESIDENT

T.E. Vrabel

The 51st Annual Meeting of the NEWSS was held January 6-9, 1997 at the Newport Marriott in Newport Rhode Island. The meeting was a great success, despite the limited attendance from our Canadian colleagues due to travel budget restrictions. Due to the strong participation in the Agronomy sections there was a necessity to move several Agronomy presentations into the Poster Session which strengthened this Session. The General Session Featured Dr. Randy Westbrook who spoke about the impact of invasive weeds on the environment. This theme was continued into an excellent General

Symposium which dealt with this topic in greater detail.
Despite the success of the our enthusiasm was dampened with the knowledge of the recent passing of Wayne Wright, one of our membership whose contributions to the Northeastern Weed Science Society have been greatly appreciated and whose participation will be sorely missed. Many thanks go to Brian Olson, whose efforts made it possible for Wayne to receive his plaque for being named Distinguished Member of the Society a couple of weeks before his passing.
Our 52nd Annual Meeting will be held for the first time in our Nation's Capitol, Washington DC. I hope that our membership will enthusiastically support our next meeting and while in Washington take advantage of its many attractions.

A key function of the Past President is serving as Awards Chairman. Nominations for Distinguished Member and Award of Merit were properly written up and supported and were approved by major majorities by the Executive Committee. Awards were presented at the General Session on January 6, 1998. Distinguished Member was received by Prasanta Bhowmik and Awards of Merit were received by Stan Pruss and Max McCormack. There were no nominations received for Innovator of the Year or the Applied Research Awards. We as Society members need to take the awards nominations process seriously in order to insure that our deserving colleagues are recognized for their contributions to our discipline.

The Poster, Photo, And Graduate Student Paper awards will be presented at the Business Meeting on January 8, 1998.

The Manual of Operating Procedures was reviewed and revised with the help of the Executive Committee. The revised MOP will be available at the January 8th Business Meeting.

CAST

R. D. Sweet

The CAST Board met November 1 and 2, 1997 in Chicago. The attendance was good and much was accomplished.

1. Two societies joined CAST, the Society for Range Management and the American Oil Chemists Society. Each has 4-5000 members. Range Management had dropped out several years ago.
2. Board size is now being reduced by limiting all societies to one Director. This will be phased in as the terms of current reps expire.
3. Dues are to be a minimum of $500 and maximum $5,000. However the rate per member was not established. I expect it to be about 70 cents. This new system means that most small societies such as NEWSS will pay more and the very large ones will pay less. Most will see little change.
4. Expenses to board meetings will be split between Societies and CAST. The latter will pay up to $500.00 per year, and the rest paid by the Society or its representative.
5. Another structural change needed at CAST is the make up of the Executive committee. As CAST continues to grow, now at 36 societies, the Executive Committee increases in importance. Many ideas put forth, but decisions not expected until the next board meeting.
6. An urgent need is for a special publication on plant resistance to pests when it is related to chemical content. Several months ago 11 scientific societies prepared such a document and sent it to EPA and FDA. They have ignored it. Rumors are each agency is trying to get the assignment so it can expand. Science always loses in power struggles like this.
7. All existing publications are being reviewed by the appropriate work group and put into one of 3 categories: a) OK as is b) revision needed c) Historical value only. At the spring meeting the "revision" group will be given priority rankings.
8. The Worldwide Food Conference was held immediately following the Board meeting. Advance registrations were considerably below expectations. Since publicity and lead time were OK speculation as to the cause was divided between: a) lack of urgency for the issues being discussed and b) relatively high cost of participating.
9. The CAST 25th anniversary recognition was to be in conjunction with the first session at the food conference. I do not know what took place. I didn't feel the cost of attending, $90.00 registration plus $155.00 for a room, worth it.
10. CAST's finances have improved from red ink to at least light pink and perhaps solid black. Expenses were reduced substantially by canceling the contract with a fund raising company, which was not performing well and by reducing services from AESOP, a D.C. agriculturally oriented lobbying firm. Fund raising will be returned to a staff person at Ames, where it traditionally had been. Several options are being evaluated for providing CAST a good presence in D.C.

PUBLIC RELATIONS
Jeffrey Derr

Photographs of the award winners, the executive committee, past presidents, and symposium speakers were taken at the annual meeting in Newport. Prints from the annual meeting were sent to Tom Vrabel for the archives. An article on the 1997 annual meeting, which included selected photographs, was prepared for the WSSA newsletter. Three issues of the NEWSS newsletter were compiled and sent to Andy Senesac for copying and distribution. The April issue listed award winners from the 1997 annual meeting and information on upcoming events. The August issue contained the call for papers and other information for the 1998 annual meeting. The November issue contained the results from the Collegiate Weed Contest and a condensed program for the 1998 meeting. A press release on the upcoming 1998 meeting in Washington D.C. was sent to approximately 25 organizations and individuals.

EDITOR
Scott Glenn

Three publications were produced and edited for the 1998 Northeastern Weed Science Society. The Program Guide was 34 pages and 800 copies were printed. The Proceedings was 214 pages, consisting of 99 new Abstracts or full length papers and 2 Abstracts from the 1997 Annual Meeting in Supplement. The Index to the Proceedings and Supplements of the Northeastern Weed Science Society (Volumes 46 to 51) was 54 pages and 150 copies were produced.

RESEARCH COORDINATOR
Renee J. Keese

The previous research coordinator (William Curran) completed the submission of paperwork for pesticide recertification to the necessary state agencies after the 1997 conference. During the interim, Tom Vrabel solicited nominees for the Innovator of the Year and Applied Research Awards. Tom will also handle the awards at the 1998 conference.
The lists of herbicide names for the 1998 program and proceedings were updated by Lewis Walker and Scott Glenn.

Requirements for authorized recertification credits were secured from the thirteen participating NEWSS states, and for the Certified Crop Advisor program during the fourth quarter of 1997. Credits will be given for many sessions at the 1998 conference in Washington, DC .

WSSA
William S. Curran

I attended both the winter and summer WSSA Board of Directors meetings in 1997. The winter meeting was held in Orlando in conjunction with the annual meeting and the summer meeting was in Chicago, the 1998 annual meeting site. A number of issues were discussed during the year that will impact the NEWSS. The following are some of the highlights.

<u>External Activities</u>

• Dr. Leonard DelFosse was appointed as the new USDA Weed Science Program Leader.
• Mr. Keith Menchy and Mr. Curtis Dell are the new Congressional Science Fellow delegates.
• WSSA retreat held in Chicago, July 1997. Recommendation from the retreat attendees and the WSSA Board of Directors is included in this report.

<u>1998 WSSA Program</u>
The 1998 WSSA annual meeting will be held at the Chicago Hilton, February 8 - 12. The following is a tentative schedule.
Sunday afternoon - committee meetings
Monday morning - committee meetings
Monday 4:00 pm - General Session
5:30 pm - Presidents Reception

Tuesday8:00 am - Poster session
10:30 am - Breakout sessions
late afternoon - Business meeting
Wed.8:00 am - Poster session
10:30 am - Breakout sessions
eve - Banquet
Thurs.morning - Breakout sessions

New format
•Will try one or two breakout sessions with expanded presentations, posters, and discussion period. This is similar to the IUPAC meetings.

Workshops/Symposia
•Experimental Design workshop - will be conducted on Sunday afternoon for about 4 hrs. Participants will be charged $40-50 extra.
•Other workshops (included in program)
1. Teaching weed science
2. Tips for publishing in weed journals
•Symposia
1. Applied technology for the next millennium
2. Integrated weed management
3. Ethics in weed science

Issues
•Nine key issues were identified at the July WSSA retreat in Chicago. The following was the Board of Directors summary of the nine issues and the current action recommended.

Priority issues organized in order from most important to less important

1. Concept: Continuity and influence of Weed Science representation on the national level (43)
Defining terms: • AESOP, EUP, Congressional Science Fellow, Other methods
• Develop solid objectives for each
• Develop solid job description/mission statement for each
Near-Term actions: •Board assign group to construct objectives and job descriptions
•Quantify productivity of current efforts
•Share results of above with membership
•Individual societies decide on support of any, some, or all
WSSA board: •Assign initial responsibility to Wash. Liaison Committee

2. Concept: Rework format of national meeting (41)
Defining terms: • Fewer to no classical oral presentations
• More posters
• More and longer special discussion sessions
• Joint regional/national meetings
Near-Term actions:• Initiate some change in 1998 meeting
• Charge program committee to explore plan
• Regional boards to consider willingness to attempt joint meeting
WSSA board:•Assign initial responsibility to Program Committee
•1998 program will include some changes

3. Concept: Conduct survey/focus groups with members, clients, prospective members, and ex-members on variety of issues(32)
Defining terms: • Serve real customer needs
• Set direction which can be embraced by many
• Expand participation in process
• Need professional help to improve quality of results
Near-Term actions:
• All boards ask groups to share ideas of survey answers and potential tools

to gain impact

• Collect and explore sources and cost of professional help and consider allocation/approval of funds

• Regional boards to consider willingness to attempt joint meeting

WSSA board: • Assign initial responsibility to Membership Committee

• Two step process; first our membership then others

4. Concept: Develop stronger links from national-regional-state-international organizations (25)

Defining terms: • Leverage/power of combined energy

• Better communication

• Stimulate grass roots influence

• Seek/gain local insight at multiple levels

Near-Term actions:

• Board appoint groups to construct proposal

• Identify state/local organizations

• Approach organizations with proposal

WSSA board: • Develop Ad Hoc committee to address

5. Concept: Serve and cater practitioners (22)

Defining terms: • Examine current means of information exchange for ease of use, timeliness, and relevancy of information and training

Near-Term actions:

• WSSA board consider practitioners magazine (Weeds Today)

• WSSA board and editorial staff evaluate necessity of two technical journals

• Appoint group to explore what, why, and how of training

WSSA board: • Assign to Publications Committee

6. Concept: Expand use of electronic communication tools (13)

Defining terms: • Timely, relevant information exchange

• Communications quality

• Reduced costs

• Expand public service and public image (via web)

Near-Term actions: • Charge relevant committee's and provide $

• Inter-society cooperation

• Link to CAST efforts

WSSA board: • Assign to Computer Committee

7. Concept: Upgrade efforts to maintain timely list of research priorities and ensure that such a list receives regular deep public debate (11)

Defining terms: • Current efforts struggling with diversity of opinion

• Efforts stagnant

Near-Term actions: • Charge research committee to utilize different tools and engage society members

• Do not worry about diversity of opinion

WSSA board: • Assign to Research Committee

8. Concept: Solidify and grow links to CAST and other societies for insight, help on common issues and leverage for $ (8)

Defining terms: • Electronic products

• Writing for public consumption

• Training tools for special issues

Near-Term actions: • Maintain support of current programs

• Pro-actively seek discussions with others outside our discipline

WSSA board: • Assign to retreat organizers (Conversations for Change group)

9. Concept: Common management of pooled financial resources (4)

Defining terms: • Better yields = more money

Near-Term actions:• all society boards get information and decide on participation
WSSA board:•Assign to Treasurer/Finance Committee

Other: Oversight Committee - establish an oversight committee to carry these actions further. Regional boards appoint a delegate. Want energetic people with passion

SUSTAINING MEMBERSHIP
David J. Mayonado

A total of 30 checks were received from Sustaining Members for 1998. That is down 2 from last year. Industry consolidation is affecting our numbers. The $25 increase in Sustaining Membership dues does not appear to have impacted membership and has been helpful in maintaining revenues with declining numbers. We still have 2 outstanding commitments for coffee break money. Assuming these are paid, Sustaining Members will have supported the society with a total of $9,350.00 for 1998. This is down $750 from last year, primarily due to fewer dollars being collected for the Weed Contest. We have received 7 requests for exhibit space from our Sustaining Members. Job placement forms have been collected and will be made available to our membership during the meeting. The forms will be forwarded to the WSSA for display at the national meeting in February.

LEGISLATIVE
Jerry Baron

FOOD QUALITY PROTECTION ACT OF 1996:

During 1997, EPA started the process of implementing the new policies and actions associated with FQPA. On January 31, 1997, EPA issued a notice (PR Notice 97-1) to registrants outlining their interim approach to implementing the new food safety requirements. The most important item in this notice is 'Risk Cup concept to handle aggregate pesticide exposure from diet, drinking water, pets and residential sources Using current risk assessment methods, EPA will allocate up to 20% of allowable exposure from non-dietary exposure sources. New uses will be allowed as long as the calculated dietary risk plus the reserved non-dietary exposure estimate does not exceed acceptable levels.

Following the issuance of the interim FQPA implementation notice, EPA registered several new active ingredients. Most of the new clearances involved pesticides classified as reduced risk. They new actions included the clearance of the herbicides thiazapyr (Visor R - Rohm and Haas), Mon21200 (Monsanto) and sulfentrozone (Authority - FMC). In addition, EPA registered a significant new use of the herbicide glufosinate ammonium.

In late spring, EPA published PR 97-2, and finally opened their door and began accepting submissions of data to support registration of conventional pesticides. However, the companies were only allowed to submit data to support their most important five registration requests or priorities. EPA developed six categories of priorities listed in decreasing order of importance (1) methyl bromide alternatives; (2) reduced risk candidates; (3) USDA/EPA identified vulnerable crops; (4) minor use priority; (5) non-minor use priority; and (6) addressing trade irritants. Using this system, EPA felt it could better utilize its resources to achieve its goals. For example, a use that has potential to replace methyl bromide would get a EPA review prior to a major crop that is classified as a non-minor use priority. Registrants could upgrade non-minor use priority to minor use priority by adding registration actions for minor crops to their submission. In certain instances companies could submit data to support more than five priorities if the data supported a methyl bromide alternative or if the data supported a replacement to a USDA/EPA identified vulnerable crop use. PR 97-2 also specifically recognized 29 major crops and defined remaining crops as minor uses.

In early August, EPA announced the schedule for reassessing approximately 10,000 existing pesticides tolerances. EPA plans on completing review of 33% of all pesticide tolerances by August 1999, 66% by August 2002, and 100% by August 2006. In their plan, they break the tolerances down into three groups. Group 1, will be examined first, and consists of 228 pesticides that appear to pose the greatest risk to public health. It includes the organophosphate, carbamate, probable/possible human carcinogens, and other pesticides that exceed their reference dose. Group 1 herbicides include acetochlor, acifluorfen, alachlor, asulam, atrazine, benfluralin, bromacil, bromoxynil, butylate, cycloate, desmedipham, dichlobenil, diclofop, EPTC, ethalfuralin, fenoxaprop, fomesafen, lactofen, metolachlor, molinate, oryzalan, oxadiazon, oxyfluorfen, paraquat, pebulate, pendimethalin, quazalofop, simazine, terbacil, thiobencarb, triclopyr, trifluralin, vernolate, and 2,4-D. Group 2 consists of 93 pesticides that are considered possible human carcinogens and are not included in Group 1. Group 2 also are the remaining pesticides subject to reregistration. This group is classified as EPA's second priority. Finally, Group 3, is 148 pesticides that are mostly biological based, inert ingredients, or recently registered (post 1984 active ingredients). These will be the last to be reassessed.

To respond to the challenges of FQPA, USDA has created the Office of Pest Management.

This Office will serve as USDA focal point for pesticide regulatory issues. The press release announcing the new office noted that it is charged with integrating and coordinating pesticide issues within USDA along with improving communications with and strengthening the existing network of grower organizations and crop specialists at land grant universities. This will help make available accurate, high quality data on pesticide use practices for regulatory decision making. The Office of Pest Management will assume the current responsibilities of the National Agriculture Pesticide Impact Assessment Program as well as coordinating actives of existing USDA programs such as IR-4, Pesticide Data Program, Pest Management Alternatives Program, IPM, and food consumption surveys. In a related development, EPA announced the a newly created Minor Use Program Team This team will work closely with grower organizations and other stakeholders to obtain and use the best available data to facilitate an open dialogue with the minor use community and to promote the development of safer pesticides for minor uses.

Following up on food consumption surveys, USDA Agricultural Research Service announced a study of domestic households to obtain data on foods eaten by children. This data will be used in risk assessments associated with FQPA. USDA noted that the children's survey is an extension of the 1994-96 nationwide food survey, "What We Eat In America," which covered all age groups. The new survey will cover children between birth and 10 years of age. The information will be combined with food intake data collected during the larger survey from about 5,700 children up to age 18.

INVASIVE PLANTS UPDATE:

Members of the WSSA were asked to present a briefing for the House Agriculture Committee on January 29, 1997 to discuss the scientific issues that involved with invasive plants. Vice President Rich Bonanno represented NEWSS. The briefing was extremely well attended by congressional staffers. This briefing laid the foundation for WSSA to serve as an unbiased, scientific resource during the upcoming debate on new legislation with invasive plants.

As a follow-up to the above meeting, representatives of WSSA and representatives of American Association of Nurserymen (AAN) met on February 4, 1997. This meeting provided a forum for open dialogue on the issue of inadvertent introduction of new invasive plants by the nursery industry. Since the first meeting AAN and WSSA have developed a formal workgroup that is charged to author a strategy for screening plant introductions for invasiveness. Gene Cross of NC Department of Agriculture and Keith Menchey of AESOP Enterprises represents WSSA in this workgroup. The first meeting of the workgroup was scheduled for July 17 & 18.

The WSSA Board of Directors endorsed the concept of nationwide coordination of invasive weed management and will co-sign a letter-urging establishment of a National Center for Invasive Weed Control.

Food Safety/Organics

On October 2, 1997, President Clinton announced an initiative to upgrade domestic food safety standards and to ensure that fruits and vegetables coming overseas are as safe as those produced in the United States. The President asked Congress to enact legislation that will require the Food and Drug Administration (FDA) to halt imports of fruits, vegetables and other food products produced in countries that do not meet U.S. food safety requirements. The President will direct the Department of Health and Human Services (HHS) and the Department of Agriculture (USDA) to work cooperatively with the agricultural community to develop guidance on good agricultural and manufacturing practices for fruits and vegetables.

The National Cancer Institute of Canada published a paper in the November 15 issue of Cancer noting that public exposure of pesticides residues in fruit and vegetables does not pose any increased risk of cancer. The panel focused primarily on exposure in the general population and reviewed a wide range of studies that addressed issues related to dietary exposure as well as incidental home and garden use. See American Cancer Society's World Wide Web Site *http://www.cancer.org* for the full document.

USDA Agricultural Marketing Service (AMS) issues proposed rules governing the marketing of organically produced commodities. The program would establish national standards for the organic production and handling of agricultural products. It also would establish National List of synthetic substances approved for use in the production and handling of organically produced products. The program also discusses an accreditation program for State officials and private persons.

WAIVERS OF LIABILITY/THIRD PARTY REGISTRATIONS UPDATE:

Registrants to limit their liability for herbicides and other pesticides on high value minor crops often use waivers of liability and third party registrations. The specific concerns involve language that appears on labels noting that without a signed indemnification agreement, the use of the product is not legal. Growers sign away some of their ability to sue the registrant. Some states have insisted that waivers of liability should not be contained on labels and that they are not enforceable by regulatory agencies while other states rely on waivers heavily. EPA, after stating that waivers of liability are a state issue, have unofficially requested the Washington State Department of Agriculture (WSDA) to withdraw a Section 24(c) due to inclusion of a waiver of liability on the label.

In early December, EPA working with some of the companies has come up language that is allowable for inclusion on special local needs registrations Section 24(c) labels. This hopefully ends this regulatory issue.

USDA-ARS WEED SCIENCE UPDATE:

In spite of concerns expressed by weed science community, the vacant USDA-ARS National Program Leader for Weed Science was not be filled with an individual with extensive weed scientist background. Dr. Ernest Delfosse has taken on the USDA-ARS National Program Leader for Weed Science position. Though, Dr. Delfosse is an entomologist by training, he has shown his willingness to work with the weed science community. He will be providing the keynote address at the 1998 NEWSS Annual Meeting General Session.

USDA was considering terminating two weed science related projects with agriculture crops and closing down one of their facilities in order to redirect resources for invasive weed research. This action was stopped at the last minute due to pressure from the State of Washington delegation. There is still concern that USDA-ARS will switch resources production agriculture research to research on biological control of invasive weeds on public lands.

CROPS99 CONFERENCE:

The coalition for Research on Plant Systems (CROPS) is a coalition of farm/commodity and scientific associations. Their mission is to establish research priorities and related education and extension activities of the agriculture industry. The CROPS99 Conference was held on November 9-11 in St. Louis, MO. Jerry Baron, Rich Bonanno and Jeff Derr represented NEWSS at the meeting. A compressive report will be provided at a later date.

NEWSS EDUCATION/OUTREACH AD HOC COMMITTEE FINAL REPORT

July 15, 1997

Nate Hartwig

Results of Education/Outreach Mission Questionnaire

The majority of those responding (86%) felt, the NEWSS should be involved in outreach education (Appendix 1). This is to be expected since the annual meeting itself is a form of outreach education.

A clear majority (68 to 73%) felt we should be more aggressive in sponsoring outreach workshops and educational programs to weed management decision-makers, practitioners and even growers, as is presently being done in turf and ornamentals.

A clear minority (34%) felt the publication of a Northeast Regional Newsletter was not a good idea. The general feeling was summed up by one person's comment that "A number of state weed extension researchers publish weed mgt. and other pest mgt. info. annually for the public. This proposed newsletter sounds like a duplication of effort, along with assumption of responsibilities that we do not need to share with the extension service.

There was a little more support (50%) for a Northeast Regional Weed Management Guide for agronomic crops, vegetables, turf, ornamentals, forestry, etc. on the net and updated at least once a year. Some of the negative comments were the same as for the newsletter; infringement on local extension territory, too much variation over the entire region, too difficult to get everyone to agree to format, herbicide rates etc. and not all are connected to the net. Mark VanGessel noted that "the net lacks depth and is often out of date. Most people glance or skim net information but in order to read information and absorb it, they need hard copies. – All this is meant to say that as widespread as the 60 to 70% of those responding felt would be useful on the net are such things as weed management methods other than herbicides, environmental impact information and regulations related to the use of herbicides.

Three fourths of the respondents thought the NEWSS should have an Education Coordinator with a seat on the executive committee. Several felt that to get a person who would commit sufficient time to this job it would have to be a paid position. Most felt it would be time consuming and require expertise in computer technology and setting up a net home page with linkage to information on the net.
Recommendations to the NEWSS Executive Committee.

1. Establish an Education Coordinator position with a seat on the executive committee.
2. Provide $3,000 - $5,000 to establish a home page for the NEWSS
3. First responsibility to develop an outline of the type of information that should be provided on the web site.

The ad hoc committee's thinking was that this position should be filled by a volunteer. The NEWSS doesn't have the money to pay such a person but if this person had some money to hire student help with some experience in developing web pages, the job could be accomplished without spending an excessive amount of time him/herself.

The questionnaire didn't ask enough questions about the kind of information that people would like on the web. Betty Marose suggested that each state should put information on the web pertinent to that state and the NEWSS web page would have links to these state web pages.
There would be some information that pertained to the business of the NEWSS that the Education Coordinator would be responsible for putting on the web and keeping it updated. Such information would include publicizing the NEWSS annual meeting etc.

Ad Hoc Education Committee
Dr. Nathan L. Hartwig, Chm., Penn State
Dr. William S. Curran, Penn State
Ms. Betty Marose, Univ. of Maryland
Dr. Mark J. VanGessel, Univ. of Del.