ROUGHSTALK BLUEGRASS SUPPRESSION IN ALFALFA/GRASS HAYFIELDS - RR Hahn and PJ Stachowski, Cornell Univ., Ithaca, NY.

ABSTRACT

A field experiment was established April 30, 2001 near Ithaca, NY to determine the value of using recommended and double seeding rates of timothy (*Phleum pratense* L., 'Mariposa') or orchardgrass (*Dactylis glomerata* L., 'Shawnee') for suppression of roughstalk bluegrass (*Poa trivialis* L.) in alfalfa (*Medicago sativa* L., 'Pioneer 5347 LH')/grass hayfields. These forage grasses were seeded at 5 and 10 lb/A with 12 lb/A of alfalfa. Other treatments included 12 lb/A of alfalfa as a nontreated check and as an alfalfa/clethodim treatment for bluegrass control. Clethodim was applied at 0.19 lb ai/A with 1% crop oil concentrate on April 16, 2002 and on May 9, 2003. Plots were harvested four times in 2002 and in 2003. In addition to measuring forage yield in tons dry matter per acre (T DM/A), botanical separation of samples was done to determine the percent alfalfa, timothy or orchardgrass, bluegrass, and forbs other than alfalfa in each plot. Forage quality analysis and milk yield calculations for each botanical component were done for the first cutting each year and these results used to calculate percent crude protein (CP), milk yield/T DM, and milk yield in lb/A.

First cutting forage yield from the nontreated check was 2.51 and 1.68 T DM/A with bluegrass contributing 46 and 30% of that yield in 2002 and 2003 respectively. Clethodim controlled 100% of the bluegrass both years but reduced forage yield to 1.39 and 1.11 T DM/A in 2002 and 2003 respectively. Forage yields from the alfalfa/timothy and alfalfa/orchardgrass treatments ranged from 2.36 to 2.97 T DM/A and were similar to the nontreated check in 2002. In 2003, the alfalfa/timothy treatments' average yield of 1.72 T DM/A was not significantly different from the nontreated check but the alfalfa/orchardgrass average yield of 2.09 T DM/A was greater than the check. Each of the alfalfa/grass mixtures effectively suppressed the bluegrass with 8% or less bluegrass in each of the alfalfa/grass treatments in 2002 and 2003. Forage from the nontreated check, which had 40 and 55% alfalfa, had CP values of 16.6 and 17.4% in 2002 and 2003 due to the bluegrass in this treatment while the alfalfa/clethodim treatment, which had 77 and 82% alfalfa, had CP values of 22.1 and 19.3% in 2002 and 2003. The alfalfa/timothy treatments averaged 14.8% CP in 2002 and 16.9% CP in 2003 while the alfalfa/orchardgrass treatments averaged 12.8 and 11.1% CP in 2002 and 2003. Although the milk yield/T DM was highest for the alfalfa/clethodim treatment in 2002, projected milk yield/A would have been less than with the alfalfa/timothy treatments which were favored by higher yields and moderate CP values (14.8%). The nontreated check and the alfalfa/orchardgrass treatments would have produced milk yields/A between the low of the alfalfa/clethodim treatment and the high of the alfalfa/timothy treatments but not statistically different from either. In 2003, the milk yield/T DM for the alfalfa/clethodim treatment was among the highest but would have produced less milk than any of the other treatments. Although the alfalfa/orchardgrass treatment with the recommended seeding rate of orchardgrass had one of the lowest CP values (11.4%), this treatment would have produced more milk/A than any of the other treatments except the alfalfa/orchardgrass treatment with the double seeding rate.

TREE-OF-HEAVEN CONTROL IN NO-TILLAGE CROPS - RG Louie, WH Phillips II, and S Glenn, Univ. of Maryland, College Park.

ABSTRACT

A 4-year study was initiated in 1995 to evaluate weed control and weed shifts in no-tillage glyphosate-resistant corn and soybean rotations. Glyphosate (1 lb ai/A) was applied at planting, early postemergence (5-inch corn; V-4 soybean), or early postemergence and late postemergence (10-inch corn; V-7 soybean). Plots not treated with glyphosate at planting were treated with 0.5 lbs/A paraquat and all corn plots were treated with 1.5 lbs/A atrazine preemergence. All plots were 20 feet by 80 feet. There were no tree-of-heaven plants present in the study area at the initiation of the study. By the end of the study, all plots were infested with tree-of-heaven. Tree-of-heaven control with all glyphosate treatments was 40% or less 8 weeks after treatment (WAT). In a separate study specifically designed to evaluate tree-of-heaven control in no-till corn, tree-of-heaven control increased with increasing postemergence application rates (ranging from 1 lb/A to 2 lbs/A) of glyphosate 3 WAT. However, 2 lbs/A glyphosate or two applications of 1.5 lbs/A glyphosate produced only 50% tree-of-heaven control 3 WAT and 30% 6 WAT. Postemergence applications of glyphosate were not effective in controlling tree-of-heaven and exclusive use of glyphosate in cropping systems may encourage tree-of-heaven infestations.

DANDELION CONTROL AS INFLUENCED BY SPRING APPLICATION TIMING - WS Curran, Penn State Univ., University Park, PA; and MM Loux, Ohio State Univ., Columbus.

ABSTRACT

Three herbicide treatments were applied at different times in the spring at four locations over two years in Pennsylvania and at two locations in Ohio for control of dandelion (*Taraxacum officinale* Weber in Wiggers.). The herbicides 2,4-D LVE, glyphosate, and 2,4-D plus glyphosate were applied using a CO_2 backpack sprayer. Glyphosate and 2,4-D were applied at 0.75 and 1.0 lb ae/acre, respectively at 20 GPA up to six different times starting in early April and ending the third week of May. Dandelion rosettes ranged from 3 to 5 inches in diameter in central Pennsylvania up to 12 inches in diameter in Ohio at the early April timing. Fall timing was included at three locations in the 2003 experiment. Visual estimates of percent control were taken several times during the season as well as weed density and/or biomass at some locations. The study was conducted as a randomized complete block with three replications. Control data were analyzed for significance looking at location, treatment and herbicide timing differences.

The fall treatments averaged 84% at the mid-May evaluation. Emergence of new seedling dandelion reduced fall control as the season progressed at the Pennsylvania locations. In general, the fall-applied glyphosate and glyphosate plus 2,4-D treatments provided better control than 2,4-D. Control with the spring timings averaged 76% at the June evaluation, but both herbicide and timing had an impact. In general, the early application timings were less effective than later; by the June evaluation, the May applications provided greater than 80% control, while control in the early April timing was 64%. When averaged over location and timing, 2,4-D applied in the spring provided 68% control, glyphosate 75% control, and glyphosate plus 2,4-D, 87% control of dandelion. In 2003, dandelion control from the spring applications averaged 63% at the NW Ohio location, 85% at the western Ohio location, 80% at the central Pennsylvania location, and 78% in southeastern Pennsylvania.

In 2003, Ohio had almost 10 inches of rainfall in April and May, while the Pennsylvania locations had 6.6 to 7.3 inches. Frequent showers may have impacted the control of some treatments and may account for some variability between locations and treatment timings. Degree day (DD) accumulation, base temperature of 40 F, from March through July ranged from a low of about 2500 in central Pennsylvania to a high 3100 in western Ohio. Differences in DD across locations, probably does not account for the variability observed.

These data show that fall application is an effective time for control of dandelion and that the performance of spring application is variable. In general, dandelion control was better with the May applications compared to the early and mid April timings and the combination of glyphosate plus 2,4-D tended to be better than either herbicide alone. This study also shows that regardless of herbicide or application timing, an integrated approach that combines several tactics will be necessary for long-term dandelion control.

ROTATIONAL CROP RESPONSE TO MESOTRIONE USE IN FIELD CORN - P Bhowmik, Univ. of Massachusetts, Amherst; D Smith, Syngenta Crop Protection, Bedford, NH; D Sanyal, and E McGlew, Univ. of Massachusetts, Amherst.

ABSTRACT

Mesotrione [2-(4-mesyl-2-nitrobenzoyl)-3-hydroxycyclohex-2-enone] is a pigment inhibitor herbicide that controls many common susceptible weed species by inhibiting the 4-HPPD enzyme. It is recommended for use in combinations either with acetochlor, alachlor, s-metolachlor, or atrazine for complete control of annual weeds in field corn. The objective was to document any injury from mesotrione treated plots from one year to rotational crops in the following spring. A field study was conducted at the Massachusetts Agric. Experiment Station in South Deerfield, MA. Plots of 13.5 by 60 feet were established in 2002. Treatments were replicated three times in a randomized block design. Corn was planted in May 6, 2002. Mesotrione treatments (3, 6, 12, and 18 fl oz/A) were applied PRE and POST in May 7 and June 13, 2002, respectively. A treatment of prosulfuron at 1 oz/A was applied POST. A nontreated check was also included in the study. All treatments were applied using a CO_2-backpack sprayer that delivered 20 GPA at 22 PSI. Corn was harvested for silage in September, 2002. In 2003, plant back study was initiated to the same plots where above-mentioned treatments were applied in 2002. Ten different plant species were planted with a Tye drill in May 20, 2003. The planter was calibrated to plant a certain number/unit row length for each plant species. 'Pioneer 91B91' Soybean, '1605 RR' sugar beet, 'Meridian' red clover, 'Vista' dry bean, 'Rainer' alfalfa, 'Copenhagen' cabbage, 'Wisconsin SMR5' cucumber, 'Provider' green bean, '230 Laxton Progress' peas, and 'San Marzano' tomato were included in plant back study. Plant injury was estimated visually on a scale of 0 to 100% (0 = no injury and 100 = completely dead plant) 7, 14, 21, 28, 35, and 42 days after emergence (DAE). Plant number/unit row length and plant height were determined 35 DAE. For greenhouse bioassay, field soil samples were taken in May 19, 2003 from plots treated with mesotrione at 6 and 12 fl oz/A PRE and at 3 and 6 fl oz/A POST and nontreated check. Composite soil samples (10 soil cores) were taken from each plot. 'Rainer' alfalfa, 'Meridian' red clover, and '1605 RR' sugar beet were used for greenhouse bioassay. Seeds of each of the species were planted in plastic cups. After emergence plants were thinned to 10 plants per cup. Treatments were replicated three times in a completely randomized design. Plants were allowed to grow for 4 weeks. Plant heights and weights were determined for the final evaluation. In general, all crop species tested were safe to plots where mesotrione was applied at 3, 6, and 12 fl oz/A PRE and 3 and 6 oz/A POST in 2002 growing season. There were no differences in plant number or plant height. In greenhouse bioassay, alfalfa, red clover, and sugar beet were safe to all treatments. In summary, mesotrione treated plots from one season are safe to rotational crops in the following spring.

EFFICACY AND CROP SAFETY OF POSTEMERGENCE APPLICATIONS OF NICOSULFURON, RIMSULFURON, MESOTRIONE, AND METOLACHLOR MIXTURES IN CORN - D Ganske, DuPont Ag & Nutrition, Winchester, VA; MF Holm, DuPont Ag & Nutrition, Johnston, IA; SK Rick, DuPont Ag and Nutrition, Raleigh, NC; and DW Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were conducted in corn (*Zea mays* L.) to determine the effect of tank mixes of Steadfast and Camix or Lumax on crop safety and efficacy on several grass and broadleaf weed species. Tank mix applications were made utilizing a nonionic surfactant or nonionic surfactant plus AMS or 28% nitrogen. Results from weed free trials show no significant crop response across treatments on corn up to 5 inch in height regardless of the additives utilized. In additional trials when applications were made at two different corn heights, crop response ratings were similar to weed free trials and did not vary between application timings. The addition of Camix or Lumax to Steadfast gave excellent control to a broad spectrum of broadleaf grass weed species when applied at labeled weed heights.

WILD GARLIC CONTROL IN CORN - DH Johnson, Penn State Univ., Manheim, PA; WS Curran, DD Lingenfelter, and CB Muse, Penn State Univ., University Park, PA.

ABSTRACT

A field trial was conducted in 2003 in no-till corn (*Zea mays*) at the Penn State Southeast Field Research and Extension Center to study wild garlic (*Allium vineale*) control with herbicide combinations with glyphosate. Glyphosate was applied alone or tank mixed with 2,4-D (ester), thifensulfuron, thifensulfuron plus rimsulfuron premix (Basis), prosulfuron, mesotrione plus atrazine, or isoxaflutole. Most of these were also applied without glyphosate. This allowed us to study if tank-mix partners can improve wild garlic control with glyphosate and also if glyphosate improves control compared to the herbicides without glyphosate. Gramoxone Extra and Liberty were also applied alone. All treatments were applied about 2 weeks prior to corn planting when wild garlic was 8 to 15 inches tall, and recommended adjuvants were used. Some of the wild garlic was starting to produce aerial bulblets at the time of application.

Best wild garlic control (86% at 8 weeks after corn planting) was with glyphosate (1 lb/a) plus 2,4-D ester (0.5 lb/a). Control was poor for thifensulfuron, thifensulfuron plus rimsulfuron premix, prosulfuron, mesotrione plus atrazine, and isoxaflutole applied without glyphosate, but adding glyphosate to these improved control to that equivalent to glyphosate plus 2,4-D. None of the combinations gave better control than glyphosate plus 2,4-D. These results show that thifensulfuron, thifensulfuron plus rimsulfuron premix, prosulfuron, mesotrione plus atrazine, and isoxaflutole do not provide adequate wild garlic control when applied to fairly large plants in late spring. Adding glyphosate to these herbicides increased control to that equivalent to glyphosate plus 2,4-D.

Wild garlic control in no-tillage corn, rated 8 weeks after planting.

Treatment	Rate (lb ai/a)	ALLVI %
Check		0
Glyphosate + AMS	1.0 + 2	80
Glyphosate + 2,4-D LVE + AMS	1.0 + 0.5 + 2	86
Thifensulfuron + NIS	0.014 + 0.25%	52
Thifensulfuron + NIS	0.028 + 0.25%	58
Glyph + thif + AMS	1.0 + 0.023 + 0.25%	77
Thif/rimsulfuron + NIS	0.023 + 0.25%	62
Glyph + thif/rim + AMS	1.0 + 0.023 + 2	85
Prosulfuron + NIS	0.018 + 0.25%	65
Glyph + prosulfuron + AMS	1.0 + 0.018 + 2	82
Mesotrione + atraz + COC + UAN	0.188 + 0.25 + 1% + 1%	43
Glyph + meso + atraz + AMS	1.0 + 0.188 + 0.25 + 2	75
Isoxaflutole	0.47	43
Glyph + isoxaflutole + AMS	1.0 + 0.47 + 2	80
Paraquat + NIS	0.75 + 0.25%	67
Glufosinate + AMS	0.42 + 2	75
LSD (0.05)		15

POSTEMERGENCE WEED CONTROL IN CORN WITH HALOSULFURON PLUS DICAMBA PRE-MIX - RA DeWaine, Monsanto Company, Sherrill, NY; TE Dutt, Monsanto Company, Fogelsville, PA; JF Haldeman, Monsanto Company, York, PA; and DJ Mayonado, Monsanto Company, Salisbury, MD.

ABSTRACT

Yukon herbicide is a package mix of halosulfuron and dicamba for postemergence weed control in corn (*Zea mays*). At use rates of 4 to 8 ounces per acre, it delivers 0.031 to 0.062 lbs. (ai) of halosulfuron and 0.125 to 0.25 lbs. (ai) of dicamba per acre. It provides control of nutsedge (*Cyperus* sp.) and many annual broadleaf weeds, and provides suppression of many perennial broadleaf weeds. Historically, in many commercial applications, dicamba was often included as a tank mix with halosulfuron (Permit® herbicide) to improve control of common lambsquarters (*Chenopodium album* L.). The dry package mix was formulated and commercialized to provide convenience and efficiency for growers and retailers.

Beginning in 2001, field studies were conducted in the Northeast as well as across the northern corn belt to evaluate the effectiveness of Yukon for postemergence weed control in corn. Testing was conducted in conventional corn as well as in glyphosate-resistant corn. Weed control and crop safety was very comparable to other common postemergence herbicide products in conventional corn. Tank mixtures of Roundup plus Yukon in glyphosate-resistant corn also showed promise for expanding label recommendations.

PRE- AND POSTEMERGENCE COMMON RAGWEED CONTROL IN FIELD CORN -

PJ Stachowski and RR Hahn, Cornell Univ., Ithaca, NY.

ABSTRACT

Field experiments were established in 2002 and 2003 near Valatie and Aurora, NY to evaluate preemergence (PRE) and mid-postemergence (MPOST) herbicide programs for control of common ragweed (*Ambrosia artemisiifolia* L.) in field corn (*Zea mays* L.). The focus of these experiments was to determine the role that mesotrione and flumetsulam/clopyralid might play in control programs for both triazine-susceptible and triazine-resistant biotypes of common ragweed. In 2002, PRE applications of 0.188 lb ai/A of mesotrione were applied in combination with 1.27 or 1.59 lb ai/A of s-metolachlor at Valatie and Aurora respectively. In 2003, 1.83 and 2.2 lb/A of the premix of s-metolachlor/mesotrione and 2.46 and 2.95 lb/A of the three-way premix of s-metolachlor/mesotrione/atrazine were applied PRE at Valatie and Aurora respectively. MPOST applications of 0.094 lb/A of mesotrione alone and in combination with 0.25 lb ai/A of atrazine were made following PRE applications of s-metolachlor at both locations in 2002 and 2003. The MPOST of applications of mesotrione were made with 1% (v/v) crop oil concentrate and 2.5% (v/v) 28% urea ammonium nitrate. PRE applications of the flumetsulam/clopyralid premix were made in 2003 at 1.37 and 2.05 oz ai/A at Valatie and at 1.37 and 2.74 oz/A at Aurora. MPOST applications of flumetsulam/clopyralid with 0.25% (v/v) of nonionic surfactant were made at both locations following PRE applications of acetochlor in 2002 and following PRE applications of s-metolachlor in 2003. Ragweed populations at both locations were of triazine-susceptible biotypes.

In 2002, late-season ragweed control with the PRE application of mesotrione plus s-metolachlor was 65% compared with 55% with a PRE application of s-metolachlor/atrazine at Valatie. At Aurora, ragweed control was 86 and 91% respectively for these treatments. When mesotrione was applied MPOST when ragweed was 2 and 4 inches tall at Valatie and Aurora, late-season ragweed control was 97 and 80% respectively. At Aurora, the addition of 0.25 lb/A of atrazine to MPOST mesotrione application boosted ragweed control from 80 to 99%. In 2003, PRE application of 1.83 and 2.2 lb/A of s-metolachlor/mesotrione at Valatie and Aurora controlled 55 and 75% of the ragweed respectively, while the three-way premix of s-metolachlor/mesotrione/atrazine controlled 88 and 96% of the ragweed respectively. Average ragweed control for the two locations with MPOST (7- to 8-inch ragweed) applications of mesotrione alone and with 0.25 lb/A of atrazine was 66 and 93% in 2003. At 1.37 and 2.05 oz/A of flumetsulam/clopyralid applied PRE with s-metolachlor, ragweed control was only 33 and 64% respectively at Valatie while control at Aurora was 63 and 89% when 1.37 and 2.74 oz/A of flumetsulam/clopyralid was applied PRE with s-metolachlor. These results suggest that PRE applications of less than 2.74 oz/A of flumetsulam/clopyralid are not adequate for ragweed control on these soils. Following PRE application of s-metolachlor, MPOST applications of flumetsulam/ clopyralid at 1.37 oz/A alone and in combination with 1 oz ai/A of dicamba provided an average of 69 and 75% ragweed control for the two locations respectively compared with 84% control with a MPOST application of 4 oz/A of dicamba.

BATTLE OF THE BLEACHERS II: HOW LOW CAN YOU GO? - DD Lingenfelter and WS Curran, Penn State Univ., University Park, PA.

ABSTRACT

Common lambsquarters is a dominant broadleaf weed in Pennsylvania field crops and typical atrazine-containing herbicide programs are often ineffective due to the presence of the triazine-resistant biotype. Isoxaflutole and mesotrione provide effective control of common lambsquarters (*Chenopodium album* L.), velvetleaf (*Abutilon theophrasti* Medicus) and other common annual broadleaf weeds when used at labeled rates in field corn (*Zea mays* L.). Previous research shows that common lambsquarters is very susceptible to these herbicides and potentially could be controlled at lower than labeled rates. With the current poor farm economy, reduced-rate herbicide tank mixtures may be a way to obtain effective control of certain problem weeds, yet be cost effective to crop producers.

In 2001 to 2003, field studies were conducted using typical, replicated, small-plot research techniques under various tillage and environmental conditions. Isoxaflutole was applied at 0.047, 0.07, and 0.094 lb ai/A, while mesotrione was applied within a range from 0.023 to 0.188 lb ai/A. Both herbicides were applied PRE alone and in combinations with atrazine and/or chloroacetamide herbicides. Mesotrione was also evaluated POST, alone and in combination with atrazine. In addition, a replicated, rate titration experiment was conducted in the greenhouse to determine the effectiveness of isoxaflutole and mesotrione. Isoxaflutole was applied PRE at 0.002 to 0.06 lb ai/A, and mesotrione was applied PRE and POST within 0.003 to 0.187 lb ai/A. Necessary adjuvants were included in the POST spray mixtures. Visual control ratings were taken periodically throughout the growing period for both field and greenhouse studies.

In the field, isoxaflutole and mesotrione applied alone PRE, provided excellent control (±95%) of common lambsquarters. Control of common ragweed (*Ambrosia artemisiifolia* L.) with isoxaflutole ranged from 88 to 98% and increased relative to rate, while mesotrione generally was less effective and more variable over years. In 2001, mesotrione provided 82 to 88% control of common ragweed at 0.094 to 0.188 lb ai/A and in 2002, 37 to 75% control. Mesotrione applied POST provided 95 to 100% control of common lambsquarters regardless of rate. Control of common ragweed increased from 69% at 0.023 lb ai/A up to 92% at 0.094 lb ai/A. The addition of 0.25 to 0.75 lb ai/A atrazine to the POST treatments improved common ragweed control.

In the greenhouse, preliminary data suggests that isoxaflutole and mesotrione applied PRE at 1/8X of the typical use rate still provided about 85% control of common lambsquarters. Mesotrione applied POST at 1/32X the typical use rate provided at least 45% control of common lambsquarters and increased with respect to rate thereafter.

In summary, both isoxaflutole and mesotrione provide effective control of many common annual broadleaves found in Pennsylvania and the Northeast cropping systems. Because common lambsquarters is extremely sensitive to both herbicides, opportunities exist to use lower rates effectively. Herbicide programs that include a reduced rate of isoxaflutole or mesotrione to primarily target common lambsquarters (including triazine and ALS-resistant biotypes) could be economical for crop producers.

WEED MANAGEMENT ISSUES IN CENTRAL ITALY - J.M. Jemison, Jr., Univ. of Maine, Orono.

ABSTRACT

Weed control is an issue in all production regions around the world. Italy is no exception. Italy produces considerable acreage of various field crops including corn, wheat, sorghum, and sunflowers along with diverse specialty crops such as grapes and olives for the wine and olive oil businesses. There is strong interest in both traditional forms weed management and lower input methodologies. In this presentation, weed management issues associated with Italian agriculture will be discussed and various weed management trials underway at the University of Perugia Agricultural Experiment Station.

IMPACT OF BIOTECHNOLOGY-DERIVED HERBICIDE-RESISTANT CROPS ON THE NE UNITED STATES - S Sankula and L Gianessi, NCFAP, Washington, DC.

ABSTRACT

Of the four currently planted biotechnology-derived crops (soybean, corn, cotton, and canola) in the US, soybean and corn are the major crops in the northeast (NE) region. Adoption of biotechnology-derived herbicide-resistant crops in the NE United States has been higher than the national average. While the national adoption of biotechnology-derived herbicide-resistant soybean, corn, and cotton has climbed to 75, 10, and 58% in 2002 (up from 68, 7, and 56% in 2001), the NE region of the United States planted herbicide-resistant soybean, corn, and cotton on 80, 18, and 64% of the respective crop acreage in 2002.

A study was conducted in 2001 to evaluate the impacts of biotechnology-derived crops on US agriculture. Impacts were assessed for four categories: changes in crop yields, crop production costs, crop value, and pesticide use.

Comparative analysis of weed management programs in conventional versus glyphosate-resistant soybean suggested that alternative herbicide programs that would provide weed control equivalent to that of glyphosate would require 3 herbicide active ingredients and 1.34 lb ai/A at a cost of $36.70. On the other hand, weed management in glyphosate-resistant soybean reduced the number of herbicide active ingredients by 67%, herbicide use by 25%, and weed control costs by 56%. Thus, the net impact of the adoption of herbicide-resistant soybean in the NE United States has been lowered production costs and increased simplicity and flexibility in weed management.

The adoption of herbicide-resistant corn in the NE region (9 states) has largely been driven by improved control of troublesome weeds such as burcucumber (*Sicyos angulatus* L.), bindweed (*Convolvulus arvensis* L.), quackgrass [*Elytrigia repens* (L.)], and wirestem muhly [*Muhlenbergia frondosa* (Poir.) Fern]. The adoption of herbicide-resistant corn has replaced or reduced the soil-applied preemergence treatments or substituted the previously used POST applications with either glyphosate or glufosinate. These substitutions have resulted in $3.1 million in savings on herbicide costs with an associated reduction of 0.31 million pounds of herbicide use.

In VA where the entire cotton production of the NE region is concentrated, unlike soybean and corn, growers have experienced a slight increase in herbicide rates and costs in herbicide-resistant cotton system. However, reductions in the number of herbicide active ingredients, applications, and tillage trips have more than offset these costs and have contributed to significant cost savings.

A crop of economic significance to the NE United States on which biotechnology could have a great impact is strawberry. Herbicide-resistant strawberry has an excellent niche in the NE region in view of significant weed control costs and few herbicide choices. Research has been ongoing to develop glyphosate-resistant strawberry.

The combined impact of herbicide-resistant soybean, corn, and cotton on the NE region of United States is a saving of $31.04 million in grower costs. Herbicide-resistant corn acreage is projected to increase in the coming years in view of its cost effectiveness and increasing availability of herbicide-tolerance trait in high-yielding varieties.

EFFECTIVENESS OF SELECTED HERBICIDES FOR CONTROL OF GARLIC MUSTARD - WS Curran, DD Lingenfelter, and CB Muse, Penn State Univ., University Park, PA.

ABSTRACT

Greenhouse trials evaluated the effectiveness of a number of herbicides for control of garlic mustard [*Alliaria petiolata* (Bieb.) Cavara & Grande]. Up to 16 different herbicide treatments were tested for control of 3 to 4 leaf-stage or 3 to 4 inch tall garlic mustard. The garlic mustard was approximately 8 weeks old at the time of application. Three to four garlic mustard seedlings were transplanted at the two leaf stage into individual cups and thinned to one or two plants per cup prior to treatment. Herbicides were applied in water using a pneumatic greenhouse sprayer at 20 GPA and 40 PSI. Plants were watered as needed, provided with supplemental light, and maintained between 50 and 70 F. Herbicides included common pasture, corn, and non cropland products. Adjuvants were included in the mixture when appropriate. Approximately three weeks after treatment, plants were visually assessed for percent control (0 to 100 scale) and above-ground portions harvested for fresh weight. The experiments were conducted as completely randomized designs with either three or four replications and repeated two to four times, depending on treatment.

Of the herbicides, only metsulfuron (Ally or Cimarron) and mesotrione (Callisto) provided greater than 90% control. Atrazine, glyphosate applied at 1.5 lb ae/A or 2.25 lb/A, imazethapyr plus imazapyr (Lightning), glyphosate plus bromoxynil and sulfometuron (Oust) provided between 82 and 90% control. Bromoxynil (Buctril), imazapyr (Arsenal), and primisulfuron (Beacon) control ranged from 75 to 78%, while 2,4-D or dicamba applied at 0.5 lb ae/A provided only 62 to 65% control. Garlic mustard control with bentazon (Basagran), glyphosate at 0.75 lb/A or less, and imazethapyr (Pursuit) was 37 to 48%. For the most part, plant fresh weight reduction results were similar to the visual control ratings.

These experiments showed how variable control of garlic mustard can be with different herbicides. In this study, two sulfonylureas and a callistemone herbicide were the most effective treatments. Glyphosate can also be effective, but a minimum of 1.5 lb/A is necessary. In conclusion, careful product and rate selection is necessary for successful control of garlic mustard.

Effect of herbicides on garlic mustard control in the greenhouse. Herbicides applied to 3 to 4 leaf stage plants.

Herbicide	Rate (lb ae or ai)	% Control [1]		% of Check (fresh wt.) [1]	
2,4-D	0.5	65	c	21	cd
Atrazine	1.0	89	fg	2	a
Bentazon	0.75	42	b	29	cd
Bromoxynil	0.25	75	def	7	ab
Dicamba	0.5	62	cde	24	cd
Glyphosate	0.375	3	a	30	d
Glyphosate	0.75	48	bc	16	bc
Glyphosate	1.5	86	fg	4	a
Glyphosate	2.25	90	fg	1	a
Glyphosate plus bromoxynil	0.75 + 0.25	81	defg	5	ab
Imazapyr	0.5	78	defg	3	a
Imazethapyr	0.063	37	b	24	cd
Imazethapyr plus imazapyr	0.056	84	efg	24	cd
Mesotrione	0.094	94	g	1	a
Metsulfuron	0.0075	93	fg	16	bc
Primisulfuron	0.036	77	defg	26	cd
Sulfometuron	0.094	86	fg	1	a

[1]Means within a column followed by the same letter are not significantly different in the LSD test at the 0.10 level.

LEAF SURFACE MICRO-MORPHOLOGY OF COMMON LAMBSQUARTERS, COMMON PURSLANE, AND VELVETLEAF - D Sanyal, Univ. of Massachusetts, Amherst; KN Reddy, USDA-ARS, Stoneville, MS; and P Bhowmik, Univ. of Massachusetts, Amherst.

ABSTRACT

Leaf-surface characteristics play a vital role in foliar absorption and activity of herbicides. Laboratory studies were conducted to examine the leaf surface, epicuticular wax content, and spray droplet behavior on common lambsquarters (*Chenopodium album* L.), common purslane (*Portulaca oleracea* L.), and velvetleaf (*Abutilon theophrasti* Medicus) to understand the relationship between the leaf surface characteristics and the spray droplet behavior on the leaves. Adaxial and abaxial leaf surfaces of the three weed species were examined using the scanning electron microscopy. Glands and trichomes are present on both the adaxial and abaxial leaf-surfaces of velvetleaf. Common purslane has neither glands, nor trichomes on either side of the leaf surface. Common lambsquarters does not have any glands or trichomes, but it has the globular mealy-granules on adaxial and abaxial leaf surfaces. Stomata are present on both adaxial and abaxial leaf surfaces in all three weed species. Common purslane has much lower number of stomata per mm^2 of leaf area as compared to velvetleaf or common lambsquarters. Common lambsquarters has the highest epicuticular wax content on the leaf surface (395.17 mg cm^{-2}), followed by common purslane (164.33 mg cm^{-2}), and velvetleaf (65.17 mg cm^{-2}). The spread of 1 ml droplet of distilled water, primisulfuron solution (without adjuvant), primisulfuron solution with Induce (nonionic low foam wetter/spreader adjuvant) (2.5% v/v), and primisulfuron solution with Silwet L-77 (organosilicone surfactant) (1% v/v) was determined on the leaf surface of each of the weed species. The spread of the1 ml droplet of primisulfuron (without adjuvant), primisulfuron with Induce (2.5% v/v), and primisulfuron with Silwet L-77 (1% v/v) were higher on the leaf surface of velvetleaf than the spread on common lambsquarters or common purslane leaf. In all the three species the spread of the droplet was much higher with Silwet L-77 followed by the primisulfuron with Induce (2.5% v/v), primisulfuron (without adjuvant), and distilled water. These results showed a relationship between leaf-surface characteristics and the spread area of the spray droplet.

MESOTRIONE COMBINATIONS WITH METOLACHLOR AND ATRAZINE FOR PREEMERGENCE WEED CONTROL IN CORN - CM Whaley, Virginia Tech, Painter; GR Armel, DuPont Crop Protection, Newark, DE; HP Wilson, and TE Hines, Virginia Tech, Painter.

ABSTRACT

Studies were conducted from 2001 to 2003 to investigate corn (*Zea mays* L.) and weed response to preemergence combinations of mesotrione, metolachlor, and atrazine at selected rates. Studies were conducted on a Bojac sandy loam with approximately 1% organic matter. Treatments included mesotrione at 0.14, 0.21, and 0.28 lb ai/A alone and in combinations with metolachlor at 0.96 lb ai/A and in three-way combinations with metolachlor at 0.96 lb/A and atrazine at 0.5 or 1.0 lb ai/A. Additional treatments of metolachlor at 0.96 lb/A plus atrazine at 0.5 lb/A or 1.0 lb/A were included. Weed species evaluated in all years were common lambsquarters (*Chenopodium album* L.), common ragweed (*Ambrosia artemisiifolia* L.), and morningglory species (*Ipomoea* spp.). Common cocklebur (*Xanthium strumarium* L.) was present in 2002 and 2003 and smooth pigweed (*Amaranthus hybridus* L.) was present in 2001 and 2003. Rainfall during 14 days after treatment (DAT) in 2001 was less than 0.5 inches, in 2002 was 1.9 inches, and in 2003 was 1.2 inches. Corn injury from treatments 14 DAT in 2002 was 11 to 19%, but no significant injury occurred in 2001 or 2003. Low rainfall in 2001 resulted in inadequate common lambsquarters, common ragweed, and morningglory control. Common lambsquarters control in 2002 and 2003 was greater than 92% with all treatments except mesotrione at 0.14 lb/A alone or in combination with metolachlor in 2002. Common ragweed control in 2002 and 2003 was greater than 95% and greater than 91%, respectively, by all three-way combinations and metolachlor at 0.96 lb/A plus atrazine at 1.0 lb/A. Morningglory control in 2002 by all three-way combinations was 71 to 79% and was 64% by mesotrione at either 0.21 or 0.28 lb/A plus metolachlor. Morningglory control in 2003 was greater than 88% by all treatments that included 0.21 or 0.28 lb/A mesotrione. In both 2002 and 2003, morningglory control with metolachlor at 0.96 lb/A plus atrazine at 1.0 lb/A was similar to treatments providing the highest level of control. Treatments providing the highest common cocklebur control in 2002 were three-way combinations that included mesotrione at 0.21 or 0.28 lb/A plus atrazine at 1 lb/A. In 2003, all three-way combinations provided similar common cocklebur control to that by mesotrione at 0.21 or 0.28 lb/A alone or by mesotrione at 0.28 lb/A plus metolachlor. Smooth pigweed control was greater than 93% with all three-way combinations in 2001 and greater than 96% by all treatments in 2003.

EFFECT OF ADJUVANTS AND APPLICATION TIMING ON EFFICACY OF POSTEMERGENCE APPLICATIONS OF NICOSULFURON PLUS RIMSULFURON AND MESOTRIONE MIXTURES IN CORN - SK Rick, DuPont Ag and Nutrition, Raleigh, NC; LH Hageman, KL Hahn, and DW Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were conducted in corn (*Zea mays L.*) to determine the effect of application timing and the effect of various adjuvant systems on the control of large crabgrass (*Digitaria sanguinalis*), green foxtail (*Setaria viridis*), yellow foxtail (*Setaria lutescens*) and giant foxtail (*Setaria faberi*) and various broadleaf weed species with nicosulfuron and rimsulfuron plus mesotrione and atrazine tank mixes. Timing of application at two growth stages, within the labeled corn heights, showed little difference in efficacy on grass and most broadleaf weed species or on crop response. In additional trials, at above maximum weed heights, it was found that use of a MSO/OS adjuvant provided the greatest control of grass weeds when used in combination with Steadfast and the tank mix partners. Crop response in these trials was similar across all adjuvant systems with all treatments.

SURFACTANTS: A CAN OF WORMS - MJ VanGessel, QR Johnson, and BA Scott, Univ. of Delaware, Georgetown.

ABSTRACT

An adjuvant is defined by WSSA as any substance in an herbicide formulation or added to the spray tank to modify herbicidal activity or application characteristics. Adjuvants can be separated into two broad categories, activator or utility adjuvants. Activator adjuvants directly enhance the efficacy of an herbicide once it has been deposited on the target surfaces. There are many products used as activator adjuvant and they fall in the broad category of wetter-spreader adjuvant, sticker adjuvant, humectants, penetration agents, or herbicide modifier. Activator agents are either included in the herbicide product during the manufacturing or formulating process or are added to the spray tank separately by the applicator. Utility adjuvants affect the properties of the spray solution or spray mixture. Utility adjuvants do not directly impact herbicide efficacy, rather they are used to make the spray process easier and ensure that more spray solution reaches the target surface. These include compatibility agents, defoaming agents, drift control agents, deposition agents, and water conditioning agents.

There is a wide range of manufacturers of adjuvants and many promotions about their utility and effectiveness. These products are not regulated like a pesticide and changes can be made to the formulation without the end users knowing it.

Most postemergence herbicide labels recommend adjuvant types without specifying specific trade names. Many of these herbicide labels are directed towards environmental conditions typically not experienced in the mid-Atlantic region. As a result there is much confusion at the grower level on which product(s) to use.

Replicated research results with a variety of adjuvants to enhance herbicide effectiveness have been evaluated over the years at the University of Delaware and typically there is little difference between brands and formulations when herbicides are used at recommended rates. Most postemergence herbicides do require an adjuvant for effective control, but there have been limited differences between which surfactants are used. Nitrogen use has only occasionally shown benefit for weed control. Ammonium sulfate has not enhanced glyphosate control unless hard water was present. Often, serious consideration of adjuvant use is under situations where marginal weed control from the specific herbicide(s) is expected. Are we expecting too much from the herbicide(s)? Under these situations, maybe better herbicide selection is more important? If pesticides exhibited increased control as infrequently as many adjuvants, would we recommend their use?

FIRST YEAR EXPERIENCES WITH KIH-485 - RL Ritter and H Menbere, Univ. of Maryland, College Park.

ABSTRACT

KIH-485 is an experimental herbicide being investigated for its preemergence activity in corn (*Zea mays*). While it appears that KIH-485 has good preemergence activity on a number of annual grasses, this material also seems to have good preemergence activity on some annual broadleaf weeds as well. The purpose of this study was to examine the preemergence activity of KIH-485 on annual weeds in no-till and conventional corn, as well as crop response.

Studies were established at the Wye Research and Education Center located in Queenstown, MD. Soil type was a silt loam with 2.0% organic matter and a pH of 6.2. The predominant annual weeds included common lambsquarters (*Chenopodium album*), giant foxtail (*Setaria faberi*), jimsonweed (*Datura stramonium*), and velvetleaf (*Abutilon theophrasti*). The other site was located on the Carl Seiler farm, located outside of Westminster, MD. Soil type was a sandy loam with 2.2% organic matter and a pH of 6.8. Predominant weeds at this site were triazine-resistant common lambsquarters and triazine-resistant giant foxtail. The Wye site was chisel plowed, disked and packed prior to planting. Asgrow RX 664 was planted on April 30, 2003. The Carl Seiler site had corn (DeKalb 5853) no-till planted on May 23, 2003.

KIH-485 was included in three corn studies at the Wye site. The first study compared all of the common preemergence grass control herbicides registered for use in corn. No atrazine was tank-mixed with them. KIH-485 applied at 0.184 lb ai/acre provided equally effective season-long giant foxtail control as the standards. Corn yield was equal and sometimes better with KIH-485 than competitive products. In another study a the Wye, KIH-485 was applied at 0.184 lb ai/acre in combination with atrazine at 1.25 lb ai/acre and compared to most of the pre-packaged herbicides containing atrazine that are registered for use in corn. Excellent season-long control of giant foxtail, jimsonweed and velvetleaf was obtained with KIH-485 plus atrazine. Excellent corn yields were also obtained. The third study at the Wye compared a rate titration of KIH-485 to a rate titration of metolachlor (Dual II Magnum). Good to excellent season-long control of giant foxtail, jimsonweed, and velvetleaf was obtained with all rates of KIH-485. While metolachlor provided good season-long control of giant foxtail, poor control of jimsonweed and velvetleaf was obtained. Although some injury in the form of stunting and discoloration was observed early in the season, excellent corn yields were obtained with all rates of KIH-485.

A similar rate titration study was conducted at the Carl Seiler farm as was conducted at the Wye. Good to excellent control of triazine-resistant giant foxtail and triazine-resistant common lambsquarters was obtained through mid-season. However, from mid-July on, control of triazine-resistant common lambsquarters declined rapidly with rates of KIH-485 less than 0.44 lb ai/acre. Good to excellent season-long control of triazine-resistant giant foxtail was observed with KIH-485 rates at or above 0.184 lb ai/acre. Metolachlor provided early-season suppression of triazine-resistant common lambsquarters; however, by late June, control started to decline rapidly. KIH-485 seemed to provide better season-long control of triazine-resistant giant foxtail in comparison to metolachlor at most of the rates utilized in this study.

MEASURING THE IMPACT OF EARLY AND LATE-SEASON WEED COMPETITION IN GLYPHOSATE-RESISTANT CORN AND SOYBEAN - H Menbere and RL Ritter, Univ. of Maryland, College Park.

ABSTRACT

A large portion of the soybean [*Glycine max* (L.) Merr.] grown in the U. S. are glyphosate-resistant. In drilled, full-season soybean, many growers are finding that one timely application of glyphosate is all that is required to achieve adequate season-long weed control. In corn (*Zea mays* L.), however, the growth of glyphosate-resistant hybrids has not been as dramatic. Due to the longer period of growth that corn requires, and due to the fact that corn is grown in wide rows, one timely application of glyphosate may not support adequate season-long weed control.

From 2001 to 2003, studies were conducted with both glyphosate-resistant corn and soybean to investigate the proper timing for postemergence applications of glyphosate. These studies were conducted at the Wye Research and Education Center located in Queenstown, MD. Soybean (Asgrow 4101 - 2001, Asgrow 4301 - 2002, 2003) were planted on May 21, 2001 and 2002, and on June 30, 2003. Corn was studied in 2002 and 2003, with Asgrow RX 670 being planted April 23, 2002 and Asgrow RX 664 on April 30, 2003. For both corn and soybean, glyphosate applications were made on a weekly basis starting at 1 week after planting and continuing until 12 weeks after planting. Applications were made on separate plots in order to examine the effects of early and late-season weed competition on yield. The primary weed in all of the studies was giant foxtail (*Setaria faberi* Herrm.). Yields were obtained with a standard field combine.

In 2001, soybean yield from plots where glyphosate applications were made 1 and 2 weeks after planting were comparable to the nontreated check. Soybean yield increased when applications were made at 3 weeks after planting, with highest yield obtained when applications were made at 5 and 6 weeks after planting. After the 6 week application, yield started to decrease. When applications were made 11 and 12 weeks after planting, yields were comparable to those obtained from the nontreated check. Similar results were obtained in 2002. However, in 2002, highest yields were obtained when applications were made at 4, 5 and 6 weeks after planting. Yield data for 2003 is still being analyzed.

In 2002, corn yield from the plots where glyphosate applications were made 1 and 2 weeks after planting were comparable to the nontreated check. Corn yield increased when applications were made at 3 weeks after planting with highest yield obtained when applications were made at 3 and 4 weeks after planting. After the 4 week timing, yield started to decrease; however, good yields were obtained with the 5, 6 and 7 week applications. When applications were made at 8, 9, 10, 11, or 12 weeks after planting, yields were comparable to those obtained from the nontreated check. In 2003, highest yields were obtained when applications were made 3 to 7 weeks after planting. Yields declined sharply in 2003 when applications were delayed until 8 weeks or later after planting.

NEW RATE AND APPLICATION RECOMMENDATIONS IN GLYPHOSATE-RESISTANT CORN - JF Haldeman, Monsanto Company, York, PA; TE Dutt, Monsanto Company, Fogelsville, PA; RA DeWaine, Monsanto Company, Sherrill, NY; and DJ Mayonado, Monsanto Company, Salisbury, MD.

ABSTRACT

Glyphosate-resistant corn was initially introduced with the GA21 event. After several years of testing, a new event has been commercially introduced. The Roundup Ready® Corn 2 System, which incorporates a new Roundup Ready event into the newest generation of glyphosate-resistant corn hybrids, provides superior in-plant resistance to glyphosate. With the Roundup Ready Corn 2 system a wider window of application and higher use rates are permitted, if needed, which allow added flexibility of application.

Expanded label use rates allow a maximum single in-crop application of 1.125 lbs ae per acre of Roundup® herbicide (glyphosate) and a maximum in-crop total application of 2.25 lbs ae per acre up to 48 inch corn. Drop nozzles are required from 30 to 48 inch corn. The expanded label use rates and wider application window will enhance control of certain perennial and late emerging annual weeds.

VINEGAR AND CLOVE OIL FOR NON-SELECTIVE CONTROL OF ANNUAL WEEDS -
WS Curran, DD Lingenfelter, and CB Muse, Penn State Univ., University Park, PA.

ABSTRACT

Field and greenhouse trials evaluated the effectiveness of vinegar and clove oil or eugenol (Matran II) for control of annual weeds. In the field, 20% vinegar was applied postemergence at 30, 60, and 90 GPA to emerged soybean [*Glycine max* (L.) Merr.] and annual weeds. Nu-Film-P surfactant was included in the mixture. In a separate experiment, Matran II was applied from 7 to 14 GPA in a total volume of 30 or 60 GPA. Both trials were conducted in mid-July and were applied using a handheld backpack sprayer. Soybean was in the 3rd trifoliolate stage and weeds ranged from 2 to 10 inches tall at application. Air temperatures at application were 76 F with mostly clear skies. High-low daily air temperatures ranged from 51 to 81 F for the five days following application. Both trials were arranged as randomized complete blocks with 3 replications. In addition, an experiment was conducted in the greenhouse evaluating two types of vinegar (Fleischmann's and Bradfield) at 30 and 60 GPA, Matran II applied at 7 GPA at 30 and 60 GPA, and a citrus, garlic, and vinegar mixture (All Down) applied at 30 and 60 GPA. The products were applied to weeds that were 1 to 3 inches and 3 to 5 inches in height. The experiment was replicated three times and repeated over time. Results from the greenhouse experiment will be summarized at the conference.

In the vinegar and Matran II field experiments, soybean, giant (*Setaria faberi* Herrm.) and yellow foxtail [*Setaria glauca* (L.) Beauv.], common lambsquarters (*Chenopodium album* L.), smooth pigweed (*Amaranthus hybridus* L.), ladysthumb (*Polygonum persicaria* L.), and common ragweed (*Ambrosia artemisiifolia* L.) were evaluated for percent control. Visual evaluations were taken 3, 8 and 16 days after application (DAA). In general, the greatest control occurred at the 3 day evaluation and decreased by 16 days. In the vinegar study, control generally increased from 30 to 60 GPA, but not usually from 60 to 90 GPA. Soybean control ranged from 47% at 30 GPA to 75% at 90 GPA 16 DAA. Giant and yellow foxtail control ranged from 28% at 30 GPA up to 42% at 90 GPA. Grass control was consistently less than for the broadleaves. Common lambsquarters control ranged from 35% at 30 GPA up to 74% at 90 GPA, while smooth pigweed control ranged from 47 to 90% over the different spray volumes applied. Smooth pigweed was the most susceptible of the species tested. Ladysthumb and common ragweed were similar in response ranging from about 35% control at 30 GPA up to 78% control at 90 GPA. Results for the Matran II study were similar to the vinegar experiment with better control at the higher volume application. In general, the higher Matran II rate showed more response at 30 GPA than at 60 GPA. For soybean, control ranged from 50 to 63% at 30 GPA and from 67 to 75% at 60 GPA. Grasses were less susceptible than broadleaves and smooth pigweed was most susceptible with control ranging from 73% at 7 GPA at 30 GPA up to 83% at 14 GPA at 60 GPA.

HERBICIDE PROGRAMS FOR THE CONTROL OF ALS-RESISTANT SHATTERCANE IN CORN - SR King and ES Hagood Jr., Virginia Tech, Blacksburg.

ABSTRACT

Previous research has described shattercane (*Sorghum bicolor*) biotypes from Nebraska, Kansas, and Pennsylvania to be resistant to several acetolactate synthase (ALS) inhibiting herbicides. Recently, growers from several adjacent counties in Virginia have experienced difficulty controlling shattercane in imidazolinone-resistant (IT) corn with imazethapyr plus imazapyr applied either preemergence (PRE) or postemergence (POST), and with nicosulfuron applied POST in conventional corn hybrids. Seed was collected and planted from several of these locations and from a known susceptible population and tested for resistance in greenhouse trials to the ALS-inhibiting herbicides: imazethapyr, imazapyr, and nicosulfuron, which were applied at four rates. Seedlings from these locations were also treated with four rates of glyphosate. Several of the populations from the locations where resistance was suspected were not affected by the ALS-inhibiting herbicides regardless of rate, while other populations were either partially or completely controlled. All populations were controlled essentially 100% with 0.5 lb ai/acre of glyphosate. Field experiments were then designed to determine the most effective herbicide program utilizing herbicide-tolerant/resistant corn hybrids for the control of shattercane. IT, glufosinate-resistant (GLU), and glyphosate-resistant (GLY) corn hybrids were planted in a location where the presence of an ALS-resistant shattercane population had been confirmed from the greenhouse trials. Early postemergence (EP), and late postemergence (LP) applications of nicosulfuron, glufosinate, and glyphosate were applied to shattercane in the IT, GLU, and GLY hybrids, respectively. EP applications of imazethapyr and imazethapyr plus imazapyr were also applied in the IT corn hybrid. Sequential (SEQ) treatments of glufosinate and glyphosate were applied in the GLU and GLY hybrids, respectively. Each herbicide program also contained a weed free (WFC) and a nontreated weedy control (WC). EP applications of imazethapyr, imazethapyr plus imazapyr, or nicosulfuron did not control shattercane, and yield from the IT hybrid was equivalent between these treatments and to yield from the WC. At five weeks after treatment (WAT), the EP treatment of glyphosate controlled shattercane 89% in the GLY corn hybrid compared to only 56% control with glufosinate in the GLU corn hybrid, and 0% control with nicosulfuron in the IT corn hybrid. At 15 WAT shattercane was controlled 71, 21, and 0% with EP treatments of glyphosate, glufosinate, and nicosulfuron, respectively. LP treatments of glufosinate and glyphosate controlled shattercane more than EP applications at 15 WAT. However, yield was greater with EP treatments of glufosinate or glyphosate within the GLU and GLY hybrids compared to LP treatments. EP treatments of glufosinate and glyphosate resulted in yields that were equivalent to 99 and 97% of the yield from the WFC of each hybrid, respectively. LP treatments of glufosinate and glyphosate resulted in yields of 79 and 76% of the WFC of each hybrid, respectively. EP applications of nicosulfuron in the GLU and GLY hybrids did not control shattercane, and yields were lower than those from EP treatments of glufosinate or glyphosate. SEQ treatments of glufosinate or glyphosate controlled shattercane greater than EP or LP treatments of glufosinate in the GLU hybrid, and greater than the EP treatment in the GLY hybrid. Yield, however, was not different between the EP or SEQ treatment in either the GLU or

GLY hybrids. Corn yields were not different between the GLU or GLY hybrids regardless of treatment. Generally high yields in treatments regardless of the level of shattercane control were likely the result of an abundance of moisture throughout the growing season. Results are expected to be different in a year where moisture would be a limiting factor for corn growth and yield due to greater competition with shattercane.

CONFIRMATION OF ALS-RESISTANT JOHNSONGRASS IN THE NORTHEASTERN UNITED STATES - RS Chandran, D Workman, M Mandal, West Virginia Univ., Morgantown; D Beasley, Southern States Cooperative, Morgantown, WV; S Harper, Harper Farms, Morgantown, WV; and J Hale, Pioneer/Dupont, Morgantown, WV.

ABSTRACT

Johnsongrass (*Sorghum halepense* L.) is an aggressive weed in row crops of the Northeastern United States and elsewhere. Control measures for this weed prior to the advent of acetolactate synthase (ALS) inhibitor herbicides in the early 1990's were often ineffective. Subsequent use of ALS inhibitors, particularly nicosulfuron, has led to the development of resistant populations of several weed species to this group of herbicides, including shattercane [*Sorghum bicolor* L. (Moench)], a close relative of johnsongrass. In 2003, failure to control johnsongrass in corn was reported in Hardy county, West Virginia (79°W, 39°N) following sequential applications of nicosulfuron at recommended use rates to nine- and 20-inch johnsongrass. Following this observation, field and greenhouse studies were conducted to investigate the possibility of herbicide resistance. In the field, nicosulfuron was applied at 0.062 lb ai/A to johnsongrass 12 to 48 inches tall. Other treatments included Lightning (imazethapyr plus imazapyr at 0.042 and 0.014 lb ai/A), Northstar (primisulfuron plus dicamba at 0.075 and 0.4 lb ai/A), and glyphosate (1.0 lb ai/A) for comparison. Weed control ratings, recorded three weeks after treatment (WAT), indicated no control of johnsongrass from the ALS inhibitor herbicides. Glyphosate provided complete control of johnsongrass at this time. Greenhouse studies evaluated the effect of nicosulfuron rates (0.031, 0.060, and 0.120 lb ai/A) on johnsongrass biotypes (Moorefield and Morgantown) designed as factorial experiments. Initial symptoms characteristic of ALS inhibitors were noted in the lower leaves of both johnsongrass biotypes at 2 WAT, however, the Moorefield-biotype outgrew these symptoms at 4 WAT, exhibiting signs of new top growth. The Morgantown-biotype of johnsongrass exhibited rapid progression of symptoms leading to death at 6 to 7 WAT. Following similar rates of nicosulfuron application, the resistant (Moorefield) biotype of johnsongrass recorded three to five times more shoot growth, and eight to 10 times more root and rhizome growth, compared to the susceptible (Morgantown) biotype of johnsongrass.

DIFFERENTIAL SUSCEPTIBILITY OF VARIOUS MORNINGGLORY SPECIES TO SEVERAL COMMERCIAL HERBICIDES - GR Armel, PL Rardon, MC McComrick, LF Houck, TP Blaesser, DA Baxter, and PM Kouba, DuPont Crop Protection, Newark, DE.

ABSTRACT

Studies were conducted in 2003 at the Stine-Haskell Research Center to evaluate commercial herbicides for control of several species in the Convolvulaceae family including red morningglory (*Ipomoea coccinea*), pitted morningglory (*Ipomoea lacunosa*), ivyleaf morningglory (*Ipomoea hederacea*), tall morningglory (*Ipomoea purpurea*), cypressvine morningglory (*Ipomoea quamoclit*), smallflower morningglory (*Jacquemontia fawnifolia*), field bindweed (*Convolvulus arvensis*), and hedge bindweed (*Calystegia sepium*). Herbicides were selected to include representatives of several different sites or modes of action including: 1) 5-enolpyruvyl-shikimate-3-phosphate synthase: glyphosate, 2) Photosystem I electron diverter: paraquat, 3) glutamine synthetase: glufosinate, 3) Photosynthesis photosystem II (PSII) site A: atrazine, metribuzin, diuron, terbacil, 4) Photosynthesis Photosystem II (PSII) site B: bentazon, bromoxynil, 5) Acetolactate synthase (ALS): pyrithiobac, flumetsulam, sulfosulfuron, halosulfuron, nicosulfuron, primisulfuron, thifensulfuron, metsulfuron, rimsulfuron, chlorimuron, imazethapyr, imazapyr 5)Auxin mimics: 2,4-D, 2,4-DB, dicamba, picloram, clopyralid 6) Protoporphyrinogen oxidase (Protox): acifluorfen, oxidiazon, carfentrazone, sulfentrazone, azafenidin, flumioxazin 7) Long chain fatty acid biosynthesis: metolachlor, acetochlor, alachlor 8) Cellulose biosynthesis: isoxaben 9) Microtubule assembly: pendimethalin, trifuralin 10) Lipid synthesis: EPTC 11) Phytoene desaturase: norflurazon 12) p-hydroxyphenyl pyruvate dioxygenase: mesotrione, isoxaflutole 13) 1-deoxy-D-xyulose 5-phosphate synthetase: clomazone. Four application rates, based on previously unpublished data, were chosen for each herbicide to aid in predicting phytotoxicity levels of 20%, 50%, and 80% on red morningglory, a species currently used in our herbicide discovery screens. Herbicide response from preemergence applications were typically variable among species, however red morningglory was the most difficult to control morningglory species with at least 8 of the 18 preemergence herbicides evaluated. Red morningglory was also most tolerant to postemergence applications of the PSII inhibitors atrazine and bentazon and the ALS-inhibitor rimsulfuron. However, smallflower morningglory was generally the most difficult to control morningglory species with postemergence applications of paraquat, glyphosate, 2,4-D, 2,4-DB, picloram, imazapyr, and bromoxynil. The majority of postemergence applied ALS-inhibitors including halosulfuron, nicosulfuron, pyrithiobac, and thifensulfuron and the Protox-inhibitor acifluorfen were least effective in controlling cypressvine morningglory in comparison to the other morningglory species.

UTILITY OF DICAMBA FOR PRE-PLANT HORSEWEED CONTROL IN NO-TILL SOYBEANS - QR Johnson and MJ VanGessel, Univ. of Delaware, Georgetown.

ABSTRACT

Dicamba is labeled for preplant application to soybean (*Glycine max*), but application restrictions (rainfall accumulation followed by waiting period) have prevented dicamba products from being widely used in this manner. The challenge of controlling glyphosate-resistant horseweed (*Conyza canadensis*) has, however sparked renewed interest in dicamba use in no-till soybean.

To help establish guidelines, rainfall data from the University of Delaware Research and Education Center in Georgetown, Delaware was used to determine the average number of days required between dicamba application and soybean planting when dicamba is applied preplant to soybean. The label restrictions will, on average for the mid-Atlantic region, require that dicamba applications at 0.25 lb ai/A occur 26 to 30 days prior to soybean planting.

Treatments from four studies conducted at three locations in Sussex County, Delaware were evaluated to determine the level of horseweed control and crop safety of preplant dicamba applications in no-till soybean. Three of the studies were established with an anticipated soybean planting date of May 15. Sixty, thirty, and fifteen day early preplant (EPP) application timings were included. Horseweed plants were in the rosette stage at application and ranged from 0.5 to six inches in size. Clarity at 8 to 16 oz/A (0.25 to 0.5 lb ai/A) provided greater than 90 percent horseweed control at all application timings when applied alone or with paraquat. Distinct (dicamba plus diflufenzopyr) at 2 to 6 oz/A was also evaluated in one of the studies and provided similar results. Control with 2,4-D ester (0.25 to 1.0 lb ae/A) was more variable. Horseweed control improved with higher 2,4-D rates and was more effective at the 30EPP than the 15EPP timing. In one study, horseweed control was reduced by as much as 40% when 2,4-D was tank-mixed with paraquat.

It is important to note that for the 30EPP and 15EPP applications, neither the rainfall accumulation requirement nor the waiting period requirement for Clarity (all rates) had been met at soybean planting, so dicamba injury was expected. Soybean injury at 7 weeks after planting ranged from 8 to 32% depending on Clarity rate. In the same study, Distinct injury ranged from 2 to 28% in response to rate and timing, and 2,4-D injury was less than 8% regardless of rate or timing. No reductions in yield occurred as a result of injury. No crop response from Clarity or 2,4-D was observed with the 60EPP timing.

While the plant growth regulators often provide excellent horseweed control alone, the addition of paraquat is often needed to aid in the control of other winter annual weeds. A fourth study was initiated in late June in response to reduced horseweed control with 2,4-D when tank-mixed with paraquat (mentioned above), and concern that a similar response could occur with dicamba. Applications were made to horseweed in the bolting stage and six to 30 inches tall. Treatments were a factorial arrangement of two rates of paraquat (0.47 or 0.75 lb ai/A) by two rates of 2,4-D (0.5 or 1.0 lb ae/A) or Clarity (8 or 16 oz/A). No reduction in horseweed control was observed with any combination of 2,4-D and paraquat versus 2,4-D alone. Clarity alone provided greater than 90% horseweed control regardless of rate. Horseweed control was

reduced when the low rate of Clarity was combined with either rate of paraquat and was no better than paraquat alone. No reductions in control were seen with the high rate of Clarity plus either rate of paraquat.

Dicamba has potential for preplant control of glyphosate-resistant horseweed. A better understanding of the factors leading to injury and further investigation of interactions with paraquat are needed.

INVESTIGATING MANAGEMENT OPTIONS FOR CONTROLLING GLYPHOSATE-RESISTANT HORSEWEED IN GLYPHOSATE-RESISTANT SOYBEANS - DJ Mayonado, Monsanto Company, Salisbury, MD; TE Dutt, Monsanto Company, Fogelsville, PA; J Lewis, and G Heck, Monsanto Company, St. Louis, MO.

ABSTRACT

Horseweed (*Conyza canadensis*) has historically been a difficult to control weed with many postemergence herbicide programs including glyphosate. Recently, horseweed populations have been identified in several areas of North America that are much less responsive to glyphosate herbicide than what we have come to historically expect. These populations are generally considered resistant to glyphosate.

The nature of this resistance does not appear to be based on reduced uptake, metabolism, differential gene expression or gene amplification. Genetic analysis indicates that resistance is a dominant trait and is nuclear transmittable. Horseweed appears to possess 3 distinct EPSPS genes. Biochemical analysis showed that two are active and one appears to be a non-functional psuedogene. These studies appear to rule out EPSPS mutation as a contributor to resistance in horseweed. One feature that does appear common across resistant populations is reduced glyphosate translocation, as illustrated by lower accumulation in roots of treated resistant plant. This is the current focus of ongoing investigations.

Field studies have been conducted over several years examining tank-mix combinations of glyphosate plus other postemergence herbicides in an effort to find effective and economical solutions for growers. Glyphosate plus 2,4-D combinations can at times be effective and is quite economical. Glyphosate plus cloransulam combinations have also been at times effective and can be used in-crop. A tank-mix combination of glyphosate plus 2,4-D and cloransulam has provided the most consistent control option for horseweed but is less economical. Glyphosate plus dicamba combinations have been examined and may also be potentially useful.

WHERE DO WE STAND WITH CONTROL OF GLYPHOSATE-RESISTANT HORSEWEED? - MJ VanGessel, BA Scott, and QR Johnson, Univ. of Delaware, Georgetown.

ABSTRACT

Glyphosate-resistant horseweed has continued to rapidly spread in the mid-Atlantic region. Other herbicides labeled for POST horseweed control (cloransulam, chlorimuron, and paraquat) are threatened by potential development of multiple herbicide resistance. As a result, extension weed specialists in the Mid-Atlantic region are recommending a 2,4-D ester based program. 2,4-D rates need to be at 1 lb ae/A to provide effective, consistent control. This requires applications 30 days prior to planting. In 2003, heavy spring winds prevented many growers from treating their fields in a timely fashion. Thus growers were forced to second and third options to control glyphosate-resistant horseweed. A range of trials conducted by the University of Delaware Weed Science program examined a variety of approaches to control horseweed. These were all replicated trials.

Previous results indicated that sequential paraquat applications provided excellent horseweed control and there was no benefit to the addition of 2,4-D with sequential paraquat applications. However, trials in 2003 showed significant improvement of horseweed control with the addition of 2,4-D at 0.5 lb ae/A with the first application in a sequential paraquat program (94% control with paraquat at 0.75 lb ai/A followed by 0.47 lb ai/A compared to 64% control; and 99% control with paraquat at 0.75 ai/A for both applications compared to 83% control). Paraquat applied in a single application (0.94 or 0.75 lb ai/A) with 1 lb ae/A of 2,4-D resulted in less than 70% horseweed control. However, the same rate of 2,4-D alone controlled 98% of the horseweed. In a separate study to further examine this reduction of control between growth regulator-type herbicides and paraquat, 30 inch tall horseweed plants were treated with 2,4-D at 0.5 and 1.0 lb ae/A and no reduction in horseweed control was observed. However, dicamba was included in this trial and dicamba alone at 0.25 lb ai/A provided 93% control, but when paraquat was added at 0.47 or 0.74 lb ai/A, control was reduced to 60 and 72% control, respectively. This indicates that under some situations, which we do not fully understand at this point, paraquat can reduce the effectiveness of growth regulator-type herbicides.

Due to heavy winds in the spring of 2003, many fields could not be treated until the horseweed was 30 inches or taller. These plants were too tall to allow adequate coverage with some sprayers, so there were many questions about mowing the field prior to planting. Mowing the field to a height of 2 to 3 inches the last week of June provided only 63% horseweed control at soybean canopy closure. Glyphosate or paraquat applied 3 days after mowing resulted in 81% horseweed control. Including 2,4-D (0.5 lb ae/A) or Canopy at 0.5 oz/A, with either gramoxone or glyphosate provided ≥94% control of mowed horseweed.

In a separate study (that did not include mowing), control of large horseweed plants treated with paraquat plus chlorimuron averaged 83% control. Results were similar with 0.47 and 0.75 lb ai/A paraquat, or chlorimuron as Canopy or Canopy XL. Results were similar for Canopy at 4 or 6 oz and Canopy XL at 0.18 or 0.2 oz/A, or if 2,4-D at 0.5 lb ae/A was included or not.

Results in 2003 were not consistent with previous years' result. However, a 2,4-D based program is still the base of the recommendation. Chlorimuron (as Canopy or Canopy XL) did provide good to excellent horseweed control, yet concerns about resistance management persist. More research is needed to understand the basis of the inconsistencies and better understand the biology of this species.

INTRODUCED VASCULAR FLORA OF SABLE ISLAND, NOVA SCOTIA, CANADA - R Stalter and Y Michaels. St. John's University, Jamaica, New York.

ABSTRACT

The non-native vascular flora of Sable Island, a sandy 3400 ha island, 160 km east of Nova Scotia, was based on five floristic inventories from 1899 to 1981. A sixth inventory, the present study, was conducted in August, 2002. The vascular flora of Sable Island consisted of 230 species in 154 genera in 60 families. Eight plant families, the Pinaceae, Aceraceae, Betulaceae, Linaceae, Portulacaceae, Rharnnaceae, Salicaceae and Saxifraceae were composed exclusively of non-native species. Seventy-six species, 33% of the flora, were not native to the island.

INTRODUCTION

The objective of this study was to report the introduced vascular flora of Sable Island, Canada. Sable Island, 3400 ha, (44° N, 60°W) is a sandy island 42.5 km long, 1.4 km wide, 160 km east of the mainland of Nova Scotia. The islands, topography and vegetation have been noted since 1505 as a treeless sandy island vegetated by low growing forbs, grasses and shrubs. There have been five major botanical surveys of Sable Island. The sixth, the present study conducted in August 2002.

Macoun was the first botanist who compiled a list of the vascular flora, of the island in 1899. Macoun's survey was followed by Gussow, who identified 83 species of which 75 were native in 1911. St. John spent a month collecting plants on Sable Island in 1913. St. John produced a list of 183 species, including 56 introduced species, 29.8% of the flora.

The most recently published floristic survey of Sable Island was that of Catling et al based on field work, August 14 to 26, 1981, and the growing seasons of 1982 and 1983. They reported 177 species of vascular plants of which 135 were native, 76.3% of the flora.

In spite of Sable Island's isolation, non-native plants have been an integral part of the island's flora. Of the 230 species identified in all of the botanical surveys of the island, 76 non-native species, 33% of the total at Sable Island, were non-native. Fifteen of the 76 non-native species were deliberately planted at Sable Island, including a questionable planting, *Colluna vulgaris*. The relatively high percentage of non-native vascular plants species on Sable Island may be related to human disturbance, especially farming and live stock raising around the five life saving stations which existed o the island since 1813.

The land farmed by the life saving residents was nearly, 4 ha, approximately, 0.17% of the island. Although the amount of land farmed was small, the disturbed soil may have been a fertile habitat for non-native forbs and grasses. More than 80,000 trees including 25 species of conifers, 79 species of hardwoods, "hundreds of shrubs" and "1000 willow cuttings" were deliberately planted on the island in 1901. The seeds of additional non-native taxa may have been brought to Sable Island in the soil around the roots of the aforementioned plantings. By 1913, only 17 of the original 80,000 plantings survived. The inhospitable environment and climate were probably responsible for the death of the plantings.

METHODS

The vascular plant species at Sable Island were sampled in August, 2002. No samples of the vascular plant species were taken because permission to collect vascular plants was not granted by the island's director, Gerry Forbs. Photos of vascular plant species were taken as reference material including *Silene vulgaris*, a new species to the island. Vascular plant native or non-native status follows Gleason and Cronquist, the definitive manual of vascular plants of eastern United States and adjacent Canada.

RESULTS AND DISCUSSION

The vascular flora of Sable Island as recorded by this survey consisted of 230 species in 154 genera in 60 families. Seventy-six species, 33% of the vascular plant species at Sable Island were non-native. Non-native plant families composed exclusively of shrubby or arborescent taxa were the Pinaceae, Aceraceae, Betulaceae, Rhamnaceae, Salicaceae and Saxifragaceae. Of the aforementioned families, all species in the Aceraceae, Betulaceae, Rhamnaceae, Salicaceae and Saxifragaceae have been extirpated. Two additional extinct families with 100% non-native herbaceous taxa were the Linaceae and Portulacaceae.

Human influence has probably played a major role in the number of non-native plant species at the island. A deliberate attempt to forest the island with non-native species was one source of non-native species. Additional non-native species may have been brought to the island in potting soil. Another source of non-native plants may have been the seed banks of visitors' soiled clothes and boots, seeds in pockets and plant cuffs, ballast seeds carried on the feet and feather of shore birds and migrating birds. Additional sources of non-native taxa may have been weed seed accidentally imported with vegetable seed when the island was farmed in the 18th and 19th centuries. While visitation to the Sable Island today is limited, expensive and controlled, visitors may still inadvertently bring seeds of non-native plants to the island.

Summary of vascular flora of Sable Island, Nova Scotia.

	Fern Allies	Ferns	Conifers	Dicots	Monocots	Total
Families	1	2	2	42	13	60
Genera	1	3	3	106	41	154
Species	1	3	5	151	70	230
Native	1	3	2	92	56	154
Introduced Species	0	0	3	59	14	76

CONTROLLING STAR-OF-BETHLEHEM - JB Beam, WL Barker, SD Askew, Virginia Tech, Blacksburg; and KW Bradley, Virginia Tech, Blacksburg.

ABSTRACT

Star-of-Bethlehem (*Ornithogalum umbellatum*, L.) (OTGUM) is a bulbous perennial that resist mowing, and is difficult to control. Star-of-Bethlehem reproduces primarily by small bulbs that form around the base of parent plants. Plowing and watershed can spread bulbs and increase concentration of OTGUM in an area. OTGUM is poisonous and problematic in pastures and hay fields. Plants grow vegetatively from January to June and interfere with spring hay and forage quality. Experiments were conducted in April 2001 and 2002 in Nelson County, VA to determine control options for OTGUM. Plots were 6 x 10 feet with 50% cover of OTGUM at first application. Herbicides tested in 2001 included: 2,4-D at 1.0, 2.0, 3.0, and 4.0 lb ai/A, 2,4-D plus dicamba at 2.0 and 1.0 lb ai/A, 2,4-D plus picloram at 0.5 plus 0.14, 2,4-D plus triclopyr at 3.0 and 1.5 lb ai/A, dicamba at 1.0, 2.0, 3.0, and 4.0 lb ai/A, glufosinate at 0.44 and 0.44 followed by 0.44 lb ai/A, glyphosate at 1.0, 2.0, 3.0, 4.0, and 6.0 lb ai/A, imazethapyr at 0.095, metribuzin at 1.0 lb ai/A, metsulfuron at 0.008 and 0.011 lb ai/A, paraquat at 0.94 followed by 0.94 lb ai/A, thifensulfuron plus tribenuron at 0.019 plus 0.009 lb ai/A, triclopyr at 0.5 and 1.0 lb ai/A, and tribenuron at 0.015 lb ai/A. Surfactants were included as indicated on individual product labels. Sequential applications were made three weeks after the initial. At the one year after initial treatment (YAIT) rating, 2,4-D at 1.0 and 2.0 lb ai/A, 2,4-D plus picloram at 0.5 plus 0.14 lb ai/A, imazethapyr at 0.095 lb ai/A, metribuzin at 1.0 lb ai/A, metsulfuron at 0.008 lb ai/A, thifensulfuron plus tribenuron at 0.019 plus 0.009 lb ai/A, triclopyr at 0.5 lb ai/A, and tribenuron at 0.015 lb ai/A did not control OTGUM and were replaced in 2002 with clopyralid at 0.25 lb ai/A, halosulfuron at 0.062 lb ai/A, halosulfuron plus dicamba at 0.062 plus 1.5 lb ai/A, mesotrione at 0.1 lb ai/A, mesotrione plus dicamba at 0.1 plus 1.5 lb ai/A, prosulfuron plus primisulfuron 0.018 plus 0.018 lb ai/A, tebuthiuron at 2.4 lb ai/A, and triclopyr plus clopyralid at 0.84 plus 0.28 lb ai/A. Other treatments were sprayed over the same plots as done in 2001. Star-of-Bethlehem control was rated two YAIT. Paraquat at 0.94 lb ai/A applied twice, 3 wk apart in 2001 and 2002, controlled OTGUM 97% two YAIT. Dicamba at rates between 2.0 and 4.0 lb ai/A applied twice over two years controlled OTGUM 80% two YAIT. 2,4-D plus dicamba at 2.0 plus 1.0 lb ai/A applied twice over two years controlled OTGUM 75% two YAIT. Control from all other treatments was

A similar experiment was initiated in March 2003 in Nelson County, Virginia to determine other control options for OTGUM. Herbicides tested included: paraquat 0.94 followed by 0.94 lb ai/A, dicamba at 4.0 lb ai/A, nicosulfuron at 0.04 lb ai/A, metsulfuron at 0.04 lb ai/A, imazapic at 0.06 lb ai/A, foramsulfuron at 0.02 lb ai/A, trifloxysulfuron 0.008 lb ai/A. A nonionic surfactant was included with each herbicide treatment, except dicamba, at 0.25% v/v. Paraquat at 0.94 lb ai/A applied twice, three wk apart, controlled OTGUM 95% six weeks after treatment. Dicamba at 4.0 lb ai/A controlled OTGUM 83% six weeks after treatment. Control from all other treatments was

EVALUATION OF IMAZAPIC AS A GROWTH REGULATOR IN ROADSIDE TALL FESCUE - AE Gover, JM Johnson, and LJ Kuhns, Penn State Univ., University Park, PA.

ABSTRACT

As part of an ongoing project funded by the Commonwealth of PA Department of Transportation, imazapic was evaluated for utility as a growth regulator on roadside tall fescue (*Festuca arundinaeca* Schreb.) turf. The primary objective of a growth regulator program on tall fescue is to eliminate seedhead production to reduce the grass biomass clipped during the first mowing cycle, which typically begins in mid-May in PA. The trial was established May 10, 2002 in the unmowed infield of the SR 22/220/764 interchange, near Duncansville, PA. Average canopy height at treatment was 20 cm, and maximum stem elongation within the leaf sheaths was 5 cm. The treatments were applied at 374 L/ha to 1.8 by 6.1 m plots arranged in a randomized complete block with three replications. Treatments included a nontreated check, imazapic at 0.035 kg/ha plus methylated seed oil at 0.38 L/ha, imazapic at 0.70 kg/ha without surfactant, metsulfuron at 0.021 kg/ha, and the combination of dicamba plus triclopyr at 0.84 plus 0.63 kg/ha alone, and in combination with the following: imazapic at 0.035 kg/ha, metsulfuron at 0.021 kg/ha, imazapic plus metsulfuron at 0.035 plus 0.021 kg/ha, mefluidide at 0.10 kg/ha, or mefluidide plus metsulfuron at 0.10 plus 0.021 kg/ha. The metsulfuron-alone and dicamba plus triclopyr combination treatments included an organosilicone-blend surfactant at 0.1 percent, v/v. The dicamba plus triclopyr plus mefluidide plus metsulfuron combination is very similar to operational treatments in PA, and was the designated standard. Tall fescue response was assessed on June 20 with visual ratings of turf color, turf injury, percent seedhead suppression compared to the nontreated check, and percent green cover, and a measurement of average canopy height. Turf color was rated on a 0 to 10 scale, with '0' indicating dead turf and '10' indicating color equal or superior to the nontreated check. Turf injury was rated on a 0 to 10 scale, with '0' being no detectable injury and '10' being dead turf.

Four treatments were rated as having significant seedhead suppression and were acceptable and not significantly different from each other when rated for tall fescue injury, color, or canopy height: metsulfuron alone, and dicamba plus triclopyr in combination with either metsulfuron, imazapic, or metsulfuron plus mefluidide. The plots treated with imazapic alone or dicamba plus triclopyr plus imazapic plus metsulfuron were free of seedheads, but received unacceptable ratings for turf color and tall fescue injury. The addition of dicamba plus triclopyr significantly moderated the response of tall fescue to imazapic alone at 0.035 kg/ha, but not to metsulfuron alone at 0.021 kg/ha. The nontreated check, and the combination of dicamba plus triclopyr alone, or with mefluidide were indistinguishable.

Response of tall fescue to growth regulator applications made on May 10, 2002. Effects were evaluated on June 20, 2002, 41 days after treatment. Turf color was rated on a 0 to 10 scale, with '0' indicating dead turf, and '10' being equal or better than the nontreated check. Tall fescue injury was rated on a 0 to 10 scale with '0' indicating no observable effect and '10' indicating dead turf. Seedhead suppression was based on the nontreated plots, which were assigned a '0' rating. Green cover is ground cover provided by green tissue, which would discount senesced or necrotic plant tissue. Each value is the mean of three replications.

Treatment[1]	Application Rate	Turf Color	Tall Fescue Injury	Vegetative Canopy Height	Seedhead Reduction	Green Cover
	oz product/A	0 to 10	0 to 10	cm	%	%
Nontreated[2]	---	10	0.0	30.5	0	40
Imazapic	0.035	2.7	8.7	19.5	100	12
Imazapic	0.07	2.7	8.7	18.6	100	12
Metsulfuron	0.021	5.3	7.7	22.9	88	20
Dicamba Triclopyr	0.84 0.63	10	0.3	28.8	17	38
Dicamba Triclopyr Metsulfuron	0.84 0.63 0.5	5.3	6.3	22.0	88	25
Dicamba Triclopyr Imazapic	0.84 0.63 0.035	5.0	6.7	22.9	95	27
Dicamba Triclopyr Imazapic Metsulfuron	0.84 0.63 0.035 0.021	3.7	8.3	21.2	97	18
Dicamba Triclopyr Mefluidide	0.84 0.63 0.1	10	0.0	27.9	0	48
Dicamba Triclopyr Metsulfuron Mefluidide	0.84 0.63 0.25 0.1	5.0	6.7	22.0	88	25
Fisher's Protected LSD (p=0.05)		1.5	1.5	2.1	19	14

[1] Imazapic alone at 0.035 kg/ha included methylated seed oil at 0.38 L/ha, imazapic alone at 0.07 kg/ha had no surfactant, and the remaining treatments included an organosilicone-blend surfactant at 0.1 percent, v/v.

[2] The nontreated check plots were assigned arbitrary values for turf color, tall fescue injury, and seedhead suppression, and therefore were not included in the analysis of variance for those dependent variables.

EFFECT OF CUT SURFACE APPLICATION TIMING ON SUPPRESSION OF TREE-OF-HEAVEN RESPROUTS - JM Johnson, AE Gover, and LJ Kuhns, Penn State Univ., University Park, PA.

ABSTRACT

This trial, part of an ongoing research project funded by PENNDOT, investigated the effect of application timing on resprouting following cut surface applications on tree-of-heaven (*Ailanthus altissima* [Mill.] Swingle). Four timings were chosen, including bud swell, full leaf expansion, post seed development, and dormancy. The corresponding treatment dates were April 24, July 5, August 30, and November 15, 2001.

The study was established along the shoulder of the SR 114 off-ramp of I-81 South near Mechanicsburg, PA. The study area was a south-facing cut slope with a large, established stand of tree-of-heaven. Each timing included cutting alone and cut plus stump treat using a solution containing 1 lb/gal triclopyr, diluted in a commercial basal oil[1], plus a dye indicator. The herbicide mixture was applied immediately following cutting to the cut surface and sides of the stump to the soil line using a squirt bottle. This mix was used for all four timings. Plots were 40 by 40 feet arranged in a randomized complete block design with three replications. Subplots measuring 20 by 20 feet were located in the center of each plot. All measurements were taken within the subplots to allow the surrounding areas to act as a buffer from adjacent treatments. Due to a preexisting decline in the tree-of-heaven stand that went unnoticed at the onset of the study, five additional plots were created to replace those not suitable for evaluation. Information collected at the time of treatment included both stem counts and stem diameter measurements. Root sucker and stump sprout data was collected August 15 through September 14, 2002. This included number, height, and stem diameter measured at 3 inches above the soil line or at point of attachment on the stump. Root suckers are defined as sprouts originating from the roots, but may include some seedlings. Stump sprouts originate from the stump.

There was no significant difference in the number of root suckers regardless of herbicide treatment or timing. Average root sucker height was the only significant interaction. The April 24 timing resulted in taller root suckers than the July 5 and November 15 timings for the herbicide treated plots with heights of 24, 12, and 15 inches respectively. The April 24 timing had the greatest amount of time and carbohydrate reserves to develop larger root suckers. There was a substantial number, but no significant difference in stump sprouts for nontreated timings. Only a few treated stumps resprouted. This happened in the August timing only and may be the result of overlooked stumps that were nontreated.

Herbicide treated plots had significantly fewer stump sprouts, increased cut stem mortality, and lower average stump sprout height than plots where no herbicide was applied. This study does not substantiate the claim that applications made during the growing season will reduce root suckering. It does demonstrate the importance to treat stumps and plan ahead for follow-up foliar applications to a tree-of-heaven stand.

[1]A 1:3 mixture of Garlon 4 (4 lb triclopyr acid/gal, as the butoxyethyl ester, Dow AgroSciences, Indianapolis, IN) and Arborchem Basal Oil (Arborchem Products, Mechanicsburg, PA).

Response of tree-of-heaven to cut surface treatments applied: April 24, July 5, August 30, and November 15, 2001. Stump sprout and root sucker data was collected August 15 to September 14, 2002. 'Percent cut stem mortality' is the number of stumps that did not resprout divided by the number of original stems multiplied by 100. 'Stump sprout number' is the total number of stump sprouts. 'Average stump sprout height' is the average height of those sprouts originating from the stump. The 'root sucker number' is the number of root suckers which may include some seedlings. Original stem numbers were evaluated as a covariate and were not significant. A '---' indicates that a significance level was not determined because the interaction was not significant.

Application timing		Original stems	Cut stem mortality	Stump sprout	Avg. stump sprout ht.	Root suckers
		no.	%	no.	in	no.
Nontreated						
Apr 24	(n=3)	72	35	88	60	250
Jul 5	(n=3)	40	31	107	49	201
Aug 30	(n=3)	67	63	86	33	348
Nov 15	(n=3)	57	37	81	30	186
LSD (p=0.05)			n.s.	---	n.s.	---
Treated						
Apr 24	(n=3)	38	100	0	0	274
Jul 5	(n=3)	36	100	0	0	157
Aug 30	(n=3)	33	96	3	26	170
Nov 15	(n=3)	63	100	0	0	235
LSD (p=0.05)			n.s.	---	n.s.	---
Interaction (Herbicide x Time)						
Significance Level (p)			0.0518	0.7947	0.0673	0.7465
Nontreated (n=12)		59	41	90	43	246
Treated (n=12)		43	99	1	7	209
Herbicide						
Significance Level (p)			0.0001	0.0001	0.0001	0.6453
Apr 24	(n=6)	55	67	44	30	262
Jul 5	(n=6)	38	65	54	25	179
Aug 30	(n=6)	50	80	44	30	259
Nov 15	(n=6)	60	68	40	15	211
Time						
Significance Level (p)			0.1784	0.8263	0.4068	0.8572
LSD (p=0.05)			n.s.	n.s.	n.s.	n.s.

EVALUATION OF HERBICIDES FOR CONTROL OF TREE-OF-HEAVEN USING CUT SURFACE APPLICATIONS - JM Johnson, AE Gover, and LJ Kuhns, Penn State Univ., University Park, PA.

ABSTRACT

As part of an ongoing research project funded by the Pennsylvania Department of Transportation, a study was established to investigate the effectiveness of several herbicide combinations applied as stump treatments at reducing tree-of-heaven (*Ailanthus altissima* [Mill.] Swingle) resprouts.

The trial was established on a cut slope along SR 81S, near Harrisburg, PA, on the following dates: August 8, 10, 14, and 15, 2001. Treatments included 0.8 lb triclopyr/gal alone or in combination with 0.04 lb imazapyr/gal or 0.10 lb picloram/gal, all in a commercial basal oil; 4 lb ae glyphosate/gal; 2 lb ae glyphosate/gal plus 0.04 lb imazapyr/gal in water; 2 lb fosamine/gal plus 0.04 lb imazapyr/gal in water; and 0.088 lb metsulfuron/gal in a commercial basal oil. All these products except metsulfuron are labeled for cut stump application.

The study was arranged in a randomized complete block design with three replications. The first and second replications were contiguous while the third replication was located approximately one-quarter mile away. Plot size was 20 ft wide by 60 to 80 ft deep. Herbicide treatments were applied using a squirt bottle to the surface and sides of each stump immediately following cutting with a chain saw.

Initial stem counts and tree diameters were recorded just prior to or during cutting. Resprout data was collected September 5 to October 27, 2002, including caliper, height, and number of root suckers and stump sprouts. Surviving stumps, those having at least one sprout, was also recorded. Root sucker counts may have included some seedlings. Stump sprouts are sprouts originating from the previously cut stump.

Treatment had no significant effect on root sucker counts, which averaged from 289 to 566 per plot. All herbicide treatments performed equally well and significantly reduced the number of sprouting stumps compared to the nontreated control. Stem mortality ranged from 84 to 96 percent in the treated plots, compared to 52 percent for the nontreated control.

The failure to control root suckers with any of the treatments suggests that the herbicides are not being effectively translocated to the root system. The application timing was thought to be favorable for the movement of these herbicides to the roots. Perhaps the disruption of the vascular system during the cutting operation limits movement of these herbicides.

This study does demonstrate that treating the stumps is critical to preventing the reestablishment of tree-of-heaven from stump sprouts. By reducing the number of large stump sprouts there should be less energy produced to reinforce the root system and a reduced canopy height to cover during follow-up treatments.

Response of tree-of-heaven to cut-stump treatments applied August 8 to 15, 2001. Number, caliper, and height measurements of stump sprouts and root suckers were taken from September 5 to October 27, 2002. The total root suckers is the number of sprouts emerging from the soil. Percent stem mortality is the percentage of stumps that had no sprouts compared to the original stem count. All values are the mean of three replications.

Treatment	Application dosage	Original stem	Total root suckers	Stem mortality
		(no.)	(no.)	(%)
Nontreated	---	110	307	52
Triclopyr[1/]	0.8 lb ae/gal	90	385	94
Commercial basal oil[2/]	80% v/v			
Triclopyr	0.8 lb ae/gal	125	402	96
Imazapyr[3/]	0.04 lb ae/gal			
Commercial basal oil	78% v/v			
Triclopyr	0.8 lb ae/gal	102	289	96
Picloram[4/]	0.10 lb ae/gal			
Commercial basal oil	75% v/v			
Glyphosate[5/]	4 lb ae/gal	92	566	90
Glyphosate	2 lb ae/gal	32	434	84
Imazapyr	0.04 lb ae/gal			
Water	48% v/v			
Fosamine	2 lb ai/gal	84	380	91
Imazapyr	0.04 lb ae/gal			
Water	48% v/v			
Metsulfuron	0.088 lb ai/gal	91	355	96
Water	5% v/v			
Commercial basal oil	95% v/v			
LSD (p=0.05)		n.s.	n.s.	15

[1/] Garlon 4, triclopyr ester, 4 lb ae/gal, Dow AgroSciences LLC, Indianapolis, IN.
[2/] Arborchem Basal Oil, 100% petroleum-based diluent with emulsifiers, Arborchem Products Co., Mechanicsburg, PA.
[2/] Arborchem Basal Oil, 100% petroleum-based diluent with emulsifiers, Arborchem Products Co., Mechanicsburg, PA.
[3/] Stalker, isopropylamine salt of imazapyr, 2 lb ae/gal, BASF Corporation, Research Triangle Park, NC.
[4/] Tordon K, picloram, 2 lb ae/gal, Dow AgroSciences LLC, Indianapolis, IN.
[5/] GlyPro, isopropylamine salt of glyphosate, 4 lb ae/gal, Dow AgroSciences LLC, Indianapolis, IN.

CARFENTRAZONE IVM HERBICIDE: A NEW FOLIAR APPLIED HERBICIDE FOR VEGETATION MANAGEMENT - RD Iverson, FMC Corporation, Philadelphia, PA; RM Herrick, Rutgers Univ., North Brunswick, NJ; and KG Watson, FMC Corporation, Philadelphia, PA.

ABSTRACT

QuickSilver™ IVM Herbicide is a new herbicide for vegetation management, approved by the Environmental Protection Agency (EPA) on March 4, 2003. The active ingredient, carfentrazone-ethyl, is an EPA "reduced risk" herbicide and is also registered for use in agronomic crops and turfgrass management. The product is a selective, contact herbicide effective against annual broadleaved weeds in a rate range of 1.0 to 2.0 fl oz/A (0.016 to 0.031 lbs ai/A). QuickSilver IVM Herbicide is a non-phenoxy herbicide, works fast on targeted weeds, has cool weather activity, is non-volatile, is rainfast within one hour, and does not harm native grass species.

Greenhouse and field trial data demonstrate that QuickSilver IVM Herbicide provides excellent control of species such as kochia (*Kochia scoparia*), Russian thistle (*Salsola kali*), field bindweed (*Convolvulus arvensis*), pigweed (*Amaranthus* spp.), tall waterhemp (*Amaranthus tuberculatos*), prickly lettuce (*Lactuca serriola*), wild sunflower (*Helianthus annuus*), wild mustard (*Sinapsis arvensis*), and curly dock (*Rumex crispus*) when applied alone or as a tank mix partner. An active field trial program to evaluate QuickSilver IVM Herbicide against a broad spectrum of broadleaved weeds is underway throughout the country.

QuickSilver IVM Herbicide provides a new option for vegetation management and represents a new tool for weed resistance management programs.

CARFENTAZONE AQUATIC HERBICIDE: A NEW TOOL FOR AQUATIC PLANT MANAGEMENT - RD Iverson, FMC Corporation, Philadelphia, PA; RM Herrick, Rutgers Univ., North Brunswick, NJ; and KG Watson, FMC Corporation, Philadelphia, PA.

ABSTRACT

Stingray Aquatic Herbicide is currently under review by the Environmental Protection Agency (EPA) for aquatic weed control. The active ingredient, carfentrazone-ethyl, is an EPA "reduced risk" herbicide and is registered for use in agronomic crops, turfgrass management, and industrial vegetation management. The product is a selective, contact herbicide effective against emerged and floating broadleaved weeds in a rate range of 0.05 to 0.2 lbs ai/A. Stingray Aquatic Herbicide is non-volatile, is rainfast within one hour, has no fishing, swimming or animal drinking restrictions, and does not harm native grass species.

Greenhouse and field trial data demonstrate that Stingray Aquatic Herbicide provides excellent control of species such as water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), and water fern (*Salvinia minima*) when applied alone or as a tank mix partner. An active field trial program to evaluate Stingray Aquatic Herbicide against a broad spectrum of aquatic weeds is underway throughout the country.

Stingray Aquatic Herbicide, when registered, will provide a new option for control of aquatic weeds and represents a new tool for aquatic weed resistance management programs.

EVALUATION OF FLUMIOXAZIN ON FRASER FIR - LJ Kuhns and TL Harpster, Penn State Univ., University Park, PA.

ABSTRACT

Weeds are the most persistent pest which Christmas tree growers must control every year. Their control is an essential part of an efficient crop production system. The triazine herbicides atrazine and simazine have been two of the most commonly used herbicides in Christmas tree plantings for at least 40 years. During this time triazine resistant strains of common weeds have developed. A set of studies was established at Kuhns Tree Farm in Boalsburg, PA to determine the tolerance of Fraser fir (*Abies fraseri* (Pursh) Poir) to flumioxazin and dithiopyr alone or in combination with older preemergence herbicides; and to determine the spectrum and length of weed control provided. A combination of simazine, pendimethalin, and oxyfluorfen was applied to represent the current industry standard.

The treatments were direct sprayed on April 24, 2003 on Fraser fir that were established in 1999. The air and soil temperatures were 60° and 45°F respectively, and winds were 0 to 4 miles per hour. Applications were made with a CO_2 test plot sprayer at 30 PSI through an OC-02 nozzle at 20 GPA. There were three replications per treatment, with ten trees per plot, and five feet between trees. Weed control and plant quality (data not presented) ratings were made July 8, 11 weeks after treatment (WAT).

The predominant weeds in the nontreated plots were downy brome (*Bromus tectorum* L.), marestail (*Conyza canadensis* (L.) Cronq.), buckhorn plantain (*Plantago lanceolata* L), annual fleabane (*Erigeron annuus* (L.) Pers.), redroot pigweed (*Amaranthus retroflexus* L.), prickly lettuce (*Lactuca serriola* L.) common ragweed (*Ambrosia artemisiifolia* L.) and Virginia pepperweed (*Lepidium virginicum* L.). Both rates of flumioxazin and the standard treatment provided excellent weed control with ratings of 9.4 or above. Yellow nutsedge (*Cyperus esculentus* L.) was the most common weed in the plots treated with flumioxazin. The predominant weed in the plots treated with simazine plus pendimethalin plus oxyfluorfen was redroot pigweed.

Except for the low rate of dithiopyr, all of the treatments containing dithiopyr had higher weed control ratings than the nontreated plots. However the only dithiopyr treatments that provided an acceptable level of weed control were those containing simazine or oxyfluorfen. The predominant weeds in the plots treated with dithiopyr were wild buckwheat (*Polygonum convolvulus* L.), common ragweed, wild carrot (*Daucus carota* L.), and Pennsylvania smartweed (*Polygonum pensylvanicum* L). None of the treatments injured the trees.

Weed control ratings on Fraser Fir at Kuhns Tree Farm. Treatments were applied on April 24, 2003. All treatments included 0.25 lb glyphosate. Plots were evaluated on July 8, 2003, 11 weeks after treatment. Weed control ratings are presented on a scale of 1 to 10, with 1 = no control and 10=total control.

Treatments	Rate in lbs ai/A	Weed Control [1/]
Control	-	1.0 e
Simazine	2.5	9.7 a
Pendimethalin	2	
Oxyfluorfen	0.5	
Flumioxazin	0.25	9.4 ab
Flumioxazin	0.25	9.8 a
Pendimethalin	2	
Dithiopyr	0.5	2.7 de
Dithiopyr	1	4.5 d
Dithiopyr	0.5	7.3 bc
Simazine	2.5	
Dithiopyr	0.5	4.3 d
Pendimethalin	2	
Dithiopyr	0.5	7.0 c
Oxyfluorfen	0.75	

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

RESPONSES OF CHRISTMAS TREE SPECIES AND SELECTED WEEDS TO FLUMIOXAZIN - RJ Richardson, BH Zandstra, Michigan State Univ., East Lansing; and J O'Donnell, Michigan State Univ., Cadillac.

ABSTRACT

Flumioxazin is currently under development for use in Christmas tree plantations. Research studies were conducted in 2002 and 2003 to evaluate response of blue spruce and selected weeds to flumioxazin and herbicide mixtures with flumioxazin. In a program comparison study, flumioxazin (0.4 kg ai/ha) was applied alone and in mixture with pendimethalin (3.4 kg ai/ha) on November 12, 2002. Comparison treatments included simazine (2.2 kg ai/ha), isoxaben (1.2 kg ai/ha), oxyfluorfen (1.2 kg ai/ha), and sulfentrazone (0.6 kg ai/ha), each in mixture with 3.4 kg/ha pendimethalin, and a nontreated control. Blue spruce visible injury on June 11, 2003 was 5% with flumioxazin plus pendimethalin and 9% with sulfentrazone plus pendimethalin. Visible injury on August 28, 2003 was 6% with sulfentrazone plus pendimethalin, but injury was not present with other treatments. The predominant injury symptom was needle necrosis and new growth was not affected. Horseweed (*Conyza canadensis*) and dandelion (*Taraxacum officinale*) control on July 16, 2003 did not differ by treatment and averaged 87% and 72%, respectively. Virginia pepperweed (*Lepidium virginicum*) control was at least 80% with all treatments, except oxyfluorfen plus pendimethalin at 47%. Common catsear (*Hypochoeris radicata*) control was 73% with flumioxazin plus pendimethalin and 87% with simazine plus pendimethalin, but did not exceed 67% with other treatments. On August 28, 2003, horseweed control exceeding 78% with only flumioxazin, flumioxazin plus pendimethalin, and sulfentrazone plus pendimethalin. Annual grass control was greater than 80% with all treatments containing pendimethalin, but was 67% with flumioxazin alone. In a flumioxazin program study, flumioxazin was applied alone at 0.14, 0.28, and 0.4 kg/ha on May 6, 2003. Other treatments included flumioxazin at 0.28 kg/ha in mixtures with pendimethalin (3.4 kg/ha), s-metolachlor (1.3 kg ai/ha), simazine (1.68 kg/ha), and simazine plus pendimethalin, a comparison treatment of simazine plus oxyfluorfen (0.56 kg/ha) plus pendimethalin, and a nontreated control. Visible injury on June 11, 2003 was 12% with treatments containing flumioxazin plus pendimethalin. Injury was not observed with other treatments and visible injury was not present on August 28, 2003. Horseweed and dandelion control exceed 80% with all treatments on July 16, 2003. Control of false dandelion was greater than 70% with treatments containing flumioxazin plus simazine and with flumioxazin plus pendimethalin. Annual grass control on August 28, 2003 was at least 86% with treatments containing pendimethalin or s-metolachlor, but was 70% with 0.14 kg/ha flumioxazin and flumioxazin plus simazine.

FLUMIOXAZIN EFFICACY AND SAFETY TO DECIDUOUS SHRUBS AND ORNAMENTAL GRASSES IN CONTAINERS - TL Mervosh and JF Ahrens, Connecticut Agricultural Experiment Station, Windsor.

ABSTRACT

Two experiments were conducted in 2003 to evaluate flumioxazin in container-grown ornamentals. For both experiments, treatments were replicated four times in randomized complete blocks. Each plot contained three plants of each species.

Plants in Experiment 1 were tatarian dogwood (*Cornus alba* 'Elegantissima') and summer sweet (*Clethra alnifolia* 'Hummingbird') in 1.5-gallon containers. Plants had been sheared to a height of 4 to 5 inches. Flumioxazin WDG rates were 0.125, 0.25 and 0.5 lb ai/A applied in a volume of 25 gal/A with a CO_2-pressurized sprayer with two 8003VS nozzle tips. A standard treatment of isoxaben (0.75 lb ai/A) plus oryzalin (2 lb ai/A) was included. The first treatment date was April 17. Plants were wet briefly with overhead irrigation just before treatment application, and were watered for 20 min beginning 15 min after treatments. On May 20, seeds of large crabgrass (*Digitaria sanguinalis*) and common groundsel (*Senecio vulgaris*) were spread uniformly in all pots. The second treatment date was September 30 to previously nontreated containers that had been kept weeded. Plant injury ratings (0 to 10, 10 = plant dead) on May 1 were variable, and determined more by extent of bud opening than by flumioxazin rate. *Cornus* injury (4.0 to 4.5) was generally more severe than *Clethra* injury (2.0 to 2.5). Newly emerged leaves were burned. On May 16, *Cornus* injury ranged from 3.8 to 5.3 with a few dead plants, whereas *Clethra* injury was 1.3 to 2.2. On June 12, *Cornus* plants treated with isoxaben plus oryzalin were slightly lower in vigor than nontreated plants, and vigor of *Cornus* treated with flumioxazin was fair to poor, declining with increasing dosage. *Clethra* had nearly fully recovered. On June 16, weed counts per pot were: nontreated (4.75), isoxaben plus oryzalin (2.74), flumioxazin at 0.125 lb/A (0.35), at 0.25 lb/A (0.18), and at 0.5 lb/A (0.0). At 0.125 lb/A, flumioxazin provided 86% crabgrass control and 97% groundsel control. Following the September treatments, injury to *Cornus* was not observed prior to leaves turning red. Flumioxazin injury to *Clethra* was slight on October 7 and up to 3.0 on October 21.

Ornamental grasses in Experiment 2 were blue fescue (*Festuca ovina* 'Elijah Blue') and pampas grass (*Cortaderia selloana* 'Rosea') potted in 2-gallon containers in June 2003. Treatments, applied on July 1, included isoxaben (0.75 lb ai/A) plus prodiamine (1.5 lb ai/A) and Snapshot 2.5TG [isoxaben (0.75 lb ai/A) plus trifluralin (3 lb ai/A)] as standards. Application rates for flumioxazin 51WDG and 0.25G were 0.25, 0.5 and 1.0 lb ai/A Granular treatments were applied over dry foliage with a calibrated auger-fed drop spreader, followed 15 min later with overhead irrigation for 15 min. Then sprayable treatments were applied as before over moist foliage, followed 15 min later with irrigation for 30 min. On July 3, crabgrass and groundsel seeds were spread uniformly in all pots. On August 1, *Festuca* was uninjured except for plants treated with either formulation of flumioxazin at 1.0 lb/A (injury of 1.0 to 1.5). Flumioxazin sprays caused considerable injury to *Cortaderia* (1.9 to 3.5) in the form of necrotic lesions on the blades. Flumioxazin granules caused minor injury to *Cortaderia* (< 1.5). The grasses generally recovered later in the season. Flumioxazin provided at least 96% weed control, equal to or better than the standard treatments.

EVALUATION OF MICRO-ENCAPSULATED HERBICIDES ALONE AND APPLIED TO BARK MULCHES - HM Mathers, J Pope, and LT Case, Ohio State Univ., Columbus.

ABSTRACT

Non-target herbicide losses are the primary contributor to herbicides in runoff water from container-grown nurseries. Frequent reapplication is necessary to maintain acceptable weed control in containers, so it is likely that the half-life of herbicides on the surface of a soilless media is less than those observed in field soils. Extending the duration of efficacy of preemergence herbicides would benefit the nursery industry. However, reduced phytotoxicity should be an important consideration when new products are developed. This study examined the use of two Monsanto microencapsulated products, alachlor 41.5% (Micro-tech) and acetochlor 42% (Degree), as well as two current formulations of these products alachlor 45% (Lasso) and acetochlor 76% (Harness) applied alone or onto two bark mulches, pine nuggets or shredded hardwood. The herbicide treated bark was compared to a control (weedy check), direct sprays of the herbicides and mulch applied alone to the container surface for a total of 15 treatments. The objective of this study was to determine if the combination of slow release formulations with slow release bark carriers gave extended efficacy. Efficacy and phytotoxicity began May 19, 2003. Efficacy was studied with, annual bluegrass, large crabgrass and common groundsel. Assessments of efficacy were made at 45 and 110 d after treatment (DAT) of treatments using a visual rating. Ratings for efficacy were based on a 0 to 10 scale where 0=poor control and 10=perfect control. Visual rating scores of 1 (no injury) to 10 (complete kill) were used for phytotoxicity on *Rosa* 'Care Free Beauty,' *Buxus* 'Green Gem' and *Spirea* 'Little Princess.' Five of the 15 treatments had commercially acceptable weed control (7 or higher) combined over the two evaluation dates; and after 107 DAT, 7 of these treatments had commercially acceptable weed control. All of the top five treatments were combinations of mulch and herbicides. The acetochlor products, Harness and Degree, on hardwood or pine gave the best control. None of the direct sprays provided commercially acceptable weed control after 107 DAT. Five treatments gave ratings of 3 or below (commercial acceptable) phytotoxicity. Four of these five were direct sprays. Harness treated hardwood was the only mulch herbicide combination with a high phytotoxicity rating (3.5) over both dates. Spirea showed the most phytotoxicity at 45 DAT, especially to direct sprays of Degree and Harness.

DIFFERENTIAL TOLERANCE OF ORNAMENTAL SPECIES TO PENDIMETHALIN FORMULATIONS - AF Senesac, Cornell Cooperative Extension, Riverhead, NY.

ABSTRACT

A container study was conducted in 2003 to examine the response of woody ornamental shrubs to over-the-top applications of two rates of two formulations of the preemergence herbicide pendimethalin (1.5 and 3.0 lbs ai/A of Pendulum 3.3EC and Hurdle 3.8CS). The treatments in one study were applied to six commonly grown shrubs on June 15, 2003 to hardened-off foliage. The species evaluated were: boxwood (*Buxus sempervirens* 'Inglis'), privet (*Ligustrum x* 'Variegatum'), catawba rosebay (*Rhododendron catawbiense* 'Grand'), fragrant sumac (*Rhus aromatica* 'Gro-Low') English yew (*Taxus baccata*), and arborvitae (*Thuja occidentalis* 'Brabant'). The plants were irrigated by within 45 minutes of treatment. The containers were placed in full sun for the duration of the study. The results of periodic visual evaluations indicated that these ornamental species can tolerate either formulation without exhibiting any significant foliar injury.

A second study evaluated the efficacy of the same herbicides on three weed species: rice flatsedge (*Cyperus iria*), common chickweed (*Stellaria media*), and marsh yellowcress (*Rorippa islandica*). Following treatment on June 15, one half of the flats were removed to a shade house (50%) and the other half were placed in full sun. Twenty four hours after treatment, all flats were overseeded with the weed species. All flats were irrigated twice a day. The flats in the shade house generally were moist throughout, while those in full sun had distinct periods of drying between irrigation events. The results indicate that the 3.8CS formulation of pendimethalin provided significantly less control of these weeds than the 3.3EC formulation. The decrease in level of control was definitely more noticeable in the flats that were in the shade than those grown in full sun. These results indicate that the rates of the 3.8CS formulation may have to be increased to obtain equivalent control of these container species.

A third container study was conducted in 2003 to examine the response of several species of herbaceous ornamentals to over-the-top applications of four formulations of pendimethalin (3.3EC, 3.8CS, 60 WDG and 2G) each applied at 1.5 and 3.0 lbs ai/A. Four annual bedding plant species were evaluated: *Gomphrena globosa* 'Buddy Purple', *Nicotiana alata* 'Hummingbird Cherry Blossom', *Salvia splendens* 'Salsa Scarlet', *Viola x wittrockiana* 'Rose Blotch'. Four herbaceous perennial species were evaluated: *Phlox paniculata* 'Robert Poore', *Potentilla neumanniana* 'Nana', *Sedum x* 'Bertram Anderson' and *Stachys byzantina*. All treatments were applied to recently transplanted, but hardened-off plants. Following treatment, irrigation was applied within one hour. The plants were grown in full sun for the duration of the study. The result of visual evaluations and aboveground fresh weight harvests indicate that there was unacceptable injury of each of the four annual species caused by each of the three sprayable pendimethalin formulations (3.3EC, 3.8CS, 60 WDG. In general, the annuals and perennials were relatively tolerant of the granular pendimethalin. Interestingly *Viola, Salvia* and *Gomphrena* were less injured by the pendimethalin 3.8 CS than the 3.3EC when it was applied at the lower rate, but not at the higher rate.

WHAT IS A MICROENCAPSULATED FORMULATION? THE MAKING OF THE NEW PENDIMETHALIN FORMULATION FROM BASF - KE Kalmowitz, M Tomasik, J Zawierucha, BASF Corporation, Research Triangle Park, NC; and K Miller, BASF Corporation, Chesterfield, VA.

ABSTRACT

Ten years ago the need was identified for a new pendimethalin formulation that would extend patent protection for one of the broadest used dinitroaniline herbicides in the world. The product concept was a better product than currently registered formulations; one that was aqueous with no solvents, equal or better in biological efficacy and in cost to produce, and a formulation that would offer reduced odor and reduced staining at the time of application to the applicator. This concept formulation was realized with the 2002 registration of the microencapsulated 3.8 lb active per gallon of pendimethalin, Pendulum® AquaCap™ Herbicide. The aqueous-based microencapsulated formulation resulted in a formulation that has increased loading of the active pendimethalin from 3.3 to 3.8 lb ai and improved bulk handling performance. The development of the formulation began with a diverse group of scientists in the Princeton, New Jersey laboratories and over the years involved chemists and field biologists on four continents.

The microcapsules are made by interfacial polymerization. This polymerization process results in the formation of the wall material that is constructed of polymer chains with cross-links of carbon and ureas. The interface is a water phase with an oil phase; the molten pendimethalin resides in the oil phase. The biological principal behind the capsule is modeled on an organic cell in which osmotic pressure controls the release mechanism. The extremely thin walls of the capsule have a degree of flexibility and this technology allows for the capsule to remain intact during the application process (stirring, pumping and the friction of liquid flow in the application operation through the hose, nozzle and screens) however, once applied the main route of capsule rupture is through wet and dry cycle pressures on the cell wall. When the capsules are broken the released liquid pendimethalin rapidly crystallizes and behaves in a similar way (biological efficacy) as the DG formulation with particles size distribution about 5 to 10 microns. The pendimethalin microcapsules are stabilized against crystallization during storage with product transfer good to -4° C.

Field and laboratory research has shown that rainfall or irrigation passing over the capsules will move the capsule from the soil surface; the percolation of the capsule into the soil, slowly extracts the pendimethalin from the capsules. Soil has a high affinity for pendimethalin and rapidly absorbs it. In both field crop applications and residue evaluations such as are found in reduced tillage, and in turfgrass trials, it has been documented the microencapsulated pendimethalin provides equal or better biological efficacy to target weed species due to the capsule movement into the soil.

NITROGEN FORM AFFECTS WEED GROWTH IN CONTAINER PRODUCTION - J Altland, Oregon State Univ., Aurora.

ABSTRACT

Nitrogen (N) is most often applied to container plants as nitrate, ammonium, urea, or a combination thereof. Some ornamental and weed species have demonstrated a preference for N form. Plants that have a preference for N form still grow, although somewhat less vigorously, when non-preferred forms are supplied. N form could be used as a cultural practice to reduce weed vigor. Therefore, the objective of this experiment was to determine if N form affects establishment and growth of container weed species.

Trade gallon containers were filled with Douglas fir bark amended with 1.5 lbs/yd^3 Micromax micronutrients. Containers were overseeded with 20 seeds of bittercress (*Cardamine hirsuta*) and oxalis (*Oxalis corniculata*) on March 3, 2003. Containers were fertilized with 150 ppm N, 62 ppm phosphorus, and 150 ppm potassium. N was applied in nitrate:ammonium ratios of 100:0, 0:100, 50:50, or as urea. Plants were grown in an unheated glass house and were fertigated with nutrient solutions described above twice weekly, and watered additionally when needed. Each N treatment was replicated 10 times in a completely randomized design with weed species randomized separately.

The influence of N form on bittercress number was subtle though significant. Bittercress fertilized with urea had fewer flowers than those fertilized with other N forms. Bittercress fertilized with only ammonium were largest. Oxalis coverage of the surface and flower number was less in containers fertilized with urea compared to those fertilized with only nitrate or ammonium. Similar to bittercress, oxalis fertilized with only ammonium had greater shoot fresh weights than those fertilized with urea. These data indicate that N form affects the growth and development of bittercress and oxalis. Nursery growers might improve weed control by switching to fertilizers with urea. Future experiments will determine the impact of using only urea on crop growth, and test for interactions between herbicide efficacy and N form.

Influence of nitrogen form on growth of bittercress and oxalis 60 days after sowing.

	Bittercress			Oxalis		
NH4:NO3	Weed number	Plants with flowers	Shoot fresh weight (g)	Surface coverage (%)	Plants with flowers	Shoot fresh weight (g)
0:100	13.7 ab[z]	7.0 a	0.7 b	77.6 ab	4.8 a	0.9 bc
100:0	11.2 b	9.4 a	2.2 a	89.3 a	6.8 a	1.7 a
50:50	15.3 a	7.2 a	0.8 b	69.0 b	3.7 ab	1.0 b
Urea	11.3 b	1.9 b	0.3 b	43.2 c	1.3 b	0.6 c

[z] Means with the same letter are not significantly different by Duncan's multipel range test (a = 0.05).

EFFECT OF FERTILIZER PLACEMENT AND HERBICIDE RATE ON WEED GROWTH IN CONTAINER-GROWN ORNAMENTALS - GB Fain, Mississippi State Univ., Crystal Springs; and J Altland, Oregon State Univ., Aurora.

ABSTRACT

Experiments were conducted in Mississippi and Oregon to evaluate the effect of fertilizer placement and herbicide rate on weed control and crop growth. In an experiment conducted in Mississippi, Osmocote 17N-3.0P-10.1K (17-7-12) was applied at 18 g (0.594 oz) per container as a top-dress (distributed evenly on the container surface), an incorporation (blended throughout the container substrate just prior to potting), or dibbled (placed just beneath the root ball of the transplanted liner about 8 cm below the container surface). Rout (oryzalin plus oxyfluorfen) was applied at 0, 28, 56, or 112 kg ha^{-1} (0, 25, 50, or 100 lbs/acre). Also included was a hand weeded control, and containers were over-seeded with prostrate spurge (*Chamaesyce prostrata*). In a second experiment conducted in Oregon, containers were fertilized with either 12 g (0.396 oz) of Apex 20N-4.3P-8.4K (20-10-10) or 14 g (0.462 oz) of Apex 17N-2.2P-9.2K (17-5-11) using similar fertilizer placement methods; and Snapshot 2.5TG (isoxaben plus trifluralin) was applied at 0, 84, or 168 kg ha^{-1} (0, 75, or 150 lb/acre). Containers were over-seeded with oxalis (*Oxalis corniculata*). In both experiments, there was an improvement in weed control with increasing herbicide rate. When no herbicide was used, dibbling fertilizer resulted in 85 to 97% weed control, while top-dressing resulted in 19 to 85% and incorporating resulted in 55 to 88% control. With the use of herbicides, dibbling resulted in 89 to 99% weed control while top-dressing resulted in 82 to 90% and incorporating 81 to 98%. Dibbling resulted in greater shoot growth of 'Compacta' holly (*Ilex crenata*), lavender (*Lavandula × intermedia* 'Grosso'), and wintercreeper euonymous (*Euonymous fortunei* 'Emerald Gaiety'). In Oregon, incorporating fertilizer resulted in increased root ratings compared to dibbling with both lavender and euonymous. Results of these experiments show that when fertilizers are dibbled, weed growth is reduced and the efficacies of the herbicides tested were improved.

CONTAINER SUBSTRATE PARTICLE SIZE AFFECTS PEARLWORT GERMINATION AND SUBSEQUENT GROWTH - J Altland, Oregon State Univ., Aurora.

ABSTRACT

Pearlwort (*Sagina procumbens*) is a troublesome weed in Pacific Northwest (PNW) container nurseries. It is a perennial that reproduces by seed. Seed are small and thus likely need to germinate near the substrate surface. In unrelated projects, it was observed that pearlwort germinated poorly when coarse bark was used as the container substrate. It was speculated that pearlwort seed were flushed too deep in the substrate between coarse particles and thus could not germinate or establish. Nurseries in the PNW typically use substrates with small particle size; however, this may be a cultural practice that enhances pearlwort establishment and growth. Therefore, objective of this experiment was to determine if substrate particle size affects germination and subsequent growth of pearlwort.

Douglas fir bark was sifted to create substrates with different particle size. Four different substrates, listed from finest to coarsest were: 1) bark that passed through a 0.25 mesh screen, 2) bark that passed through a 0.5 inch screen, 3) non-sifted bark, and 4) bark that would not pass through a 0.5 inch screen. Square container 5.5 inches tall and wide were filled with substrates, topdressed with 0.21 oz. Osmocote 18-6-12 controlled release fertilizer, and over-seeded with 20 pearlwort seed on July 10, 2003. Containers were grown in full sun, on gravel, and received 0.5 inch overhead irrigation per day split in two equal cycles. Each substrate treatment was replicated 10 times in a completely randomized design.

By 90 days after over-seeding, pearlwort growth was greatest in containers with the smallest substrate particle size. Many nursery growers in the PNW use fine substrates (author's observation), which could be compared most closely to the substrate passed through the 0.25 mesh in this experiment. Substrates with such a fine particle size may exacerbate pearlwort infestations. The substrate composed of bark that would not pass through a 0.25 inch screen provided excellent pearlwort control (98.5%) for 90 days with no herbicide; however, the substrate may have been too coarse for growing nursery crops. Future experiments will evaluate substrate particle size for its effect on weed establishment and crop growth simultaneously.

Pearlwort growth in bark substrates of different particle size, 90 days after overseeding.

Bark particle size	Container surface covered (%)	Shoot fresh weight (g)
Passed through 0.125 mesh	60.0 a[z]	12.5 a
Passed through 0.25 mesh	34.5 b	5.7 b
not sifted	18.2 b	2.1 b
Would not pass through 0.25 me	1.5 c	0.1 c

[z] Means with the same letter are not significantly different by Duncan's multiple range test (a = 0.05).

COMPARING OXYFLUORFEN FORMULATIONS AND FLUMIOXAZIN IN CONTAINER ORNAMENTALS - RE Wooten, JC Neal, and CA Judge, North Carolina State Univ., Raleigh.

ABSTRACT

Container nursery weed management programs rely upon broad spectrum preemergence herbicides such as OH2 3G (oxyfluorfen plus pendimethalin) or Snapshot TG (isoxaben plus trifluralin). Most of such herbicide combinations include a dinitroaniline herbicide to expand the spectrum of weeds controlled. Growers who would like to avoid the use of dinitroaniline herbicides have had limited choices for weed control. Recently two new herbicides have been introduced that may provide broad-spectrum weed control without the addition of a dinitroaniline herbicide. Weedfree 63 is a 2% granular formulation of oxyfluorfen; Broadstar is a 0.25% formulation of flumioxazin. These two herbicides were compared to Scotts OH2 and Snapshot TG for efficacy and safety in container grown woody ornamentals. Additionally, Weedfree 75, a new granular formulation of oxyfluorfen (2%) plus trifluralin (3%) was also included.

The treatments included OH2 at 3 lb ai/A, Snapshot TG 2.5G at 5 lb ai/A, Broadstar at 0.375 and 0.75 lb ai/A, Weedfree 63 at 2 and 4 lb ai/A and Weedfree 75 5G (2 plus 3) 5 and 10 lb ai/A. Treatments were applied over-the-top on April 24 and June 19, 2003 using a hand-held shaker jar. The ornamental species were *Rhododendron* x 'Girard Rose', *Hibiscus syriacus* 'Lucy', *Hydrangea paniculata* 'Grandiflora', *Nandina domestica* 'Compacta', *Ligustrum japonicum*, *Juniperus conferta* 'Blue Pacific', *Ilex crenata* 'Compacta', *Pittosporum tobira* 'Louisiana Compacta', *Itea virginica* 'Henry's Garnet', and *Spiraea* x *bumalda* 'Norman'. The weed species evaluated were *Euphorbia maculata* L., *Cardamine hirsuta* L., *Digitaria sanguinalis* (L.) Scop., *Phyllanthus tennelus* Roxb. and *Eclipta prostrata* L. Evaluations were conducted at approximately two week intervals throughout the growing season.

Hydrangea was injured by all the treatments containing oxyfluorfen or flumioxazin. Injury consisted of foliar burn and killed terminals, but all the injured plants recovered by season end. The tip damage stimulated branching and resulted in fuller plants. Itea was stunted by the high rate of Broadstar, but the stunting was not significant by the end of the study. None of the remaining species were injured.

All treatments provided season-long control of hairy bittercress, spotted spurge, and longstalked phyllanthus control. Crabgrass control was generally comparable among treatments. On some rating dates, low rates of Weedfree 64 and 75 provided somewhat less crabgrass control than Snapshot which tended to provide the best control. Eclipta was not well controlled by labeled rates of any herbicide. By 6 weeks after the second treatment only Broadstar at 0.375 and 0.75 lb ai/A, and Snapshot provided any control, 41%, 85% and 51%, respectively.

FLUMIOXAZIN SPRAYS FOR FIELD-GROWN ORNAMENTALS IN 2003 - JF Ahrens and TL Mervosh, Connecticut Agricultural Experiment Station, Windsor.

ABSTRACT

Flumioxazin has shown potential as an herbicide for certain deciduous and coniferous ornamentals. To expand the database and contribute to ornamental label registrations, we conducted four field experiments in 2003 with flumioxazin 51WDG. All applications were made with a CO_2-powered backpack sprayer in 30 gal/A. Treatments were replicated four times in randomized complete blocks. Experiment 1 was in Colorado spruce (*Picea pungens*) seedbeds at the Connecticut State Forest Nursery at Voluntown. Currently, oxyfluorfen 2XL is the only herbicide registered for preemergence use in conifer seedbeds and alternatives are needed. Seeds were drilled on April 4 in a loamy sand soil with about 4% organic matter, and flumioxazin was applied at 0.25, 0.5 and 1.0 lb ai/A immediately afterward. Plots, 4 ft x 8 ft, were irrigated after treatment and pine needle mulch was applied. The mulch was removed on May 13 following spruce germination and a shade cover was applied. Oxyfluorfen at 1 lb/A caused slight injury, but flumioxazin at all rates killed the seedlings.

Experiments 2 and 3 were in liners of *Euonymus alatus* 'Compacta' and *Viburnum farreri* 'Nanum' that were planted in April 2002 in a loamy sand soil at Imperial Nurseries in Granby, CT. Plots were 6 ft x 8 ft and contained 12 plants. *Viburnum* buds were swollen at treatment application on April 2, whereas *Euonymus* buds were tight and appeared dormant. All plants were sheared on April 2 to a height of 6 inches. *Euonymus* were sheared just before treatment, and *Viburnum* were sheared about 2 hr after treatment. Flumioxazin rates were 0.25, 0.5 and 1.0 lb/A. For *Euonymus*, no plant injury was observed in the first 2 months, but vigor was later reduced 20% for plants treated with 1.0 lb/A of flumioxazin. *Viburnum* growth was suppressed 45 to 55% early, but completely recovered in 6 weeks with no detectable injury.

In Experiment 4, flumioxazin was applied at 0.25, 0.5 and 1.0 lb/A at planting (May 1) and 4 weeks (June 3) and 8 weeks (July 1) after planting six different conifers into a fine sandy loam at Kogut Nurseries in Enfield, CT. Three plants of each conifer were planted in each plot. The plants were 'Dark American' arborvitae (*Thuja nigra*), 'Emerald Green' arborvitae (*T. occidentalis* 'Smaragd'), junipers 'Sea Green' and 'Old Gold' (*Juniperus chinensis*), yew (*Taxus x media* 'Densiformis') and eastern hemlock (*Tsuga canadensis*). Buds on all plants were swollen on May 1, and foliage was actively growing on June 3 and July 1. Large crabgrass (*Digitaria sanguinalis*) and common ragweed (*Ambrosia artemisiifolia*) were 1 to 2 inches tall on June 3 and several inches tall on July 1. The May treatments gave 89% or better weed control through August. June sprays gave good early postemergence control but many weeds recovered. Control of volunteer poplars (*Populus* spp.) was observed in some flumioxazin plots. Only hemlock was injured by flumioxazin. Slight tip necrosis on hemlocks from May treatments was outgrown in June. June and July sprays caused 40 to 50% necrosis, which is not commercially acceptable.

Flumioxazin sprays should be very useful in dormant deciduous and coniferous ornamentals and certain actively growing evergreens, such as yews, junipers and arborvitae. However, seedling spruce and actively growing hemlocks are very sensitive, as were actively growing true firs (*Abies* spp.) in prior experiments.

HERBICIDE TREATED MULCHES FOR ORNAMENTAL WEED CONTROL - LT Case, HM Mathers, and J Pope, Ohio State Univ., Columbus.

ABSTRACT

Any method of application that would increase efficiency, safety and longevity of preemergence herbicides used in ornamental culture would be of significant interest to nursery and landscape managers. This experiment is composed of two studies with three objectives: 1) determine the efficacy and duration of weed control with three common weed species, common chickweed (*Stellaria media*), annual bluegrass (*Poa annua*), and prostrate spurge (*Euphorbia maculata*) of seven mulches treated with herbicides flumioxazin 1X (0.38 kg ai ha^{-1}) and 0.5X and oryzalin 1X (0.90 kg ai ha^{-1}) and 0.5X, the mulches alone, directed sprays of the herbicides, oryzalin plus oxyfluorfen (granular) 1X (0.27 kg ai ha^{-1}), and a Geodisc™ for a total of 43 treatment combinations, 2) assess the phytotoxicity of the different herbicide treated mulches, direct chemical applications, and Geodisc™ on *Ligustrum x vicaryi* 'Golden vicary', *Buxus microphylla* 'Wintergreen' and *Juniperus horizintalis* 'P.C.Youngstown'; and, 3) to compare the long-term duration of efficacy of three herbicides acetochlor 1X (2.80 kg ai ha^{-1}), flumioxazin 1X, and oryzalin 1X, applied alone or in combination with two mulches (pine nuggets and Douglas fir) for a total of 12 treatments.

For the first study, evaluations of efficacy and phytotoxicity were conducted via dry weights and visual ratings at 45 and 115 days after treatment (DAT) in 2001 and 2002. For efficacy, ratings were based on a 0 to 10 scale; a rating of 7 and above represents commercially acceptable control, and for phytotoxicity, ratings were based on a 1 to 10 scale with 3 and below commercially acceptable. The two years produced significantly different results for efficacy and phytotoxicity visual ratings and dry weights. Seventeen of the 43 treatments gave a rating of 7 or higher for efficacy at 45 DAT in 2001 and 3 in 2002. At 115 DAT, 5 treatments gave a rating of 7 or higher in 2001 and only one gave a rating of 7 or higher in 2002. In 2001, the five treatments that gave commercially acceptable control at 45 and 115 DAT were: rice hulls plus flumioxazin at 0.5 and the 1.0X rate, hardwood plus flumioxazin at 0.5X rate, pine nuggets plus oryzalin at the 1X rate, and Geodisc™. In 2002, only oryzalin plus oxyfluorfen gave commercially acceptable control at both evaluation dates. When averaged across evaluation dates and weed species, directed sprays of oryzalin plus flumioxazin and 0.5X flumioxazin were the most phytotoxic treatments in 2001. In 2002, the most phytotoxic treatments were directed spray of flumioxazin and oryzalin plus flumioxazin. Ligustrum was most affected by phytotoxicity for both years. Study 2 started on August 1, 2001. Visual ratings were taken twice at 121 DAT and 303 DAT. Dry weights were also taken at 303 DAT. The data indicates a significant reduction of weed control with the direct sprays compared to the herbicide treated mulches. At 121 DAT, four treatments gave a rating of 7 or higher; one of these (acetochlor) was a direct spray. At 303 DAT, 6 treatments gave a rating of 7 or higher, again only one direct spray (acetochlor). The best three treatments at both evaluations that gave a visual rating of 7 or higher were the Douglas fir plus acetochlor, acetochlor alone, and pine nuggets plus oryzalin. The least efficacious treatments were the direct application of oryzalin, nontreated pine nuggets and the acetochlor plus pine nuggets. The direct applications of oryzalin and flumioxazin gave a rating of below 7 at both evaluation dates.

EVALUATION OF DICHLOBENIL AND FLUMIOXAZIN PREEMERGENCE FORMULATIONS FOR ORNAMENTAL WEED CONTROL - HM Mathers, J Pope, M Bigger, and LT Case, Ohio State Univ., Columbus.

ABSTRACT

Various researchers have found that as little as one weed in a small (3.8 l) pot affects the growth of a crop. However, even if weeds did not reduce growth, a container plant with weeds is a less marketable product than a weed-free product. Managing weeds in a container nursery involves eliminating weeds and preventing their spread in the nursery. This usually requires chemical controls, however, they should never be the only management tools implemented. Examination of new chemicals or formulations and innovative methodologies that could reduce problems associated with current chemical use is vital to the industry. The objective of this study was to evaluate the extent and duration of efficacy and phytotoxicity of two new formulations of dichlobenil (Casoron 50WP and Casoron CS), applied alone or onto two bark mulches, pine nuggets or shredded hardwood. The herbicide treated bark was compared to a control (weedy check), direct sprays of the herbicides and mulch alone. Three granular preemergence herbicides, one not registered for container use, dichlobenil (Casoron 4G) and two new formulation of flumioxazin (Broadstar 0.17G, VC1351 and VC1453) were also evaluated for a total of 12 treatments. The trial started on May 23, 2003. Visual ratings and dry weights were evaluated for efficacy at 4, 8 and 16 weeks after treatment (WAT) and phytotoxicity 2, 4, 8 and 16 WAT. Ratings of efficacy were based on a 1 to 10 scale where, 0 represents no control, 10 represents complete control and 7 or above represents commercially acceptable. Visual rating scores of 1 (no injury) to 10 (complete kill) were used for phytotoxicity on Salvia 'May Night.' The two most efficacious treatments are Casoron CS as a directed spray (7.9) and treated on pine nuggets (9.0). The hardwood bark with Casoron CS also was providing an efficacy rating of 7.75 in the analyses of combined dates 4 and 8 WAT. The weed control provided by the nontreated hardwood bark and pine nuggets was not significantly different from the control. The Casoron 50 WP applied as directed sprays onto the container surfaces and Casoron 4G provided below commercially acceptable weed control in the analyses of combined dates 4, 8 and 16 WAT, with rating of 0.8 and 0.2, respectively. Four treatments Casoron CS and 4G, Casoron CS on pine and CS on hardwood provided ratings of 3 and above for phytotoxicity, in the analyses of combined dates 2, 4, 8 and 16 WAT. Although the Casoron CS was the second most efficacious treatment it had a phytotoxicity rating of 9.25 over combined dates. The CS on pine however had a significantly reduced phytotoxicity rating (3.5) and superior efficacy.

YELLOW FIELDCRESS CONTROL WITH IMAZAPIC AND HALOSULFURON - RJ Richardson and BH Zandstra, Michigan State Univ., East Lansing.

ABSTRACT

Yellow fieldcress (*Rorippa sylvestris*) is a perennial weed species that has invaded nurseries in Michigan and other states. Field and greenhouse studies were conducted in 2002 and 2003 to evaluate control of this weed with postemergence herbicide applications. Field treatments included imazapic (0.2 kg ai/ha), halosulfuron (0.1 kg ai/ha), ethametsulfuron (0.02 kg ai/ha), flumioxazin (0.28 kg ai/ha), glufosinate (1.1 kg ai/ha), glyphosate (1.1 kg ai/ha), dicamba (1.1 kg ai/ha), clopyralid, 2,4-D (2.2 kg ai/ha), triclopyr (0.85 kg ai/ha) plus clopyralid (0.28 kg/ha), and clopyralid (0.17 kg/ha) plus MCPA (0.95 kg ai/ha). Nonionic surfactant at 0.25% v/v was included with imazapic, halosulfuron, and ethametsulfuron treatments and a nontreated control was included for comparison. Control at 6 wk after treatment (WAT) exceeded 90% with dicamba, 2,4-D, glufosinate, triclopyr plus clopyralid, and MCPA plus clopyralid. At 8 months after treatment, control was 90% or greater with dicamba, 2,4-D, imazapic, halosulfuron, triclopyr plus clopyralid, and MCPA plus clopyralid. Two greenhouse studies were also conducted. The first study included treatments identical to field studies, while the second study evaluated five rates of imazapic and halosulfuron. In the first greenhouse study, yellow fieldcress control at 4 wk after treatment exceeded 80% with 2,4-D, glufosinate, triclopyr plus clopyralid, and 2,4-D plus clopyralid. Dry weights generally reflected visual control, and regrowth after dry weight harvest was low with 2,4-D, glyphosate, glufosinate, imazapic, halosulfuron, triclopyr plus clopyralid, and MCPA plus clopyralid. In the second greenhouse study, yellow fieldcress was controlled by imazapic and halosulfuron at rates as low as 0.035 kg/ha of each herbicide.

HERBICIDES FOR NEWLY PLANTED CONTAINER-GROWN WOODY ORNAMENTALS - JF Ahrens, Connecticut Agricultural Experiment Station, Windsor; S Barolli, and R Gray, Imperial Nurseries, Granby, CT.

ABSTRACT

Evaluations continued of alternative sprayable and granular herbicides for use in newly planted woody ornamentals. Based on prior experiments the treatments included: diuron 80DF; dithiopyr 40WSP; flumioxazin 51WDG; and flumioxazin 0.25G, all at rates of 0.25, 0.5 and 1.0 lb ai/A and five combinations of herbicides (Table 1). The standard spray treatment was isoxaben 80DF plus prodiamine 0.65DG, and the standard granular treatment was oxyfluorfen plus pendimethalin (OH-2®). Sprays were applied in a volume of 50 gal/A by CO_2-powered backpack and granules were applied with a calibrated auger-feed applicator. Treatments were initially applied on June 6, 2003 within 3 days of planting into 2-gallon containers and re-applied on August 7. Sprays were applied on wet foliage and irrigated off within 45 minutes; granules were applied on wet foliage and washed off the foliage within 4 minutes. The soil mix was 70% pine bark, 15% sand and 15% peat by volume.

Three plants of each of seven ornamentals were included in each plot. Treatments were replicated four times in randomized complete blocks. The ornamentals were: holly (*Ilex x meserve* 'Blue Princess'), rhododendron (*Rhododendron catawbiense* 'Grandiflorum'), heavenly bamboo (*Nandina domestica*), dwarf burning bush (*Euonymus alatus* 'Compactus'), butterfly bush (*Buddleia davidii* 'Black Knight'), emerald green arborvitae (*Thuja occidentalis* 'Smaragd'), and juniper (*Juniperus squamata* 'Blue Star'). All but burning bush were actively growing at treatment. In addition to irrigation as needed, rainfall was 1.5 times normal in June and 3 times normal in September.

Weeds were naturally invading volunteers, and were pulled and counted at 4-week intervals. Common groundsel (*Senecio vulgaris*) and prostrate spurge (*Euphorbia supina*) were predominant. Populations were very low following the June 6 treatments; control based on numbers are in Table 2. Common groundsel was seeded in the Euonymus cans 4 weeks after the August treatment. Flumioxazin sprays provided 92 to 100% control, and flumioxazin granules at 0.25, 0.5 and 1.0 lb/A gave 60, 85 and 95% control, respectively. The granular standard (OH-2) gave only 45% control and the other herbicides gave poor control. These results seem to indicate the importance of sanitation in preventing weed seed invasion following herbicide treatments. All treatments reduced invasion of liverwort (*Marchantia* spp.) after two applications, but diuron and flumioxazin were most effective. Diuron did not control prostrate spurge.

Two applications of herbicides usually injured plants more than one application did (Table1). Ratings of 1 or less (0 = no injury; 10 = plants dead) are considered commercially acceptable. None of the treatments injured the arborvitae or juniper. Flumioxazin granules were less injurious to plants than sprays (except for juniper and arborvitae), but more injurious to some plants than was OH-2. Treatments with isoxaben were more injurious to butterfly bush than those with diuron or dithiopyr. Diuron, dithiopyr and flumioxazin all have potential uses in selected species of container-grown woody ornamentals and warrant label registrations.

Table 1. Herbicide efficacy and safety to newly potted container-grown woody ornamentals.

^Plant injury (0 to 10) after one and two applications

Trt. No.	Treatment	lb ai/A	Ilex		Nandina		Buddleia		Euonymus		Rhododendron	
			One	Two	One	Two	One	Two	One	Two	One	Two
1	Nontreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	diuron 80DF	0.25	0.0	0.8	0.0	0.5	0.0	0.3	0.0	0.0	0.0	0.5
3		0.5	0.0	2.8	0.0	0.0	0.0	0.3	0.0	0.0	0.0	2.5
4		1	0.0	6.5	0.0	2.0	0.5	0.0	0.0	0.0	2.3	4.8
5	dithiopyr 40WSP	0.25	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.5
6		0.5	0.0	0.0	0.0	0.0	0.5	0.8	0.0	0.0	0.0	0.0
7		1	0.0	0.0	0.0	0.0	2.0	1.8	0.0	0.0	0.0	0.0
8	Flumioxazin 51WDG	0.25	0.3	2.0	0.0	0.8	7.8	7.5	7.8	6.3	2.5	4.0
9		0.5	0.5	2.8	0.0	1.3	8.5	9.6	8.3	8.3	5.5	4.8
10		1	0.5	2.8	0.0	2.5	9.8	9.6	9.0	9.0	6.8	8.5
11	Flumioxazin 0.25G	0.25	0.0	0.5	0.0	0.0	0.0	0.8	0.0	0.0	0.0	1.0
12		0.5	0.0	0.3	0.5	0.0	1.8	1.0	0.0	0.0	2.0	2.5
13		1	0.0	0.3	0.5	0.3	2.8	2.3	0.3	0.0	3.8	4.0
14	OH-2: oxyfluorfen + pendimethalin (2 + 1)G	2.5 1.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	isoxaben 75DF + Prodiamine 65DG	0.75 0.65	0.0	0.0	0.0	0.0	4.3	4.5	0.0	0.0	0.0	0.0
16	diuron 80DF + Prodiamine 65DG	*0.25 0.65	0.0	1.0	0.0	0.5	0.0	0.3	0.0	0.0	0.0	0.8
17	dithiopyr 40WSP + isoxaben 75DF	*0.25 0.75	0.0	0.3	0.0	0.0	5.0	6.0	0.0	0.0	0.0	0.0
18	dithiopyr 40WSP + diuron 80DF	*0.25 *0.25	0.0	1.8	0.0	0.5	1.0	0.8	0.0	0.0	0.0	2.0

^ Plant injury: 0 = none; 10 = plant killed

* Rates of diuron and dithiopyr were increased to 0.375 lb/A in the second application of the spray combinations.

No treatments injured juniper or arborvitae.

Table 2. Herbicide efficacy for newly potted container-grown woody ornamentals. Weed control (%) after one and two applications.

Trt. No.	Treatment	lb ai/A		All weeds	Liverwort
				One	Two
1	Nontreated			0	15
2	diuron 80DF	0.25		0	100
3		0.5		68	100
4		1		73	100
5	dithiopyr 40WSP	0.25		79	59
6		0.5		99	83
7		1		97	93
8	Flumioxazin 51WDG	0.25		97	100
9		0.5		99	100
10		1		99	100
11	Flumioxazin 0.25G	0.25		71	83
12		0.5		97	99
13		1		100	100
14	OH-2: oxyfluorfen + pendimethalin (2 + 1)G	2.5 1.25		81	75
15	isoxaben 75DF + prodiamine 65DG	0.75 0.65		92	85
16	diuron 80DF + prodiamine 65DG	*0.25 0.65		84	100
17	dithiopyr 40WSP + isoxaben 75DF	*0.25 0.75		89	63
18	dithiopyr 40WSP + diuron 80DF	*0.25 *0.25		93	95

EVALUATION OF PREEMERGENCE HERBICIDES ON FIELD GROWN NURSERY STOCK - LJ Kuhns, TL Harpster, Penn State Univ., University Park, PA; and S Guiser, Penn State Univ., Doylestown, PA.

ABSTRACT

The study was conducted at Lewis Nursery in Fountainville, PA. On May 15, 2003, treatments presented in data table were applied to red maple (*Acer rubrum* L. 'Red Sunset'), river birch (*Betula nigra* L. 'Heritage' and 'Duratree'), green ash (*Fraxinus pennsylvanica* Marsh. 'Summit'), thornless common honeylocust (*Gleditsia triacanthos* L. var. *inermis* Willd. 'Skyline'), frontier elm (*Ulmus carpinifolia x U parvifolia* Townsend 'Frontier') and zelkova (*Zelkova serrata* (Thunb.) Mak. 'Village Green'). All treatments contained 0.25 lb/A glyphosate to eliminate weeds present at the time of application. Trees were planted within three weeks of the first application. All except the birch were approximately 0.75 to 1 inch in diameter six inches above the soil line. The birch were multi-stemmed plants ranging from 2 to 2.5 feet tall, and were located on a farm separate from the other trees. The field in which the birch were planted had significantly more weeds than the other farm. Applications were made with a CO_2 test plot sprayer at 30 PSI through an OC02 nozzle. Treatments were applied in 18-inch wide strips to both sides of the tree rows. Approximately 6 to 10 inches of the lower part of each trunk was covered with the spray solution. The spray system had an output equivalent to 19 GPA. The air and soil temperatures were 62 and 60°F respectively, and wind was 3 to 8 mph. Rainfall equivalent to 0.2 inches fell overnight following application. There were five trees per plot, and each treatment was replicated three times for each species. All except the simazine treatments were reapplied July 17, 2003 with the same equipment and output as the first application. Because it was clear that weeds were invading the treated areas, glyphosate at 0.25 lb/A was included in treatments containing flumioxazin, napropamide, and prodiamine in all trees except the birch. The birch had foliage to the ground that would have been injured by the glyphosate. Weed control was evaluated on June 10, 4 weeks after treatment (WAT), July 17 (9 WAT) and September 9 (16 WAT). Plant quality was evaluated on September 9. Estimates of weed species and densities were recorded.

The following weeds were present in the test area: common ragweed (*Ambrosia artemisiifolia* L.), Pennsylvania smartweed (*Polygonum pensylvanicum* L.), yellow rocket (*Barbarea vulgaris* R. Br), common lambsquarter (*Chenopodium album* L.), yellow nutsedge (*Cyperus esculentus* L.), yellow (*Setaria glauca* (L.) Beauv) and giant foxtail (*Setaria faberi* Herrm.), horsenettle (*Solanum carolinense* L.), fall panicum (*Panicum dichotomiflorum* Michx.), common yellow woodsorrel (*Oxalis stricta* L.), goldenrod (*Solidago* spp), Virginia pepperweed (*Lepidium virginicum* L.), black medic (*Medicago lupulina* L.), prickly lettuce (*Lactuca serriola* L.), shepherds-purse (*Capsella bursa-pastoris* (L.) Medicus), wild carrot (*Daucus carota* L.), common evening primrose (*Oenothera laciniata* Hill), black nightshade (*Solanum nigrum* L.), hedge bindweed (*Calystegia sepium* (L.) R.Br.), common Venuslookingglass (*Triodanis perfoliata* (L.) Nieuwl.), scarlet pimpernel (*Anagallis arvensis* L.), annual fleabane (*Erigeron annuus* (L.) Pers.), buckhorn plantain (*Plantago lanceolata* L), broadleaf plantain (*Plantago major* L.), white clover (*Trifolium repens* L.), common dandelion (*Taraxacum officinale*

Weber in Wiggers) and velvetleaf (*Abutilon theophrasti* Medicus).

None of the treatments injured any of the plants. Because of weed competition, some nontreated plants had lower plant quality ratings than treated plants. All the treatments provided good weed control at 4 WAT. By 9 WAT the halosulfuron plots had reduced common ragweed populations and stunted grasses, but overall unacceptable control. Prodiamine provided marginally unacceptable weed control in this study. Though it controlled grasses well, the broadleaved weeds overran the plots. Flumioxazin, napropamide, and simazine provided excellent control except in the birch, where the weed population was exceedingly dense. By 16 WAT halosulfuron treated plots resembled the control. Including glyphosate with the second application would have greatly improved the control ratings. With the help of the glyphosate, flumioxazin provided excellent control in the one field. The predominant weed in the flumioxazin treated plots was horsenettle. In the birch, where the glyphosate was not used, only the highest rate provided any control. With the help of the glyphosate, napropamide and prodiamine provided weed control ratings of 4.5 to 8.8, with most below 7, which is considered to be commercially acceptable. The napropamide and prodiamine treatments provided good annual grass control, but resulted in the release of common ragweed and other broadleaved weeds. Simazine provided excellent control on the one farm. In the birch, weed control in simazine treated plots was similar to the nontreated control.

Weed control ratings made June 10, 2003, 4 weeks after treatment (WAT), July 17, 2003 (9 WAT), and September 9, 2003 (16 WAT) at Lewis Nursery. 1 = No control and 10 = total control. Plant quality was rated on a scale of 1 to 10 with 1=dead and 10= highest quality. Treatments were applied on May 15, 2003, and included 0.25 lb/A glyphosate. Except for simazine, treatments were reapplied on July 17. Glyphosate at 0.25 lb/A was applied with the flumioxazin, napropamide, and prodiamine. The lb ai/A follows the herbicide name.

Birch	June 10	July 17	Sept 9	Plant Quality
Control	-	1.0 b	1.0 b	7.3 e
Halosulfuron 0.045	-	4.7ab	1.0 b	8.4 bcd
Halosulfuron 0.09	-	5.5 ab	1.0 b	7.8 de
Halosulfuron 0.180	-	5.2 ab	1.0 b	8.3 bcd
Flumioxazin 0.25	-	3.2 b	1.0 b	8.0 cde
Flumioxazin 0.5	-	3.3 b	1.0 b	7.4 e
Flumioxazin 1.0	-	8.6 a	5.0 a	9.8 a
Simazine 2	-	3.8 b	1.0 b	8.8 bc
Simazine 4	-	4.5 ab	1.7 b	9.1 ab
Simazine 8	-	5.7 ab	2.3 b	9.1 ab
Red Sunset Maple				
Control	1.0 d	1.0 e	1.7 c	8.5 bcd
Halosulfuron 0.045	9.3 c	3.5 d	1.0 c	8.5 bcd
Halosulfuron 0.09	9.3 c	4.5 cd	1.0 c	8.1 d
Halosulfuron 0.180	9.7 abc	5.3 bcd	1.0 c	8.4 cd
Flumioxazin 0.25	10 a	9.6 a	7.5 ab	8.6 bcd
Flumioxazin 0.5	9.9 ab	9.4 a	9.5 a	9.4 a
Flumioxazin 1.0	10 a	9.7 a	9.8 a	9.4 a
Simazine 2	10 a	9.2 a	7.8 ab	8.5 bcd
Simazine 4	10 a	9.6 a	9.3 a	9.1 ab
Simazine 8	10 a	9.7 a	9.83 a	8.7 abcd
Prodiamine 0.65	9.4 c	6.3 bc	5.3 b	8.8 abcd
Prodiamine 1.5	9.7 abc	6.8 b	5.3 b	8.7 abcd
Prodiamine 3.0	9.5 bc	6.8 b	8.8 a	8.9 abc
Summit Ash				
Control	1.0 b	1.3 b	2.7a	9.7 a
Halosulfuron 0.045	9.4 a	4.3 ab	1.3a	9.1 b
Halosulfuron 0.09	9.4 a	4.7 ab	1.3 a	9.7 a
Halosulfuron 0.180	9.3 a	5.8 a	1.7 a	9.7 a

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

Locust	June 10	July 17	Sept 9	Plant Quality
Control	1.0 b	1.0 b	4.7 a	6.3 a
Halosulfuron 0.045	9.9 a	5.8 a	1.0 b	5.8 a
Halosulfuron 0.09	9.9 a	6.3 a	1.0 b	6.6 a
Halosulfuron 0.180	10 a	6.7 a	1.0 b	6.3 a
Elm				
Control	1.0 c	1 d	2.7 bc	7.7 ab
Halosulfuron 0.045	9.80 ab	5.7 c	1.0 c	7.8 ab
Halosulfuron 0.09	9.9 a	6.5 bc	1.0 c	8.8 a
Halosulfuron 0.180	9.83 a	6.5 bc	1.0 c	8.1 ab
Napropamide 4	9.5 b	7.0 b	4.5 ab	7.6 b
Napropamide 8	9.7 ab	8.3 a	6.3 a	8.2 ab
Napropamide 16	9.7 ab	8.3 a	6.0 a	8.0 ab
Zelkova				
Control	1.0 d	1.0 e	2.3 b	6.6 a
Halosulfuron 0.045	9.9 abc	6.2 d	1.0 b	6.6a
Halosulfuron 0.09	9.9 ab	6.7 cd	1.0 b	6.5 a
Halosulfuron 0.180	10.0 a	7.3 bc	1.0 b	6.3a
Napropamide 4	9.7 c	7.8 ab	6.0 a	5.8 a
Napropamide 8	9.8 bc	8.7 a	6.3 a	6.3 a
Napropamide 16	9.8 bc	8.7 a	7.0 a	6.8 a

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

IR-4 ORNAMENTAL PROGRAM: PROVIDING SOLUTIONS TO PEST PROBLEMS IN FLORAL, NURSERY, LANDSCAPE, TURF, CHRISTMAS TREES, AND FORESTRY -

RM Herrick and JJ Baron, Rutgers Univ., North Brunswick, NJ.

ABSTRACT

The mission of the IR-4 Ornamental and Non-Food Specialty Crop Program is to provide high quality pest management solutions for floral, nursery, landscape, turf, Christmas tree, and forestry producers. IR-4 will achieve this mission by working effectively with producers, researchers, registrants, and regulatory agencies to facilitate the timely registration of new active ingredients in ornamental and non-food specialty crops. IR-4 will also work to add new plants and crops to the label of products that are already registered for use on ornamentals and non-food specialty crops.

A program strategy encompassing a multi-faceted testing program, upgraded capabilities, and the conduct of a premier workshop will be utilized to fulfill the program's mission. Project priorities will be established to address both national and regional needs. A pilot program for setting "Super A" priorities or those that are intended to focus on national pest problems will be conducted during the 2004 season. During the 2003 Ornamental Workshop held in Windsor, CT, a group consisting of producers, university extension/research specialists, and USDA/ARS research specialists established project priorities for 2004. The "Super A" priority for weed management was identified as preemergence weed control in herbaceous perennial plants. The priority for each of the 2004 weed management projects may be viewed at the IR-4 website (www.ir4.rutgers.edu).

The success of the IR-4 Ornamental and Non-Food Specialty Crop Program is dependent on several key components. These include excellent stakeholder relationships, adequate funding to conduct an effective research program, focused priorities to maximize efficiencies, awareness of new technologies for potential evaluation, technical expertise to carry out efficacy and crop safety evaluations, and the involvement of everyone who is interested in providing high quality pest management solutions for floral, nursery, landscape, turf, Christmas tree, and forestry producers.

UTILIZING PHP, MYSQL AND OTHER LANGUAGES TO EXPEDITE NEWSS TITLE AND ABSTRACT SUBMISSION AND IMPROVE PROCEEDINGS SCHEDULING AND EXECUTION - DK Kolev and SD Askew, Virginia Tech, Blacksburg.

ABSTRACT

The NEWSS moved to a new and efficient web interface to exchange and display information to members and render the annual meeting program and proceedings. Newss.org is housed on a UNIX server, where it uses some of the UNIX components to send mail, validate email addresses and so on. The server also uses third party software such as the Apache™ Web Server. The new system saves user input in a MySQL database unlike previous on-line systems that simply relayed information via email. To interface the MySQL database with its users, the site uses a hypertext preprocessor called PHP. The system consists of custom PHP modules created by the senior author with input from the coauthor. These modules and various others are available for purchase or by-monthly usage at the Veshter Network (http://www.veshter.com) or by contacting the senior author.

Modules are separate programs that work in collaboration with each other. One module may use several subprograms and sometimes other modules to achieve the needed result. The modules allow the site to grow as new modules can be developed and inserted into the system without downtime. The modules are individually tested which isolates them and allows complete verification of functionality. Since PHP is a programming language and, in itself, cannot display web page content, embedded hypertext markup language or HTML is required. The page you see is based on what PHP algorithms specify, and embedded HTML may be different every time. For sophisticated content, the system employs programming languages such as JavaScript™, cascaded style sheets (CSS), XML, C++, and Perl.

The new NEWSS system keeps sensitive user account information encrypted at all times. The encryption is unidirectional, meaning no information that has been encoded can be decoded or used by systems other than NEWSS. Even administrators such as the webmaster can not see your password. Encryption insures that sensitive user information such as emails, phone numbers, and passwords can not be "hacked" from the outside. If you forget your password, an email will be sent to your address with an encrypted link that allows you to change your password. The server is also protected by state-of-the-art firewall equipment from Sonic Wall™ (hardware and software to block unfriendly users and programs). The system automatically logs you off if you are inactive for five minutes but keeps your session information and helps bring you back to the last viewed page.

Members can type or cut and paste an abstract directly into the system. Keywords and additional authors are added with the click of a mouse. Your abstract is added to the database immediately. You need only to click the "apply" button. However, you can make additional changes at any time and see your finished result using the "preview" button. When abstract or title submission closes, all members who submitted information receive an email confirming their submission.

By rendering proceedings and the meeting program from the SQL database, the system improves consistency. Misspelled keywords are eliminated and users use the

same keywords rather than inventing multiple versions of the same theme. In the future, keyword selection will be split into multiple categories based on subject areas. For example, all soils related keywords would be placed in a "soils" subcategory. The system was designed to function consistently as well. Similar options are repeated as much as possible. For example, the "keyword" and "additional author" selectors are almost identical. Consistency also extends to the finished product, the proceedings. After all abstracts are entered, the system will be able to export the glossary and index in any format desired. Paragraphs can be formatted with tabs or line breaks as the editor desires. Titles can be bolded, all cap, or regular font all with a few changes of code in the export program.

Future efforts will include preserved formatting of italics and special character when pasted from a word processor and user notices when Internet browsers are not fully compatible with the system.

THE IR-4 PROCESS - E Lurvey, Cornell Univ., Geneva, NY.

ABSTRACT

IR-4 is the only publicly funded program that conducts research and submits data to the U.S. EPA for tolerances/clearances. This data to supports the registration of pest management tools on minor crops for the benefit of consumers, growers and food processors. The IR-4 research process can not begin without a Project Clearance Request (PCR) from a grower/grower group, or agricultural extension or research worker. All new requests are reviewed by the manufacturer/registrant, to confirmation the company will add the use to their label, if a tolerance is established. Projects are also reviewed by the EPA, prior to initiating research, for impediments to establishing a residue tolerance. All active projects are prioritized by pest management experts once a year that the IR-4 Food Use Workshop. The field research on the workshop's top priorities is initiated within the year, the residue analysis completed within 2 years, and the completed data package submitted to the EPA within 30 months. The EPA evaluates the data package, conducts a risk assessment and establishes a tolerance. At that point, the registrant can add the new crop use to its product label for use by the growers.

IR-4: FORTY YEARS OF PROVIDING PEST MANAGEMENT SOLUTIONS TO MINOR CROP GROWERS - DL Kunkel, M Arsenovic, FP Salzman, M Braverman, JJ Baron, and R Holm, Rutgers Univ., North Brunswick, NJ.

ABSTRACT

IR-4 celebrated its 40 year anniversary in 2003. IR-4 is the only publicly funded program in the U.S. that conducts research and submits petitions to Environmental Protection Agency (EPA) for registration of minor crop pest control products. The IR-4 Program is recognized as a unique, highly collaborative organization involving the USDA (ARS and CSREES), the land grant university system, the crop protection industry, the EPA, minor crop growers, and their commodity group organizations. IR-4 conducts and/or coordinates the field and laboratory research for the generation of data so that IR-4 can obtain Pesticide Tolerances that allow new product registrations.

IR-4 has supported more than 7,000 food use clearances since 1963. In 2003 alone, IR-4 data helped to establish over one hundred tolerances for minor crops and these tolerances should support over 600 new minor uses being added to pest control product labels. These actions comprised over 50% of the total granted by EPA. Many of the new approvals were a direct result of the partnerships that IR-4 developed with the U.S. EPA and California's Department of Pesticide Regulation who jointly reviewed with the EPA 20% of the IR-4 petitions as well as with those companies that produce pest control products.

THE VALUE OF HERBICIDES IN CROP PRODUCTION OF THE NE UNITED STATES - S Sankula and L Gianessi, NCFAP, Washington, DC.

ABSTRACT

The discovery of synthetic herbicides serves as a significant milestone in the history of weed management. Crop production in the United States has undergone several changes since that time. Prior to the advent of herbicides, weeds in crop fields were removed by manual labor and/or mechanical cultivation.

Among pesticides used in crop production, herbicides account for greatest volume and expenditure, which emphasizes the importance of weeds as crop pests. In spite of obvious benefits, the role of herbicides in crop production is poorly understood, often misunderstood, and frequently questioned by the public and media.

A study was conducted by the National Center for Food and Agricultural Policy to document the value of herbicides on crop production in the United States. The role of herbicides in the production of 40 specific crops was evaluated by estimating the likely impacts on crop yields, weed control costs, labor requirements, and soil erosion of substituting alternative weed control methods for herbicides. Estimates were drawn from studies conducted by WSSA, USDA, and AFBF in 1990s. The crops were categorized into field crops, vegetables, fruits and berries, and specialty crops. This paper highlights the impact of herbicides on vegetables (green beans, sweet corn, tomatoes, and potatoes) and fruits (apples, peaches and blueberries) grown in the northeast (NE) region of the United States.

In general, yields of vegetable and fruit crops in the NE have increased significantly since the introduction of herbicides. On an average, yields of sweet corn, green beans, tomatoes, potatoes, apples, peaches, and blueberries would drop by 17, 18, 28, 20, 17, 25, and 67%, respectively, if no herbicides were used in crop production.

The study identified that hand labor is a major replacement for herbicides. Timed right, hand weeding may be equally effective as herbicides for most crops. However, growers may not substitute herbicides with hand-weeding due to high labor demands and high costs associated with this practice. For example, the number of hours needed to hand-weed an acre of tomatoes and maintain yields similar to those achieved with herbicide use ranges from 182 to 259/A. Hand-weeding costs were approximately $0.50 an hour through the 1950s, doubled in the early 1960s to $1.0/hr, and have increased steadily since then to $7.0/hr in 2000.

Mechanical weed control methods are not viable as stand-alone alternatives to herbicide use. In certain crops such as blueberries and green beans, mechanical methods are not feasible due to spreading nature of the crop. Other shortcomings such as inadequate weed control in crop rows, root injury, and loss of soil moisture prevent sole dependence on mechanical weed control.

Overall, the study indicated that a movement away from herbicide use would result in severe yield losses, increased crop production costs, and increased soil erosion. The findings from this study may serve as a guide for regulatory agencies, policy makers, the public and media to understand crop production realities in the United States and the implications of herbicide policy changes on weed management, crop yields, and overall crop production.

HERBICIDE PROGRAMS FOR GLYPHOSATE-RESISTANT CORN - JL Lloyd, RM Edmund, CM Mayo, and DW Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Studies were conducted at 17 locations in 2003 comparing herbicide systems in glyphosate-resistant corn (*Zea mays* L.). Glyphosate applied alone early postemergence was compared to tank mixtures of glyphosate and rimsulfuron and to tank mixtures containing glyphosate and metolachlor and glyphosate, metolachlor and atrazine. A standard tank mix of Steadfast, Callisto and atrazine (nicosulfuron, rimsulfuron, mesotrione and atrazine) was included. Key weeds included giant foxtail (*Setaria faberi* L.), yellow foxtail (*Setaria glauca* L.), fall panicum (*Panicum dichotomiflorum* L.), ivyleaf morningglory (*Ipomoea hederacea* L. Jacq.) and tall waterhemp (*Amaranthus tuberculata* L. Moq). For season long weed control it was necessary to add a residual product to the glyphosate for control of both grass and broadleaf weed species. Rimsulfuron provided good residual control of many grass and small-seeded broadleaf species and improved the control of the glyphosate on several broadleaf species. For most weed and grass species the tank mix of Steadfast, Callisto and atrazine provided equal or superior season long control compared to treatments including glyphosate.

EFFECT OF POSTEMERGENCE APPLICATION TIMING ON CROP SAFETY OF NICOSULFURON PLUS RIMSULFURON MIXTURES IN CORN - HA Flanigan, EP Castner, RE Ethridge, and DW Saunders, DuPont Ag & Nutrition, Johnston, IA.

ABSTRACT

Field studies were established in corn (*Zea mays* L.) to assess crop response from applications of nicosulfuron plus rimsulfuron and various tank mixtures when applied to two, four and six leaf collar corn. To reduce the impact of environment at the time of herbicide application, planting dates were varied so a single application timing could be used. Crop response at seven days after treatment with nicosulfuron plus rimsulfuron was comparable to nicosulfuron plus rimsulfuron plus atrazine, mesotrione or dicamba. Minimal differences in crop response were seen from applications made to various corn growth stages. Plant health at the time of herbicide application was the greatest determining factor in crop response.

VINEGAR FOR WEED MANAGEMENT IN CORN AND SOYBEAN - CB Coffman, JR Radhakrishnan, and JR Teasdale, USDA-ARS, Beltsville, MD.

ABSTRACT

Weed management in organic production systems generally begins with clean, weed-free fields, and requires timely and correctly performed cultivations during the growing season. In addition, farmers also utilize crop rotations and animal systems to manage weeds. Organic farmers report that weeds are the primary problem in crop production. Several years ago research was commenced at Beltsville to determine the utility of vinegar for weed management in organic cropping systems. Initial investigations utilized vinegar at 5, 10, 15, 20, and 30% acetic acid concentrations. Reports of these studies have been presented at previous conferences. Initial investigations indicated greater susceptibility of weeds in the seedling stage than at anthesis. Crop tolerance to vinegar applications also varied with plant age. The objectives of this investigation were to assess the tolerance of vegetable soybean and sweet corn to basal applications of 20% acetic acid vinegar, and to characterize weed responses to vinegar applications.

Vegetable soybean was sown in 36 inch rows in a clean-cultivated field on an organic farm near Buckeystown, MD, on 15 July, 2003, at a rate of 130,000 seeds/A. Weeds between rows were controlled by timely cultivations. Plots 20 ft long and 3 rows wide were randomly located throughout the field. Plots were divided into 2 groups, the first was treated with vinegar 4 weeks after planting (WAP) and the second group 6 WAP. Treatments consisted of 20% vinegar applications to the basal area of the soybean plants in the center row to achieve complete coverage to runoff of the within-row weeds, plus nontreated controls. All treatments were replicated 4 times. Treatments were visually rated 2 weeks following spraying, using an injury score of 0 to 100, where 0 = no effect of the vinegar and 100 = plant death. Weed flora was dominated by redroot pigweed (*Amaranthus retroflexus*), and giant foxtail (*Setaria faberi*).

Sweet corn was sown in 30 inch rows on 30 July, 2003, in a clean-cultivated field, on the Beltsville Agricultural Research Center, at a rate of 27,000 seeds/A. Weeds between rows were controlled by cultivation. Plots were 20 ft long and 3 rows wide, and were randomly located throughout the field. Plots were divided into 2 groups. Basal applications of vinegar were made to weeds in the center rows of the first group 3 WAP, and to the second group 5 WAP. Treatments consisted of vinegar treatments and controls, and were replicated 6 times. Weed flora was dominated by smooth pigweed (*Amaranthus hybridus*) and carpetweed (*Mollugo verticillata*) in the first group, and by smooth pigweed, smallflower galinsoga (*Galinsoga parviflora*), and several weedy annual grasses in the second group. Injury ratings were as in the soybean investigation.

Preliminary results from the soybean investigation indicated no differences between groups, and all weeds were adequately controlled, with injury scores ranging from 70 to 90. Soybean plants displayed tolerance to the vinegar treatments with injury scores of 0 to 5. Soybean plants were harvested 11 weeks after sowing and bean yields will be determined. Corn plants in both groups displayed injury scores ranging from 0 to 5, whereas weed injury scores ranged from 75 to 90. Corn plants were harvested 11 weeks after sowing and biomass will be determined.

CONTROL OF UNDESIRABLE WOODY SPECIES IN PASTURES AND HAYFIELDS - SR King, ES Hagood Jr., PL Hipkins, Virginia Tech, Blacksburg; and PL Burch, Dow Agrosciences, Christiansburg, VA.

ABSTRACT

The recent registration of Grazon P+D in selected regions within the Mid-Atlantic United States has allowed growers to effectively and economically control most annual, biennial, and perennial broadleaf weeds in pastures and hayfields. Growers, however, continue to request information regarding control of various undesirable woody species in pastures and hayfields. Experiments were conducted throughout Virginia to evaluate the control of various woody species with registered herbicides as well as two new herbicide combinations. The two new herbicide combinations are Surmount, which contains 0.67 plus 0.67 lbs ae/gallon of picloram and fluroxypyr, respectively, and Pasturegard, which contains 1.5 plus 0.5 lb ae/gallon of triclopyr and fluroxypyr, respectively. The species evaluated include: buckbrush (*Syphoricarpus orbiculatus*), black hawthorn (*Crataegus douglasii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), eastern red cedar (*Juniperus virginiana*), southern dewberry (*Rubus trivialis*), and yucca (*Yucca filamentosa*). Experiments were arranged in randomized complete block designs. Treatments and rates varied between experiments. Buckbrush was controlled 75, 70, 82, and 88% with 3 pts of Grazon P+D, 1 pt of Remedy, 3 pts of Grazon P+D plus 1 pt of Remedy, and 4 pts of 2,4-D, respectively, at 1 month after treatment (MAT). Equivalent buckbrush control of 97% at 3.5 MAT was attained with 3 pts of Grazon P+D plus 1 pt of Remedy and with 4 pts 2,4-D alone. Excellent (95 to 100%) control of black hawthorn and multiflora rose was observed with all treatments at 4 MAT. These treatments included Surmount applied at 1.0 and 2.0% v/v, Pasturegard at 1.0 and 2.0% v/v, Crossbow at 1.5% v/v, Grazon P+D at 1.0% and Remedy at 0.5% v/v, and 1 ounce of Ally applied per 100 gallons of water. Similar levels of control with most these treatments occurred when applied to autumn olive, however, Ally applied at 1 ounce per 100 gallons of water only controlled autumn olive 30%. Southern dewberry was controlled 90% or greater with 3, 4, and 5 pts of Surmount, however, 6 pts of Pasturegard or 8 pts of Crossbow were required for equivalent control. Control of eastern red cedar was generally ineffective with all treatments. Small cedars (10 inches) were controlled less than 50% with all treatments. Previous experiments by the authors evaluated various treatments for the control of yucca in hayfields. Subsequent experiments were then designed using treatments that afforded the best control. These treatments consisted of glyphosate alone and diquat alone, or glyphosate and diquat in combination with Escort. At 8 weeks after treatment 48 and 69% control of yucca was afforded with 6 qts of glyphosate alone and 6 qts of glyphosate in combination with 0.75 ounces of Escort, respectively. All tests will be evaluated at 1 year after treatment to establish the utility of these herbicide treatments for long-term woody species control.

POTENTIAL USE OF BISPYRIBAC FOR ANNUAL BLUEGRASS CONTROL IN COOL-SEASON TURFGRASS - DW Lycan and S Hart, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Previous studies have shown that bispyribac-sodium has activity on annual bluegrass (*Poa annua* L.) in creeping bentgrass (*Agrostis stolonifera* L.). However, the relative tolerance of other cool-season turfgrass is not well understood. Field experiments were conducted in the summer of 2002 and 2003 at Adelphia, New Jersey to evaluate the tolerance of four cool-season turfgrass species to varying rates of bispyribac. Bispyribac was applied at 37, 74, 111, 148, and 296 g ai/ha to mature stands of Kentucky bluegrass (*Poa pratensis* L. 'Gnome'), perennial ryegrass (*Lolium perenne* L. 'Jet'), tall fescue (*Festuca arundinacea* Schreb. 'Houndog 5'), and chewings fine fescue (*Festuca rubra* L. ssp. *commutata* Gaudin 'Shadow II'). All applications were made to 0.9 x 3.0 m plots with a CO_2 backpack sprayer delivering 374 L/ha. Visual injury was evaluated and clippings were collected from the interior of each plot at 35 and 70 days after treatment (DAT) to determine the response of each species. Clippings were dried and weighed and expressed as percent of nontreated check. Visual injury on all species at 35 DAT increased with increasing bispyribac rate. Kentucky bluegrass injury reached 27% when bispyribac was applied at 296 g/ha. Injury on other species did not reach 20%. Initial injury was primarily in the form of discoloration on perennial ryegrass, tall fescue, and fine fescue. Kentucky bluegrass exhibited more severe stunting and thinning symptoms. Bispyribac at 37 to 296 g/ha reduced Kentucky bluegrass clipping weights by 5 to 35%, respectively, as compared to the nontreated check at 35 DAT in 2002. Initial perennial ryegrass, tall fescue, and fine fescue injury dissipated to 5% or less by 70 DAT. However, recovery of Kentucky bluegrass was less complete.

These studies suggest that bispyribac can severely injure Kentucky bluegrass. Kentucky bluegrass may not adequately tolerate bispyribac at rates necessary for annual bluegrass control. Perennial ryegrass, tall fescue, and fine fescue may show initial symptoms of injury, but levels are less severe and persistent than those exhibited by Kentucky bluegrass.

EXPLORING FACTORS INFLUENCING DALLISGRASS AND BAHIAGRASS DISTRIBUTION ON GOLF COURSES - GM Henry, MG Burton, and FH Yelverton, North Carolina State Univ., Raleigh.

ABSTRACT

Paspalum dilatatum (dallisgrass) and *Paspalum notatum* (bahiagrass) are rhizomatous, perennial grass species that readily invade golf course fairways and roughs. These species are widely distributed throughout the state of North Carolina due to their tolerance of both droughty, sandy soils and moist, clay soils. To date, studies of weed species distribution on golf courses have been limited by species identification and low GPS resolution.

The distribution of these species was evaluated in both golf course fairways and roughs. Hidden Valley Country Club, in Fuquay Varina, NC, was selected based on the presence of both weed species. Individual plants were mapped in the fairway and rough of several holes using a high precision (RTK) GPS unit to obtain their location. The RTK unit was also used to delineate between the rough and fairway height of cut as well as the elevation characteristics of each particular hole. Soil samples and soil moisture (theta probe) readings were taken on a 9 m grid. Characteristics used for initial correlation analysis consisted of mowing height, elevation, pH, phosphorus, potassium, calcium, magnesium, sulfur, sodium, and volumetric soil water content.

DOES BERMUDAGRASS POST-DORMANCY GREEN-UP INFLUENCE EFFICACY OF TRIFLOXYSULFURON DURING SPRING TRANSITION? - WL Barker, SD Askew, JB Beam, Virginia Tech, Blacksburg; and RJ Keese, Syngenta Crop Protection, Carmel, IN.

ABSTRACT

Many golf courses have bermudagrass (*Cynodon dactylon* (L.) Pers.) fairways that are overseeded with perennial ryegrass (*Lolium perenne* L.) during bermudagrass dormancy in Virginia. Unfortunately, perennial ryegrass does not always transition naturally, thus herbicides are used for its control. Recently several herbicides have been registered for perennial ryegrass control in bermudagrass turf. These recent additions have brought about interest in how these new herbicides can be best utilized. Although these herbicides effectively control cool-season grass species, control is one only one factor to consider when applying them. Another factor is bermudagrass greenup and being able to keep a constant green playing surface during the transition. Therefore application timing of these herbicides must ensure a smooth transition from perennial ryegrass to bermudagrass without destroying aesthetics, affecting ball play, or impairing bermudagrass health. A study was conducted at Independence Country Club in Richmond, VA to determine the best time to apply trifloxysulfuron sodium and rimsulfuron with relation to bermudagrass greenup. The trial was conducted as a randomized complete block with a three by four factorial treatment design and four replications. Herbicides included trifloxysulfuron sodium at 5, 10, and 15 g ai/ha and rimsulfuron at 18 g ai/ha and were applied at 60, 80 and 100% bermudagrass greenup. Perennial ryegrass control, bermudagrass injury, perennial ryegrass coverage and bermudagrass coverage were evaluated at 1, 3 and 6 weeks after each herbicide application timing (WAT). All chemicals controlled perennial ryegrass more effectively when applied at 80 or 100% greenup compared to 60% greenup at 1 and 3 WAT. At 6 WAT, there were no differences in perennial ryegrass control between herbicide application timings. Bermudagrass cover and color were also improved when herbicides were applied at either 80 or 100% greenup compared to 60% greenup. Results indicate that waiting until 80% bermudagrass greenup to apply transition herbicides could improve perennial ryegrass control and improve turfgrass aesthetics during bermudagrass postdormancy transition.

A REVIEW OF COMPARATIVE GENOMIC METHODS FOR DIAGNOSTICS IN TURFGRASS WEED SCIENCE - NM Kaufman and SD Askew, Virginia Tech, Blacksburg.

ABSTRACT

At present, there are many techniques available that can detect variation within and/or differentiate between weed populations or turfgrass cultivars. In this review we attempt to identify some of the methods that could be useful for diagnostic detection in turfgrass. Amplified fragment length polymorphism (AFLP) selectively amplifies and detects restriction fragments from endonuclease digests of genomic DNA. Knowledge of genomic sequence is not required. This method will generate more polymorphisms than RFLP's. Applications include rapid identification and mapping of genomes. The process requires labeled primers, which may be expensive. Random amplified polymorphic DNA (RAPD) detects frequencies of phenotypic diversity among populations. It is useful in monitoring population dynamics, calculating genetic distance, identifying biotypes, and genetic mapping of cultivars. Knowledge of genomic sequence is not required and small amounts of starting material may be used. This method is difficult to reproduce and can not detect heterozygosity because of dominant gene action. In restriction fragment length polymorphism (RFLP), organisms are differentiated based on patterns derived from cleaving their genomic DNA and sorting the resulting fragments by size via electrophoresis. RFLP has applications in genome evolution and species divergence, as well as in genetic screening for possible deleterious genes. Downfalls in dealing with turf are the need for great amounts of starting material, which may be impossible to get from small plants, and that the identified markers are co-dominant, which are not useful in all instances. Intersimple sequence repeats (ISSR) is a polymerase chain reaction (PCR) based method that targets regions flanking the microsatellites throughout the genome for detecting intraspecific polymorphisms. This method is more reproducible than RAPD but also can not detect heterozygosity because of the dominate marker. Unlike SSR, this method does not require knowledge of sequence information. Randomly amplified DNA fingerprinting (RAF) is used to identify DNA markers linked to disease resistance genes and assess genetic relatedness of genotypes within several plant species. This is a robust technique that does not require ultra pure DNA and is capable of identifying codominant loci. Restriction amplification fragment length polymorphism (RAFLP) produces a distinct phenotype for each genotype at a polymorphic locus. The goal of this method is to determine the number of polymorphic restriction sites within DNA fragments amplified using arbitrary primers. Fragments are easy to generate and the method requires only a small amount of starting tissue. This method is not influenced by the environment or stage of plant growth. Simple sequence repeats (SSR) are used in creating linkage maps and reveal high allelic variation in genomes. Although plant SSRs have a high probability of demonstrating polymorphism, this method is time consuming, expensive, and requires some prior knowledge of the genomic sequence. Genetic markers generated via variation in SSR length may provide a useful complement to the RFLP and RAPD markers currently in use.

EXPANDING HERBICIDE OPTIONS FOR CANADIAN CHRISTMAS TREE GROWERS
- N Cain, Cain Vegetation Inc., Acton, Canada; T Leuty, Ontario Ministry of Agriculture and Food, Fergus; and L Huffman, Ontario Ministry of Agriculture and Food, Harrow.

ABSTRACT

A four-year research program was initiated in Ontario since 2001 to provide data for Minor Use Registration of 10 herbicide treatments for conifers grown as Christmas trees. The research has been done on four species: white pine, white spruce, Fraser fir and balsam fir. The data will also support the registration of these treatments in other woody crop situations such as landscape and nursery production.

The treatments being evaluated are currently registered for use in orchards and other horticultural crops. The work also includes treatments that are available to American Christmas tree producers. These herbicide treatments will improve the weed spectrum and program options for Christmas trees growers.

One set of treatments will provide data to register Lontrel 360 (clopyralid) on additional species other than balsam fir and at an increased rate of application on all species to control a wider weed spectrum. The registration of Dual II Magnum (s-metolachlor) will provide an option for preemergence grass and yellow nutsedge control. The addition of Goal 2XL (oxyfluorfen) will provide a product for seedling burn down and a product with an alternative mode of action for preemergence weed control.

The registration of a three-way tank-mix of Dual II Magnum plus Vantage Plus (glyphosate) plus Simazine 80W (simazine) will increase the weed spectrum of both dicot and monocot species and provide both postemergence and preemergence weed control. The tankmix of Simazine 80W plus Vantage Plus will provide another alternative for both postemergence and preemergence weed control.

The multi-year program in four different crops has permitted evaluations of the response of different weed populations in different canopy situations, in trees established 1 to 2 years. This program has been supported by contributions and funding from different growers, grower associations and the Federal and Provincial governments.

EVALUATING PERENNIAL GROUNDCOVERS FOR WEED SUPPRESSION: ROADSIDE TRIALS AND DEMONSTRATIONS - AF Senesac, I Tsontakis-Bradley, Cornell Cooperative Extension, Riverhead, NY; J Allaire, and L Weston, Cornell Univ., Ithaca, NY.

ABSTRACT

In areas near guide rails along roadsides and median strips, low maintenance turf can not be grown because mowing is difficult and impractical. In these areas, herbicides are applied to reduce weed growth. A reduction or elimination of herbicide use in these areas is a goal shared by many.

A cooperative research project has been established between the NY State Department of Transportation and Cornell Cooperative Extension of Suffolk County and Cornell University. This four-year project has evaluated nearly 100 herbaceous perennial groundcover species for their ability to grow and establish rapidly after planting and thereby reduce and suppress weed growth. Recently, five demonstration plantings were established on Long Island and upstate New York to further evaluate the best performing plants'

Eleven species were chosen for evaluation on Long Island. Three sites with differing requirements were chosen. The plantings were established during June and July 2003. Periodic weeding and mulching were required at all three sites. The success of establishment of each site will be determined in the spring of 2004. The species evaluated on Long Island were: blue lyme grass (*Leymus arenarius* 'Blue Dune'), creeping wild thyme (*Thymus serpyllum* 'Suffolk Co.'), bearberry (*Arctostaphylos uva-ursi*), fleabane (*Erigeron karvinskianus* 'Blutenmeer'), catmint (*Nepeta x faassenii* 'Walker's Low'), dwarf goldenrod (*Solidago sphacelata* 'Golden Fleece'), lady's mantle (*Alchemilla mollis*), big blue lilyturf (*Liriope muscari* 'Royal Purple'), creeping raspberry (*Rubus x* 'Betty Ashburner'), spring cinquefoil (*Potentilla neumanniana* 'Nana') and variegated sedge (*Carex morrowii* 'Ice Dance').

EFFECT OF VINEGAR ON POTATO WEED CONTROL - RS Chandran, M Stenger, and M Mandal, West Virginia Univ., Morgantown.

ABSTRACT

Weed management in organically-grown potatoes is often labor intensive. The effect of vinegar application rates, timings, and methods were compared to hand-cultivated plots in field experiments during 2003. Vinegar treatments at 6.25 or 12.5% acetic acid (v/v), applied either as a directed spray or as a broadcast application at early, late, or early plus late growth stages of potato were evaluated for weed management and tuber yield from plots 8 ft wide and 12 ft long, replicated six times for each treatment. Broadleaf plantain (*Plantago major* L.) and yellow wood sorrel (*Oxalis stricta* L.) counts were lower in vinegar-treated plots compared to those in nontreated plots during the growing season. Yellow nutsedge (*Cyperus esculentus* L.) and orchardgrass (*Dactylis glomerata* L.) were suppressed for two to three weeks following vinegar application but exhibited re-growth later. Potato yields sorted into different categories (USDA Grade A, Grade B, and under-sized) were analyzed for treatment effects by performing analyses of variance using LSD for separating means. No treatment differences were noted (P=0.05) for Grade A and under-sized potatoes, however, Grade B potato yields were higher in hand-cultivated plots and plots that received two applications of vinegar, compared to nontreated plots. Hand-cultivation plots recorded highest total potato yields (P= 0.05). However, there were no differences in total potato yield from hand-cultivated plots and those that received vinegar either twice at the low rate, or once at the high rate as early directed treatments, at the 10% probability level. Hand cultivation resulted in 63% higher yields compared to control plots, whereas, a directed spray of vinegar at high application rate during early growth stage, or at the low application rate during early plus late growth stage resulted in 36% higher tuber yield compared to nontreated plots.

ATTEMPTS TO SAFEN SULFENTRAZONE FOR LIMA BEAN PRODUCTION - MJ VanGessel, QR Johnson, and BA Scott, Univ. of Delaware, Georgetown.

ABSTRACT

The spectrum of weed control provided by sulfentrazone would complement the current herbicide program used by lima bean producers in the Mid-Atlantic region. However, there is concern about crop safety, specifically from a rain shower shortly after lima bean emergence that causes sulfentrazone treated soil to splash onto the bean hypocotyl and leaves. The objective of this study was to evaluate herbicide incorporation with irrigation and different sulfentrazone rates to reduce sulfentrazone injury to the newly emerged lima bean crop. This study was conducted at the University of Delaware's Research and Education Center with sandy loam soils that were chisel plowed and field cultivated prior to initiating the trial. Treatments consisted of PRE sulfentrazone application 7 days prior to planting; sulfentrazone applied PRE after planting and then incorporated within 24 hr of planting with 0.5 in of water (plus an additional 1 in of rain prior to crop emergence); and sulfentrazone applied PRE at two rates at planting with no incorporation (plots were covered with plastic to prevent the rainfall incorporating sulfentrazone). Sulfentrazone rate was 0.4 lb ai/A for all treatments except the one with a lower rate which received 0.2 lb ai/A. This study was arranged as a randomized complete block design with six replications. The entire study area received 0.5 in of water when the lima beans were at the cotyledon to early unifoliate leaf stage from a traveling gun irrigation system that resulted in large water droplets to maximize the amount of soil splashing. The day following the traveling gun irrigation, an additional 0.5 inch of rain fell.

The number of healthy plants (no necrotic tissue) 1 week after rainfall was 35 plants per 10 ft of row for the nontreated check and three plants or fewer for all treatments with sulfentrazone. Number of plants showing severe tissue necrosis was similar for all treatments receiving 0.4 lb/A (averaging 17 plants/10 feet of row) and the plot treated with 0.2 lb/A resulted in 6 plants severely injured. Visual injury rated two weeks after rainfall was based on plant biomass, a combination of stand loss and stunting. Injury was greatest for 0.4 lb/A applied at planting regardless of incorporation with rainfall, and averaged 82% injury. Sulfentrazone (4 lb/A) applied 7 days prior to planting resulted in 68% injury, while 0.2 lb/A applied at planting with no irrigation resulted in 39% injury.

Although lower sulfentrazone rates and a delay between application and planting can lessen the injury to lima beans from a splashing rain, injury can still be quite severe at the rates tested. Incorporation with 0.5 inches of irrigation did not lessen sulfentrazone injury. Previous research with sulfentrazone has shown that 0.15 lb ai/A is the mininum rate to provided consistent control of morningglory species. Thus, reducing sulfentrazone rate much beyond those used in the present study is not a viable option to minimize lima bean injury.

HALOSULFURON IN SNAP BEAN - CM Whaley, HP Wilson, and TE Hines, Virginia Tech, Painter.

ABSTRACT

Field experiments were conducted from 2001 to 2003 to evaluate snap bean (*Phaseolus vulgaris* L.) and weed response to weed management programs which included halosulfuron preemergence (PRE) and postemergence (POST). Experiments were arranged in a randomized complete block design with three replications. All plots received a PRE application of metolachlor (0.96 lb ai/A). Treatments included halosulfuron PRE at 0.024 lb ai/A alone and followed by bentazon at 0.5 lb ai/A or fomesafen at 0.25 lb ai/A POST, halosulfuron POST at 0.024 lb/A alone and in combination with bentazon at 0.5 lb/A or fomesafen at 0.25 lb/A, bentazon at 0.5 lb/A or fomesafen at 0.25 lb/A POST alone, and metolachlor PRE alone. All POST treatments were applied each year to 3-trifoliate snap bean approximately 2 to 3 weeks after planting. Snap bean response and weed control was evaluated pre-harvest. Weed species evaluated in 2 of 3 years were common lambsquarters (*Chenopodium album* L.), morningglory species (*Ipomoea* spp.), spurred anoda (*Anoda cristata* (L.) Schlecht.), and smooth pigweed (*Amaranthus hybridus* L.). Snap bean injury occurred each year, but diminished with time. Common lambsquarters control in 2001 was significantly better with halosulfuron PRE followed by either bentazon or fomesafen POST. In 2003, all treatments controlled common lambsquarters 95% or greater except halosulfuron POST alone. In both 2002 and 2003, treatments including fomesafen POST provided the highest level of morningglory control. Spurred anoda control was more effective by treatments that contained either bentazon or fomesafen POST. Smooth pigweed control was greater than 91% in both years regardless of treatment. Snap bean yields in 2001 were higher by treatments that included fomesafen POST and halosulfuron PRE followed by bentazon. In 2002 and 2003, yields by all treatment combinations were generally higher than yields from metolachlor alone.

VISUAL INJURY, BIOMASS REDUCTION AND YIELD LOSS OF FOUR MARKET CLASSES OF EDIBLE BEAN GROWN ONE YEAR AFTER APPLICATION OF ISOXAFLUTOLE AND ISOXAFLUTOLE PLUS ATRAZINE - DE Robinson and PH Sikkema, Univ. of Guelph, Ridgetown, ON.

ABSTRACT

The effects of isoxaflutole and isoxaflutole plus atrazine residues on visual injury, plant fresh and dry weight, and yields varied among four classes of edible beans planted one year after herbicide application in field trials conducted in Ridgetown, Ontario in 2001 and 2002. In either year of the study, greater tolerance was observed in the white and kidney beans, compared with black and cranberry beans. It is recommended that black and cranberry beans should not be grown in the year following application of isoxaflutole plus atrazine, and that yield loss is still possible in the more tolerant white and kidney bean classes.

IMPACT OF AGROCHEMICALS IN WATERMELON PRODUCTION ON WEED GROWTH - BA Scott, MJ VanGessel, Univ. of Delaware, Georgetown; KL Everts, Univ. of Maryland, Salisbury; and JM Whalen, Univ. of Delaware, Newark.

ABSTRACT

Watermelon (*Citrullus lanatus*), weeds, insects, and pathogens interact with one another and the environment in a complex system. Pesticide applications intended to decrease or inhibit crop disease and insect damage may have the potential to create more conducive growing condition for weeds found in the treated area as well as reduce diseases and insect damage to the weeds. A study was established at two locations, one in Delaware and one in Maryland, to determine what effect(s) agrochemicals used in watermelon production had on weed growth.

The study was a factorial design, weed location and pesticide program, with four replications. Study treatments consisted of fungicide; insecticide; fungicide plus insecticide; and a nontreated check. The weed species, common cocklebur (*Xanthium strumarium*), common ragweed (*Ambrosia artemisiifolia*), velvetleaf (*Abutilon theophrasti*), and Palmer amaranth (*Amaranthus palmeri*), were transplanted into black plastic in the watermelon row, and into row middles. Watermelons were grown under plastic culture. Three plants of each weed species were grown in 7.5 cm diameter peat cups for transplanting. Weed species were seeded in greenhouse at the time watermelons were transplanted in the field three weeks after seeding. In DE, drip irrigation was used, and the MD location utilized overhead irrigation. Insecticide treatments consisted of thiamethoxam rotated with abamectin, and fungicide treatments consisted of chlorothalonil rotated with azoxystrobin. Plots were hand weeded and selective herbicides were used to control unwanted weeds.

Average weed heights and observation of insect species were noted at two week intervals. At watermelon maturity, measured by fungicide plus insecticide treatment, two harvests were completed in DE, one harvest in MD. Weed biomass samples were removed after watermelon harvest at both locations. In DE, at weed harvest plants were examined for number of insect bore holes, number and identification of insects present, and length of tunneling measured in main stem and five branches (chosen at random) for pigweed, ragweed, and cocklebur. Velvetleaf main stem and three branches were sampled. Visual evaluations were made on the occurrence of anthracnose (*Colletotrichum orbiculare*) and gummy stem blight (GSB) (*Didymella bryoniae*) at each location prior to watermelon harvest.

Significant weed location and pesticide program interaction occurred with respect to number of lepidoptera larva found inside cocklebur stems. Fungicide plus insecticide treatment reduced larva occurrence in cocklebur. Weeds did not increase severity of GSB nor anthracnose. Incidence of disease decreased significantly with fungicide treatment. Weed biomass showed a significant difference in weed placement. All four weed species growing in row showed greater vigor than those growing in row middles. There were no differences in weed heights or biomass among the treatments. Use of agrochemicals to control watermelon diseases and/or insects had little impact on weeds.

EVALUATION OF STRAWBERRY GROWTH AND DEVELOPMENT AND WEED SUPPRESSION USING COVER CROPS AND REDUCED TILLAGE SYSTEMS - JW Zandstra, Univ. Guelph, Ridgetown, ON; F Tardif, Univ. Guelph, Guelph, ON; J O'Sullivan, Univ. Guelph, Simcoe, ON; L Huffman, Ontario Ministry of Agriculture and Food, Harrow; P Fisher, Ontario Ministry of Agriculture and Food, Simcoe; and A Verhallen, Ontario Ministry of Agriculture and Food, Ridgetown.

ABSTRACT

Managing weeds in matted row strawberries is challenging, because they take a long time to establish soil cover and are not very competitive with weeds. The planting year is a particularly difficult time to control weeds because of few safe herbicide choices, the shallow nature of strawberry roots, and high weed pressure of many strawberry fields with good fertility and drainage. Reduced tillage systems have improved weed control for field crops and vegetable growers, and may be useful for strawberries. Strawberries were transplanted into a site that had a fall-established rye cover crop that was killed with glyphosate in spring before planting. Four tillage systems were set up: no-till (rye cover crop residue killed with glyphosate), reduced till (two passes with a conventional disk), zone till (single pass with a trans-till unit (single shank followed by double fluted coulters) providing a tilled zone 15 to 20 cm wide) and conventional tillage (rye residue incorporated by rototiller 10 to 12 cm deep). Strawberries were transplanted directly with a commercially available Holland transplanter retrofitted with a tool bar using 3 fluted coulters before the planting shoe, narrow press wheels and 80 kg extra tractor weights. 3 weed control treatments were superimposed: Sinbar at 5 weeks, weed free (by hand) and weedy. All plots were trickle irrigated. Strawberries established successfully in all systems, including untilled soil with a rye cover crop, showing no impact on plant growth and development. No-till with a rye cover crop significantly reduced weed pressure up to 15 weeks when compared to conventional tillage. Weed growth (shown by reduced weed biomass) in subplots with no additional weed control was reduced in the no-till treatment for 15 weeks. Weed biomass in the zone-tilled treatments was higher than no-till, even though the majority of the area was untilled, due to significant weed growth in the tilled zone. Weed control with Sinbar was poor due to very dry conditions. Further improvements in weed control may be possible by increasing crop residues from the rye cover crop, and by using sprinkler irrigation to activate Sinbar to improve weed control.

EVALUATING PLANTBACK INTERVALS FOLLOWING RESIDUAL HERBICIDES FOR NEW VINEYARDS - LA Huffman, Ontario Ministry of Agriculture and Food, Harrow, Ontario; and HP Pfeifer, EuroNurseries and Vineyards Harrow, Ontario.

ABSTRACT

New vineyard sites may contain herbicide residues from previous crops that will stunt new vines, reducing yields and vine health for many years. Soybean and corn herbicides containing imazethapyr and flumetsulam have caused severe stunting to new vines. Chemical analysis of soil for herbicide residues may not be practical due to the expense, the inaccuracy of soil sampling, and the lack of information to correlate herbicide levels with crop safety. Herbicide companies recommend using a field bioassay. This technique was tested on three sites. Vine growth was significantly reduced where imazethapyr or flumetsulam was used the previous year. One problem is the need for virgin sites for adequate comparison of vine growth. This technique is of limited use because the sample site chosen may not have residues, and that one growing season is required to complete it. Greenhouse bioassays were also evaluated as an inexpensive method to assess residues. Soil samples were taken on a grid pattern from 2 fields with unknown herbicide use histories to determine suitability for new grape plantings. Each soil sample was placed in a tray in a greenhouse, and planted with known numbers of seeds of sugar beets, tomatoes, and/or oats. No stunting was observed from either site for 4 weeks, but by 6 weeks one field showed severe stunting. Vines were planted in the non-stunting site the following spring showing no adverse results. An in-field bioassay was tried in a field showing severe injury to new grapevines. Sugar beets and tomatoes were planted as test crops directly into areas suspected of having herbicide residues due to severely stunted crops. The sugar beet and tomato test crops did not show any effect for 4 weeks, but by 6 weeks were showing degrees of stunting and/or death. This technique is interesting to diagnose areas in the field where stunting is obvious. It may be useful to detect residues in the field during the year before planting. However, it will not give a quick answer about herbicide residues at the time of planting new vines.

BLOW©:BIOLOGY AND LIFE CYCLE OF WEEDS - PROTOTYPE OF AN EDUCATIONAL TOOL ON WEED GROWTH AND LIFE CYCLES - RS Chandran, A Nandeshwar, VM Zachariahs, and M Mandal, West Virginia Univ., Morgantown.

ABSTRACT

Identifying weeds at different stages of growth is important to delineate timely control measures. Images to represent the gradual growth of weeds under field conditions will help the user to better understand their life cycles. A prototype of a tool to identify weeds and to study their life cycles was developed by time-lapse photography of selected weed species over a period of one month. After discarding noise-affected images, video files were digitally created using remaining images. These files clearly show the growth of different weeds on a selected time scale. Upon further development, this interactive tool is hoped to be useful for students, teachers, scientists, and other practitioners of weed science.

CURRENT STATUS AND SIGNIFICANCE OF GIANT HOGWEED - P Bhowmik, Univ. of Massachusetts, Amherst; and RS Chandran, West Virginia Univ., Morgantown.

ABSTRACT

Giant hogweed, *Heracleum mantegazzianum* Sommier & Levier, is an invasive species. It is a member of the carrot family, Umbelliferae. Giant hogweed is a perennial with tuberous root stalks. It colonizes a wide variety of habitats but is most common along roadsides, other rights-of-way, vacant lots, streams and rivers. A native to the Caucasian mountains and southwestern Asia, it was introduced as an ornamental plant to Europe, the United Kingdom, Canada and the United States. Because of its tenacious growth habit, the species escaped and became an invasive weed in the United States. It is found in Connecticut, New York, Oregon, Pennsylvania, Maine, Massachusetts, and Washington State. The latest recording of giant hogweed was cited in 2002 in 23 sites in six counties in Massachusetts. Survey conducted by WV State Department of Agriculture in 2003 indicated that giant hogweed is not present in West Virginia. This species represents an increasing public health hazard. The plant exudes a clear watery sap that sensitizes the skin to ultraviolet radiation, resulting in severe burns. The affected/exposed areas may develop blisters and painful dermatitis which may later become purplish or blackened scars. Giant hogweed takes several years from germination to produce the first flowering stalk. Reproduction is through seed and perennial buds formed on the crown and tuberous root stalk. It may grow from 15 to 20 feet in height. The hollow stems can be 2 to 4 inches in diameter. Stalks and stems have sturdy bristles. It has compound leaves that may expand to 5 feet in breadth and each leaflet is deeply serrated. The inflorescence is a broad flat-topped umbel composed of many small white florets. Each inflorescence may attain a diameter of 2.5 feet. It produces large elliptic dry fruits marked with brown swollen resin canals. Plants die after first flowering and seed set. Seed longevity is known to be greater than seven years. We must continue to monitor the spread of giant hogweed.

CHEMICAL CONTROL OF JAPANESE KNOTWEED IN DELAWARE - Z Skibo, M Isaacs, and B Hearn, Univ. of Delaware, Georgetown.

ABSTRACT

Japanese knotweed (*Fallopia japonica*) is an invasive perennial plant that is becoming a major weed throughout Delaware. Greenhouse experiments were conducted in 2003 to evaluate selected postemergence (POST) herbicides that translocate apoplastically and symplastically. Vegetative buds were planted in 4 inch pots and grown for 30 days then transplanted to 6 inch pots and cut back once prior to herbicide application. The experimental design was a randomized complete block design with three replications. Herbicides were applied with greenhouse bench sprayer delivering a spray volume of 25 GPA at 30 PSI with 8001 even flat fan nozzles.

POST applications were made to plants at 4 to 6, 6 to 8, 10 to 12, and 12 to 14 inch heights. Treatments included Accent Gold (0.136 lb ai/A) plus Banvel (0.25 lb ai/A) plus COC plus UAN, Aim (0.0052 lb ai/A) plus atrazine (1 lb ai/A) plus Banvel (0.25 lb ai/A) plus NIS, Marksman (1.2 lb ai/A) plus NIS, Basis Gold (0.78 lb ai/A) plus Banvel (0.25 lb ai/A) plus COC plus UAN, Basis Gold (0.78 lb ai/A) plus Callisto (0.094 lb ai/A) plus COC plus UAN, Permit (0.061 lb ai/A and 0.045 lb ai/A) plus Banvel (0.375 lb ai/A and 0.5 lb ai/A) plus NIS, Beacon (0.0178 lb ai/A) plus Banvel (0.5 lb ai/A) alone and in combination with atrazine (1 lb ai/A) plus NIS, Exceed (0.0356 lb ai/A) plus Banvel (0.25 lb ai/A) alone and in combination with atrazine (1 lb ai/A) plus NIS, Celebrity Plus (0.21 lb ai/A) plus NIS plus UAN, Callisto (0.094 lb ai/A) plus Banvel (0.25 lb ai/A and 0.5 lb ai/A) plus atrazine (1 lb ai/A) plus COC plus UAN, Callisto (0.166 lb ai/A) plus Banvel (0.25 lb ai/A) plus atrazine (0.63 lb ai/A) plus COC plus UAN, Callisto (0.2 lb ai/A) plus atrazine (0.63 lb ai/A and 0.75 lb ai/A) plus COC plus UAN, Roundup WeatherMax (0.95, 1.65, and 2.75 lb ai/A) and ReadyMaster ATZ (2 lb ai/A). Data collected included visual control at 7, 14, 21, and 28 DAT and fresh weights 28 DAT. Data was subjected to analysis of variance (ANOVA) and treatment means separated using Fischer's Protected LSD Test at 5% level of significance.

The herbicide combination of Callisto (0.094 lb ai/A) plus Banvel (0.5 lb ai/A) plus atrazine (1 lb ai/A) provided the best control (76%) of Japanese knotweed 28 DAT when applied at the third growth stage. All other herbicide combinations were ineffective in providing control, including the high rates of Roundup. Future research will entail evaluating Callisto combinations with additional POST herbicides at various growth stages under field conditions and measuring re-growth of this invasive weed.

RESPONSE OF DAYFLOWER TO PRE- AND POSTEMEGENCE HERBICIDES - LJ Kuhns and TL Harpster, Penn State Univ., University Park, PA.

ABSTRACT

Asiatic dayflower (*Commelina communis* L.) is an annual monocot that resembles a dicot. It can creep along the ground, rooting at the nodes, and cover large areas. Or, if it grows into a tree with low branches it can ascend up into the tree using the branches for support. Asiatic dayflower has been reported as a serious weed problem in several Christmas tree plantations in Pennsylvania and Maryland that were using standard herbicide-based weed control programs. The standard programs actually released the dayflower from competition from other weeds. The objective of this study was to evaluate a variety of pre- and postemergence herbicides that might control the dayflower. The results of several years of preliminary studies showed that flumioxazin provided an acceptable level of control of dayflower. In this study flumioxazin and simazine plus metolachlor plus oxyfluorfen were applied as standard treatments. Cloransulam, dithiopyr, and imazaquin were included to expand the spectrum of chemistry types tried on dayflower.

The preemergence treatments used are presented in Table 1. The postemergence treatments are listed in Table 2. Several postemergence herbicides have also been evaluated over a two-year period and none provided satisfactory control. In this study cloransulam, imazaquin, and halosulfuron were evaluated.

The preemergence treatments were applied on March 27, 2003 to Douglas fir (*Pseudotsuga menzesii* (Mirb) Franco) that were planted in 1999. Treatments were direct sprayed through an OC-02 nozzle in the equivalent of 22 GPA. Dayflower control was rated on May 20, 8 weeks after treatment (WAT), and July 17, 16 WAT, on a scale of 1 to 10 with 1 = no control and 10 = total control.

Postemergence treatments were applied on May 20, 2003 to Douglas fir that had been established for one year. The dayflower was 2 to 7 inches tall with 2 to 4 leaves. Treatments were applied as a directed spray through an OC-02 nozzle in the equivalent of 20 GPA. The spray contacted the lower 6 to 8 inches of both sides of the trees. Dayflower control was rated on June 10 (3 WAT) and July 17 (8 WAT), on the same scales as the preemergence treatments.

The preemergence applications of flumioxazin and high rate of dithiopyr provided excellent control through mid summer. The simazine, metolachlor and oxyfluorfen combination provided good control at 8 WAT, but weakened by 16 WAT. Cloransulam, a pre and postemergence herbicide labeled to control Asiatic dayflower in soybeans; imazaquin; and isoxaben provided poor preemergence control of dayflower.

Of the postemergence treatments, both cloransulam and imazaquin appeared to be providing good control of the dayflower at 3 WAT. The dayflower had grown significantly and was providing a heavy cover, but it appeared to be severely injured. It was stunted compared to the controls, yellow, and had many dead growing points. By 8 WAT only the high rate of cloransulam continued to provide good control. The halosulfuron treatments had no effect on dayflower. None of the pre or postemergence treatments appeared to injure the trees. Additional studies must be conducted to find a way to control this aggressive weed in Christmas trees.

Table 1. Dayflower control ratings made on May 20 and July 18, 2003, following preemergence herbicide applications made on March 27, 2003. Dayflower control ratings are on a scale of 1 to 10, with 1= no control and 10=total control.

Treatments	Rate lb/A	May 20 8 WAT[1/]	July 18 16 WAT
1. Nontreated		1.0 c	1.0 d
2. Isoxaben	0.5	1.0 c	1.0 d
3. Simazine	3.0	9.7 a	5.3 b
Metolachlor	3.8		
Oxyfluorfen	0.5		
4. Cloransulam	0.031	1.0 c	3.7 bc
5. Cloransulam	0.062	1.3 c	2.0 cd
6. Dithiopyr	0.5	6.3 b	4.7 b
7. Dithiopyr	1.0	9.4 a	8.2 a
8. Flumioxazin	0.25	9.6 a	9.5 a
9. Flumioxazin	0.5	9.7 a	9.6 a
10. Imazaquin	0.5	1.0 c	2.0 cd
11. Imazaquin	1.0	1.3 c	3.7 bc

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

Table 2. Dayflower control ratings made on June 10 and July 18, 2003, following postemergence herbicide applications made on May 20, 2003. Dayflower control ratings are on a scale of 1 to 10, with 1= no control and 10=total control. Dayflower in the control plots were 2 to 7 inches tall with 2 to 4 leaflets at the time of application.

Treatments	Rate lb/A	June 10 3 WAT[1/]	July 18 8 WAT
1. Nontreated	-	1.0 c	1.0 d
2. Cloransulam	0.031	7.7 a	4.8 b
0.25% NIS [2/]			
3. Cloransulam	0.062	8.0 a	9.0 a
0.25% NIS			
4. Imazaquin	0.5	7.0 b	2.7 c
5. Imazaquin	1.0	8.0 a	4.0 b
6. Halosulfuron	0.045	1.0 c	1.3 d
0.25% NIS			
7. Halosulfuron	0.09	1.0 c	1.0 d
0.25% NIS			

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

[2/] 'LI 700 Surfactant, Penetrant and Acidifier' Loveland Industries Inc., Greely, CO. was included at 0.24% v/v in treatments containing cloransulam or halosulfuron.

SEED GERMINATION TECHNIQUES FOR DIFFICULT TO GROW WEED SPECIES - LF Houck, III and MC McComrick, DuPont Crop Protection, Newark, DE.

ABSTRACT

Studies were conducted at the Stine-Haskell Research Center to evaluate various techniques for improving germination of several weed species of agronomic importance. Seed germination is often dependent on several environmental factors including soil moisture and temperature, light intensity and day length, and gas exchange. Germination of weed seeds may also be delayed by impervious seed coats or inhibitory substances contained in or around the seed. Since several factors often influence the consistency of weed seed germination, multiple germination enhancement techniques are often used depending on the weed species. Eastern black nightshade (*Solanum ptycanthum*), for example, requires mashing of the fruit to create a fluid mixture of fruit and separated seed. After a fermentation period of 3 days, the mixture increases in acidity from pH 4.9 to pH 3.7, weakening the seed coat thereby improving seed germination. In contrast, common ragweed (*Ambrosia artemisiifolia*) germination is greatly increased through a water scarification process involving 3 to 4 days of seeds being submerged in a running stream in late autumn and early winter. This water scarification process was optimized for laboratory methods using plastic tubing, compressed air, and cold water. Weed species with particularly dense seed coats such as giant ragweed (*Ambrosia trifida*), morningglory species (*Ipomoea* spp. and *Jacquemontia fawnifolia*), field bindweed (Convolvulus arvensis), and hedge bindweed (*Calystegia sepium*) have exhibited more consistent germination when treated with 98% sulfuric acid for 15 to 30 minutes, depending on the specific seed coat density.

FOREIGN DEVELOPMENT OF *PHOMA EXIGUA* AS A POSSIBLE AVENUE FOR CONTROL OF RUSSIAN KNAPWEED IN THE USA - D Berner, F Eskandari, USDA-ARS, Fort Detrick, MD; and B Tunali, Plant Protection Central Research Institute, Ankara, Turkey.

ABSTRACT

Russian knapweed, (*Acroptilon repens* (L.) DC., Asteraceae) is an invasive weed in the northwestern United States, and a target of biological control efforts. It is also becoming a noxious weed in wheat fields in Turkey. In the summer of 2002, dying Russian knapweed plants were found on a roadside near Cankiri, Turkey (40° 21' 41" N, 33° 31' 8" E, 699 m elevation). No healthy plants were found in the immediate area. Dying plants had irregular, charcoal-colored, necrotic lesions at the leaf tips and margins, and frequently, whole leaves and plants were necrotic. Symptomatic leaves were air-dried and sent to the Foreign Disease-Weed Science Research Unit, USDA/ARS, Fort Detrick, MD. There, diseased leaves were surface-disinfested and placed on moist filter paper in petri dishes. Pycnidia producing one-celled hyaline conidia were observed after 4 to 5 days. Fungal morphology and DNA sequences showed that the organism was *Phoma exigua*. Stems and leaves of 20 three-week-old plants were spray-inoculated with an aqueous suspension ($1x10^7$ conidia/ml) of *P. exigua* strain 02-059 spores and placed in an environmental chamber at 25°C with constant light and continuous dew for 3 days. Plants were then moved to a greenhouse bench and watered twice daily. After six days, symptoms were observed on all plants. Once symptoms had progressed to the mid-veins of the leaves, the disease progressed rapidly on the plants, indicating the possibility of systemic infection or systemic movement of toxins. *Phoma exigua* strain 02-059 was re-isolated from the stems, petioles, and leaves of all inoculated plants. In a separate test, 12 plants were inoculated as described above and 8 additional plants were sprayed with water only. After inoculation, plants were handled as described above. The first lesions developed after three days on all except the youngest leaves of inoculated plants. After ten days, three inoculated plants were dead, and all other inoculated plants had large necrotic lesions. No symptoms developed on control plants. This strain (02-059) of *P. exigua* is a destructive pathogen on Russian knapweed, and severe disease can be produced by inoculation of foliage with an aqueous suspension of conidia. These characteristics and the ability to easily produce large volumes of spores make this strain of *P. exigua* a good candidate for biological control of this weed.

However, because *P. exigua* strain 02-059 is not native to the U.S. and causes some damage to some non-target plants, use of the organism for biological control of Russian knapweed in the U.S. is unlikely at this time. However, the fungus is a good candidate for a mycoherbicide in Turkey where the fungus is native and Russian knapweed is becoming a serious problem in wheat fields. If the fungus can be successfully developed and commercialized as a mycoherbicide in Turkey, then there are improved possibilities that the mycoherbicide could eventually be approved for use in the USA. These possibilities would be further improved if prolonged ecologically safe use of the mycoherbicide were demonstrated.

BIOLOGY OF THE INVASIVE PLANT PALE SWALLOW-WORT - LL Smith, A DiTommaso, J Lehmann, Cornell Univ., Ithaca, NY; and S Greipsson, Troy State Univ., Troy, AL.

ABSTRACT

The perennial vine, *Vincetoxicum rossicum* (Kleopow) Barbar. [pale swallow-wort] (Asclepiadaceae) has become a major invasive weed of the Great Lakes Basin in the Northeastern United States and Ontario, Canada and is displacing several threatened or rare native plant and animal species. This introduced plant exhibits a remarkable ability to colonize a wide range of natural areas often forming dense monospecific stands in old fields and forest understories. The species currently covers more than 800 hectares in the Henderson Shores area of NY State alone. Although a perennial, this plant reproduces primarily by wind-dispersed seeds that can be transported long distances. To date, conventional methods of control such as mowing and burning have not been effective and no herbicides are currently registered for the control of this aggressive invasive species. Cardiac glycosides found in this plant provide an effective natural chemical defense that appears to inhibit native or naturalized herbivores from consuming plant material. In order to develop and implement effective control strategies for this plant, we must gain a better understanding of its growth and reproductive potential in invaded sites such that management strategies could better target susceptible phases of its life cycle. Thus, the primary objective of this research is to determine the growth and reproductive ability of pale swallow-wort in an invaded site in Henderson Shores, NY that is typical of areas colonized by this species (i.e. shallow top-soil layer, high pH). A 3-year replicated field experiment was established in early May 2003 to monitor the growth and reproductive output of individual pale swallow-wort plants. Data were collected bi-weekly and included tiller height, time to flowering, time to follicle (fruit) appearance, and time to seed maturation. At the end of the growing season, the number and weight of viable seeds produced, and above-ground dry biomass of tillers was determined. The population dynamics of seedlings was also monitored during the season in replicated sub-plots. Data from this first year of study indicate that the mean height (1.2 m), total aboveground biomass (96 g) and seed production of established pale swallow-wort plants can be substantial in these habitats. Seedling densities were also extremely high and peaked in late June at 4,000 plants m^{-2}. By early August, seedling densities had decreased to just above 1,000 plants m^{-2}. These preliminary findings indicate that effective management of this species may be challenging given the rapid growth and high seed output of established pale swallow-wort plants in these areas.

THE EFFECT OF SITE HETEROGENEITY AND DISTURBANCE ON THE ESTABLISHMENT AND FECUNDITY OF *MICROSTEGIUM VIMINEUM* - M Booher, DA Mortensen, and B Jones, Penn State Univ., University Park, PA.

ABSTRACT

The spread of *Microstegium vimineum* into a seemingly indiscriminate range of environments has caused concern for the integrity of forest ecosystems. This study was conducted to investigate the effects of site heterogeneity and disturbance on the establishment and fecundity of *M. vimineum.* Six sites were selected from the forested area surrounding the Russel Larson Research Farm at Rock Springs, PA. Sites were selected to represent a variety of environmental and edaphic conditions, and included: tertiary roadside, wetland, intact forest with understory cover, intact forest without understory cover, cut forest with understory cover, and cut forest without understory cover. At each site, treatment plots were established in a paired experiment. Each pair consisted of two 1-m^2 plots, one being disturbed by the removal of forest detritus and raking of exposed soil, and the second left undisturbed. Each treatment pair was replicated 5 times per site, for a total of 30 treatment pairs. On 17 April each plot was sown with approximately 75 grams of a seed and soil mixture gathered from a local source with the goal of establishing a population of 200 to 300 plants m^{-2}. On 9 May, 21 May, and 6 June *M. vimineum* in each plot was counted to determine plant populations. Plants were then allowed to grow until anthesis and in the first week of October, plants and seeds were hand harvested from one half of each plot. Dry matter biomass was then measured for each plot. Results of the data show that environment and soil disturbance significantly impacted seed germination. Seed germination within intact and cut forest sites lacking substantial understory was shown to be greater than in intact and cut forest sites with understory as well as in non-forested sites. The occurrence of soil disturbance increased final biomass of *M. vimineum* in three out of four sites. Preliminary seed production data suggests that the fecundity of *M. vimineum* is magnified by disturbance. Results of this study may provide insight into the susceptibility of a spectrum of environments and floral ecosystems to colonization by *M. vimineum.* By understanding the effect of environment and disturbance level on the germination rate of *M. vimineum* seed and the fitness and fecundity of established plants, it becomes apparent which areas are most conducive to initial colonization and which areas possess the most seed-producing potential. A closer look at the role of disturbance in dispersing and fostering *M. vimineum* may show how habitat management can be altered to increase resistance to colonization.

EVALUATING PERENNIAL GROUNDCOVERS FOR WEED SUPPRESSION: FIELD SCREENING TRIALS - I Tsontakis-Bradley and AF Senesac, Cornell Cooperative Extension, Riverhead, NY.

ABSTRACT

A study was conducted to quantify the ability of several herbaceous perennial groundcover species to compete with weeds during the first two years of establishment. Twenty-two groundcover species were planted in the field in September 2000. An additional twenty-two species were planted May 2002. Each of the species was submitted to three weed management regimes: (1) maintaining plots completely free of weeds by hand weeding throughout the growing season; (2) maintaining plots by hand weeding for the first half of the first growing season; and (3) performing no hand weeding at all.

The percent cover of the crop and of the weeds, the light transmittance through the crop canopy, and the amount of time needed to hand weed the plots were measured during each of the two-year periods. The species evaluated in the first planting were: *Achillea tomentosa* 'King Edward', *Alchemilla mollis*, *Arctostaphylos uva-ursi* 'Pt. Reyes', *Carex morrowii* 'Ice Dance', *Chrysogonum virginianum* 'Pierre', *Fragaria* x 'Lipstick', *Houstonia serpyllifolia*, *Hydrangea anomala* 'Petiolaris', *Imperata cylindrica* 'Red Baron', *Lamiastrum galebdolon* 'Herman's Pride', *Liriope muscari* 'Royal Purple', *Liriope spicata* 'Majestic', *Leymus arenarius* 'Blue Dune', *Lysimachia nummulaira* 'Aurea', *Mazus reptans*, *Nepeta x faasseni* 'Walker's Low', *Phlox subulata* 'Emerald Blue', *Sedum reflexum* 'Blue Spruce', *Solidago sphacelata* 'Golden Fleece', *Thymus praecox* 'Albiflorus', *Veronica spicata* 'Goodness Grows', and *Vinca minor*. Species evaluated in the second planting were *Aubrieta deltoidea*, *Aurinia saxatilis* 'Gold Dust', *Carex pensylvanica*, *Cerastium tomentosum*, *Dianthus deltoides* 'Brilliant', *Erigeron karvinskianus* 'Blutenmeer', *Gypsophila cerastioides*, *Heuchera americana* 'Chocolate Veil', *Mentha x piperita*, *Minuartia verna*, *Nepeta subsessilis*, *Oenethera pallida*, *Phlox stolonifera* 'Sherwood Purple', *Rhus aromatica* 'Gro Low', *Silene uniflora* 'Maratima', *Solidago cutleri*, *Stachys byzantina*, *Thymus serpyllum* 'Suffolk County', *Trifolium repens* 'Atropurpureum', *Vaccinium macrocarpon*, and *Veronica repens*.

By the end of their second growing season, six species in each of the plantings were outstanding in their ability to cover the ground in both hand weeded and non-hand weeded treatments, in their reduction of light transmittance, and in their ability to suppress weeds. These species were *Alchemilla mollis, Leymus arenarius, Liriope spicata, Nepeta x faassenii* 'Walker's Low', *Phlox subulata* 'Emerald Blue', and *Solidago sphacelata* 'Golden Fleece', *Aurinia saxatilis* 'Gold Dust', *Heuchera americana* 'Chocolate Veil', *Mentha x piperita, Nepeta subsessilis, Stachys byzantina*, and *Thymus serpyllum* 'Suffolk County'.

ESTABLISHING WEEDS FOR TURFGRASS FIELD RESEARCH - J Borger and T Watschke, Penn State Univ., University Park, PA.

ABSTRACT

In order to conduct turfgrass weed research in the field, an evenly distributed weed population in a known species/variety of turfgrass is desirable. Weeds in turfgrass sites tend to germinate and grow in areas of lesser competition. Therefore, the weed population density is often random and inconsistent within any site, forcing weed scientists to conduct research on sites consisting of large areas. Additionally, control ratings are often variable from year to year, due to varying weed populations. Such problems were the rational for establishing turfgrass weed research sites at the Valentine Turfgrass Research Center, Penn State University, University Park, PA that would, hopefully, address some of these problems. Six turfgrass weed research sites were established starting in 1999. A broadleaf weed/perennial ryegrass (*Lolium perenne*) research site was established in July of 1999. A seedbed was prepared and planted with 2 lbs/M 'SR4200' perennial ryegrass and 44 lbs/A dandelion (*Taraxacum officinale*). Following the initial seeding, subsequent overseedings of this research site have totaled 301 lbs/A dandelion seed, 246 lbs/A white clover (*Trifolium repens*) seed, and 64.5 lbs/A of buckhorn plantain (*Plantago lanceolata*) seed to date. A complete fertilizer is applied at 1.0 lb N/M to areas where product evaluations are conducted in the current growing season. The research site was mowed three times per week at 1.0 inch. Two smooth crabgrass (*Digitaria ischaemum*) research sites were established in July of 1999. Seedbeds were prepared and seeded with SR4200 perennial ryegrass seed at 2 lbs/M and 'Midnight' Kentucky bluegrass (*Poa pratensis*) seed at 3 lbs/M. The research sites are annually overseeded with 1 lb/M smooth crabgrass seed in the fall. The smooth crabgrass site maintenance has been the same as the broadleaf weed research site. A minimum of two years of overseeding the broadleaf weed and smooth crabgrass sites are required prior to product evaluation. A ground ivy (*Glechoma hederacea*) research site was established in 1999. Each growing season 4.25 inch diameter plugs of ground ivy are planted into a stand of SR4200 perennial ryegrass in groups of four that form a 12 inch square pattern. The 4,000 ft^2 research area has received over 3,000 ground ivy plugs to date. Annual bluegrass (*Poa annua*) seed was harvested from the numbers nine and ten fairways of the original Penn State White Golf Course, University Park, PA prior to renovation. The harvested seed was planted at the Valentine Turfgrass Research Center at the rate of 1.0 lb/M in July of 2001. On a separate site, 'Winter Play' rough bluegrass (*Poa trivialis*) was seeded at 3 lbs/M in July of 2001. Both research sites are maintained at 0.5 inch height with a five gang reel mower, and receive one application of 3 lbs N/M from IBDU in late fall, early winter, or prior to spring greenup. Additionally, fertilizer applications of 0.5 lb N/M from urea were applied as needed throughout the growing season to maintain growth and color.

DAZOMET FOR RENOVATING TURFGRASS INFESTED WITH NIMBLEWILL - SD Askew, JB Beam, and WL Barker, Virginia Tech, Blacksburg.

ABSTRACT

Current extension recommendations from several universities in the northern US indicate that nimblewill (*Muhlenbergia schreberi* J.F. Gmel.) control requires turfgrass renovation with a nonselective herbicide. Glyphosate is the most commonly recommended herbicide for such renovation. However, single glyphosate treatments rarely control nimblewill completely. Often, homeowners are faced with more severe nimblewill infestations after treating with glyphosate and seeding turfgrass anew since lack of turfgrass competition allows surviving nimblewill to spread rapidly. Many sources therefore recommend that multiple glyphosate treatments be applied prior to turfgrass seeding. Since it takes as long as four weeks to observe considerable nimblewill recovery between treatments, multiple glyphosate treatments usually delay lawn renovation for over two months. A quicker solution is needed for nimblewill control and turfgrass renovation. Dazomet and methyl bromide are nonselective herbicides registered as Basamid® and Bromogas®, respectively for control of weeds and pathogenic microorganisms in turfgrass and other crops. Since dazomet is more available to homeowners and lawn care professionals than methyl bromide, it seems a likely alternative to glyphosate for nimblewill control and turfgrass renovation.

Studies were conducted at Blacksburg, VA to evaluate the effect of glyphosate pretreatment, tillage, and plastic on nimblewill control with dazomet compared to methyl bromide and glyphosate alone. The study area consisted of Kentucky bluegrass (*Poa pratensis* L.) with at least 30% cover of nimblewill. Studies were conducted twice in the season to simulate timings for spring and fall seeding of cool-season grasses. Each study was arranged as a randomized complete block with a 2 x 2 x 2 factorial treatment design and three comparison treatments. Factors consisted of dazomet applied at 392 kg ai/ha with or without the use of glyphosate at 1.1 kg ai/ha two weeks prior to dazomet treatment, tillage to 15 cm to incorporate dazomet, and plastic to cover treated plots after irrigation. These eight treatments of the factorial design were compared to three treatments including a nontreated control; glyphosate alone; and glyphosate followed by tillage, methyl bromide at 1355 kg ai/ha, and plastic.

Glyphosate did not control nimblewill more than 10% in spring since nimblewill was still partially dormant. Glyphosate controlled nimblewill 90% when applied in late summer; however, glyphosate did not significantly affect nimblewill control with dazomet systems in either study. All dazomet treatments completely controlled nimblewill 5 weeks after treatment (WAT) except when neither tillage nor plastic was used. Dazomet surface applied without tillage or plastic controlled nimblewill 90 and 76% 5 WAT in spring and fall, respectively. Methyl bromide completely controlled nimblewill in both studies. Although long-term ratings are needed to draw conclusions, initial results indicate that dazomet could be an effective nimblewill control as long as tillage or plastic is utilized.

DEMONSTRATION OF LATE SUMMER BROADLEAF WEED CONTROL IN AN INTRODUCTORY TURFGRASS SCIENCE COURSE - M Fidanza, D Sanford, Penn State Univ., Reading, PA; and R Scoresby, The Scotts Company, Mt. Vernon, OH.

ABSTRACT

During the fall 2003 semester, nine sophomore-level undergraduate students enrolled in Turf 235, an introductory turfgrass science course at the Berks Campus of the Pennsylvania State University in Reading, Pennsylvania, participated in a broadleaf weed control field experiment. The objective was to conduct a field experiment to evaluate broadleaf weed control from one granular and one liquid product readily available at lawn and garden centers or home improvement stores. With guidance from the instructor, the students designed and conducted the field experiment and evaluated the weed control characteristics of the treatments tested. Although the students worked together on this project, each student was required to submit a final report similar in format to an article in Weed Technology.

The test site was located at the Urban Horticulture Education and Research Center at the Penn State Berks Campus in Reading, Pennsylvania. Heavy populations of white clover (*Trifolium repens* L.) and buckhorn plantain (*Plantago lanceolata* L.) were uniformly distributed throughout the test area with very sparse populations of nimblewill (*Muhlenbergia schreberi* J.F. Gmel.) and tall fescue (*Festuca arundinacea* Schreb.). The test site is considered a low maintenance area and mowed to a height of 76 mm (three inches) with a rotary mower and clippings are not removed. Two commercially available turfgrass weed control products were evaluated: Scotts Winterizer with Plus 2 Weed Control "Fall Weed and Feed" 22-4-11 (this granular product contains the herbicides 2, 4-D and mecoprop), and Ortho Weed-B-Gon (this liquid product contains the herbicides 2,4-D, mecoprop, and dicamba). The granular product was applied at the 1X rate (correct product label rate) and 3X rate (to demonstrate excessive and incorrect application rate). The liquid product was applied at the 1X rate (correct product label rate). Treatments were applied in early September 2003. The granular product was applied at both 1X and 3X rates according to three scenarios: (i) treatments applied with natural dew and leaf wetness present on the target vegetation, (ii) dry plots were irrigated with a garden hose to simulate dew and leaf wetness and then treatments applied to wet vegetation, and (iii) treatments applied to dry target vegetation. The liquid treatment was applied to dry plots. In summary, there were six granular treatments, one liquid treatment, and one nontreated check for a total of eight treatments. Treatments were arranged as a randomized complete block design with four replications. Individual plot size measured 1.5 x 1.5 m (5 x 5 ft). Granular treatments were applied by hand uniformly in the test plot in two directions. The liquid treatment was applied through a one gallon pump-up garden sprayer again uniformly in the test plot in two directions. Weed control was evaluated through visual observations on a 0 to 100% scale, where 100% = entire plot area covered with weeds and 0% = no weeds present. The field experiment was concluded in late October 2003.

Students needed guidance on how to visually evaluate plots and record valid and meaningful observations. In general, all herbicide-treated plots exhibited a significant reduction in weed cover versus the nontreated plots. Although weed injury symptoms

were observed in the liquid-treated plots several days before the granular-treated plots, overall weed control was considered similar in liquid- versus granular-treated plots. Weed control among granular treatments was considered similar in plots that received the 1X versus 3X rate, however, an overall trend of improved weed control was observed in plots treated with dew or leaf wetness present versus dry plots. The students agreed that this was a worthwhile outdoor laboratory exercise that helped integrated principles of weed control and practical turfgrass management.

APPLICATION OF PESTICIDES BY CONSUMERS - R Scoresby, The Scotts Company, Mt. Vernon, OH; and R Baker, The Scotts Company, Marysville, OH.

ABSTRACT

Homeowner use of pesticides is one of the areas the US EPA regulates under the FIFRA laws. Homeowners have a multiplicity of products to choose from, for most weed, insect, disease, or other pest control needs. Besides various products they then have to choose what method they will apply the product for controlling the pest. Liquid consumer products come either as concentrates that need mixed or are applied through hose end sprayers or as ready to use products that come with the method of application as part of the product. Dry products meant for broadcast do not need mixing but must be loaded into a spreader for application. This paper will explain the methods used to supply homeowners the ability to accurately apply pesticides to their home and home yard.

INTRODUCTION

Pesticides used by homeowners have developed as an extension of products for agriculture being marketed to homeowners. The EPA under the FIFRA law regulates each pesticide with a separate risk category for use by consumers. Consumer use adds to the overall 'risk cup' of each pesticide in making decisions to allow particular uses for each pesticide to be used safely. There are approximately 50 million home lawns in the US with an estimated size of 8.6 million acres (Augustin, 2003).

The methods that consumers use to apply pesticides have developed through the years and now each product either comes with an applicator or with instructions for use with specific applicators. The types of applicators available to the consumer are generally in a few categories. The applicators can be divided into two general categories, liquid and dry applications. Liquid applicators have several sub categories which are Ready To Use (RTU) including aerosols, tank sprayers, hose end applicators, small hydraulic sprayers pulled by lawn tractors that imitate sprayers used in agriculture, and odds and ends like watering cans. Dry applicators are generally dusters, shaker cans or bags, and the drop and rotary spreaders used for granular applicators.

The ability of consumers to make accurate applications depends on three main items: 1. The applicator will or can be set and calibrated to put out exactly the amount specified, 2. The product label is written so consumers can follow the directions to make the correct application, 3. The user of the product accurately follows the directions on the package and uses the applicator correctly. Amount of active ingredient in the product and the amount needed for proper pest control and safety to the environment is determined by the product manufacturer and approved by the EPA and state governments. The amount of product consumers actually use can be determined through studies but the consumer must bear the responsibility of reading and following label directions. Product manufacturers must be responsible for making the product labels easy to understand and follow using available application equipment.

MATERIALS AND METHODS

RTU Products. Sprayers from two manufacturers were tested by taking 2 sets of 9 trigger sprayers at random and spraying with 50 trigger pulls per sprayer and looking for consistency of volume between sprayers. The spray pattern was also tested for consistency in size and equal distribution across the pattern. Shaker can or shaker bag calibration is done by measuring the ideal amount of product per area, spread the correct amount evenly over an area and put a picture of properly spread product on the package for the consumer to imitate. Consumer research was conducted to determine how much product consumers actually use by having consumers treat a known area. The product used was calculated by subtracting the post weight from the pre weight.

Hose End Sprayers. Hose end sprayers come in 2 versions, one with a preset dilution of product with water and one has variable dilution settings. A variable volume dilution sprayer was set at both 2 and 6 oz per gallon setting. Water and 4 formulations of increasing concentrations of the same herbicide were sprayed for 15 seconds. The volume of herbicide that was mixed with water was measured by subtracting pre and post weights of the applicator. The data is expressed as percent change from water.

Granular applicators. The effective spreading swath width of a rotary spreader is determined by collecting the amount of product spread over a 20-foot wide area. Nineteen collection pans spaced at one-foot intervals to cover 20 feet. Several passes are made at 3 MPH over the collection pans until a measurable amount is in each pan. These amounts are analyzed by a computer application to determine the optimum spreading swath width for that particular spreader and product combination.

With the swath width determined, the spreader settings are determined. The spreader is placed on a flow test device that turns the wheels of the spreader at 3 MPH and collects the product as it comes out of the spreader. The flow test device turns the spreader wheels the distance that would cover the equivalent of 500 sq ft at the predetermined swath width. Three runs are performed for 3 to 4 spreader settings. The setting determined to apply the desired product amount is then reevaluated for confirmation purposes. For a drop spreader, the same procedure is performed with the flow test device to determine the proper spreader setting.

RESULTS AND DISCUSSION

RTU Products. RTU products come with many type of applicators. When used correctly RTU applicators are very efficient for spot spraying. Most RTU applications have simple use directions such as "Spray until wet," "Spray until slightly wet without soaking," "Aim at center of weed and spray until slightly wet," or "thoroughly cover all plant surfaces until slightly wet but not to the point of runoff." Trigger sprayers are finely engineered pieces of equipment usually made with some hardened plastic material that can be quickly and inexpensively produced. Table 1 shows trigger sprayers from 2 manufacturers and the variability between spray heads. The actual volume of use is determined by the consumer. Some spot treatments with granular or dust products are made using shaker cans or shaker bags. These calibrations are all made by the manufacturer. Figure 1. Shows data on how much herbicide consumers applied. Thirty five of 49 product users applied the product within + or - 1 standard deviation. Seven product users were above and 7 users were below 1 standard deviation from the desired application volume. Many manufactured products include a dye or foam to help the consumer see where and how much product has been applied to eliminate over application and missing weeds that may be overlooked during application. Other RTU sprayers would be the Pull-n-Spray and or Power Sprayer from the Scotts Company and the pressurized bottle sprayer from United Industries. The Pull n-Spray II has a defined cylinder volume that is filled and the pesticide solution expelled as a trigger is pulled. Another RTU applicator is the aerosol can. Weed, insect, and disease control products are available as aerosols. The applicator is supplied as part of the product and the consumer must determine when the appropriate amount of product has been applied.

Hose end Sprayers. The Ready To Spray (RTS) spray head is chosen based on the desired dilution rate. Each product with applicator is calibrated to put out the correct dilution by aspirating the pesticide and mixing it with a stream of water. Hose end sprayers usually come with instructions to cover a measured area or spray until wet. The accuracy of the application will depend on the consumer putting the proper amount of product on the right area. Variable rate hose end applicators can be set for dilutions from 1 teaspoon up to 8 oz of pesticide per 1 gallon of water. Since all pesticides have a different viscosity the actual dilution varies from the desired dilution. Table 2. shows one herbicide with 4 different formulations and the variation in output with the increasing concentration of the formulation. The volume of water that passes through the metering hole of the sprayer in one minute will vary with the pressure of the water stream but the change in water pressure will also increase or decrease the amount of aspirated liquid to maintain the correct ratio.

Tank Sprayers. Liquid concentrate products are most often applied with tank sprayers. Tank sprayers are usually ½ to 4 gallons in size and contain a device to pressurize the spray. Spray is delivered to the target through a wand that can be adjusted to either spray as a mist or as a stream. Weed control products for lawns all contain instructions for use that states "mix x amount of product (usually in ounces, teaspoons or tablespoons) in 1 gallon of water and evenly spray over xxx square feet (usually from 250 to 500 square feet)." This calculation gives an exact amount of active ingredient per acre. There is really no calibration to do with the tank sprayer itself. To get an even application the person using the tank sprayer should measure the desired square footage and practice applying 1 gallon over that area. Insecticides and fungicides usually have the dilution instructions of x ounces, teaspoons, or tablespoons of product in 1 gallon of water then spray foliage or target until wet or spray thoroughly to cover all plant surfaces. Many homeowners buy concentrate, mix it then use a tank sprayer to spot treat areas needing treated.

Granular Applicators. Having determined that the effective spreading swath width was 5 feet and the desired product amount is 3.45 lb per 1000 sq ft, the following table contains the spreader setting collection information. Consumer retail granular spreaders are designed and tested under the same principles and methods as commercial/professional granular applicators. These spreaders are produced to deliver the product as accurately as possible at an affordable cost. One rotary spreader comes with a guard to prevent granules from being spread over sidewalks and flower beds.

Homeowners have a multiplicity of products to choose from for most weed, insect, disease, or other pest control needs. When product manufacturers provide good instructions for consumers and products are calibrated for the proper applicators homeowners can accurately apply pesticides.

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Table 1. Variation between trigger sprayer types from 2 manufacturers.

	Sprayer Type A	Sprayer Type B
Desired Volume	1.1	1.3
Actual Spray Volume	1.12	1.26
Standard Deviation	0.03	0.014

Table 2. Change in flow rate with increased concentration of a herbicide.

	Hose end sprayer setting	
Herbicide	2 oz/gal	6 oz/gal
18%	-12%	7%
25%	-33%	2.60%
41%	-22%	-13%
50%	-42%	-42%

Table 3. Data gathered during calibration of rotary spreader.

Rotary Spreader setting	Collection runs 1	2	3	Mean	Standard deviation	Lb Product per 1000 sq ft	Percent of desired amount
3	1.50	1.52	1.46	1.49	0.03	2.98	86.4%
3.25	1.64	1.60	1.66	1.63	0.03	3.36	97.4%
3.5	1.82	1.80	1.82	1.81	0.01	3.62	104.9%
Rerun							
3.25	1.61	1.58	1.55	1.58	0.03	3.16	91.6%

Table 4. Data gathered during calibration of drop spreader.

Drop Spreader setting	Collection runs 1	2	3	Mean	Standard deviation	Lb Product per 1000 sq ft	Percent of desired amount
5.25	1.52	1.48	1.48	1.49	0.02	2.98	86.4%
5.5	1.64	1.66	1.64	1.65	0.01	3.30	95.7%
5.75	1.88	1.88	1.86	1.87	0.01	3.74	108.4%
Rerun							
5.5	1.64	1.60	1.72	1.65	0.06	3.30	95.7%

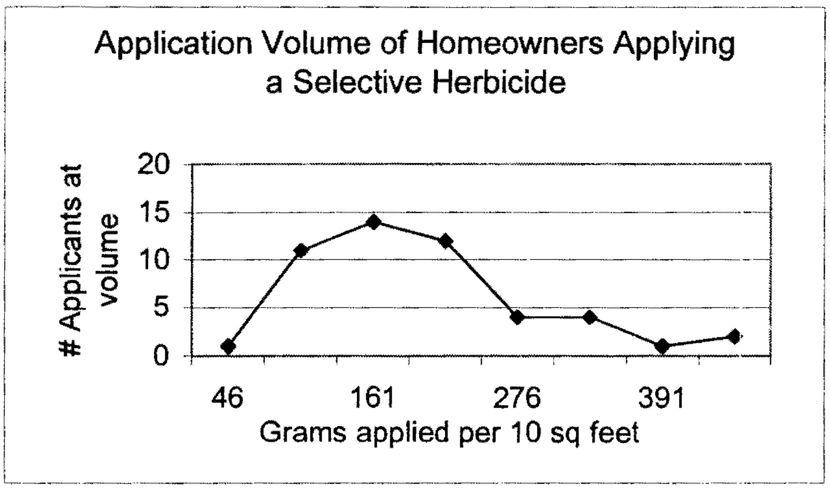


Figure 1. Application volume of granular product by 49 consumers.

SUPPRESSION OF JAPANESE STILTGRASS IN TURF WITH ULV APPLICATIONS OF FLUAZIFOP - RR Johnson, Waldrum Specialties, Inc., Doylestown, PA.

ABSTRACT

The exotic weed, Japanese stiltgrass, (*Microstegium vimineum*), is becoming a common invasive annual grass in fine and rough turf in the northeastern United States. Fluazifop controls several annual weed grasses and has limited turf tolerance on some perennial grass species. Applications of broadleaf weed control herbicides and turf growth regulators using a thin invert emulsion and special nozzles that produce small uniform spray droplets have been effective at spray volumes of 5 gal/A or less. This system was used to apply fluazifop to a dense stand of stiltgrass, smooth crabgrass (*Digitaria ischaemum*), and nimblewill, (*Muhlenbergia schreberi*) in a mixed creeping red fescue (*Festuca rubra*) and bluegrass (*Poa pratensis*) turf. Application was made on July 5, 2003, with a backpack sprayer equipped with a specially designed ultra low volume nozzle using a thin invert emulsion as a carrier to apply fluazifop at 0.25 lb/A in a total spray volume of 5 gal/A.

Evaluation 30 DAT showed the following percent injury to the target annual grasses and the fescue and bluegrass turf: Japanese stiltgrass (60%), smooth crabgrass (95%), nimblewill (10%), red fescue (10%), and bluegrass (60%). Evaluation 90 DAT showed total recovery of red fescue, partial recovery of bluegrass, total control of crabgrass, and no control of nimblewill. Stiltgrass partially recovered, but did not set seed before frost. ULV treatment using a thin invert emulsion as a carrier was effective in suppressing growth and regrowth of stiltgrass with little injury to red fescue. The treatment injured bluegrass severely. Future ULV trials will use grass control herbicides that have shown greater turfgrass tolerance.

SOIL RESIDUAL ACTIVITY OF SULFOSULFURON AND BISPYRIBAC ON COOL-SEASON TURFGRASS - DW Lycan and S Hart, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Sulfosulfuron and bispyribac-sodium have postemergence activity on annual bluegrass (*Poa annua* L.) and roughstalk bluegrass (*Poa trivialis* L.) in turfgrass. However, the level of preemergence activity these herbicides have on cool-season turfgrass is not well understood. Field experiments were conducted in the fall of 2002 and 2003 at Adelphia, New Jersey to investigate the soil residual activity of sulfosulfuron and bispyribac on three cool-season turfgrass species. Soil type was a Holmdel sandy-loam with a pH of 6.5 and 2% organic matter content. Sulfosulfuron (0.03 and 0.07 kg ai/ha) and bispyribac (0.15 and 0.3 kg ai/ha) were applied to an established stand of Kentucky bluegrass (*Poa pratensis* L.) at 6, 4, 2, and 1 week before seeding (WBS). Sulfosulfuron applications included nonionic surfactant at 0.25% (v/v). All applications were made with a CO_2 backpack sprayer delivering 374 L/ha. The existing turf was controlled with a non-selective herbicide spray one week before seeding to facilitate evaluations of desired seedlings. Creeping bentgrass (*Agrostis stolonifera* L. 'L-93'), perennial ryegrass (*Lolium perenne* L. 'Pizzazz'), and Kentucky bluegrass 'Kenblue' were verti-seeded into treated plots in early September. Ground coverage was evaluated 3 and 7 weeks after seeding (WAS) and once the following spring. Sulfosulfuron applied 1 WBS at either rate reduced ground coverage of all species as compared to the nontreated check at 3 WAS in 2002. These plots recovered from initial injury by the following spring. Bispyribac did not reduce ground coverage of any species in 2002. Reduction of ground coverage was more prevalent in 2003. Sulfosulfuron at 0.03 kg/ha and bispyribac at 0.15 kg/ha applied 1 WBS reduced Kentucky bluegrass coverage by 75 and 69%, respectively, at 3 WAS. Sulfosulfuron applied 2 WBS at either rate and 4 WBS at 0.07 kg/ha reduced Kentucky bluegrass cover. All treatments made 1 WBS reduced perennial ryegrass cover by at least 28% as compared to the nontreated check at 3 WAS. Both rates of sulfosulfuron and bispyribac at 0.3 kg/ha reduced creeping bentgrass coverage when applied 1WBS.

Preemergence control of annual bluegrass was evaluated in a separate study. Sulfosulfuron (0.01 to 0.03 kg/ha), bispyribac (0.07 to 0.15 kg/ha), dithiopyr (0.28 and 0.42 kg ai/ha), and bensulide (5.6 and 11.2 kg ai/ha) were applied to bare ground in early September of 2002 and 2003 at Adelphia, NJ. Sulfosulfuron and bispyribac applications provided preemergence control of annual bluegrass that was comparable to or superior than both dithiopyr and bensulide in both years. Sulfosulfuron provided greater than 90% control of annual bluegrass, while bispyribac, dithiopyr, and bensulide provided 63 to 85% control at 6 weeks after treatment in 2003.

These studies suggest that establishment of Kentucky bluegrass, perennial ryegrass, and creeping bentgrass may be negatively affected by sulfosulfuron applications made 2 to 4 weeks before seeding and bispyribac applications made 1 to 2 weeks before seeding. In addition, both sulfosulfuron and bispyribac appear to have substantial preemergence activity on annual bluegrass when applied to bare ground.

SEASONAL ANNUAL BLUEGRASS EMERGENCE PATTERNS IN CENTRAL MARYLAND - JE Kaminski and PH Dernoeden, Univ. of Maryland, College Park.

ABSTRACT

Annual bluegrass (*Poa annua* L. ssp. *annua*) is a major weed problem of golf course turf. There have been no studies conducted in Maryland to monitor the seasonal emergence patterns of annual bluegrass. Annual bluegrass seedling emergence was monitored in a bermudagrass (*Cynodon dactylon* [L.] Pers.) rough at the University of Maryland Golf Club in College Park between 1999 and 2003 and at Woodmont Country Club in Rockville, MD between 2002 and 2003. In August or September of 1999 to 2002, four circular spots approximately 0.09 m^2 in area were killed with glyphosate. Annual bluegrass seedlings were counted and removed weekly from inside each spot between September and May of each year. During this period, an average of 431 seedlings 0.09 m^{-2} $year^{-1}$ germinated. Between 1999 and 2002, the majority of annual bluegrass seedlings (63 to 78%) emerged between September and mid-October and 90% of the total seedlings emerged by early-December. Annual bluegrass seedlings emerged in small numbers between December and May in all three years. In the final year (2002 to 2003), peak annual bluegrass germination at both locations occurred between early-October and mid-November (64 to 68%), but 90% germination was not reached until March 2003. Each year, annual bluegrass germination within each of the four monitored spots varied greatly. During the first three years, however, year to year variation was insignificant. An early frost and colder than normal temperatures between autumn 2002 and winter 2003 may have contributed to a lower level of germination in the autumn and the extended germination period of annual bluegrass into March 2003.

EFFECT OF COMPOSTED POULTRY LITTER ON THE GERMINATION OF DIFFERENT WEED SPECIES - M Mandal and RS Chandran, West Virginia Univ., Morgantown.

ABSTRACT

Poultry litter, a waste product of the poultry industry, is an excellent source of nutrients for crops. Using composted poultry litter as a soil conditioner may help establishment of turfgrasses in compacted soils and may indirectly benefit weed management in turf. The effect of poultry litter compost extract on the germination of 13 weed species was studied using bioassays. Weed species used were annual ragweed [*Ambrosia artemisiifolia* (L.)], barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], common lambsquarters [*Chenopodium album* (L.)], giant foxtail (*Setaria faberi* Herrm.), green foxtail [*Setaria viridis* (L.) Beauv.], ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], johnsongrass [*Sorghum halepense* (L.) Pers.], large crabgrass [*Digitaria sanguinalis* (L.) Scop.], pigweed [*Amaranthus hybridus* (L.)], small flower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.], tall morningglory [*Ipomoea purpurea* (L.)], yellow foxtail [*Setaria glauca* (L.) Beauv.], and yellow nutsedge [*Cyperus esculentus* (L.)]. Experiments designed as a completely randomized design were carried out using petri-dishes in growth chamber maintained at 25°C with 12-hr day length. Twenty five seeds of each weed species were placed on filter papers moistened with 8-ml solutions of compost extracts in each petri-dish. Compost extracts at three different concentrations (compost:water w/w) 1:8 (low), 1:5 (medium), and 1:2 (high) were compared to distilled water (control) for seed germination. The highest concentration arrested the germination of annual ragweed, giant foxtail, ivyleaf morningglory, johnsongrass, tall morningglory, yellow foxtail, and yellow nutsedge completely. This concentration also inhibited barnyardgrass, green foxtail, and small flower morningglory germination > 80%, and crabgrass and pigweed germination by 60%, compared to control. The medium concentration inhibited > 80% germination of annual ragweed, johnsongrass, and tall morningglory while the low concentration inhibited > 50% germination of johnsongrass and yellow nutsedge.

PREVENTION AND REMEDIAL TREATMENTS FOR INJURY IN MOWER TRACKS CAUSED BY DISLODGED RIMSULFURON - WL Barker, SD Askew, and JB Beam, Virginia Tech, Blacksburg.

ABSTRACT

Virginia lies within the climatic transition zone, where both cool- and warm-season grasses survive, but neither thrives. Bermudagrass (*Cynodon dactylon* (L.) Pers.) is often used on golf fairways and is commonly overseeded with perennial ryegrass (*Lolium perenne* L.) during dormancy. Rimsulfuron selectively controls most cool-season turf species in bermudagrass, including perennial ryegrass and creeping bentgrass (*Agrostis stolonifera* L.). Lateral movement of rimsulfuron from treated perennial ryegrass fairways to creeping bentgrass greens via mowers and/or foot traffic is a concern for many superintendents. Three trials were conducted in 2002 and 2003 in Blacksburg, VA to determine lateral relocation potential of rimsulfuron. The study was conducted as a randomized complete block with treatments arranged in a two by four factorial design. Each treatment was replicated three times within each study. Plots were 2 m wide and 4 m long. Half of each plot consisted of perennial ryegrass that received herbicide treatment and the other half consisted of creeping bentgrass that received mower tracking. Perennial ryegrass was treated with rimsulfuron in the afternoon and overridden with a triplex mower the following morning when dew was present. The mower was driven through the perennial ryegrass and across adjacent creeping bentgrass. Factors included rimsulfuron rate (18 or 35 g ai/ha) and irrigation regime (none, irrigate perennial ryegrass two hours after rimsulfuron application, irrigate bentgrass 15 minutes after tracking, and irrigate both perennial ryegrass and bentgrass). Three additional comparison treatments included applications of gibberellic acid (GA) at 12 kg/ha, foliar iron (Fe) at 1.3 kg/ha, or both GA and Fe, to bentgrass after track appearance when perennial ryegrass was treated with 35 g ai/ha rimsulfuron. A nontreated control was also included for comparison. Distance of visible track and percent turfgrass color difference between areas inside and outside the original mower tire path were evaluated at five-day intervals after treatment. Time required for complete turfgrass recovery was recorded as the number of days required for distance of visible track to equal zero. Track length and color difference were greatly reduced by irrigating perennial ryegrass and irrigating both perennial ryegrass and bentgrass compared to other irrigation regimes at 5, 10 and 25 days after treatment. Turfgrass recovery took as long as 25 days after treatment when no irrigation was applied, and as few as 5 days when both perennial ryegrass and bentgrass were irrigated. Often, tracks were not detected when the low rimsulfuron rate was applied to perennial ryegrass and watered in two hours later. Irrigation had no effect on perennial ryegrass control. Remedial treatments of GE and Fe did not help speed recovery or improve turf aesthetics after track appearance. Results suggest that when applying rimsulfuron near creeping bentgrass, one should apply the lowest effective rate and irrigate two hours after treatment to prevent offsite injury.

CREEPING BENTGRASS CONTROL WITH ALTERNATIVES TO GLYPHOSATE - GM Henry, FH Yelverton, North Carolina State Univ., Raleigh; and S Hart, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Studies were conducted in the spring and summer of 2002 in Raleigh, NC to evaluate the response of a mature stand of non-glyphosate resistant 'Penncross' creeping bentgrass to postemergence herbicides. Two applications of glyphosate at 1.7 kg ai/ha were required to achieve 98% bentgrass control 8 WAT. Fluazifop at 0.4 kg ai/ha, clethodim at 0.3 kg ai/ha, and sethoxydim at 0.4 kg ai/ha exhibited herbicide activity, but two sequential applications were required to reach > 82% control of bentgrass 8 WAT. Two sequential applications of clethodim or the combination of glyphosate plus fluazifop provided 98% control of bentgrass 8 WAT. Of the other herbicide treatments evaluated, only atrazine and sulfosulfuron provided > 80% control 8 WAT. The results of this study demonstrate that the herbicides fluazifop, clethodim, and sethoxydim have substantial herbicide activity on creeping bentgrass and may be viable alternatives to glyphosate for the control of glyphosate-resistant creeping bentgrass in areas where it is not desired.

ALTERNATIVES TO GLYPHOSATE FOR CREEPING BENTGRASS CONTROL - SD Askew, JB Beam, Virginia Tech, Blacksburg; and DC Riego, Monsanto Company, Carmel, IN.

ABSTRACT

Glyphosate-resistant creeping bentgrass (*Agrostis stonlonifera* L.) is under review by the United States Department of Agriculture for use on golf course fairways and greens. This registration could come as early as 2005. Creeping bentgrass resistant to glyphosate will increase weed management options for golf course managers. However, since glyphosate is the most common herbicide used for turfgrass renovation, escaped plants will require alternative herbicides. Glyphosate is not always completely effective for creeping bentgrass control but alternative herbicides must be just as affective as glyphosate or more so. In addition, creeping bentgrass is naturally found in riparian areas where few herbicides can be used. Imazapyr, glyphosate, and mesotrione all have an environmental and toxicological profile conducive to aquatic use. A study was conducted in Blacksburg, VA to evaluate several herbicides for creeping bentgrass control. The study was established on a sward of creeping bentgrass 'L-93' maintained at 1.5 cm height and conducted as a randomized complete block with three replications. Treatments included imazapyr as a 480 g/L formulation applied at 0.5, 1.0, 1.5, and 2.0 % v/v; glyphosate as a 480 g/L formulation applied at 2.0% v/v, dazomet surface applied at 420 kg/ha and watered daily for 7 d, glufosinate as a 120 g/L formulation applied at 3.1% v/v, and mesotrione applied twice at 0.28 kg ai/ha in two-week intervals. All liquid treatments were applied with water at 935 L/ha to 1 m by 2 m plots. Nonionic surfactant was included at 0.25% v/v with mesotrione. All treatments except mesotrione controlled creeping bentgrass at least 96% 2 weeks after treatment (WAT). At 6 WAT, all treatments controlled creeping bentgrass at least 96%. At 13 WAT, glyphosate and all rates of imazapyr controlled creeping bentgrass 100% while dazomet, mesotrione, and glufosinate controlled creeping bentgrass 97, 85, and 57%, respectively. These results indicate that imazapyr and mesotrione should be evaluated further in aquatic environments. Imazapyr is completely effective for creeping bentgrass control in terrestrial environments but residual soil activity may limit its use if reseeding is desired. Mesotrione, glufosinate, and surface-applied dazomet may require sequential treatments or tank mix combinations for complete creeping bentgrass control.

BROADLEAF WEED CONTROL WITH CARFENTRAZONE COMBINATIONS IN TURFGRASS SETTINGS - L Weston and J Barney, Cornell Univ., Ithaca, NY.

ABSTRACT

QuickSilver®, carfentrazone-ethyl, is a new postemergence broadleaf turf herbicide manufactured by FMC. Carfentrazone, a protox inhibitor, causes rapid necrosis and death of sensitive broadleafs by disruption of photosynthesis and subsequent membrane degradation. When applied in combination with other broadleaf herbicides, the spectrum and rapidity of broadleaf control is enhanced. Currently PBI Gordon is marketing Speed Zone and Power Zone, consisting of carfentrazone-ethyl formulated with 2,4-D, MCPP and dicamba or MCPA, MCPP and dicamba. Carfentrazone remains active in cool weather conditions (45 F or higher) and formulations containing QuickSilver are generally rainfast within hours. Compared to many broadleaf products, carfentrazone-ethyl also has limited soil persistence and good toxicological properties. A series of studies were performed to evaluate the efficacy of QuickSilver applied at a standard rate (0.020 kg/ha) in combination with other broadleaf herbicide mixtures including Eliminate (dicamba, MCPA, triclopyr), Trimec Classic (2,4-D, dicamba, MCPP), and Chaser 2 Amine (2,4-D and triclopyr) at standard rates. Application occurred in late May 2003. A separate study was conducted to evaluate QuickSilver at a standard rate with several rates of Confront (triclopyr plus clopyralid), Turflon (2,4-D plus triclopyr) and Garlon EV (triclopyr). Herbicides were applied in early July 2003. It was hypothesized that a synergistic effect of QuickSilver and selected broadleaf herbicides would result in greater control of difficult to manage broadleafs than either herbicide product applied separately. In late May, postemergence applications resulted in minimal broadleaf control of dandelion (*Taraxacum officinale*), broadleaf plantain (*Plantago major*), white clover (*Trifolium repens*) and healall (*Prunella vulgaris*) (10 to 30%). Combinations of QuickSilver and Eliminate, Trimec Classic or Chaser 2 Amine provided increased broadleaf control for weeds described above (60 to 80%). However, ratings were generally not significantly improved in comparison to these products applied alone at standard rates. In early July, QuickSilver T&O at standard rates again provided only moderate control (10 to 40%) of broadleaf weeds such as dandelion, white clover, veronica spp. ground ivy (*Glechoma hederacea*) and broadleaf plantain. However, when applied in combination with Confront, Turflon or Garlon, control was generally markedly improved to levels of 70 to 90% or greater. In combination with these products, QuickSilver appeared to act synergistically in this instance, as control was significantly improved for most weeds and most product combinations as compared to each product applied separately.

BROADLEAF WEED CONTROL IN 2003 - J Borger and T Watschke, Penn State Univ., University Park, PA.

ABSTRACT

The first study was conducted on a mature stand of perennial ryegrass (*Lolium perenne L.*) at the Valentine Turfgrass Research Center, Penn State University, University Park, PA. The test site was mowed at 1.5 inches and irrigated to prevent wilt. The objective of the study was to determine the efficacy of selected broadleaf herbicides for the control of dandelion (*Taraxacum officinale*), buckhorn plantain (*Plantago lanceolata*), and white clover (*Trifolium repens*). This study was a randomized complete block design with three replications. All of the treatments were applied on June 5, 2003 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two, flat fan, 11004 nozzles at 40 PSI. The individual plot size was 30 square feet Control of individual weed species was rated on August 4. The best control of dandelion occurred as a result of applications of Velocity, Velocity and Drive 75 DF plus MSO at 1.0% v/v, and Drive 75DF plus MSO at 1.0% v/v with 2,4-D (3.8L) at 1.0 lb ai/A. Most treatments provided good control to excellent control of white clover, the exception being Quicksilver T&O (1.9EW) at 0.019 lbs ai/A, Chaser 2, and Quicksilver T&O (1.9EW) and MacroSorb Foliar at 2 oz/M. Although the addition of 2 oz/M of MacroSorb Foliar tended to improve the control from Quicksilver T&O. Quicksilver T&O and Drive 75DF did not provide good control of buckhorn plantain. However, when Drive 75DF plus MSO at 1.0% v/v was combined with Velocity, the control of buckhorn plantain was complete. The second study was conducted on a mature mixed stand of perennial ryegrass (*Lolium perenne L.*), Kentucky bluegrass (*Poa pratensis*) and fine fescue (*Festuca spp.*) on a home lawn in Julian, PA. The objective of the study was to determine the efficacy of selected broadleaf weed herbicides for the control of ground ivy (*Glechoma hederacea*). Although there were many types of broadleaf weeds in the stand they were not uniform enough to evaluate control on a species by species basis. The term "other weed" (used in this abstract) thus refers to buckhorn plantain, common plantain (*Plantago major*), dog fennel (*Anthemis cotula*), slender speedwell (*Veronica filiformis*), wild violet (*Viola supp.*), wild strawberry (*Fragaria virginiana*), yellow woodsorrel (*Oxalis stricta*), white clover, dandelion, yellow hawkweed (*Hieracium pretense*), mouse ear chickweed (*Cerastium vulgatum*), thymeleaf speedwell (*Veronica serpyllifolia*), healall (*Prunella vulgaris*), wild carrot (*Daucus carota*), and yarrow (*Achillea millefolium*) that were present at the time of the herbicide application. The study was a randomized complete block design with three replications. All of the treatments were applied on June 25, 2003 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two, flat fan, 11004 nozzles at 40 PSI. Each plot was rated for ground ivy cover and other weed cover prior to treatment. The site was mowed at two inches with a rotary mower with clippings returned. The site was not irrigated. All of the treatments except Quicksilver provided excellent control of ground ivy (>90%). Control of the other weed population present to an acceptable degree (>80%) was only attained from the application of Confront and Trimec Classic. Drive plus 2,4-D plus MSO, Quicksilver plus Trimec Classic, and Speed Zone alone did not exhibit acceptable broad spectrum control for the weeds found on this experimental site.

SMOOTH CRABGRASS CONTROL (PRE- AND POSTEMERGENCE) IN 2003 - T Watschke and J Borger, Penn State Univ., University Park, PA.

ABSTRACT

Preemergence control of smooth crabgrass (*Digitaria ischaemum*) was evaluated on a mature stand of 'Midnight' Kentucky bluegrass (*Poa pratensis*), at the Valentine Turfgrass Research Center, Penn State University, University Park, PA. The objective of the study was to determine the efficacy of selected preemergence herbicides for the control of smooth crabgrass. This study was a randomized complete block design with three replications. Treatments were applied on April 29, 2003 (PRE) and some treatments were applied on June 10, 2003 (6WAT) using a three foot CO_2 powered boom sprayer calibrated to deliver 80 GPA using two, flat fan, 11004 nozzles at 40 PSI. After application the entire test site received approximately 0.5 inch of water. On May 20, 2003, 0.5 lb N/M was applied from urea and 0.5 lb N/M from a 31-0-0 IBDU fertilizer was applied to the test site. The site was mowed two times per week with a rotary mower at one inch with clippings returned to the site. Smooth crabgrass germination was first noted in the test site on May 1, 2003. Control was rated on August 5, 2003. No phytotoxicity was noted from the application of any of the treatments. Acceptable control (85% or above) was determined for the following treatments; Dimension Ultra 40WP at 0.25 lbs ai/A followed by another 0.25 lbs ai/A six weeks later, Dimension Ultra 40WP at 0.5 lbs ai/A, Pendulum 3.8CS at 1.5 lbs ai/A followed by another 1.5 lbs ai/A six weeks later, Barricade 65WDG at 0.325 lbs ai/A followed by another 0.325 lbs ai/A six weeks later, Barricade 65WDG at 0.65 lbs ai/A, Barricade 4FL at 0.325 lbs ai/A followed by another 0.325 lbs ai/A six weeks later, and Barricade 65WDG and 4FL at 0.5 lbs ai/A followed six weeks later with 0.25 lbs ai/A. In a second study, postemergence smooth crabgrass control evaluations were conducted on a mature stand of Midnight Kentucky bluegrass at the Valentine Turfgrass Research Center, Penn State University, University Park, PA. The objective of the study was to determine the efficacy of selected postemergence herbicides for the control of smooth crabgrass. This study was a randomized complete block design with three replications. Treatments were applied on July 25, 2003 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two, flat fan, 11004 nozzles at 40 PSI. The test site was maintained at 1.0 inch with a rotary mower that returned clippings to the site. Irrigation was provided on an as needed basis. None of the treatments provided acceptable (>85%) control of smooth crabgrass. However, Acclaim Extra 0.57EW at 20 oz/A plus MacroSorb Foliar at 2 oz/M came close with a rating of 82% control. The same rate of Acclaim Extra alone, only provided 68% control, therefore the activity of Acclaim Extra appeared to be enhanced due to the addition of the MacroSorb Foliar, particularly when the smooth crabgrass was in a more mature growth stage.

PREEMERGENCE SMOOTH CRABGRASS AND POSTEMERGENCE ANNUAL BLUEGRASS CONTROL IN TURFGRASS - PH Dernoeden, JE Kaminski, and SJ McDonald, Univ. of Maryland, College Park.

ABSTRACT

Two field studies were conducted to evaluate herbicides for annual bluegrass (*Poa annua*) and smooth crabgrass (*Digitaria ischaemum*) control. The annual bluegrass study was conducted on a bentgrass (*Agrostis stolonifera*) fairway at Norbeck C.C., Rockville, MD, where soil was a silt loam with a pH of 5.4 and 7.0% organic matter (OM). The crabgrass study was conducted in a perennial ryegrass (*Lolium perenne*) turf at the University of Maryland Paint Branch Turfgrass Research Facility in College Park, where soil was a silt loam with a pH of 5.9 and 3.4% OM. Dates and rates for crabgrass herbicide applications appear in the data table. In both studies, herbicides were applied in 50 GPA using a CO_2 pressurized (35 PSI) backpack sprayer equipped with an 8004E nozzle. Plots in both studies were 5 ft by 5 ft and arranged in a randomized complete block with four replications. Percent of plot area covered with smooth crabgrass or annual bluegrass was assessed visually on a 0 to 100% linear scale. Data were subjected to ANOVA and significantly different means were separated by the Fisher's Protected LSD test at P = 0.05.

Preemergence herbicide treatments were initiated on 28 March and the first crabgrass seedlings were observed 14 April 2003. Germination levels were low in April and May due to unseasonably cool and wet weather. During the study period there were numerous rain events, which stimulated crabgrass germination as late as August. The slow spring development of crabgrass was evident on 18 July, when only trace levels of crabgrass were observed in most herbicide-treated plots. An exception was Pendulum (pendimethalin) 3.3EC (both rates), which provided no crabgrass control. Many crabgrass plants were small and could not be detected in the turf canopy at this time. Warmer weather prevailed thereafter and crabgrass plants tillered and became more vigorous. By 18 August, most treated plots exceeded 10% crabgrass cover. Only plots treated with Barricade 4F (prodiamine; 0.50 plus 0.25 lb/A), Barricade 65DG (0.50 plus 0.25 lb/A), L-0441, L-0442, and L-0445 had ratings of 40% crabgrass cover) was observed in plots treated with Pendulum 3.8CS (1.5 plus 1.5 lb/A), L-0444, L-0447, Dimension 2EW (dithiopyr; 0.5 lb/A) and Dimension Ultra (0.5 lb/A). The highest level of control was provided by Barricade 4F (0.5 plus 0.25 lb/A) and Barricade 65DG (0.5 plus 0.25 lb/A). Plots treated with sequential applications of Dimension Ultra (0.25 plus 0.25) and L-0441, L-0442, and L-0445, which were applied only once, had crabgrass levels statistically equivalent to the aforementioned sequential treatments. Evidently, the excessive rainfall had contributed to a more rapid degradation of the herbicides than occurs in an average year.

Velocity (bispyribac-sodium) was assessed for postemergence annual bluegrass (ABG) control in two application timings beginning on either 14 May (Timing I) or 16 July (Timing II). There were four treatments as follows: 30 gr ai/A; 30 gr ai/A applied 14 and 28 May and 12 June (Timing I) or 30 gr ai/A applied 16 and 30 July (Timing II); 45 gr ai/A; and 60 gr ai/A. Annual bluegrass levels initially ranged from 10 to 30% across the site. Velocity treatments, regardless of rate, elicited a brilliant chlorosis in both species

for about two weeks. The yellowing was so uniform it was difficult to visibly distinguish ABG from bentgrass. Velocity-treated plots exhibited little if any loss of density and turf regained its normal color. Plots were rated for ABG cover on 13 October and the ABG levels were lower than when the study was initiated in May. Velocity applied at 30 plus 30 gr ai/A in Timing II was the only treatment that reduced ABG cover (4.3% ABG) significantly, when compared to the nontreated control (12.0% ABG). In Timing II, there were no significant differences among all four treatments and ABG cover ranged from 4.3 to 7.5% in Velocity-treated plots.

Smooth crabgrass control with various preemergence herbicides, College Park, MD, 2003.

	Rate	% crabgrass cover		
Treatment*	(lb ai/A)	18 Jul	18 Aug	5 Sept
Pendulum 3.3EC	3.0	5.3 a**	66 a	82 a
Pendulum 3.3EC	1.5 + 1.5	2.6 b	58 ab	80 a
Pendulum 3.8CS	3.0	0.9 c	49 b	68 ab
Pendulum 3.8CS	1.5 + 1.5	0.2 c	29 c	53 bcd
Dimension Ultra 40WP	0.5	0.0 c	16 d-g	41 cde
Dimension Ultra 40WP	0.25 + 0.25	0.0 c	10 efg	24 fg
Dimension 2EW	0.5	0.1 c	19 cde	53 bc
Barricade 65WDG	0.5	0.1 c	18 c-f	37 def
L-0441 Lesco/MicroFlo Hammerlock 0.45% Prodiamine + 19-3-7	0.65	0.0 c	9 efg	26 efg
L-0442 Lesco Barricade 0.45%+19-3-7	0.65	0.1 c	8 fg	24 fg
L-0444 Lesco/Microflo Prodiamine 65WP	0.65	0.7 c	22 cd	54 bc
L-0445 Syngenta Barricade 65WP	0.65	0.2 c	8 fg	23 fg
L-0447 Syngenta Barricade 40.7F	0.65	0.4 c	28 c	56 bc
Barricade 65WDG	0.5 + 0.25	0.2 c	7 fg	20 g
Barricade 4F	0.5 + 0.25	0.0 c	6 g	16 g
Nontreated control	---	3.3 b	52 b	79 a

*Treatments were applied initially on 28 March and sequentials were applied 16 May 2003.

**Means in a column followed by the same letter are not significantly different (P=0.05) according to Fisher's protected least significant difference test.

RESPONSE OF CREEPING BENTGRASS GREENS TO FALL APPLICATIONS OF BENSULIDE AND DITHIOPYR - S Hart, DW Lycan, and J Murphy, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

The preemergence herbicides bensulide and dithiopyr may be used in late summer/fall as a preventative treatment to reduce the potential of annual bluegrass (*Poa annua* L.) encroachment onto newly constructed or renovated creeping bentgrass (*Agrostis stolonifera* L. greens. Field experiments were conducted from 1999 to 2001 in New Jersey to evaluate the response of pure stands of 'L-93' creeping bentgrass to September or October applications of bensulide (5.5, 11.0, or 22.1 kg/ha) or dithiopyr (0.21, 0.42 or 0.84 kg/ha). Creeping bentgrass was grown in a sand and peat root zone mixture, conforming to United States Golf Association guidelines. Plots were evaluated for percent creeping bentgrass cover at one month after treatment (MAT) and the following spring. Four cores were also sampled from each plot at a depth of 15 cm to determine root mass. In 1999, no herbicide treatment reduced bentgrass cover or root mass at 1 MAT. In the spring of 2000, bentgrass cover remained unaffected, but root mass was lower when bensulide was applied at 22.1 kg/ha or dithiopyr was applied at all rates. Dithiopyr treatments at 0.41 and 0.84 kg/ha in the fall of 2000 reduced bentgrass cover and root mass 1 MAT and the following spring. These results suggest that bensulide may be used on creeping bentgrass greens in the fall with a greater degree of safety than dithiopyr.

INTERACTION OF PLANT GROWTH REGULATORS AND FUNGICIDES ON CREEPING BENTGRASS - M Fidanza, Penn State Univ., Reading, PA; J Loke, Bent Creek Golf Club, Lititz, PA; T Laurent, Saucon Valley Golf Club, Bethlehem, PA; A Bagwell, Wyncote Golf Club, Oxford, PA; ML Agnew, Syngenta Professional Products, Kennett Square, PA; J Fowler, Syngenta Professional Products, Oxford, PA; L Kozsey, Syngenta Professional Products, Bethlehem, PA; and M DelSantro, Syngenta Professional Products, Greenville, PA.

ABSTRACT

Fungicide rotation and tank-mix programs are commonly applied to golf course greens and fairways in the Mid-Atlantic region, especially from late spring through late summer. Plant growth regulators, however, are typically applied in the spring and fall, but recently their use on creeping bentgrass (*Agrostis stoloniferous*) has expanded throughout the summer months. The interaction of plant growth regulators applied with fungicides on creeping bentgrass, however, has not been clearly evaluated in a replicated field study. Therefore, the objectives of this field study were to evaluate creeping bentgrass quality, the effects on annual bluegrass (*Poa annua*), and summer disease control from repeated applications of a fungicide program applied as a tank-mix with plant growth regulators trinexapac-ethyl (Primo 1MEC) or paclobutrazol (Trimmit 2SC).

Field studies were conducted on a creeping bentgrass fairway at three locations: (i) Bent Creek Golf Club, Lititz, PA, (ii) Saucon Valley Golf Club, Bethlehem, PA, and (iii) Wyncote Golf Club, Oxford, PA. The study sites were mowed regularly with a reel mower to a height of 7.0 mm (0.275 inch), 7.6 mm (0.300 inch), and 8.3 mm (0.325 inch); respectively. A typical fungicide tank-mix program contained a contact fungicide (i.e., chlorothalonil [Daconil Ultrex 82.5WDG]) plus a systemic fungicide (i.e., propiconazole [Banner MAXX 1.24MEC] or azoxystrobin [Heritage 50WG] or fludioxonil [Medallion 50WP]). At Bent Creek and Saucon Valley, the fungicide program was applied on a 14-day interval from June through August 2003 for a total of five applications. At Wyncote, the fungicide program was applied on a 21-day interval from June through August 2003 for a total of three applications. Treatments included the fungicide program alone, fungicides plus Primo, fungicides plus Trimmit, fungicides plus Primo plus Trimmit, and a nontreated check. Primo or Trimmit was not applied alone. At all three locations, plot size was 1.5 x 18 m (5 x 60 ft) and all treatments were arranged as a randomized complete block design with three replications. All treatments were applied with a CO_2 pressurized (206 kPa [30 PSI]) back-pack sprayer calibrated to deliver 815 L water per ha (2.0 gal water per 1000 sq ft) from a single boom with three 8004E flat-fan nozzles spaced 48 mm (19 inch) apart. Creeping bentgrass and annual bluegrass quality/injury was evaluated on a visual 1 to 9 scale, where 9 = best color, density, and quality, and 6 = minimum acceptable quality. Since dollar spot (*Sclerotinia homoeocarpa*) was the only disease present, dollar spot severity was determined by counting number of active infection centers per plot.

In general, creeping bentgrass quality was improved in those plots treated with fungicides plus Primo, fungicides plus Trimmit, or fungicides plus Primo plus Trimmit. Poor annual bluegrass quality and apparent injury was more pronounced in plots that

received fungicides plus Trimmit. Dollar spot severity was significantly reduced in all fungicide-treated plots, and therefore fungicide efficacy was not influenced by the plant growth regulators.

ANNUAL BLUEGRASS, ROUGHSTALK BLUEGRASS, AND DOLLAR SPOT CONTROL WITH BISPYRIBAC - SD Askew, JB Beam, DS McCall, WL Barker, HB Couch, Virginia Tech, Blacksburg; and JR Chamberlin, Valent USA Corporation, Snellville, GA.

ABSTRACT

Annual bluegrass (*Poa annua* L.), roughstalk bluegrass (*Poa trivialis* L.), and dollar spot (*Sclerotinia homoeocarpa* F.T. Bennett) control with bispyribac-sodium was evaluated in three separate trials. Studies were conducted at multiple locations in Virginia. Bispyribac injured creeping bentgrass (*Agrostis stolonifera* L.) for extended periods when applied sequentially at 74 g ai/ha. Creeping bentgrass injury was characterized as chlorotic foliage and increased with increasing bispyribac rate. Roughstalk bluegrass control required multiple bispyribac treatments and was best initiated in spring or summer rather than fall. Annual bluegrass was not controlled with single bispyribac treatments of 148 g ai/ha. However, perennial ryegrass (*Lolium perenne* L.) overseeding decreased annual bluegrass populations and plant size by over 97% and bispyribac stunted annual bluegrass and improved turfgrass aesthetics in overseeded plots. Perennial ryegrass turned chlorotic soon after bispyribac treatment but fully recovered within two weeks. Dollar spot control increased from 12 to 69% as bispyribac rate increased from 12 to 74 g ai/ha. Bispyribac at rates below 12 g ai/ha did not control dollar spot.

INTRODUCTION

Annual bluegrass and roughstalk bluegrass are troublesome weeds in creeping bentgrass turf. In creeping bentgrass, selective postemergence herbicides are not available for roughstalk bluegrass control and only ethofumesate selectively controls annual bluegrass. Bispyribac-sodium or V-10029 is an experimental herbicide that is registered for use in turfgrass as Velocity Herbicide® in some states. Bispyribac has shown promise for selective control of these two weeds in creeping bentgrass. Separate studies were conducted to evaluate roughstalk bluegrass control in creeping bentgrass and annual bluegrass control in perennial ryegrass.

Dollar spot is a major disease of turfgrasses worldwide. The causal agent of this disease is the fungus *Sclerotinia homoeocarpa* F.T. Bennett, and affects both warm and cool season grasses. In the United States, dollar spot is most damaging on creeping bentgrass and annual bluegrass from late spring through early fall. More money is spent annually for the control of dollar spot than any other disease of turfgrass. In preliminary studies aimed at selective annual bluegrass control with bispyribac, the incidence of dollar spot was noticeably lower in treated areas versus nontreated areas. In separate studies, the relative effectiveness of bispyribac was examined for the control of dollar spot at various rates, using iprodione, a standard dollar spot fungicide, as a basis for comparison.

MATERIALS AND METHODS

Roughstalk bluegrass. A field study was conducted five times over two locations and two years to determine effects of bispyribac on roughstalk bluegrass control and creeping bentgrass injury and color. Locations included golf course fairways at Robert Trent Jones Golf Course (RTJ), near Manassas, VA in 2002 and 2003 and at Stony Creek Golf Course (SC) at Wintergreen, VA in 2002. Both locations consisted predominately of 'Penncross' creeping bentgrass maintained at 1.3 cm. Bispyribac was applied at 0, 37, 37 followed by 37 followed by 37, 74, and 74 followed by 74 followed by 74 g ai/ha. Sequential treatments of bispyribac were applied on two-week intervals. Ethofumesate was applied as a comparison treatment at 841 followed by 841 g ai/ha, applied four wk apart. Initial treatments were applied starting in June, August, or September depending on location.

Annual bluegrass. A field study was conducted to evaluate the effect of perennial ryegrass seeding rate on annual bluegrass populations, annual bluegrass phenotype, and bispyribac efficacy. Perennial ryegrass was overseeded onto dormant 'Midiron' bermudagrass (*Cynodon dactylon* (L.) Pers.) at 0, 224, 448, and 672 kg/ha. Bispyribac was treated at 148 g/ha at first annual bluegrass bloom or at one month after first annual bluegrass bloom.

Dollar spot. The test site consisted of a mature stand of 'Penncross' creeping bentgrass at the Virginia Tech Turfgrass Research Center, Blacksburg, VA. Diseased creeping bentgrass (50 to 60% blighted) was treated with bispyribac once at 2.5, 12, 37, and 74 g ai/ha. Bispyribac was diluted in water and applied at 8 L per 100 m^2 (813 L/ha), a common rate for fungicides to ensure uniform coverage. Each of two trials was randomized through four replications. Ratings were based on a visual estimate of percent blighted foliage in each plot on a scale of 0 to 10, where 0 equals no disease and 10 equals completely blighted foliage within the test plot. Mean disease ratings were converted to percent disease control with the level of disease in the nontreated control plots serving as the base point for disease incidence. One application was made on July 3, 2003. The initial rating was 14 days after the application, and subsequent ratings were made every 7 days for three weeks.

RESULTS AND DISCUSSION

Roughstalk bluegrass. At 2 weeks after initial treatment (WAT), bispyribac injured creeping bentgrass 15 to 36% both years at RTJ and 10 to 16% at SC. Duration of creeping bentgrass injury increased with bispyribac rate and when multiple bispyribac treatments were used. At 7 WAT, bispyribac applied at 74 g/ha three times injured creeping bentgrass 36, 28, and 16% when applied at RTJ in 2002, RTJ in 2003, and SC in 2002, respectively. Injury dissipated by 11 weeks after treatment (WAT) at all locations. At RTJ 10 WAT, bispyribac applied three times controlled roughstalk bluegrass 48, 11, and 88% when applied at 37 g/ha in summer, fall, and spring, respectively and 95, 31, and 93% when applied at 74 g/ha in summer, fall, and spring, respectively. At SC 11 WAT, bispyribac applied three times controlled roughstalk bluegrass 33 and 11% when applied at 37 g/ha in summer and fall, respectively and 45 and 41% when applied at 74 g/ha in summer and fall, respectively. Ethofumesate did not control roughstalk bluegrass and usually did not injure creeping bentgrass.

Annual bluegrass. Annual bluegrass population density decreased from 55 plants per m^2 to 1 plant per m^2 as perennial ryegrass overseeding density increased from 0 to 672 kg/ha. Annual bluegrass tiller density also decreased from 150 tillers per plant to 8 tillers per plant as perennial ryegrass overseeding density increased from 0 to 672 kg/ha. At 4 WAT, bispyribac did not control annual bluegrass at either treatment timing. However, bispyribac stunted annual bluegrass plants such that annual bluegrass was inconspicuous in overseeded plots. Bispyribac discolored perennial ryegrass initially but plants recovered by 2 WAT.

Dollar spot. Bispyribac at rates of 12, 37, and 74 g/ha significantly decreased disease incidence. Bispyribac applied at 2.5 g ai/ha did not reduce dollar spot incidence while 12 g/ha controlled dollar spot 19 to 42% (slight to moderate control). Bispyribac applied at 37 and 74 g ai/ha controlled dollar spot 45 to 69% (moderate to good control). Iprodione, applied at the standard label rate of 30 g ai/100 m^2 (3 kg ai/ha) controlled dollar spot 70 to 100% (good to excellent control). Although these data indicate that bispyribac has some curative effect on dollar spot infested creeping bentgrass, other research suggests bispyribac is more effective as a preventative treatment. Future studies will evaluate how bispyribac weed control systems might delay or reduce the need for dollar spot fungicides.

MANAGEMENT OPTIONS FOR BROADLEAF WEEDS IN COOL-SEASON TURFGRASS - P Bhowmik, S Ghosh, N Tharayil-Santhakumar, Univ. of Massachusetts, Amherst; and DL Loughner, Dow AgroSciences, LLC, Huntington Valley, PA.

ABSTRACT

Broadleaf weeds exhibit a variety of weed complex in turfgrass environments. Because of regulatory requirements, limited control options are available for broadleaf control, especially in home lawn situations. Field experiments were conducted on established Kentucky bluegrass (*Poa pratensis* L.) areas to evaluate the postemergence activity of various herbicide combinations in controlling perennial broadleaf weed species. In most trials at the University of Massachusetts Turfgrass Research Center, South Deerfield, major weeds were common dandelion (*Taraxacum officinale* Weber, TAROF), broadleaf plantain (*Plantago major* L., PLAMA), white clover (*Trifolium repens* L., TRFRE) and common chickweed (*Stellaria media* (L.) Vill., STEME). Experimental area was maintained at a 1.5 inch cutting height and the clippings were left on the plots. The area was fertilized with 0.5 lb/N, twice a year. All treatments were applied to 3.5 by 10 feet plots with a CO_2-backpack sprayer at a pressure of 22 PSI in 50 GPA. Postemergence treatments were applied to the fully developed broadleaf weeds in May 11, 2001, June 8, 2002, and May 16, 2003. Turfgrass injury was visually estimated on a scale of 0 to 100% (0%=no injury and 100%=dead turfgrass) and turfgrass density was rated on scale of 1 to 9 (where 1=thin stand and 9=dense stand). Weed control was visually estimated on a scale of 0 to 100% (where 0%=no weed control and 100%=complete control) 4, 8, 12 and 16 weeks after treatment (WAT). In 2001 trial, EH 1381 (2,4-D plus MCPP plus dicamba plus carfentrazone) and EH 1383 (MCPA plus MCPP plus dicamba plus carfentrazone) treatments at 4 to 5 pts/A controlled TAROF, TRFRE, and PLAMA effectively (over 95%) 12 WAT. These treatments had no turfgrass injury. In another trial (2002), confront at 1.0 and 2.0 pt/A, Garlon EV (EW formulation) at 3.0, 4.5, and 6.0 pt/A, and Bastion T at 2.5, 3.0, and 3.5 pt/A provided excellent control of TRFRE, TAROF and STEME 8 WAT without any Kentucky bluegrass injury. Also, granular formulation of Garlon EV at 88, 131, and 175 lb product/A provided excellent control of TRFRE, TAROF and STEME 8 WAT. In 2003 trial, fluroxypyr in combinations with either 2,4-D, MCPP or triclopyr (in fertilizer form) at 175 lb/A resulted in 80 to 90% control of TAROF, TRFRE, PLAMA, and STEME. Results from these studies over the last three years demonstrate alternative choices for broadleaf weed control in cool-season turfgrass.

ITALIAN RYEGRASS CONTROL IN COOL-SEASON TURFGRASS PRODUCTION -
JB Beam, SD Askew, and WL Barker, Virginia Tech, Blacksburg.

ABSTRACT

Infestations of Italian ryegrass (*Lolium multiflorum* L.) in cool-season turfgrass decrease sod marketability and are difficult to control once established. Tests were conducted at three locations in Virginia in 2002 and 2003 to determine herbicide control options for Italian ryegrass in tall fescue (*Festuca arundinacea* Schreb.) and Kentucky bluegrass (*Poa pratensis* L.) seeded the previous fall. Herbicides included primisulfuron and nicosulfuron each at 13.3 followed by 13.3, 26.6 followed by 26.6, 39.3, and 52.6 g ai/ha, diclofop at 421.1 followed by 421.1, 631.6, and 842.1 g ai/ha, a mixture of fluazifop plus fenoxaprop at 112.3 and 30.2 g ai/ha, respectively, metsulfuron at 10.5 and 21.1 g ai/ha, and chlorsulfuron at 52.6 g ai/ha. A nonionic surfactant was included with each herbicide treatment at 0.25% v/v. Italian ryegrass control, turfgrass injury and color were rated at 2, 5, and 11 wk after treatment (WAT). Diclofop at 842.1 g ai/ha, fluazifop plus fenoxaprop, metsulfuron at 21.1 g ai/ha, and chlorsulfuron at 52.6 g ai/ha controlled Italian ryegrass less than 40% 11 WAT. Nicosulfuron at 52.6 g ai/ha controlled Italian ryegrass from 70 to 95% 11 WAT and injured turf less than 35% at all locations, highest injury was noted at 5 WAT. Primisulfuron at 52.6 g ai/ha controlled Italian ryegrass less than 30% 11 WAT in 2002, and 60% 11 WAT at two locations in 2003. Primisulfuron injured turf less than 20% at all locations and rating periods. Results indicate nicosulfuron can be used to control Italian ryegrass in cool-season turfgrass if temporary injury is acceptable.

THE INFLUENCE OF APPLICATION TIMING ON TURF TOLERANCE AND ANNUAL BLUEGRASS CONTROL WITH BISPYRIBAC - JC Fausey, Valent USA Corporation, Lansing, MI.

ABSTRACT

Managing *Poa annua* is a dilemma sod producers and golf course superintendents face. *Poa annua* is an extremely diverse weed that thrives in cool, moist turf conditions with rich soils, but tolerates a variety of harsh environments including low frequent mowing and compacted soils. Several perennial subspecies of *Poa annua* exist and do not respond to preemergence herbicides once they are established. Unfortunately, these perennial *Poa annua* plants in time often dominate the flora. Over the past several years numerous active ingredients for managing *Poa annua* have been evaluated, with some of these materials showing good activity against *Poa annua*. However, few of these materials have displayed selectivity to creeping bentgrass. The lack of an effective selective postemergence herbicide continues to leave sod producers and golf course superintendents with few means of *Poa annua* control once established. One new compound, Velocity herbicide, has been evaluated in creeping bentgrass and consistently displayed selectivity against *Poa annua* without disrupting creeping bentgrass growth. Bispyribac-sodium, the active ingredient in Velocity herbicide, is being developed by Valent U.S.A. Corporation for use in sod farms and golf courses. Velocity has shown excellent safety to cool season turfgrass and provides postemergence control of several aggressive weeds including *Poa annua*, yellow nutsedge (*Cyperus esculentus*) and dandelion (*Taraxacum officinale*). Experiments were conducted throughout the United States the past four growing seasons to evaluate the potential use of Velocity on creeping bentgrass. The objective of these trials was to evaluate the performance of Velocity when applied under different environmental conditions to determine the potential for this herbicide in the turfgrass market. In addition to evaluating Velocity at several locations, treatments included evaluation of different rates, timings and application intervals. Data from these trials confirmed Velocity provides a *Poa annua* management strategy for sod producers and golf course superintendents.

PLANT GROWTH REGULATORS AS A TOOL FOR ANNUAL BLUEGRASS CONTROL - J Borger and T Watschke, Penn State Univ., University Park, PA.

ABSTRACT

This study was conducted on a mature stand of 'Penneagle' creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*Poa annua*) at the Valentine Turfgrass Research Center, Penn State University, University Park, PA. The objective of the study was to determine if summer and fall applications of Trimmit and Primo MAXX could eliminate annual bluegrass under fairway conditions over a two year period. This study was a randomized complete block design with three replications. Treatments were applied on May 30, June 27, July 18, Aug 14, Sept 13, Oct 12, 2001, April 16, May 15, July 10, July 31, September 10, and October 9, 2002 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two, flat fan, 11004 nozzles at 40 PSI. The test area was maintained at 0.5 inches using a triplex reel mower clippings collected. The test site was treated similar to a fairway with respect to irrigation and fertility. Ratings of the percent change in annual bluegrass population were taken on May 13, 2002 and May 8, 2003. Annual bluegrass increased in the nontreated check (34.4 and 58.3% respectively), but increased significantly more in plots treated with Primo MAXX alone (100 and 91.7% respectively). Plots receiving Trimmit plus Coron had the greatest reduction of annual bluegrass, but not significantly more than those that received Trimmit alone. It should be noted that, from a turf color/quality perspective, when Trimmit was supplemented with Coron, the treated turf had higher quality than turf without a Coron supplement. There did not appear to be any advantage in annual bluegrass reduction by including an October application of Trimmit as part of the management strategy.

SEEDHEAD SUPPRESSION OF ANNUAL BLUEGRASS - T Watschke and J Borger, Penn State Univ., University Park, PA.

ABSTRACT

The first study was conducted on a mixed stand of creeping bentgrass (*Agrostis stolonifera*) and annual bluegrass (*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 adjuvants, for the seedhead suppression of annual bluegrass. Treatments were applied on April 23, 2003 (BOOT) and for the Proxy/Primo combination again on May 13, 2003 (3 WAT) using a three-foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two 11004 flat fan nozzles at 40 PSI. The turf was maintained using cultural practices for irrigation, mowing, and fertilization that would be typical for a putting green. Ratings were taken on May 2 for phytotoxicity and on May 20 for turf quality and seedhead suppression. The turf quality ratings were and amalgamation of color, density, texture, and seedhead suppression. Phytotoxicity was rated nine days after the April 23 application date, which was considered to be when the annual bluegrass seedheads were in the "BOOT" stage of development. Phytotoxicity ratings below 7 were considered to be unacceptable. Turf treated with Embark alone at 40 oz/A and in combination with MacroSorb Foliar at 4 and 8 oz/M, MacroSorb Foliar with and without Minors at 1.5 oz/M, and GBJ1 at 4 oz/M, was rated as having unacceptable phytotoxicity. On May 20, the lowest quality rating was observed for nontreated turf, primarily because of emerged seedheads. Turf having the best combination of quality and seedhead suppression was treated with Primo MAXX (0.125 oz/M) plus Proxy (3 oz/M) applied twice, Primo MAXX (0.125 oz/M) plus Proxy (5 oz/M) plus MacroSorb Foliar (4 and 8 oz/M) applied once, and Primo Maxx (0.125 oz/M) plus Proxy (5 oz/M) applied once. When the Primo MAXX rate was reduced to 0.06 oz/M in combination with Proxy (3 oz/M) and MacroSorb Foliar (8 oz/M), quality was very good (8.5), as was seedhead suppression (82%). It appears that the addition of MacroSorb Foliar at 8 oz/M to lower the rates of both Primo MAXX and Proxy enhanced quality without causing a significant loss of seedhead suppression. The second study was conducted on a mature annual bluegrass (*Poa annua*) stand at the Valentine Research Center, University Park Pa. The objective of the study was to evaluate selected growth regulators, with and without adjuvants, for the seedhead suppression of annual bluegrass maintained at a fairway height of cut. Treatments were applied on April 23, 2003 (BOOT STAGE) using a three-foot CO_2 powered boom sprayer calibrated to deliver 40 GPA using two 11004 flat fan nozzles at 40 PSI. The turf was maintained using cultural practices for irrigation, mowing, and fertilization that would be typical for a golf course fairway. Phytotoxicity rated on May, 2, 2003 revealed that turf treated with Cutless plus Primo at 0.25 lb ai/A and 0.25 oz/M respectively, Cutless plus Primo at the same rates, but with the addition of MacroSorb Foliar at 2 oz/M, and Cutless plus Primo at the same rates but with the addition of GBJ1 at 2 oz/M had unacceptable ratings (below 7.0). These same treatments provided excellent seedhead suppression (90%) on this rating date, but by the second rating date (May 19) these treatments provided the poorest suppression of seedheads. The best treatments, when both injury and degree of suppression were considered were Embark T/O at 60 oz/A plus GBJ1 at 2

oz/M and 4 oz/M, Embark at 60 oz/M, plus Coron at 0.2 lbs N/M and Embark at 60 oz/A, plus Coron at 0.2 lbs N/M plus MacroSorb Foliar at 2 oz/M.

SEQUENCING ALS IN ANNUAL BLUEGRASS: IMPLICATIONS FOR HERBICIDE RESISTANCE - NM Kaufman, SD Askew, JB Beam, and WL Barker, Virginia Tech, Blacksburg.

ABSTRACT

The number of herbicides registered for use in turfgrass that inhibit acetolactate synthase (ALS) has increased from four to nine in the last two years. The four ALS-inhibiting herbicides registered for use in turfgrass prior to 2001 include chlorsulfuron, halosulfuron, metsulfuron, and imazaquin. These four herbicides were originally marketed for purposes other than annual bluegrass control, but some of them are often used for that purpose. However, of the five ALS-inhibiting herbicides registered since 2001, bispyribac-sodium, foramsulfuron, rimsulfuron, and trifloxysulfuron are marketed predominately for annual bluegrass control and sulfosulfuron can be used for that purpose. These herbicides constitute a major change in use patterns for annual bluegrass control in turfgrass and increase the chances of selecting for ALS-resistant biotypes of annual bluegrass. Assuming that molecular based resistance to ALS-inhibiting herbicides will occur in annual bluegrass as it has in other weeds, it is desirable to gather information that would help predict the nature of potential resistance and how one would avoid it. The attempt at sequencing the ALS gene in annual bluegrass was an effort to identify any highly variable regions that may relate to gene mutations eliciting resistance to newly-registered turfgrass herbicides. Custom primers were designed using the highly conserved regions of the ALS gene of the closely related plant species barley (*Hordeum vulgare*), rice (*Oryza sativa*), Italian ryegrass (*Lolium multiflorum*), and corn (*Zea mays*). Genomic DNA was extracted from annual bluegrass using the Qiagen DNeasy Plant Mini Kit. The ALS region of annual bluegrass genome was then PCR amplified using custom designed primers. The amplicon was cloned into an Invitrogen TA cloning vector and sequenced using Applied Biosystems BigDye 3.1 sequencing chemistry. Future work will include analysis of the sequence data, identifying variable regions, performing ALS point mutations, and enzyme studies.

WEED CONTROL AND VARIETAL TOLERANCE IN TOMATO TO THIFENSULFURON

- DE Robinson, PH Sikkema, Univ. of Guelph, Ridgetown, ON; and AS Hamill, Agriculture and Agri-Food Canada, Harrow, ON.

ABSTRACT

Trials were conducted between 2001 and 2003 to determine tolerance of a number of processing tomato varieties to thifensulfuron-methyl. A second objective of this research was to determine the level of weed control thifensulfuron-methyl provided when used following a standard pre-plant incorporated herbicide treatment, or when applied in various post-emergence tank mix combinations. In many of the varieties tested, there was no commercially significant injury, no reduction in plant fresh or dry weight, no delay of maturity and no reduction in yield. Other varieties did exhibit leaf cupping and distortion, chlorosis of new growing tissues, and delayed maturity. Thifensulfuron-methyl was registered on tomato in 2002, and work is ongoing to identify sensitive varieties to which this herbicide cannot be safely applied. Thifensulfuron-methyl, when applied following a pre-plant incorporated tank mix of s-metolachlor plus metribuzin, gave excellent control of triazine-resistant common lambsquarters, a major weed problem for field tomato producers in Ontario.

PRELIMINARY EXPERIENCES WITH NEW HERBICIDES IN TRANSPLANTED LETTUCE

RR Bellinder, Cornell Univ., Ithaca, NY; A Erb, Cornell Coop. Ext., Lake Plains, NY; D Moyer, Cornell Coop. Ext., Suffolk Co., NY; J Van der Heide, Cornell Coop. Ext., Oswego Co., NY; and A Bonanno, University of Massachusetts, Methuen.

ABSTRACT

Weeds are a significant problem in lettuce and there are few registered herbicides for either direct-seeded or transplanted crops. A multi-year project was begun in 2003 to develop new chemical and non-chemical approaches to weed management for these crops. Five trials were conducted with transplanted lettuce in western NY (1), Long Island (1), and at the H.C. Thompson Vegetable Research Farm in Freeville, NY (3). The herbicides and rates used were similar in all trials but did take into account location differences (e.g. some products are banned on Long Island) and space constraints. Four trials evaluated the products applied immediately after transplanting; one trial evaluated the same treatments applied before transplanting. The same or similar varieties were used in 4 of the 5 trials (bibb, romaine, red leaf lettuce, 'crisphead' also called 'Batavia' type). The fifth trial (post-transplant) was identical to the other 4 but was done with 4 'crisp head' varieties. The herbicides evaluated were: s-metolachlor (0.66, 1.32 lb ai/A), pendimethalin 3.8CS (0.75, 1.5 lb ai), imazamox (0.024, 0.032, 0.048 lb ai), imazethapyr (0.024, 0.032, 0.048 lb ai), pyrithiobac (0.02 lb ai), ethofumesate (1.0 lb ai), thiobencarb (2.0 lb ai), pronamide (2.0 lb ai), flucarbazone (0.035 lb ai), KIH 485 (0.112 lb ai) and dimethenamid-p (0.5 lb ai, western NY only).

When herbicides were applied prior to transplanting, 'Esmeralda' (bibb), 'Coastal Star' (romaine), 'New Red Fire' (leaf), and 'Sparta' (crisp head) varieties all tolerated (minimal crop injury and yields equivalent to the hand weeded check) s-metolachlor (0.66 lb), pendimethalin (1.5 lb), ethofumesate (1.0 lb), and pronamide (2.0 lb). New Red Fire tolerated all the treatments except the 0.048 lb rate of imazamox. Varietal responses were positive with thiobencarb (3), flucarbazone (2) and imazethapyr (2).

Despite some variability with trial location (post-transplant trials), bibb, romaine, and crisp head types responded similarly in all trials. New Red Fire was very tolerant of many products in the western NY trial but much less tolerant in the trial conducted in Freeville, NY. As seen in the pre-transplant trial, tolerance to s-metolachlor, ethofumesate, thiobencarb and pronamide was generally good. On Long Island none of the varieties showed tolerance to pendimethalin. One noteworthy observation was the fact that when applied post-transplant, s-metolachlor (1.32 lb), ethofumesate, and KIH 485 caused a significant number of malformed heads. The crisp head varieties ('Loma', 'Tahoe', 'Nevada', 'Sierra') were overall somewhat more sensitive to all treatments than were the bibb and romaine types. Among these varieties, Loma was more sensitive than the other three.

Flucarbazone, pyrithiobac, and KIH 485 caused unacceptable injury at the rates used in these first trials.

EVALUATIONS OF CLOMAZONE, ETHALFLURALIN AND HALOSULFURON IN PUMPKINS - TL Mervosh, Connecticut Agricultural Experiment Station, Windsor.

ABSTRACT

Herbicide options for pumpkins (*Cucurbita pepo* L.) were evaluated in 2002 and 2003 in experiments conducted at the Connecticut Agricultural Experiment Station in Windsor. Treatments were replicated four times in plots arranged in randomized complete blocks. Pumpkin seeds were planted by hand in freshly tilled sandy loam soil containing about 2% organic matter. Plots were 10 ft wide by 18 ft long, and contained "hills" spaced 4 ft apart along the plot centerline. Five seeds per variety were planted, 1.5 to 2 inches deep, together in a hill. In 2002, plots contained three hills, one each of 'Howden', 'Spooktacular' and 'Baby Pam' varieties. In 2003, plots contained two hills, one each of 'Howden' and 'Oz'. Plants were thinned to two per hill after 2 weeks.

Treatments included a nontreated check and a hand-weeded check. Herbicides were applied in a spray volume of 25 gal/A using a CO_2-pressurized sprayer with three 8003VS nozzle tips spaced 20 inches apart. The following treatments were applied 2 or 3 days after the planting date (June 11, 2002; June 19, 2003): ethalfluralin 3EC (1.125 lb ai/A), clomazone 3ME (0.5 lb ai/A), Strategy 2.1ME [ethalfluralin plus clomazone (0.4 plus 0.125, 0.8 plus 0.25, and 1.2 plus 0.375 lb ai/A)], and ethalfluralin (0.563 lb ai/A) plus halosulfuron 75DF [0.375 and 0.75 oz ai/A (2002); 0.25, 0.5 and 0.75 oz ai/A (2003)].

Halosulfuron was also applied as postemergence treatments. In these plots, ethalfluralin (0.563 lb ai/A) was applied preemergence to prevent annual grasses. In 2002, postemergence halosulfuron treatments [0.375 and 0.75 oz ai/A (with or without 0.25% nonionic surfactant)] were applied on July 9. In 2003, postemergence halosulfuron treatments (0.25, 0.5 and 0.75 oz ai/A with 0.25% nonionic surfactant) were applied at "Early Post" (July 7) or "Late Post" (July 17) timings.

Adequate rainfall occurred both years shortly after preemergence applications to activate herbicides in the soil, but 2002 was a drier summer than 2003. In general, weed control was better in 2003. All treatments containing ethalfluralin and/or clomazone prevented more than 90% of large crabgrass (*Digitaria sanguinalis*) and stinkgrass (*Eragrostis cilianensis*). Ethalfluralin at the full rate (1.125 lb/A) provided good to excellent control of redroot pigweed (*Amaranthus retroflexus*) and carpetweed (*Mollugo verticillata*) both years, but inconsistent control of purslane (*Portulaca oleracea*) and common lambsquarters (*Chenopodium album*). Clomazone provided excellent purslane and lambsquarters control, but was poor to fair on pigweed and had no activity on carpetweed. The best weed control was provided by ethalfluralin plus clomazone combinations, except for Strategy at the lowest rate. Halosulfuron PRE provided better control of purslane and lambsquarters than did halosulfuron POST, which was very weak on these weeds. All halosulfuron treatments were excellent in terms of pigweed, carpetweed and yellow nutsedge (*Cyperus esculentus*) control.

Halosulfuron was the only herbicide to injure pumpkins. Stunting and chlorosis occurred with both PRE and POST treatments. Injury depended on application rate, but occurred even at the lowest rate and regardless of whether surfactant was included. Most plants eventually recovered, especially from PRE treatments. However, yields for

halosulfuron-treated pumpkins were lower than yields for other treatments, except for the lowest rate of Strategy and clomazone alone, which had poorer weed control.

HALOSULFURON HERBICIDE: LABELING AND USE IN VEGETABLE CROPS - PJ David, Gowan Company, Lititz, PA.

ABSTRACT

SANDEA® Herbicide (halosulfuron) is a selective herbicide recently registered for use is key vegetable crops for control of certain broadleaf weeds and nutsedge. Currently registered crops include: asparagus, cucumbers, certain melons, pumpkins, winter squash, dry beans, snap beans, lima beans, and tomatoes. Row-middle applications are also registered for use in a number of crop groups. Additional registrations are planned. Research trials and commercial experience with the product have indicated good crop tolerance and excellent control of labeled weed species. The product is currently registered for PRE and/or POST applications. The complete label is available at the www.gowanco.com website.

EVALUATION OF MESOTRIONE COMBINATIONS IN SWEET CORN - BK Hearn, MA Isaacs, QR Johnson, Univ. of Delaware, Georgetown, DE.

ABSTRACT

Mesotrione is a preemergence (PRE) and postemergence (POST) herbicide for field corn which shows promise for use on sweet corn. Field experiments were conducted in 2001 and 2002 in Georgetown, DE to evaluate weed control and crop sensitivity to Mesotrione. PRE treatments included s-metolachlor (Dual II Magnum at 0.96 lb ai/A) applied alone and in combination with atrazine (0.5 and 1 lb ai/A), Dual II Magnum (0.96 lb ai/A) combined with atrazine (0.5 lb ai/A) plus mesotrione (Callisto at 0.14 lb ai/A), Callisto (0.14 lb ai/A) combined with Dual II Magnum (0.96 lb ai/A), Callisto (0.14 lb ai/A) combined with atrazine (0.5 lb ai/A) and Callisto (0.14, 0.187, 0.21, 0.374 lb ai/A) applied alone. POST treatments included Callisto (0.094 lb ai/A) applied alone and in combination with atrazine (0.25 lb ai/A) or bentazon (Basagran at 0.5 lb ai/A) with COC (1% v/v) and 30% UAN (2.5% v/v), Basagran (0.5 lb ai/A) and atrazine (0.25 lb ai/A) applied alone with COC (1% v/v) and 30% UAN (2.5% v/v), diflufenzopyr plus dicamba (Distinct at 0.175 and 0.262 lb ai/A) with NIS (0.25% v/v).

The experimental design was a randomized complete block with 3 replications. Plots were 10 ft wide by 25 ft long, and treatments were applied with a tractor mounted sprayer delivering a spray volume of 25 GPA at 29 PSI. The sweet corn variety used was a fresh market (sh2) named 'Ice Queen'. Data collected consisted of crop injury, weed control, and yield. Yield data was collected from the center 10 ft of 2 rows and included number ears/per plot, number rows/ per ear, and ear weight (husked and unhusked). Weed species rated in 2001 consisted of common lambsquarters and common ragweed, and in 2002 consisted of fall panicum, smooth pigweed, and common lambsquarters.

No crop injury was observed with any of the treatments. In 2002 PRE treatments of Callisto alone and the low rate of Callisto (0.14 lb ai/A) plus atrazine (0.5 lb ai/A) provided poor control of fall panicum. All other treatments provided excellent control of fall panicum. PRE treatments of Dual II Magnum (0.96 lb ai/A) plus atrazine (0.5 lb ai/A), Dual II Magnum (0.96 lb ai/A) plus atrazine (1 lb ai/A), and Dual II Magnum (0.96 lb ai/A) PRE plus atrazine POST (0.25 lb ai/A) with COC and 30% UAN provided poor control of common lambsquarters. All other treatments provided excellent control of common lambsquarters. All treatments provided excellent control of smooth pigweed. Ear length was reduced in a few treatments; however, there were no significant yield differences in ear weight in 2002. Data from 2001 showed very similar results to 2002 data. From this research, it appears Callisto can provide excellent control on noted broadleaf species with no crop injury to Ice Queen.

IR-4 PROJECT: HERBICIDE REGISTRATION UPDATE - M Arsenovic, FP Salzman, DL Kunkel, and JJ Baron, Rutgers Univ., North Brunswick, NJ.

ABSTRACT

The IR-4 Project is a publicly funded effort to support the registration of pest control products on minor or specialty crops. The IR-4 Project continues to actively work to provide growers with weed control options despite a climate in which there are fewer herbicides to evaluate. Herbicide petitions submitted to the EPA by IR-4 since October 2002 include: clethodim on flax; ethofumesate on carrot (PNW only) and garden beet; terbacil on watermelon; and paraquat on ginger and the cucurbit vegetable group, metribuzin on garlic, and oxyfluorfen on safflower.

Petitions were also submitted for carfentrazone on the root and tuber vegetable; leaves of root and tuber vegetable; bulb; leafy vegetable; brassica leafy vegetable, legume vegetable; foliage of legume vegetables; cucurbit; berry; grass forage, fodder, and hay; and herbs and spices groups. Additional carfentrazone petitions were submitted for hops, various oil seed crops; sugarcane; peanut; and strawberry.

Since October 2002 to date, EPA has published in the Federal Register Notices of Filing for: dimethenamid-p on the root and tuber vegetable and bulb vegetable groups; flumioxazin on grape; and sulfentrazone on potato, horseradish, cabbage, lima bean (regional), asparagus, mint, and sunflower.

EPA has established tolerances from October 2002 to date for: mesotrione on popcorn, s-metolachlor on sugar beet, grass forage and hay, spinach, sunflower, tomato, carrot, horseradish, rhubarb, Swiss chard, asparagus, and green onion. The EPA also ruled that imazamox is exempt from all tolerances. The status of these and other IR-4 Project studies will be updated.

FLORAL DELAY IN LEGUMES WITH POSTEMERGENCE APPLICATIONS OF IMAZAMOX WITH ADJUVANTS, UAN, AND BENTAZON - RR Bellinder, Cornell Univ., Ithaca, NY; and A Miller, Cornell University, Ithaca, NY.

ABSTRACT

Imazamox injury in legumes is well documented and has been described as a "yellow flash". In 1999 and 2000, research conducted at Cornell focused on reducing this response by adding bentazon to the tank mix along with nitrogen-containing nonionic surfactants. While some lessening of injury symptoms occurred, they were not noteworthy and yield differences were negligible. From 2001 to 2003, UAN replaced the nonionic surfactants used in earlier studies. In the first year striking delays in flowering were observed in succulent peas, snap beans and dry beans. Trials in these three years were conducted in snap (2002, 2003) and dry beans (2001 to 2003) to evaluate the impact of applying 0.032 lb ai/A imazamox with a nonionic surfactant (NIS), a crop oil concentrate (COC), urea ammonium nitrate (UAN) alone, or in two-way combinations (NIS or COC plus UAN). Each of the combinations was applied with and without 0.25 lb ai/A bentazon.

Imazamox, regardless of choice of adjuvant, reduced snap bean yields in both years. Differences between adjuvants alone or in combination with UAN were not significant. In 2003, when preharvest pod samples were taken, it was evident that the number of pods/plant decreased with these treatments. Addition of bentazon to all single adjuvant treatments significantly increased the number of pods/plant (a virtual doubling) and thus, yields were equivalent to the chemical standard, fomesafen plus bentazon (0.16 plus 0.25 lb ai/A). While yields with adjuvants plus UAN plus bentazon improved, they were still lower than the chemical standard.

In dry beans, when all treatments included COC and UAN (2001), addition of bentazon significantly decreased the "yellow flash" and pod samples taken a month before harvest indicated that numbers of small pods were greater in treatments without bentazon. Similarly, the percent immature beans was greater in samples taken weekly until early September. By harvest in mid-September, differences were negligible and yields were equivalent to the chemical standard. Less visual injury occurred in 2002 than in 2003, when injury responses were the same as seen in 2001. Pod samples differed in the latter two years as well. In 2002, using the variety California Early Light Red Kidney, flowering and pod maturation was significantly delayed until early September in all treatments without bentazon. In 2003, using the variety 'Cabernet', pod development was not consistent with the use of bentazon and yields of all treatments were equivalent.

In a single trial conducted with succulent peas in 2002, little visual injury occurred in either 'Cabree' or 'Estancia' varieties but yields were significantly increased with addition of bentazon to imazamox plus COC plus UAN.

EFFECTIVENESS OF FLUMIOXAZIN FOR WEED CONTROL IN VINEYARDS - RM Dunst, TR Bates, Cornell Univ., Fredonia, NY; and GW Kirfman, Valent Corporation, Grand Rapids, MI.

ABSTRACT

Preemergence herbicide options for use in vineyards are limited. Flumioxazin has been evaluated for its effectiveness for weed control in bearing vineyards and during vineyard establishment for three years. In 2003, several experiments were conducted in the grape production region along the southern shore of Lake Erie in commercial vineyards and at the Lake Erie Regional Grape Program research farms in North East, PA and Fredonia, NY. Vineyards were selected for high previous weed pressure of common annual weed species including horseweed (*Conyza Canadensis* (L.) Cronq.), giant foxtail (*Setaria faberi* Hermm.), velvetleaf (*Abutilon theophrasti* Medicus), common ragweed (*Ambrosia artemisiifolia* L.) and pigweed (*Amaranthus*) species. All experiments were conducted in own-rooted 'Concord' (*Vitis Labruscana*, Bailey) vineyards. Precipitation was above average and highly variable in the region in 2003. May to September rainfall was less than 19 inches at the Fredonia Lab and over 41 inches at the North East Lab located about 50 miles southwest of Fredonia.

Flumioxazin was evaluated at 3, 6, and 12 oz ai/A at most locations. Dormant applications only were made to first and second year establishment vines since previous experience has indicated severe injury from flumioxazin contact with green grapevine tissue. Applications in bearing vineyards were made at bud break in early May, at the beginning of grape bloom in mid-June, or as split applications at both timings. Most bearing vineyard applications were made as tank mixes with glyphosate at 1 lb ai/A, but 6 oz flumioxazin alone (without glyphosate) was applied in some locations to determine the effectiveness of its post-emergence activity on weeds. Appropriate standard herbicide treatments were included for comparison.

General observations include:

- Bud break applications of 3 oz ai/A flumioxazin were often less effective than higher rates of flumioxazin or effective standard treatments in controlling common vineyard annual weeds. Bloom applications at the same rate were more effective, and split applications (3 oz ai/A applied twice) were very effective.
- Bud break applications of 6 oz ai/A flumioxazin provided effective control of most annual weeds, except where weed pressure was heavy and where standard treatments, especially 4 lb ai/A diuron plus 4 lb ai/A simazine, also failed to provide effective weed control. Flumioxazin applications delayed until bloom were more effective in these situations.
- Flumioxazin has substantial postemergence activity on many weeds, but control of most weeds was improved with the addition of glyphosate.

COMPARISON OF 'CLEAN CUT' VS. WIPING AND CUTTING FOR WEED CONTROL IN WILD BLUEBERRIES - DE Yarborough and K Lough, Univ. of Maine, Orono.

ABSTRACT

Wild blueberry (*Vaccinium angustifolium*) fields in Maine are infested with a variety of woody and herbaceous weeds, which reduce wild blueberry crop production and hinder harvest. In the summer of 2003, a clean-cut adapter on hand clippers and a wiper were evaluated for their effectiveness in reducing woody and herbaceous weeds. The clean-cut adaptor consists of an attachment that dispenses a thin film of herbicide on the blade of a hand-clipper, which is drawn into the roots of weeds as they are cut. A control and five treatments were applied to grey birch (*Betula populifolia*), bracken fern (*Pteridium aquilinum*) and dogbane (*Apocynum androsemifolia*) stems, each treatment was applied to ten separate stems. Treatments include stems cut once without herbicide, stems cut with 100% glyphosate (Touchdown 5 formulation), stems cut with 100% glyphosate with 2% w/v ammonium sulfate, stems wiped with a 20% v/v solution of glyphosate, and stems wiped with a 20% solution of glyphosate with 2% ammonium sulfate. Treatments were applied 27 June on bracken fern and dogbane stems at Blueberry Hill Experimental Farm in Jonesboro, ME and on 2 July on birch stems in a commercial wild blueberry field in T-18 MD, ME. In September 2003, each stem was rated for vigor and phytotoxicity of the adjacent wild blueberry plants was recorded. Results indicate the five treatments reduced the growth and survival of all three species compared to the control (Figure 1 to 3). For both dogbane and birch, cutting alone did not significantly reduce the survival of the weeds as well as the cutting with the herbicide or wiping alone or with the ammonium sulfate. There were no differences in the survival of either the woody or herbaceous weeds based on the type of application, or if ammonium sulfate was included. Application of the herbicide with the wiper resulted in more phytotoxicity to wild blueberries than with the clean-cut adapter on hand clippers for both the ferns and the dogbane, but not for the birch. A follow-up evaluation is planned for 2004 to determine the continued effectiveness of the treatments.

Figure 1. Effects of Cut and Wipe herbicide applications on dogbane

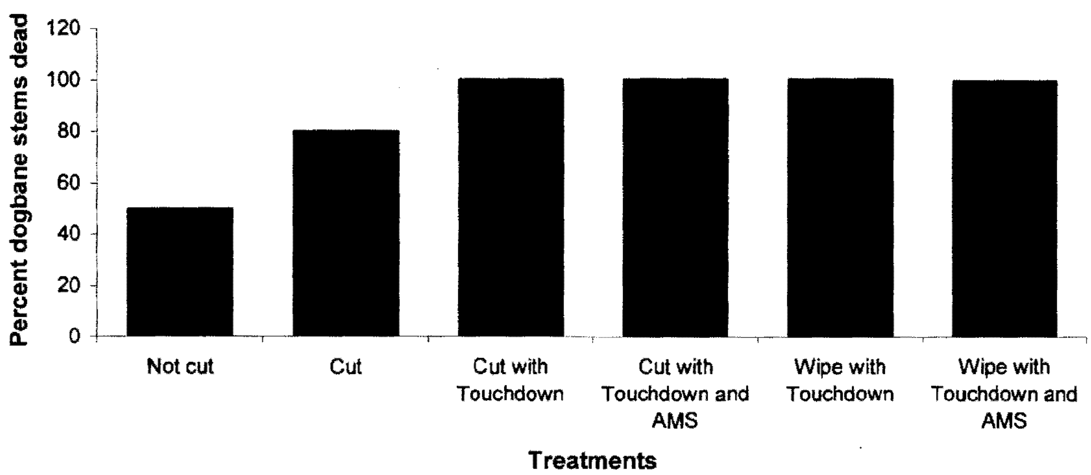


Figure 2. Effects of Cut and Wipe herbicide applications on ferns

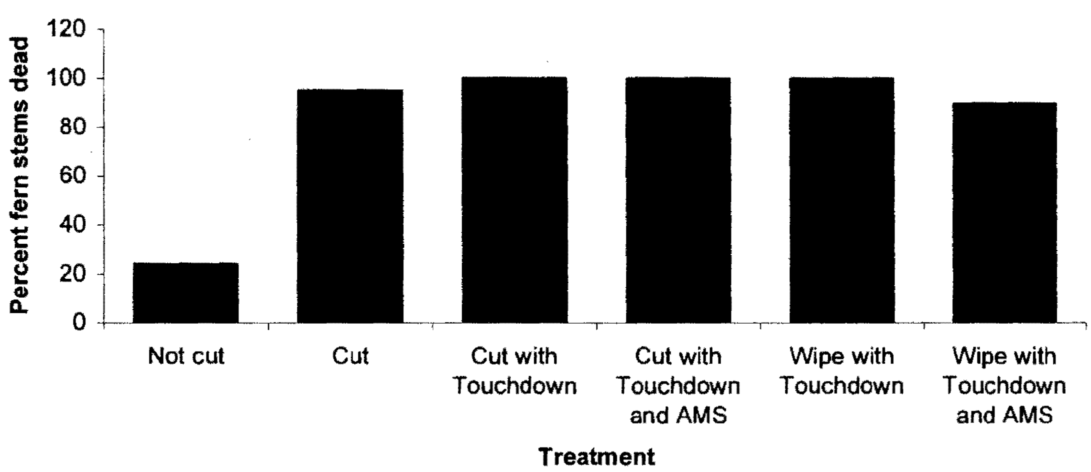
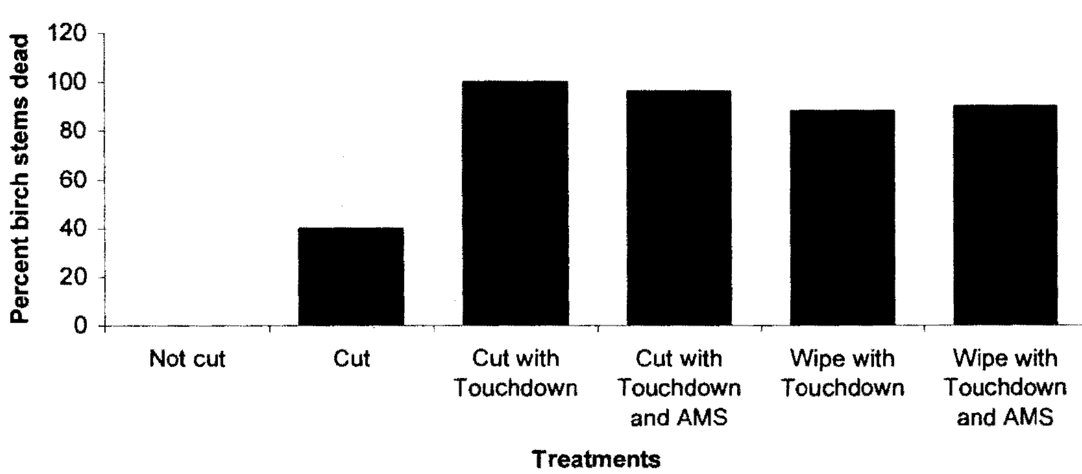


Figure 3. Effects of Cut and Wipe herbicide applications on birch trees



UTILIZATION OF MESOTRIONE FOR WEED CONTROL IN CRANBERRIES - BA Majek and AO Ayeni, Rutgers Univ., Bridgeton, NJ.

ABSTRACT

Weeds continue to cause serious problems in cranberry (*Vaccinium macrocarpon* Ait.) production. Greenhouse and field screening has identified mesotrione as a potentially useful herbicide for use in cranberries with good crop safety. Mesotrione has demonstrated good crop safety at up to 1.5 lb ai/A applied to dormant cranberries in early May, to actively growing and blooming cranberries in June, or after fruit set in July. Experiments conducted to evaluate the control of serious cranberry weeds in growers' bogs have indicated that mesotrione has the potential to control weeds that cannot currently be controlled in cranberries. Mesotrione applied at 0.375 lb ai/A in the spring has controlled false nutsedge (*Cyperus strigosus* L.), soft rush (*Juncus effusus* L.) and red-root (*Lachnanthes tinctoria* (Walt.) Ell.) when applied in May or June. Red-root control in a second study was less effective. The failure to control red-root could have been due to excessively wet conditions during and after application in 2003 or higher soil organic matter at the 2003 research site. Recent communications with the manufacturer indicated that the maximum rates of mesotrione that could be supported for registration by current environmental fate data for use in cranberries is 0.03 lb ai/A per acre per application and a maximum of 0.5 lb ai/A per year. A minimum of fourteen days is needed between applications, and a ninety day preharvest interval would be needed.

WEED MANAGEMENT IN ORGANIC BLUEBERRY SYSTEMS - WJ Sciarappa, Rutgers Cooperative Extension, Freehold, NJ; and BA Majek, Rutgers University, Bridgeton, NJ.

ABSTRACT

Weed control consistently ranks as the number one problem in organic crop production systems. Weeds are especially problematic in highbush blueberry which has a long establishment period, shallow-fibrous roots, and poor competitive ability in obtaining water, nutrients and sunlight. Weedy fields have been shown to decrease fruit yields and vegetative growth significantly as well as increase insect and disease problems. Thus, weeds need to be especially well managed prior to establishment and during the first five years of crop growth.

Commercial demonstrations at organic certified blueberry fields compared cultural management methods at two sites in NJ. The trials utilized both new and established blueberry blocks having trickle or overhead irrigation. Some common weed species in these trials include annual grasses like large crabgrass (*Digitaria sanguinalis*) and foxtail species (*Setaria spp.)*. Perennial weeds include quackgrass (*Elytrigia repens)*, goldenrod (*Solidago)* and aster species. Commercial methods investigated included rotary cultivation, mowing, propane flaming, cover crops, landscape fabric and various mulches. Mulch comparisons in the first year of this multi-year study include pine bark mulch, hardwood mulch, coffee grinds, cocoa grinds, municipal leaf mulch and composted tea leaves. Plots were 3 x 12 feet and were replicated 4 times in 4 adjoining rows. Applications of 3 to 4 inches of these mulches within the crop row to a new planting of Duke highbush blueberry have provided a combined weed control level of over 95% during 2003.

Walkway weed suppression in new plantings was achieved with the establishment of two types of fine leafed turf fescues and monthly mowings. Regular mowings since 2001 in a 30 year old established planting of a mixed stand of native weeds selected for a grass dominated row middle that allowed both equipment and customer traffic in wet spring periods. In other established blueberry fields, regular cultivation with tines and discs effectively uprooted new germinating weeds and provided clean middle rows. The rotary cultivator was found highly effective at navigating within the crop row of both new and established crops with overhead irrigation.

The organic blueberry grower may need to resort to OMRI approved materials as Scythe, Burnout, white vinegar, and corn gluten. These non-selective and non-persistent herbicides may find a place in pre-plant situations and weed management between the rows along with the cultural methods described.

ECOLOGICAL ASSESSMENT OF MUGWORT GROWTH AND REPRODUCTION - J Barney, A DiTommaso, and L Weston, Cornell Univ., Ithaca, NY.

ABSTRACT

The invasive perennial weed mugwort (*Artemisia vulgaris* L.) spreads primarily through rhizome fragments in disturbed habitats, and more recently, natural areas. The invasion and subsequent spread of this rhizomatous weed often leads to dense monospecific stands, excluding native vegetation and reducing overall biodiversity. This study reports the rates and mechanisms of vegetative proliferation of two mugwort populations (ITH-1 and ITH-2) over three growing seasons (2001 to 2003) under a disturbed fallow field habitat, and a ryegrass (*Lolium* spp.) turfgrass field, as well as being subjected to a monthly mowing versus no mowing (2 populations x 2 habitats x 2 management treatments x 3 seasons). Over the three year growing period the two mugwort populations experienced exponential growth with respect to total ramet number, with the ITH-2 population generating significantly more ramets than ITH-1 in both habitats. However, ramet numbers between the two habitats differed dramatically, with an average of between 550 and 925 for the fallow field and 90 to 550 for the turfgrass field. This difference exemplifies the variation in invasive strategy (i.e. rates of spread) between the populations, as well as between the mowing treatments. Monthly mowing had a much greater effect on treatments in the turfgrass field than in the fallow field, keeping total ramet number below 100 total ramets (500 for non-mowed) versus the fallow field where mowing reduced total ramet number by only 100. These mugwort populations were collected from Ithaca, NY, of which both were maintained identically in a landscape previous to the experiment, have shown major phenotypic differences in lateral spread, total ramet production, average height, biomass, and response to mowing. These results are important for both testing invasive potential in obligate clonally reproducing invasive species, as well as examining phenotypic (and likely genotypic) variation within a species.

ASSESSING LONG-DISTANCE SEED DISPERSAL - J Dauer, O Skarpaas, and DA Mortensen, Penn State Univ., University Park, PA.

ABSTRACT

Weed management requires adequate knowledge of weed population dynamics, including dispersal. A number of theoretical and empirical studies suggest that long-distance dispersal is a critical determinant of invasion speed and the regional dynamics of established plants. Unfortunately, solid empirical data on dispersal distances are lacking for most wind dispersed weed species. Studies conducted on two wind dispersed species, musk thistle (*Carduus nutans* L.), and horseweed (*Conyza canadensis* L.), suggest that long distance dispersal greatly affects how we plan to manage these difficult to control weeds. Thistles are large plants (up to 3 m tall) that quickly establish in pastures and reach densities of 25 plants m^{-2}, which readily reduces forage quality and habitable grazing pastures. Horseweed may affect crop yield even at low densities (5 to 15 plant m^{-2}) and is an increasing concern as more farmers adopt no-tillage crop production. High fecundity (musk thistle ~ 20,000; horseweed ~ 150,000 seeds per plant) and very low settlement velocities (musk thistle 0.422 m s^{-1}; horseweed 0.278 m s^{-1}) suggest a high potential for long-distance dispersal. Two studies isolated seed sources and surrounded them with sticky traps. Traps were located up to 120 m for musk thistle and 500 m for horseweed. Traps were concentrated more heavily in the prevailing wind direction in an effort to characterize the dispersal kernel for each species. Musk thistle seed were observed to travel more than 40 m in moderate winds. Horseweed seed were trapped at 350 m in the prevailing wind direction but were most concentrated to 200 m. The measured maxima are based on a very small sample of the seeds dispersed, and are likely to grossly underestimate true maximum dispersal distances. Both species' seeds can easily move out of a single field to affect adjacent fields or neighboring farms. Therefore maintaining field quality and yield requires management that should not be limited to singular fields, but rather expanded to a local or regional scale.

HOW DO *BRASSICA* COVER CROP RESIDUES HELP MANAGE WEEDS? EFFECTS ON SEEDLING RECRUITMENT AND PLANT GROWTH - ER Haramoto, E Gallandt, and T Molloy, Univ. of Maine, Orono.

ABSTRACT

In addition to important contributions to soil quality, the practice of cover cropping may provide benefits to farmers seeking to reduce herbicide use. The residue-mediated effects of cover crops on weeds may include physical, biological, and chemical impacts on all stages of a weed's life cycle. With certain cover crops, allelopathy, a chemical residue-mediated effect, may operate through a reduction in the establishment of weeds and a suppression of the growth of those that are recruited to the community. Members of the Brassicaceae can be used as cover crops in the northeast and have promising allelopathic potential due to their glucosinolate content. Glucosinolates hydrolyze to form compounds toxic to a variety of organisms including seeds, fungal propagules, and insects. Brassicas vary widely in glucosinolate concentration. Canola (*Brassica napus*), for example, is bred to contain very low concentrations of glucosinolates, mustards (such as *Sinapis alba*) typically have very high concentrations, and rapeseed (also *Brassica napus*) is of intermediate glucosinolate content. To examine the effects of brassica cover crop residues on weed and crop emergence and growth, two experiments were conducted in 2002 and 2003 in Stillwater, ME.

In one experiment, crop and weed seeds were planted following an early season fallow treatment, incorporation of brassica residues (canola, rapeseed, and yellow mustard), and incorporation of non-brassica residues, including buckwheat (*Fagopyrum esculentum*), crimson clover (*Trifolium incarnatum*), and oats (*Avena sativa*). It was hypothesized that total emergence would be lower following the glucosinolate-containing brassicas, particularly the high-glucosinolate yellow mustard. Because larger-seeded species generally are better able to tolerate stresses, it was also hypothesized that reductions in emergence would be inversely proportional to seed size. All cover crop residues reduced seedling emergence relative to the fallow treatment ($p<0.001$ in both years), however, contrary to expectations, emergence following brassicas and non-brassicas was similar ($p=0.406$ in 2002, $p=0.703$ in 2003). Seed size differences failed to explain variation in the number of seeds that emerged ($p=0.567$ in 2002, $p=0.899$ in 2003).

The second experiment examined the effect of incorporated mustard and canola residues on redroot pigweed (*Amaranthus retroflexus*) and green bean (*Phaseolus vulgaris*) growth when grown in monoculture and in mixture. It was hypothesized that redroot pigweed growth would be slower following residue incorporation, with the high-glucosinolate mustard causing more of a reduction in growth. Because the larger-seeded green bean would better tolerate residue-mediated stresses, it was hypothesized that green bean, when grown with pigweed, would have a competitive advantage following canola and mustard residues and would suffer less yield loss. Contrary to these hypotheses, brassica cover crop residues did not decrease the biomass of redroot pigweed at any of the six sampling dates. Per-plant bean biomass was lower following mustard and canola residues at two early sampling dates in 2002 ($p=0.035$ for first sample; $p=0.036$ for second sample), but exhibited enough

compensatory growth so that biomass was equal in all treatments by the end of the season ($p=0.208$ in 2002; $p=0.559$ in 2003). Yield of harvestable beans did not differ between cover crop treatments in either year ($p=0.393$ in 2002; $p=0.156$ in 2003), but yield of beans grown with pigweed was significantly lower than that of beans grown alone ($p<0.001$ in both years). Plant height, leaf area, and relative growth rates were similar following the two residue treatments and fallow.

Despite the presence of glucosinolates in the incorporated residues, the residue-mediated effects of brassicas on weed dynamics appear to be similar to other commonly grown cover crops. Thus, while brassica cover crops may provide distinct advantages over other cover crop species for suppression of soil-borne insects and pathogens, their effects on weed recruitment and growth appear to be similar to other cover crop residues.

SPECIES COMPOSITION OF THE WEED SEED-BANK WITH VARYING CROP AND SOIL MANAGEMENT IN OHIO - LM Sosnoskie and J Cardina, Ohio State Univ., Wooster.

ABSTRACT

Weed density, species diversity, and community composition in the soil seedbank was characterized in a long-term study with three crop sequences (continuous corn, corn-soybean, and corn-oat-hay) and three tillage systems (conventional-, minimum- and no-tillage). Germinable seeds were identified and counted in the top 10 cm of soil in early spring (1997 to 1999) to calculate seed density, species diversity indices, and a synthetic relative importance index for each species. Repeated measures ANOVA showed that total seed density differed with crop sequence and tillage system, with an interaction among these factors and years. Seed density was higher in the continuous corn than the other crop sequences (two of three years), and higher in no-tillage than other tillage systems. There were more species in the corn-oat-hay sequence than in corn-soybean or continuous corn, and species diversity declined with increasing soil disturbance. Canonical discriminant analysis showed that the first axis explained the greatest amount of the within-subjects variation for species composition and was strongly associated with crop sequence, for all three years. Plots planted to corn-oat-hay clustered separately in a two-dimensional plot, derived using the first two canonical axes, from those in continuous corn and corn-soybean. Tillage system did not separate to a similar degree along any axis, suggesting that crop rotation was more important in influencing community composition. Weed control and other cultural practices in the corn-oat-hay system favored species with life-history characteristics (i.e. prostrate growth habit, with fibrous root systems) that differ from species more commonly associated with corn and soybean systems.

NATURAL VEGETATION AND ITS INFLUENCE ON WEED POPULATIONS IN NEIGHBORING CROP FIELDS - ST Jelinek, JP Mueller, and MG Burton, North Carolina State Univ., Raleigh.

ABSTRACT

Natural vegetation on farms such as field borders and wooded areas provide increased biodiversity, structural diversity, habitat for wildlife and beneficial insects, and can act as protective buffers against agrochemical drift. Nevertheless, farmers frequently view these areas as potential sources of weeds, pests, and diseases. Weed species diversity and density were examined in cropland bordered by natural versus managed areas to determine if differences in weed infestation exist. Weed density was measured in crop fields along permanent transects that extended from field borders to the center of the crop fields. Transect data from fields with borders of natural vegetation were compared to transect data from fields with managed borders using analysis of variance. Weed abundance within the fields did not differ as a consequence of field border type.

WEED DYNAMICS IN MAIZE PLANTED ON ANTHROPOGENIC TERRA PRETA DE ÍNDIO AND SURROUNDING OXISOLS IN THE CENTRAL BRAZILIAN AMAZON - J Major, A DiTommaso, Cornell Univ., Ithaca, NY; and CR Clement, Instituto Nacional de Pesquisa da Amazônia (INPA), Manaus, Brazil.

ABSTRACT

Soils in the Amazon basin are generally considered to be nutrient-impoverished. However, there are areas of black, highly fertile anthropogenic soils, called 'Terra Preta de Índio' (Indigenous Black Earth, TP) that are distinctly different from the dominant, nutrient-poor adjacent soils (AS). These areas were likely formed by activities of indigenous peoples in Pre-Columbian times. Surprisingly, TP soils have generally maintained their high fertility levels. The fertility of TP soils allows for more intensive crop management and reduces the need to frequently clear surrounding forest. The TP system also affords a unique opportunity to study the effect of high fertility on weed-crop competitive dynamics under tropical growing conditions.

The primary focus of this work was to compare weed population dynamics and crop growth in TP and AS soils. From January to July 2003, field studies were conducted at four different locations near Manaus (Amazonas, Brazil), on land that had been prepared using traditional slash-and burn techniques. At each location, two maize (*Zea mays* L.) plantings were carried out, one on TP and one on AS. Thus, for the four sites, a total of eight plantings were established. In each planting, three treatments were applied in a completely randomized block design: (i) weeds only with no crop, (ii) maize plus weeds, and (iii) maize crop weeded monthly using a hoe. The maize plantings were visited monthly for four months and various weed and maize population parameters were recorded. At harvest, maize and weed biomass were obtained.

Site history varied widely between the two soil types and study sites, so weed and maize dynamics are discussed in relation to the 8 plantings used in the study. While there was no significant treatment effect on maize performance, soil effects on maize height, cob and stalk biomass were most striking at sites where fertility differences between TP and AS were greatest. At two of the locations, the TP had been severely degraded and maize performance was quite poor. The weeded treatment had significantly fewer weeds, lower weed percentage ground cover and biomass at harvest than either maize plus weeds or weeds only treatments. Positive weed responses in TP soils were also most obvious at locations where the TP was significantly more fertile than the AS. Legume and annual weedy species were generally more abundant and had greater cover on TP plantings than AS plantings. The reproductive strategy (i.e. sexual or vegetative) most common on each site was highly dependent on past site history use.

Findings from this research support previous results showing that weed populations are highly variable between and within agricultural fields, including in tropical regions. This variability has important crop and weed management implications in Amazonian regions of Brazil.

A GROWER FRIENDLY WEB DATABASE OF WEED BIOLOGY AND ECOLOGICAL WEED MANAGEMENT - C Mohler and A DiTommaso, Cornell Univ., Ithaca, NY.

ABSTRACT

Integrated Weed Management requires grower access to information about weeds and weed management for its success. Although information on weed management with herbicides is readily available to growers from a variety of sources, farmer friendly information on the ecology of weeds and ecologically based approaches to weed management is scarce. To increase access to information on weed ecology and management, we are developing an extensive internet-accessible database. The database has two principal components; (1) a "toolbox" that consists of short descriptions of ecologically-based weed management methods and aspects of weed biology, and (2) descriptions of individual species. The latter includes (i) a taxonomic description and color photographs of various life stages to assist in identification, (ii) information about the biology and ecology of the species, and (iii) information on ecological approaches to management that refer to the "toolbox" for additional detail. Other parts of the database include bibliographies on weed identification and weed management, summary tables of weed characteristics, and pop-up definitions of terms. The principal target audience for the database is home and market vegetable gardeners, but much of the information will be useful to extension personnel, students and large-scale crop farmers. The database can be accessed at http://www.css.cornell.edu/WeedEco/WeedDatabase.

Topics covered in the "toolbox" include both practical management and basic information on weed biology. Topics include: what is a weed?; weed early and shallow; pulling weeds; hoeing weeds; flame weeding; exhaust perennial roots; remove storage organs; target nutrients and water; crop competitiveness (dense planting, solid seeding, use competitive varieties, use transplants, planting date, and intercropping); summer cover crops; winter cover crops; timing of germination; tillage and germination; clean fallow; crop rotation and germination; crop rotation and weeding; organic mulches (weed seeds in mulch, when to mulch, how much mulch, notes on particular mulches); synthetic mulches (weeds along edges, irrigation and mulch, disposal, spun ground covers, old carpeting); soil tilth and weeding; new gardens; weeds along fences; seeds in compost; chickens for weed control; photosynthetic pathways; seed weight; reproductive styles; and seed longevity.

Biological data for individual species includes: origin and distribution; seed weight; dormancy and germination; seed longevity; dispersal; timing of emergence in ny; emergence depth; photosynthetic pathway; sensitivity to frost; drought tolerance; response to fertility; soil physical requirements; response to shade; sensitivity to disturbance; time from emergence to flowering; pollination; reproduction; common natural enemies; crop diseases hosted; crop damaging insects hosted; and palatability. Currently, the species portion of the database covers only 12 species, but we are seeking funding to expand this to include the 80 most common agricultural weeds in the Northeast.

DIVERSITY AND INTENSITY OF COVER CROPPING SYSTEMS: EFFECTS ON WEED SEEDBANK DYNAMICS - E Gallandt and T Molloy, Univ. of Maine, Orono.

ABSTRACT

Surveys at the national as well as state level indicate that weed management is the foremost production-related problem faced by organic and diversified vegetable farmers, and mechanical tillage is their principle weed management method. Considering the multiple points at which cover cropping practices may contribute to these goals, a cropping systems comparison was initiated in 2001 featuring the following: (a) A conventionally-managed 2-year rotation of broccoli and winter squash; (b) an organic, "land-limited" system, also a 2-year rotation of broccoli and winter squash, but with winter cover crops (e.g., rye/hairy vetch) planted following harvest of the cash crops; (c) an organic, 4-year rotation of broccoli, winter squash, cereal/red clover, and red clover sod; and (d) an organic, 4-year rotation including broccoli, cover crop/summer fallow/cover crop, winter squash, and cover crop/summer fallow/cover crop. The germinable weed seedbank, weed biomass, seed production, and satellite trials focused on seed predators characterize the effects of these cover cropping practices on annual weed dynamics. After the first season the density of germinable *Chenopodium album* seeds was greater following winter squash in each system (4060 m^{-2} to 10 cm depth) compared to following broccoli (1100 m^{-2} to 10 cm depth). The decline in the seedbank due to the disturbance-intensive cover cropping practices (d, above) was evident in comparison to the sod-based cover cropping system (c, above), with mean densities of 1200 and 4600 germinable C. album seeds m^{-2}, respectively. This systems comparison highlights the challenge offered by crops likely to have high levels of seed rain, e.g., winter squash, and promises to refine our ability to recommend cover cropping practices based on weed management requirements.

EFFECTS OF COVER CROPPING SYSTEMS ON RESIDENT WEED SEED PREDATORS - R Lynch and E Gallandt, Univ. of Maine, Orono.

ABSTRACT

Low-input, organic, and diversified vegetable producers share the need for strategies that reduce weed seedbank densities while maintaining or improving soil quality. It is hypothesized that sod-based cover crops will encourage the activity of invertebrate seed predators as demonstrated by pitfall trapping and the resultant activity-density parameter. Furthermore, disturbance associated with summer fallowing will reduce opportunities for seed predation. Based on the potential contributions of cover cropping practices to both weed and soil management, in 2001 a cropping systems comparison was initiated composed of: (a) a conventionally-managed 2-year rotation of broccoli and winter squash; (b) an organic, "land-limited" system, also a 2-year rotation of broccoli and winter squash, but with winter cover crops (e.g., rye/hairy vetch) planted following harvest of the cash crops; (c) an organic, 4-year rotation of broccoli, winter squash, cereal/red clover, and red clover sod; and (d) an organic, 4-year rotation including broccoli, cover crop/summer fallow/cover crop, winter squash, and cover crop/summer fallow/cover crop. Quantification of seed predation in these cover-cropping systems will guide decisions related to soil disturbance and the management of reproductive weeds on organic and diversified vegetable farms. The predominant invertebrate seed predator was a carabid beetle, *Harpalus rufipes*. Pitfall trap counts in August 2002 and 2003 revealed considerable greater density-activity of *H. rufipes* in vegetated plots compared to those recently tilled and planted to a fall cover crop of oat. To determine the rate of seed predation caused by resident invertebrates, a typical "feeding" trial was conducted in which 25 seeds of each of six weed species were placed in the field. Averaged over weed species (interaction $P = 0.441$), seed recovery was 89% with vertebrate plus invertebrate exclosures, intermediate at 55% with the vertebrate exclosures, and least at 43% with no exclosure ($P < 0.001$). Buried seeds would likely experience considerably lower predation rates, raising to question recommendation for fall cover cropping following a crop with abundant weed seed rain.

BREEDING FOR INCREASED RYE ALLELOPATHY - C Reberg-Horton, Univ. of Maine, Orono; NG Creamer, and JP Murphy, North Carolina State Univ., Raleigh.

ABSTRACT

The rye breeding program at North Carolina State University was started in 2001 to develop a rye cover crop with higher allelochemical content. Petri-dish bioassays were used to screen hundreds of rye accessions for their ability to inhibit root elongation. Those accessions exhibiting the most inhibition were chosen to cross with the widely adapted cultivar 'Wrens Abruzzi' and create a synthetic population. This population was randomly mated and will be available for screening and heritability studies in 2004. Bioassays, field studies and chemical composition studies could be employed to assess the heritability of allelopathic potential and determine whether this trait can be bred for. The initial bioassay screening revealed that 70% of the rye accessions severely inhibited goosegrass (*Eleusine indica* (L.) Gaertn.) root elongation whereas only 16% of the accessions severely inhibited pigweed (*Amaranthus retroflexus* L.). Those most toxic to pigweed were also effective against goosegrass, suggesting it may be possible to breed for "broad spectrum" allelopathic potential. If petri dish bioassays form the core of the selection process, the question of what simple bioassays are actually measuring becomes important. Some screening with other methods will be necessary to prevent selection for compounds that are toxic in petri dishes but ineffective in the field environment. Field trials and studies of individual chemical components could be combined with the petri dish selection to monitor improvement of allelochemical production.

THE EFFECT OF CROP SPATIAL PATTERN ON WEED SUPPRESSION IN SPRING WHEAT - L Kristensen, Cornell Univ., Ithaca, NY; J Olsen, and J Weiner, KVL Botanical Section, Kopenhagen, Denmark.

ABSTRACT

Recent advances in understanding competition among individual plants suggest that the potential for many crops to suppress weeds is much greater than appreciated. Crop-weed competition in cereals was investigated by varying seeding rate (crop density) of spring wheat (*Triticum aestivum* L. cv. Leguan) and sowing pattern (spatial distribution). Five field experiments were carried out from 2001 to 2003, using three crop densities (200, 450, 720 seeds m^{-2}), and two sowing patterns: normal row pattern (12.8 cm) and a uniform (grid-like) pattern with equidistant spacing within and between rows. A modified precision sowing machine designed for row vegetables (Kverneland Accord Corporation, Soest, Germany) was used to sow wheat in the two dimensional grid, and a standard sowing machine with 12.8 cm row spacing to sow in the normal row pattern. To achieve a uniform grid pattern, the precision seeder was adjusted to have the same mean seed spacing and row width. Thus, in the uniform planting pattern, the row distance changed with density. The experiments were carried out at The Royal Veterinary and Agricultural University research farm in Taastrup, Denmark (55°40′N, 12°18′E). The soil is a sandy clay loam typical of eastern Zealand, Denmark. Different density-pattern combinations were tested with 4 different weed species: Common lambsquarters (*Chenopodium album*), ryegrass (*Lolium multiflorum*), yellow mustard (*Sinapis alba*) and common chickweed (*Stellaria media*) over two years, and with different fertilization regimes, ranging from 0 to 80 kg N ha^{-1}, over three years.

Results indicate that improved weed suppression can be achieved by a combination of increased crop density and more uniform crop spatial planting pattern. Significant differences were observed between weed species. Nitrogen fertilization regime significantly influenced competition between the wheat crop and weeds.

Weed biomass decreased 16 to 31% in the uniform pattern compared with the row pattern depending on year and experimental conditions. In one of the five experiments, the uniform planting pattern resulted in increased weed biomass. Crop biomass was 8 to 16% greater in the uniform pattern compared with the row pattern depending on year and experimental conditions. In general, the yield advantage of the uniform planting pattern ranged from 5 to 25% compared with the typical row pattern. In several instances, this effect was evident only at low and medium crop densities. Findings from this work suggest that increased density and increased uniformity of planting have a substantial impact on weed management in spring wheat cropping systems where no herbicides are available (i.e. organic cropping systems). However, technological developments are needed to facilitate the implementation of these methods into current agricultural practices.

CHARACTERISTICS AND SIGNIFICANCE OF JAPANESE KNOTWEED: AN INVASIVE SPECIES - P Bhowmik, N Tharayil-Santhakumar, and D Sanyal, Univ. of Massachusetts, Amherst.

ABSTRACT

Japanese knotweed (*Polygonum cuspidatum* Sieb. & Zucc.), is an invasive, herbaceous perennial species. It belongs to Polygonaceae family. A native of South-East Asia, the species was introduced to Europe in 1825 as an ornamental hedge and for erosion control. Japanese knotweed was subsequently introduced to the United States by late nineteenth century. Because of its tenuous growth habit it escaped from cultivation and is currently one of the serious weeds in 36 states of the U.S. Japanese knotweed is primarily found along the riverbanks. However, it colonizes a wide variety of habitats such as wetlands, waste places, along roadways, and other disturbed areas. Japanese knotweed is an erect, herbaceous, rhizomatous perennial that can grow over ten feet in height. Stems are hollow, smooth, stout and are swollen at the nodes. Leaves are normally about 6 inches long by 3 to 4 inches wide, broadly ovate to somewhat triangular with pointed tips. Plants are strictly dioecious, and except from its native habitat, the occurrence of male plants is very rare. Populations rely solely on vegetative regeneration of rhizomes and fresh stems for propagation. It has an extensive rhizome system that extends to about 20 feet laterally and to a depth of 6 to 7 feet. Rhizomes can sprout from 1 m depth. New shoots appear in early spring from underground rhizomes after over-wintering. Above ground plant growth is very rapid (stem elongation of 3 inch/day). The plants become very competitive with large foliar canopy growth. Established plants flower in late August or early September. Flowers are greenish white and on a branched panicle. Fruits are 3-angled achenes. In general, plants senesce after reproduction, and the above ground parts are killed by the first frost. It thrives on disturbance and has been spread by both natural means and by human activity. Japanese knotweed poses a severe threat to riparian habitats since it can survive severe floods and can rapidly colonize scoured shores and islands. It spreads quickly to form dense monoculture stands by crowding out all other native vegetation, and greatly alter the natural ecosystem. Established Japanese knotweed populations are extremely persistent, and are difficult to control. High regenerative capacity of the stem and rhizome fragments makes mechanical control more difficult. However, cutting the stem at least 3 to 4 times during the growing season is found to offset rhizome production. Glyphosate at 2.2 lb ai/A when applied to the foliage during early to mid summer controls Japanese knotweed effectively. Repeat applications over several years might be an effective method for complete control. Finally, this species should be monitored carefully for its future infestation in other habitats.

FUNGICIDE CONTROL OF THE BIOLOGICAL CONTROL CANDIDATE *COLLETOTRICHUM GLOEOSPORIOIDES* ON SPINACH - C Cavin and WL Bruckart III, USDA-ARS, Fort Detrick, MD.

ABSTRACT

A Hungarian strain of *Colletotrichum gloeosporioides* is under evaluation for biological control of Russian thistle (*Salsola tragus*) in the United States. This strain kills *S. tragus*, but it does not affect another *Salsola* sp. closely related to *S. tragus*, referred to as Type B (Ryan and Ayres 2000). In preliminary tests, symptoms of infection were noted on spinach (*Spinacia oleracea*) on older leaves or when it was bolting and in flower, suggesting that the fungus is manifest in older or senescent tissues. Although this indicates that spinach for vegetable production would not likely be at risk from the use of this isolate in the U.S., if permitted for biological control, there may be other mitigating factors and options that would essentially eliminate the risk to spinach. The objective of this study, then, was to test whether fungicides used in commercial spinach production for foliar disease control would also control either the isolate of *C. gloeosporioides*, which is under investigation for biological control of Russian thistle, or *C. dematium*, a U.S. pathogen of spinach.

Recently, a test with Kocide® 2000 (53.8% Copper hydroxide; Griffin LLC, Valdosta, GA), registered for control of foliar diseases on spinach, was run in a 2 by 3 factorial treatment design including all combinations of the fungicide and two pathogens. The objective was to determine if such a fungicide would also provide protection against the Russian thistle isolate of *C. gloeosporioides*. Kocide was applied to half of 4 wk old spinach plants at the rate of 2.25 lb/acre (= 2.52 kg/ha). The plants were then treated either with *C. dematium, C. gloeosporioides*, or they were left uninoculated. Inoculum of *C. gloeosporioides* was applied at the rate of $1x10^6$ conidia/ml, and *C. dematium* inoculum concentration averaged $0.5x10^6$ conidia/ml; the experiment was replicated three times. Inoculum was applied in water until plants were wet. There were 10 plants per treatment combination. Plants were given dew for 16 hr at 25 C overnight and then placed in a greenhouse at 20 C with a 12 hr photoperiod using supplemental lighting. Plants were rated weekly for disease symptoms. After 4 wk, plants were harvested and both fresh and dry weights were measured. Flowering or senescence of spinach was not significant in this experiment.

Results of the study indicate there were no differences between treatments with *C. gloeosporioides*, with or without Kocide, and the controls. However, spinach plants inoculated with *C. dematium* had less biomass than controls. Least square means of the $\log_{10}$ (fresh wt + 0.1), after covariate analysis with $\log_{10}$ (dry wt + 0.1), were 0.343 for *C. dematium*, 0.346 for *C. dematium* plus Kocide, and 0.369 for the Controls (probabilities that *C. dematium* treatment means = controls: 0.036 and 0.060, respectively). Under conditions of the experiment, therefore, *C. dematium* caused infection and damage to spinach, while *C. gloeosporioides*, even at twice the inoculum concentration, did not. Under these conditions of high inoculum load and optimal conditions for infection, Kocide did not protect spinach inoculated with *C. dematium*. This experiment is being repeated with Quadris® (Azoxystrobin Technical, 22.9%) at 6.2 oz/a (= 0.43 kg/ha), another fungicide registered for control of spinach leaf diseases.

Spinach, despite some minor infections noted in earlier experiments on bolting or senescent plants, was not damaged by *C. gloeosporioides* in this study. By comparison, *C. dematium*, a pathogen manageable in commercial spinach production by fungicides, caused significant biomass loss. Data in the present experiment do not provide evidence for conclusions about the effectiveness of Kocide for control of *C. gloeosporioides* (or *C. dematium*, for that matter) on spinach.

LITERATURE CITED

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GREENHOUSE EVALUATION OF *CERCOSPORELLA ACROPTILI* FOR BIOLOGICAL CONTROL OF RUSSIAN KNAPWEED - F Eskandari and WL Bruckart III, USDA-ARS, Fort Detrick, MD.

ABSTRACT

Russian knapweed (*Acroptilon repens*) is a major weed pest of the western rangelands, displacing valuable forage often in monoculture stands. It is a perennial species introduced in the late 19th century probably as a contaminant of alfalfa seed from Turkistan. Russian knapweed spreads primarily by roots, although viable seeds are produced as well. It is unpalatable to grazing animals and is of low value as a forage plant. Two introduced biological control agents, a mite (*Aceria acroptiloni*) and a nematode (*Subanguina picridis*), along with a rust fungus (*Puccinia acroptili*) already present in North America, have not reduced stand densities. A pathogen from Turkey, discovered by R. Sobhian (USDA-EBCL, Montpellier, France), was submitted for evaluation as a candidate for biological control of Russian knapweed in the U.S. Objectives of this study were to isolate and identify the fungus, satisfy Koch's postulates for pathogenicity, and conduct preliminary evaluations on its potential to control of Russian knapweed.

The fungus was isolated and identified originally as *Ramularia acroptili*. It was renamed by Uve Braun and colleagues as *Cercosporella acroptili*. Sporulation is best on modified potato carrot agar (broth from 140 g each of potatoes and carrots, 15 g agar, 1 liter water), and conidia harvested from cultures are suspended in water and sprayed on healthy plants. Plants maintained under continuous light in dew chambers set at 12, 15, 20, and 23 C air temperatures were removed after 4, 8, 12, 16, 20, 24, 36, and 48 hr, placed in a greenhouse at 25 C and monitored for symptoms. The most infection developed on plants given 48 hr dew at 23 C. Plants inoculated with 10^6 conidia/ml, given 48 hr dew at 23 C under continuous light were harvested two months after inoculation. Average root fresh and dry weights from inoculated plants were 17.7 and 4.64 g, respectively, significantly less than controls (22.8 and 6.49 g, respectively; $P = 0.008$ and 0.002, respectively). More recently, an attempt was made to find conditions of dew and temperature that were more realistic and reflective of expected natural conditions. Inoculated plants were exposed to three different lighting regimes at 23 C: continuous dark, 8-hr photoperiod, and continuous light, for a 48 hr dew period. Significantly more disease occurred on plants kept in the dark than on plants under continuous light, and the amount of disease on plants exposed to an 8-hr photoperiod was intermediate to disease from the two lighting extremes.

Cercosporella acroptili is capable of damaging Russian knapweed in greenhouse tests and it is limited in its host range to Russian knapweed in tests of closely related plants in the Tribe Cardueae of the Asteraceae. It has been difficult to measure damage to the target in greenhouse tests, particularly when plants are large and perennial in nature. Future studies will focus on clarifying the potential damage *C. acroptili* can cause to Russian knapweed, completion of host range studies, and if reasonable, propose introduction of this fungus into the U.S. for biological control of Russian knapweed.

EFFICACY OF FLOODING FOR THE CONTROL OF DODDER AND SEVERAL BROAD-LEAVED SPECIES IN COMMERCIAL CRANBERRY PRODUCTION IN SOUTHEASTERN MASSACHUSETTS - HA Sandler and J Mason, Univ. of Massachusetts, East Wareham.

ABSTRACT

One of the most problematic weeds in the MA cranberry industry is swamp dodder, an obligate shoot parasite capable of significantly reducing cranberry yields. Current recommendations include the use of cultural practices (e.g., sanding) along with herbicides to manage this pest. Anecdotal evidence from growers indicated that short floods may reduce dodder growth in the treatment year. To investigate the potential of integrating non-chemical alternatives into the management plan for dodder on commercial cranberry farms, a 2-year project was initiated in 2002 to determine the efficacy of short-term floods (24 to 48 hr) for the control of dodder. This project also included evaluating a 10-day summer flood for the control of broadleaf species.

The broadleaf flood study included one paired site in the first year only, and the flood was held July 2 to 11, 2002. Thirteen weed species were identified. Vegetation surveys conducted on the 10-day flood study indicated lower species richness, species diversity, and percentage weed coverage on the flooded piece compared to the control. Unfortunately, plots markers were removed, preventing second-year evaluation.

Several flooded/non-flooded pairs were evaluated for dodder control in each year. Floods were placed on the treatment piece in early-mid May. Two different methods of assessing dodder response to the flooding treatment were used. In Year 1, attached dodder stems were collected from random 460-cm^2 quadrats of parasitized cranberry vines 10 wk post-flood. Dodder was removed by hand, and fresh and dry biomass was recorded for each pair. This method introduced sampling subjectivity since dodder infestations are very patchy, encouraging the selection of areas that had obvious emergent dodder growth. To increase the objectivity in assessing dodder response, 6 small mesh pouches with equivalent amounts of dodder seed were placed in each test location (prior to the flood) in Year 2. Pouches were retrieved after the flood was removed, the seeds were incubated, and percentage germination was determined.

In Year 1, paired t-tests indicated that dodder stem weights were lower on flooded pieces in 3 out of 7 locations. In 2 additional locations, the flooded bog was paired with a historically low-infestation piece, and this may have masked the dodder reduction achieved in the flooded piece. In Year 2, no differences in the number of germinated seedlings between the 5 treatment pairs were noted. The lack of treatment effect may be related to the timing of the flood and seedling emergence patterns. Year 2 floods were put on about 1 wk of initial dodder germination, whereas floods in Year 1 were put on about 3 wk after initial germination. Likely, timing the flood to coincide with a certain period of seedling emergence is important for obtaining significant dodder reduction. Further research is warranted to ascertain the susceptible timeframe of the parasite's life cycle. Despite the lack of control seen in Year 2, flooding may offer a viable option that can be integrated into the overall management plan for several problematic cranberry weed species, especially dodder.

A METHOD FOR INVESTIGATING THE INFLUENCE OF SOIL WATER POTENTIAL ON WEED SEED GERMINATION - L Kristensen, A DiTommaso, C Mohler, and R Schindelbeck, Cornell Univ., Ithaca, NY.

ABSTRACT

Soil conservation and weed management are two major areas of concern in agricultural production. Mulch can contribute to the suppression of weeds, by shading and/or by releasing compounds that inhibit weed seed germination. Mulches impact soil water and temperature dynamics, and thus indirectly affect weed seed germination. The work reported here is a component of a Multistate Research Project titled: Improved weed control through residue management and crop rotation. One objective of this research is to explore the effect of water potential on the seed germinability of common agronomic weeds through a series of studies including 1) germination of seeds from three weed species; velvetleaf (*Abutilon theoprasti*), barnyardgrass (*Echinochloa crus-galli*) and giant foxtail (*Setaria faberi*) in polyethylene glycol (PEG) at water potentials ranging from 0 to -1000 kPa. Germination data of common lambsquarters (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*), and common ragweed (*Ambrosia artemisiifolia*) in PEG have been published by other workers and will be used as baseline data in this research, and 2) germination of weed seeds from these six species in potted soil (i.e. solid matrix) at water potentials ranging from 0 to -1000 kPa and at varying amounts of added rye-mulch.

The objective of the sub-project presented here is to develop a method for studying the impact of both soil water potential and mulch under controlled laboratory conditions and to compare germination results with findings obtained at different water potentials using the PEG solution. There are two main problems when germinating seeds at fixed water potentials in pots: 1) maintenance of a stable moisture environment (i.e. to compensate for evaporative losses, etc.), and 2) continuous measurement of soil water content (e.g. by using time-domain reflectometry) in order to monitor and ensure stable experimental conditions. To overcome these constraints, a self-regulating system was developed. The test sample is placed on porous ceramic pressure plate equipped with a hanging water column. The pressure plate system can be set to constant water potential which 1) compensates for evaporation by drawing water from a reservoir or 2) removes surplus water through tension from the hanging water column. This approach is based on traditional methods aimed at measuring the non-capillary porosity of soil samples. The disadvantage of this method is that a maximum of -80 kPa can be achieved due to the physical properties of water.

A pilot study was conducted to evaluate the potential use of this method for measuring seed germination. Velvetleaf seeds were germinated in a solid matrix at -5 kPa and at -80 kPa, at 5 and 20°C, and with and without rye-mulch, respectively. The solid matrix used was comprised of homogenous glass beads 27mm in size. Germination was recorded daily for 21 days with results expressed as germination percentages.

Findings from these preliminary experiments are presented and compared with results from the PEG studies. Methodological challenges of this approach are also discussed.

ECOTYPIC VARIATION IN GERMINATION RESPONSE OF POWELL AMARANTH SEEDS TO AMMONIUM NITRATE - DC Brainard, A DiTommaso, and C Mohler, Cornell Univ., Ithaca, NY.

ABSTRACT

Manipulation of the rate and timing of fertilization may facilitate weed management by reducing the number of weeds emerging synchronously with crops. The objectives were 1) to assess the influence of ammonium nitrate (NH_4NO_3) fertilization rate and timing on emergence of seeds of the nitrophilic annual species *Amaranthus powellii* (=Powell amaranth or green pigweed) and 2) to evaluate whether seed response varied significantly by cropping system of origin. It was hypothesized that 1) emergence of seeds of *A. powellii* would be stimulated by N applications, 2) split applications of N would result in reduced early emergence of A. powelli, and 3) *A. powellii* seeds originating on farms using synthetic fertilizers ('conventional farms') would be more responsive to NH_4NO_3 applications than those originating from farms using organic sources of N ('organic farms'). Seeds from 5 conventional and 5 organic vegetable farms in Central New York State were collected in the fall and grown for a second generation under greenhouse conditions in order to control for maternal environmental effects on seed dormancy. Second generation seeds were sown in the field the following summer and treated with two total fertilizer rates (45 or 180 kg N/ha) applied all at once or in two equal split applications. Seeds from all farms were also tested for germinability at 0, 0.002, and 0.02 M NH_4NO_3 at 30/25 C in light and dark conditions in Petri dishes. In the field, increasing total fertilization from 45 to 180 kg N/ha resulted in a significant increase (33%) in final cumulative emergence percentage. Split applications of the 180 kg N/ha rate significantly reduced early emergence on 3 out of 10 farms, but had no significant effect on final emergence. Contrary to the hypothesis, the influence of fertilization rate on emergence did not vary significantly based on the habitat from which the seed originated. In petri dishes, germination responses to N paralleled emergence responses to N from the field experiment. The most N-responsive seeds were found to respond to NH_4NO_3 both in light and darkness, while less responsive seeds only responded in light. These results suggest that 1) fertilization with NH_4NO_3 could be used to enhance stale seed bed effectiveness by enhancing emergence of A. powellii, 2) split fertilizer applications may reduce early emergence of *A. powellii*, but that 3) the effectiveness of these approaches is likely to vary considerably from farm to farm.

INTRODUCTION TO JAPANESE STILTGRASS BIOLOGY AND IMPLICATIONS FOR CONTROL PROGRAMS - JF Derr, Virginia Tech, Virginia Beach.

INTRODUCTION

Japanese stiltgrass [*Microstegium vimineum* (Trin.) A. Camus var. Imberbe (Nees) Honda], also referred to as annual jewgrass, bamboograss, flexible sesagrass, Japanese grass, Mary's grass, and Nepalese browntop, is a shade-tolerant C4 summer annual grass. A native of Asia, it was first discovered in the U.S. in 1919 near Knoxville, Tennessee. From this initial infestation it has spread rapidly and is now widely distributed in wetlands throughout the eastern United States and may pose a threat to rare native species.

Microstegium has a fibrous root system, stems that are upright or reclining, and stems can root at the nodes. Leaves are about 4 inches in length and ½ inch in width and taper at both ends. Most leaves have a distinct white midvein; however a key identifying feature of this grass is that the midvein does not divide the leaves into equal halves. The seedhead is composed of 1 to 6 terminal spike branches. Pictures of microstegium are available on the following Virginia Tech website: http://www.ppws.vt.edu/weedindex.htm

Unlike most C4 plants, Japanese stiltgrass is uniquely adapted to low light conditions. Japanese stiltgrass occupies a range of shady, moist habitats including river banks, flood plains, damp fields, swamps, lawns, woodland thickets, roadside ditches, river bluffs, and roadsides. More recently, it has encroached into crop production acreage, landscape plantings and turfgrass. Suggested control measures have been hand weeding or mowing in late summer or early fall prior to seed set.

Since Japanese stiltgrass has become an important weed in Virginia, as it has throughout much of the northeastern United States, I have been conducting experiments on the biology and management of this weed. I have also been cooperating with several of my colleagues in Weed Science, including Dr. Joseph Neal and Ms. Caren Judge at North Carolina State University.

MATERIALS AND METHODS

Experiments were conducted to determine the germination pattern for this weed. 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. Microstegium plants began flowering in the second week of October in Virginia Beach. Microstegium was planted September 30, 2002 and allowed to set seed. Japanese stiltgrass was germinating on March 18, 2003, several days in advance of smooth and large crabgrass germination. The mid-March germination was observed in both full sun and heavy shade conditions. Plants have showed signs of stress when grown in full sun conditions during drought conditions.

Also mowing was investigated as a way to stop seed production. Mowing in September reduced seed production of microstegium in my trial. Some plants mowed approximately one month before bloom were able to produce seedheads, although seedhead numbers were significantly reduced compared to unmowed plots. Later mowings were more effective.

My colleagues and I have conducted research on alternative methods of control, including selective preemergence and postemergence herbicides. Good to excellent control has been observed with the crabgrass preventors used in turf and ornamental sites. Preemergence herbicide application timing has been investigated and use of repeat applications. Numerically best control was seen with the recommended rate applied in early March, or repeated applications of reduced rates in December plus March plus May. Surviving plants, though, were able to grow and produce seed. Certain postemergence herbicides used for selective control of grassy weeds in broadleaf crop, and in certain cases turfgrass, as well as several nonselective herbicides, have also controlled Japanese stiltgrass in my trials.

RESULTS AND DISCUSSION

Microstegium appears to germinate slightly earlier than smooth crabgrass and other common summer annual grasses yet flowers later. Hand-weeding is an effective control option but is labor intensive for large areas. Also, additional plants may germinate after hand-weeding, requiring one to make repeat trips to the site. Microstegium tolerates mowing heights used for cool-season turfgrass, although the plant must set seed in order to germinate in subsequent years. Therefore mowing will not control existing plants but late season mowing can reduce seed production. Also, mowing is not practical for certain sites infested with Japanese stiltgrass. Obtaining a low, uniform mowing height will be necessary for successful use of this technique.

There are additional control options besides handweeding and mowing. Microstegium can be controlled preemergence using available crabgrass herbicides for turf and ornamentals. Applications should be made in late winter or early spring prior to germination. Timing should be slightly earlier than that used for smooth crabgrass control. Hand weeding or use of postemergence herbicides will be needed for complete control since some plants may escape the preemergence application. Postemergence herbicides, especially selective ones, may be preferably in most situations. Well-timed applications of postemergence herbicides can be highly effective and one application may be sufficient One needs to scout sites treated early in the season with postemergence herbicides to determine if any subsequent germination has occurred, thus requiring a second application. Applications too late in the season may not stop seed production. Use reduced rates with caution, since Japanese stiltgrass may be able to outgrow damage from low rates of postemergence herbicides.

JAPANESE STILTGRASS SEED DORMANCY CHARACTERISTICS AND GERMINATION REQUIREMENTS - CA Judge and JC Neal, North Carolina State Univ., Raleigh.

ABSTRACT

Japanese stiltgrass [*Microstegium vimineum* (Trin.) A. Camus var. imberbe] is an invasive, C_4, summer annual grass. As an annual, knowledge of seed ecology can enhance effective management and reclamation of invaded ecosystems. Anecdotal evidence suggests that Japanese stiltgrass maintains a persistent seed bank, yet conflicting reports suggest between 3 and 7 year seed bank longevity. Little else is known about its seed dormancy or germination requirements. A critical component of seed ecology is understanding the environmental conditions that overcome dormancy and induce germination. Therefore, an experiment was conducted to determine if Japanese stiltgrass seeds have dormancy and if so, to elucidate the appropriate conditions to overcome dormancy and environments for successful germination.

Freshly harvested Japanese stiltgrass seeds were collected from local (Raleigh, NC) populations Nov 11, 2002. Seeds were exposed to stratification conditions for 0, 15, 30, 60 or 90 days. Stratification conditions were moist, cool storage or dry, room temperature storage. After each respective stratification interval, seeds were placed in petri dishes with moist filter paper and exposed to various germination conditions. The main germination treatments were either a chamber of alternating temperatures (24/18 C) or a chamber of a constant temperature (24 C), each with 14 h light and 10 h dark. Within each chamber, seeds were either exposed to light or dark germination conditions. All combinations of stratification type, stratification interval, and germination conditions had four replicates and were arranged in a randomized complete block design within each chamber. Each petri dish was seeded with 50 seeds, wrapped with plastic film, and percent germination was determined 30 days after seeding.

No fresh seed (0 day stratification) germinated while all 90-day stratified seed germinated. These data suggest fresh seeds are dormant when shed from mature plants in the fall, but overcome dormancy by 90 days after harvest, regardless of the storage or germination conditions. For 15, 30, and 60 day stratified seed, all main treatment effects were significant and any interactions that were significant were attributed to differences in trends of main effects. For 15, 30, and 60 day stratified seed, germination was higher in alternating temperatures than constant temperatures, germination was higher in light than dark, and germination was higher when seeds were stored dry at room temperatures than moist at cool temperatures. However, after 90 days of either type of storage and exposure to any of the germinating conditions, dormancy was broken and all seeds germinated.

These results have implications on the potential longevity of the persistent seed bank. Under field conditions, seeds are exposed to conditions required for breaking dormancy, thus all seeds have high potential for germinating. Therefore, contributions to the persistent soil seed bank should be minimal. Managing the population to prevent seed input annually should deplete the seed bank rapidly. Additionally, these data are useful for Japanese stiltgrass researchers in maintaining seed populations. After 90 days of storage, seed germinability should be near 100%. Gaining a better understanding of the

environmental conditions that overcome dormancy and induce germination in nature will improve long-term seed bank management strategies with the intent of eradicating Japanese stiltgrass invaded ecosystems.

THE INFLUENCE OF JAPANESE STILTGRASS SUPPRESSION TACTICS ON NATIVE SPECIES DIVERSITY AND ABUNDANCE - B Jones, DA Mortensen, and M Booher, Penn State Univ., University Park, PA.

ABSTRACT

Management and control of Japanese stiltgrass (*M. vimineum*) is a growing concern for many land managers and stakeholders. While chemical measures provide options for control, there are questions concerning the stability and diversity of established, sensitive forest ecosystems following treatment. In 2003, four sites with established populations of *M. vimineum* were selected in the Rothrock State Forest, near State College, PA. Sites were located approximately 100 meters from each other along a forest access road. Within each site, five 18.5 m^2 experimental plots were treated with the following herbicides: fenoxaprop at 0.19 kg ai ha^{-1}, sethoxydim at 0.649 kg ai ha^{-1}, imazapic at 0.07 kg ai ha^{-1}, glyphosate at 1.1 kg ai ha^{-1}, and a control plot receiving no herbicide treatment. Herbicide treatments were applied on 15 July with a CO_2-pressurized backpack sprayer. Approximately 4 weeks after treatment, *M. vimineum* control was visually rated for each treatment. Species diversity, total percent ground cover, and ground cover of each species were estimated. All herbicide treatments provided greater than 90% control of *M. vimineum* at the time of rating. Ground cover was determined by visually estimating the total amount of bare ground persisting following treatment. As expected, ground cover varied significantly between herbicide treatments, with the control plot having nearly 90% ground cover, followed by sethoxydim (70%), fenoxaprop (65%), imazapic (50%), and glyphosate (25%), respectively. Interestingly, species diversity followed this trend very closely, with sethoxydim leaving eleven different species, fenoxaprop nine, imazapic six, and glyphosate four. While ground cover of the control plot was large (>90%), species diversity was relatively poor, with only six different species. Of those, *M. vimineum* dominated, composing >95% of each control replication. In this experiment, *M. vimineum* was effectively controlled with all herbicide treatments. However, sethoxydim was observed to be most effective at maintaining an acceptable level of species diversity following treatment, as well as leaving enough ground cover to provide stability against soil loss factors.

ORGANIZATIONAL MODELS AND FUNDING SOURCES FOR WEED CONTROL/ERADICATION PROGRAMS - AV Tasker, USDA-APHIS, Riverdale, MD; and AE Miller, USDA-APHIS, Raleigh, NC.

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) is a dense, shade tolerant mat-forming annual grass that occupies creek banks, floodplains, forest roadsides and trails, damp fields, swamps and eventually all forest areas, especially following natural disturbances. It is very aggressively displacing native plants. The grass currently ranges from Mississippi to Florida and north to Arkansas, Kentucky, Ohio, New York, and Connecticut. Eastern states typically do not have extensive weed regulatory authority or organization. Several alternative organizational approaches and possible funding sources will be discussed.

GRASS-ROOTS WEED MANAGEMENT PROGRAMS: WHO, HOW, AND WHAT CAN RESEARCHERS AND EDUCATORS PROVIDE THAT WILL HELP? – M Imlay, Sierra Club, Bryans Road, MD.

ABSTRACT

Volunteers are making a major contribution to the control of alien invasive plants around the nation and in the northeastern regions. For our national Sierra Club program on invasive control projects to rescue our native plants and animals, a web search of "remove invasive plants "Sierra Club" revealed about 2,350 postings. Our five year goal is that it is considered standard that such invasive plant removal projects are normally done in natural areas throughout the region.

Japanese Stilt Grass is the alien invasive species that is the most important of all for us to all work on in this region of the country. To translate the energy of volunteers to this particular species several considerations are noted.

To maintain morale, empowering ourselves and our volunteers, there are general methods and species specific methods such as best season for species, wet soil condition for pulling, handouts, extent of area of natives seen rescued, delayed gratification, targeted use of herbicides and effective use of pulling, and matching funds for staff to do what volunteers find hard to do.

Volunteers are best utilized in maintenance or pristine situations. Volunteer groups primarily use mechanical and limited chemical control methods. Several research needs for volunteer effectiveness are described.

SUMMARY OF CONTROL OPTIONS FOR JAPANESE STILTGRASS - JC Neal, CA Judge, North Carolina State Univ., Raleigh; and JF Derr, Virginia Tech, Virginia Beach.

ABSTRACT

Japanese stiltgrass [*Microstegium vimineum* (Trin.) A. Camus var. imberbe] is an invasive, C_4, summer annual grass. Several experiments have been conducted to identify effective strategies for Japanese stiltgrass control for different sites. Preliminary research in containers demonstrated that preemergence herbicides labeled for use in lawns for crabgrass control also controlled Japanese stiltgrass. Similarly, in container research, postemergence applications of non-selective herbicides, glyphosate (Roundup Pro) and glufosinate (Finale), controlled Japanese stiltgrass, and the selective postemergence graminicides, clethodim (Envoy), fenoxaprop-p (Acclaim Extra), fluazifop-p (Fusilade II), and sethoxydim (Vantage), also controlled Japanese stiltgrass. Two applications of postemergence herbicides were sometimes necessary for complete control. These data suggested that in turfgrass areas and landscape plantings, satisfactory control could be achieved with labeled herbicides.

In forest understories and floodplains infested with Japanese stiltgrass, the use of residual herbicides is less desirable. In natural stands of Japanese stiltgrass, the effectiveness of selective control measures, fenoxaprop-p, sethoxydim, and imazapic (Plateau), were compared under various conditions. Tests were conducted in 2002 and 2003 in both Virginia and North Carolina. The first year was an extremely dry year, while the second year received higher than average rainfall. Tests were conducted to compare application timings, herbicide doses, and frequency of application. Each herbicide was applied early season (pre-tiller), mid-season (1 to 2 tillers) and late season (pre-flowering). All three herbicides controlled Japanese stiltgrass. Early season applications provided season long Japanese stiltgrass control, while mid-season and late-season applications were variable over time and location. At mid-season, two applications of fenoxaprop-p or sethoxydim provided better control than single applications. Two applications at ½ the labeled rate controlled Japanese stiltgrass as well as full-labeled rate applications.

Field trials have also been conducted to compare currently recommended strategies for managing Japanese stiltgrass, including hand-removal, mechanical removal, and glyphosate late in the season prior to floral induction, with selective early season removal using fenoxaprop-p. The hypothesis is that selective removal of Japanese stiltgrass early in the season, rather than non-selective control late in the season, will encourage recruitment and establishment of native flora and ultimately provide a flora less susceptible to further Japanese stiltgrass invasion. Preliminary data from the first two seasons support this hypothesis. Native species recruitment has been greater in fenoxaprop-p treated plots than in glyphosate or mowed plots. Whether these newly established stands of native species will be more resilient to invasion by Japanese stiltgrass is yet to be determined.

These data and others clearly show that Japanese stiltgrass can be controlled by several means. Selective and non-selective herbicides are effective. Hand weeding and mowing before anthesis can also control this invasive weed. However, the data thus far suggest that controlling Japanese stiltgrass in early summer, rather than at the

traditional late summer timing, may improve native species recruitment and establishment.

IMAZAPYR, IMAZAPIC, PENDIMETHALIN, AND SETHOXYDIM USE AND RESTRICTIONS IN SITES INFESTED WITH JAPANESE STILTGRASS - CT Horton, BASF, Macon, NC.

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) can invade and grow on a variety sites. From parks and pastures to flower beds and residential lawns, this shade tolerant and moisture loving annual grass knows no limits. There are a number of studies available that address a variety of chemistries for controlling this invasive annual grass. Choosing the correct herbicide for the right site and use at the proper application rates will be critical in the efforts to control microstegium and return the site back to its original or pre invasion habitat.

Herbicides such as pendimethalin under the trade name Pendulum® and sethoxydim under the trade name Vantage® can be used to control microstegium in flowerbeds or other residential natural areas where desirable trees and shrubs may be present. Pendulum can also be used on a variety of residential turf grasses for pre emergent control of microstegium. Imazapic or Plateau® herbicide can be used in bermudagrass hay fields and meadows on a variety of bermudagrass forages. Plateau can also be used in Conservation Reserve Program acres where tall grass prairie species are desired. Imazapyr under the trade name Arsenal® Applicators Concentrate can be used for microstegium control in loblolly pine and other conifer plantations and Chopper® herbicide can be used for site preparation treatments that are to be planted with loblolly, longleaf, or slash pine. Arsenal herbicide is labeled for use in noncropland areas such as roadsides, railroads, and non-irrigation ditch banks. Imazapyr also carries an aquatic label under the trade name Habitat® herbicide.

There are several herbicides that can be used effectively for control of Japanese stiltgrass. When selecting the herbicide, consult the individual product specimen label. The herbicide specimen labels are written and routinely updated to give applicators the necessary information to make a successful treatment. Many herbicides available in the market today have reached post patent status. There are many herbicides that have the same active ingredient but may vary in use rates and sites that the product can be applied. Always read and follow specimen label directions.

THE FUTURE OF HERBICIDE DEVELOPMENT - R Ratliff, Syngenta Crop Protection, Greensboro, NC; DJ Nevill, M Quadranti, and N Leadbitter, Syngenta Crop Protection, Basel, Switzerland.

ABSTRACT

We shall review advances in the science of crop protection in the context of rapid changes in the marketplace. This dynamism in both technology and business provides an exciting environment for innovation. We propose a three component strategy (new active ingredients, product enhancement research and the development of crop solutions) which will enable continued innovation and growth for the research-based companies. Case studies for each of these strategic components will be shown to help support the feasibility of this approach.

FUTURE DEVELOPMENTS IN HERBICIDE-RESISTANT CROPS - CA CaJacob and B Bussler, Monsanto Company, MO.

ABSTRACT

Since the introduction of glyphosate resistance in soybean and canola in 1996, the use of herbicide-resistant crops has grown rapidly in acreage and the technology has been utilized in multiple crops including corn. This trend continues as existing products such as glyphosate-resistant corn and cotton undergo technical improvements and the technology is extended to other crops such as wheat, alfalfa and turf. USDA field trial permits for herbicide-resistance technology related to other commercial products such as glufosinate- and imidazolinone-resistant crops indicates that improvements continue in those technologies as well. The list of USDA approved 2003 field trials also indicates that efforts are underway to develop resistance to other herbicides such as isoxaflutole, PPO's, and dicamba. The next generation of herbicide-resistant products will be stacked with other traits such as insect control traits followed by other quality and yield traits.

INCORPORATION OF ECOLOGICAL PRINCIPLES INTO WEED MANAGEMENT - BD Booth and CJ Swanton, Univ. Guelph, Ontario, Canada.

ABSTRACT

There are two areas of ecology that we feel will become particularly useful to weed scientists. These are the fields of invasion biology and community assembly. Both areas are developing an extensive theory, but researchers in these fields also tend to have a practical side. Also, information we will gain from these fields overlaps, and this is one place where weed scientists could lead the field in research.

Invasion biology is a new and growing field – and it has a practical side that that will make it more applicable to weeds of managed environments. An invasion is the expansion of a species into an area not previously occupied by that species. To be a successful invader, a species must disperse to a new area, be able to sustain itself through reproduction, and withstand the conditions of the new environment. There is a body of ecological theory regarding the invasion process. While the average person may think of an invasive plant as a non-native plant invading a natural or non-managed environment, native plants can be invasive and managed systems certainly are sites of invasions. The theory basis of invasion biology is applicable to managed systems because agricultural weeds are just plants that are good at invading highly disturbed, nutrient rich communities.

Community assembly is a field of ecology concerned with how communities are assembled as they follow a trajectory through time. An above-ground plant community is composed of a subset of the species available in the total species pool. Community assembly attempts to explain what biotic and abiotic filters constrain community composition between the total species pool and the realized community. Filters remove species that lack specific traits; for example, spring tillage (an abiotic filter) acts against spring germinating species. Thus, traits (rather than species) are filtered. One way that community assembly can help weed scientists is by focusing attention on traits rather than species. Current research on weed community ecology focuses on weed species shifts in response to some management regime. However, if we focus on how traits respond to management, then concepts and principles gained would be universal rather than specific to sites and/or species. Community assembly provides a conceptual framework to understand processes that determine species composition in a particular site.

Invasion biology and community assembly are two areas of ecology that lend themselves to the field of weed management, and will help us transform from a reactive science to a predictive one. These fields focus attention on how, why, and when weeds invade, and on how species traits interact with the environment to determine whether an invasion is successful.

DEVELOPMENTS IN BIOLOGICAL WEED CONTROL - A DiTommaso, Cornell Univ., Ithaca, NY.

ABSTRACT

The control of weeds through the deliberate use of natural enemies (i.e. biological control) has played a variable role in the management of weedy vegetation to date. Successful biological control programs have for the, most part, been limited to the classical approach where effective management of such problem rangeland exotic weeds as *Opuntia* spp., leafy spurge (*Euphorbia esula* L.) and St. John's wort (*Hypericum perforatum* L.) has been achieved. Concerns over safety and spread of exotic biological control agents and possibly more stringent regulatory government policies especially targeted at macro-organisms such as insects, may hamper the continued development of this valuable and cost-effective management tactic in the future. Any severe restrictions on the ability of biocontrol practitioners to import and release promising candidates from abroad will negatively impact the management of aggressive exotic weeds of natural and semi-natural habitats. This situation is especially problematic given the dramatic increase in the number of invasive exotic plant species that have been purposely or accidentally introduced into North America and for which no effective and economical methods of control currently exist. The management of problem weeds in agricultural systems (i.e. row crops) using bioherbicides has been disappointing with only a limited number of products successfully marketed. One of the major obstacles to the development of bioherbicides continues to be the poor field efficacy achieved with foliar-applied pathogens largely because of their fastidious environmental requirements. Unfortunately, considerable effort to overcome these constraints through improved product formulation has not achieved results that can be used economically in the field. These limitations however, have been partially overcome by the use of soil-applied pathogens that are less susceptible to unfavorable field conditions. The use of biocontrol candidates with relatively weak virulence has also contributed to the poor control achieved in the field. Lastly, a relatively limited market potential for bioherbicide products (i.e. niche markets) has also made it difficult to justify large capital investments into research and development. Despite these limitations, several important approaches and advances in the coming years will likely substantially improve the efficacy and reliability of bioherbicides in cropping systems. These include the use of bioherbicides in tank mixtures with chemical herbicides to achieve synergistic effects, the use of more virulent and broader spectrum pathogens, and the insertion of specific hypervirulent genes into weakly mycoherbicidal strains to increase their virulence. Undoubtedly, increased public pressure on regulatory agencies to reduce chemical herbicide use in urban environments and agricultural systems because of human health and environmental concerns may provide unique opportunities for increased development and wider adoption of bioherbicide products over the next decade.

WEED MANAGEMENT FROM A LANDSCAPE PERSPECTIVE - AG Thomas, JY Leeson, Agriculture and Agri-Food Canada, Saskatoon, AL; and LM Hall, Alberta Agriculture, Food and Rural Development, Alberta, AL.

ABSTRACT

Provincial weed surveys have been conducted periodically across Manitoba, Saskatchewan and Alberta since 1975. Densities of weed populations were determined in nearly 18,000 fields of spring cereal, oilseed and pulse crops by counting plants remaining in the crop in late summer. Shifts in abundance are used to identify trends in the relative importance of problematic species. Species maps track changes in geographic distribution and lead to predictions of the future extent of the infestation. Additional insight is gained by grouping the species into life forms and identifying shifts in density and relative abundance of the groups. Classification techniques are used to identify weed communities that can be shown to vary in time and space. Significant value is added to the weed abundance data by collecting information on the specific farm management practices used on the surveyed fields. Multivariate ordination approaches are used to explore the association of individual species, life history groups, or weed communities with ecological divisions of the landscape, climate, weather, physical and chemical soil properties, agronomic factors, and other explanatory variables. Data from Alberta surveys are used to illustrate the application of ordination techniques for partitioning the variance in the species data that is related to selected explanatory variables. In the Alberta example, ecoregion explained 34% of the total variance and a combination of climate, soil and crop variables explained an additional 20%. The remaining 46% is due to weather, various farm management practices and stochastic processes. These analytical approaches have the potential to help agricultural agencies set priorities, develop recommendations, and design weed management strategies for the extension, research, and agri-business communities.

THE USE OF INFORMATION GATHERING SYSTEMS FOR SPATIALLY EXPLICIT DECISION-MAKING - DA Mortensen, Penn State Univ., University Park, PA.

ABSTRACT

In 1997, the National Research Council argued that site specific agriculture would be practiced at a scale relevant to the cropping systems response. Scale can be considered for both information sources and management actions. Depending on the situation, data from different scales may be combined and used to determine management actions at another scale. Over the past decade, enabling site-specific technologies and information service providers have come and gone in the anticipated shakedown of a new technology. This paper will briefly revisit the promise of this technology. While some applications have been realized, the use of spatially explicit information in farming has evolved in some predictable and other less predictable ways. The much heralded "precision" weed management has been largely relegated to high cash value cotton and vegetable crops with near- and far-remote sensing guiding tactical control practices. While the spatial resolution of far-remote sensing has improved considerably over the past decade and exciting applications for weed mapping have been realized for noncropland weeds, it is unlikely that such sensing (alone) will enable tactical weed management in large acreage low cash value row-crops. Significant progress in "fusing" spatially explicit data collected over a series of visits to fields is an area that remains largely untapped even though preliminary attempts at knowledge extraction using such techniques as logistic regression, mean weights of evidence and bayesian methods have demonstrated considerable promise. The increased portability, durability, affordability and the development of accessible software for portable handheld computers promises to greatly enhance site-specific data collection and synthesis. Use of such systems enable summary of weed management efficacy trials within and over sites. An exciting example of such an application is a handheld/software application co-developed by The Nature Conservancy and the Bureau of Land Management for documenting and monitoring invasive weed management outcomes. In this example the handheld is used to record the results of a practitioner's weed management trial but also is capable of performing data mining operations in which the results of other weed managers can be viewed and summarized. In effect, such locally collected data could be used to define inference domains associated with weed management outcomes. The future holds promise for site-specific weed management. The management question, scale associated with the question and extent of technology adoption will drive the development and application of site-specific weed management technologies and practices.

WEEDSOFT®: A WEED MANAGEMENT DECISION SUPPORT SYSTEM - A Martin, Univ. of Nebraska, Lincoln.

ABSTRACT

WeedSOFT® is a Windows based weed management decision support system developed for use in seven North Central states. This effort resulted in each cooperating state having a version of WeedSOFT® that addresses its unique soil and climatic conditions, weed species and crop production practices. This regional project involves Illinois, Indiana, Kansas, Michigan, Missouri, Nebraska and Wisconsin. WeedSOFT® consists of three modules, Advisor, EnviroFX, and WeedVIEW. Advisor supports preemergence, postemergence and pre- and postemergence weed management decisions in four crops: corn, sorghum, soybean, and wheat. EnvironFX supports site and herbicide specific assessment of groundwater contamination potential. WeedVIEW provides visual images as an aid in weed identification.

Advisor computes a crop yield loss and dollar loss based on weed density, weed free yield goal, and expected crop price. Weed management strategies evaluated include cultivation, band herbicide application, broadcast herbicide application, and combinations of these tactics. The user may specify herbicide price, seed cost associated with herbicide-resistant crop, application cost, cultivation cost, row spacing, and herbicide band width. Advisor then ranks the available strategies, including cultivation and various herbicide treatments and application methods in order of net return or in order of crop yield depending on the user's preference. Additional herbicide treatment selection criteria based on user input include soil properties, rotational crop, ground and surface water based restrictions, and crop and weed growth stage. Output includes an ordered ranking of weed management strategies based on net return or crop yield and a detailed economic and efficacy analysis of individual treatments. In addition an estimate of each treatments effect on the weed seedbank is provided. New features of Advisor include a seed calculator, tank mix calculator, and field record keeper.

WeedSOFT® is useful in a teaching environment. Learning modules addressing Postemergence Application Timing, Weed Seedbanks, and Environmental Factors have been included in the 2004 version of WeedSOFT®. Among the biological principles that can be illustrated using WeedSOFT® are: differences in competitiveness of different crop species and weed species, the influence of weed and crop growth stage on crop-weed interference, and the influence of production practices including crop row spacing on crop competitiveness. The influence of environmental factors including soil properties and precipitation pattern on herbicide efficacy and risk to rotational crops can be systematically illustrated with WeedSOFT®.

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PRESIDENTIAL ADDRESS

David J. Mayonado
Monsanto Company

STEWARDS OF THE TRUTH

I would like to thank the NEWSS for giving me the opportunity to serve as your President. I must admit that the experience was not nearly as demanding as I originally feared. The wonders of modern electronic technology have greatly simplified the process. I implore my colleagues from industry to become involved in the workings of the society. We strive to maintain a balance of industry and academia and with the consolidation that continues in industry, there are fewer of us to carry the torch. Please get involved. I also want to thank the members of the executive committee for their service to the society in 2002. I want to personally thank Jeff Derr for mentoring me through the Presidency. I also thank my wife Nancy for her supporting me throughout my professional career.

Today I want to speak to you about a matter I am very passionate about. Working for Monsanto has at times been very demanding and very challenging. But at the same time, I've been blessed to have been able to work on some of the most fascinating technology in the world. I have watched and have been part of history in the making. Genetically enhanced corn and soybeans have revolutionized the way weeds and insects are being controlled. I've been blessed to have been a small part of it all.

But, as with the introductions of many new technologies, not everyone is happy about it. Some have accused genetically enhance crops as being unsafe for human consumption and unsafe to the environment. Others say that tests prove these crops are as safe as their non-enhanced relatives. Today, I'd like to discuss this ongoing debate and the role I believe we, as scientist, should play in assuring the arguments each side is using are based in fact.

An inscription on the National Academy of Sciences building reads "To science, pilot of industry, conqueror of disease, multiplier of the harvest, explorer of the universe, revealer of nature's laws, eternal guide to the truth". This inscription reflects the faith we Americans have in the usefulness of science to improve the quality of our lives. Yet over the years, we have been bombarded by a number of hysterical reports about technologies whose use could be catastrophic to people or the environment. Many factors have been attributed to the public's perception of risk. Dr. Robert Peterson of Montana State University outlines key factors in his report on agricultural and biological risk assessment. He lists the following factors as important to public acceptance of risk: control, catastrophic potential, dread familiarity, equity, level of knowledge, voluntariness of exposure, effects on children and future generations, clarity of benefits, media attention, and trust in organizations or institutions. It is this last factor that plays such an important role in the differences between European and American acceptance of genetically enhanced crops.

Europe does not have a trusted regulatory agency akin to the EPA/USDA/FDA that citizens turn to for assurance. So European citizens place more credibility on non-governmental organizations such as Greenpeace for information on potential risks than do we Americans. This reliance on non-government organizations in Europe has created a situation where sensationalized reporting of potential risks is essentially unchallenged. This leads to a climate of fear and mistrust that once established is very hard to overcome. First impressions are indeed lasting impressions.

Groups opposing the use of genetically enhanced crops include: Greenpeace, Friends of the Earth, Environmental Defense, Earth First, the Organic Consumers Association, and the Earth Liberation Front. While these groups share much in common, their tactics vary from peaceful protest to violent acts of terrorism. But what truly motivates these groups I propose is the same thing that motivates most of us in this room. What we all strive for is a better, safer, healthier world in which to raise our children. What we differ in is our approach to how we would achieve those goals. Some, including most of us in this room, believe the way to achieve this goal is through the judicious use of knowledge and technologies, to more efficiently use the resources available to mankind. The world's natural resources are to be sensibly used for the progress of our species. The needs of mankind are placed above the needs of the environment. Other groups believe that excessive use of technology threatens natural processes that could lead to permanent damage to eco-systems. They believe that man should work in harmony with nature, versus against nature, to create a more meaningful quality of life, that the needs of the natural world are often placed above the needs of mankind. When people approach an issue from such varied philosophical perspectives, conflict is inevitable.

When one is predisposed to believe in something, very little evidence is needed to bolster their position. Their threshold for evidence is lowered. When people feel strongly about an issue, they are more inclined to take extreme measures to encourage others to follow. This would include stretching the truth, leading to outrageous claims being made. Many outrageous claims have been made about agricultural and food technologies. These include claims by anti-technology groups that irradiated foods do nothing but insulate meat processor from liability if anyone gets sick, a newspaper article claiming that pesticides blown in from hundreds of miles away was killing frogs, and my favorite, an article about organic wine that doesn't cause headaches because it doesn't contain unseen chemicals.

When the average citizen, untrained in the sciences, reads these claims in the newspaper, what is he or she to think? Citizens often hear very different stories from the technical community on one side and the anti-technologist on the other. Who are they to believe? Since the average citizen is the majority and in our country majority rules, what they end up believing is what is acted upon in the political arena. I believe that is it vitally important that we as a group of truth-seeking scientists become engaged in these on-going debates. If one doesn't feel comfortable engaging directly in this debate, then at least play the role of referee. We should not allow the debates to be based on misinformation or fear driven images. We should all insist that the dialogue be based on facts. Former Senator Daniel Patrick Moynihan made the often-quoted statement that "We are all entitled to our own opinions, but we are NOT entitled to our own facts". We should not stand idle when we see the debate straying from the facts. We in the scientific community must be "stewards of the truth".

Again, I thank you for the opportunity to serve. I appreciate the time you all have taken to listen to me this morning. I hope you all enjoy the meeting ahead.

57th Annual Business Meeting of the NORTHEASTERN WEED SCIENCE SOCIETY

Hyatt Regency Hotel, Baltimore, MD
January 8, 2003

1. Call to Order

The annual business meeting was called to order by President David Mayonado on January 8, 2003 at 4:45 p.m.

2. Approval of Minutes

A motion was brought forward by Brian Olson to accept the Minutes of the 56th Annual Business Meeting, distributed to the membership at the meeting. Jeff Derr seconded, and without any further discussion, the minutes were approved by the membership.

3. Necrology report

Dave Yarborough indicated that he had not been informed of any members that had passed away and asked if there were any reports from the floor, hearing none he ended his report.

4. Executive Committee Reports

All of the executive committee reports were compiled in a handout and available to the membership.

a. Presidents Comments - David Mayonado
David indicated that he was pleased with the excellent program and the hotel accommodations and thanked the sections chairs for running the meeting and making the extra effort to obtain LCD projectors for their sessions. He then thanked Art Gover and Jeff Derr for organizing the Invasive symposium that contributed to a high quality three-day meeting. Dave thanked Robin for developing and assembling the program and the NEASHS for joining us over the past four years.

b. Secretary/Treasurers Update - Dave Yarborough
Dave indicated we had 176 members preregister for the meeting and had 216 NEWSS members and invited speakers attending the meeting, which was up from last year at 195 members. In addition, 11 people registered for the invasives session and 31 NEASHS members attended the concurrent Horticulture meetings. He reported our expenses for 2002 were $32,091.28 and our income was $30,909.05, which gave us a net loss of $1,182.23. Dave pointed out that the student reimbursement in 2002 was $2,905, much higher than the previous year at $1,300. He reported our current net worth was now $47,852.04.

c. Audit Committee Report - Dave Yarborough

Dave reported that the books were audited and attested to be correct by members John Jemison, Jr. and Chris Reberg-Horton, who signed the financial statement. John then confirmed that the audit was completed by him and was correct.

d. Archives Committee - Robin Bellinder
Robin indicated that she had received the archives.

e. Awards - Jeff Derr
   i. Distinguished Member - Jeff announced that Nate Hartwig, Professor Emeritus at Penn State University, was recognized as a distinguished member.
   ii. Award of Merit - Jeff indicated that no award was given this year.
   iii. Outstanding Educator - Jeff announced Andy Senesac, Senior Extension educator at Cornell University Cooperative Extension on Long Island, NY received the outstanding educator award.
   iv. Outstanding Researcher - Jeff announced that Art Gover, Research support Associate at the Penn State University had been chosen as outstanding researcher.
   v. Collegiate Weed Contest Winners - Jeff announced the contest winners (below) and thanked Grant Jordan for all of his work on the Weed Contest.

Undergraduate division
Teams:
First: North Carolina State University: Josh Gaddy, Sarah Hans, Robert Parker
Second: University of Guelph: Kevin Dufton, Shawn Winter
Third: State Univ. of New York at Cobleskill: Daniel Dowling, Mathew Fritz

Individuals:
1st : Sarah Hans, NC State
2nd : Robert Parker, NC State
3rd : Josh Gaddy, NC State

Graduate division
Teams:
First: North Carolina State University, Team A: Hennen Cummings, Scott McElroy, Andrew MacRae, Shawn Troxler
Second: North Carolina State University, Team B: Ian Burke, Carrie Judge, Russell Nuti
Third: Virginia Tech: Whitnee Barker, Josh Beam

Individuals:
1st: Scott McElroy, NC State
2nd: Matt Myers, Penn State
3rd: Shawn Troxler, NC State

vi. Graduate student presentation awards - Brian Olson

Brian thanked the judges which consist of the past-presidents for the last five years. Brian indicated 13 students had signed up for the contest and 12 had presented papers to be judged. Although data slides were better than last year he urged the students to keep it simple. The introduction should include why the study is being conducted and give background, it should then build to the objective, hypothesis and materials and methods, but he stressed again to keep all of this clear and simple. The results should be related to the current knowledge and to the conclusion, all this in 12 minutes. This can't be done well unless the talk is well focused. Brian thanked BASF for their continued financial support of this contest. He then presented the awards and checks to the graduate student contest winners.

1st (tie). *Periodicity of Weed Emergence and the Implications for Weed Management in Corn.* Matt Myers, William Curran, David Mortensen and D. Calvin, Penn State University.

1st (tie). *Influence of Seed Treatment with Sodium Hypochlorite on Seed Germination and Radicle Elongation in Three Annual Weed Species.* Robert Nurse, Antonio DiTommaso, Cornell University.

2nd. *Spatial Heterogeneity of Edaphic Variables and Sedge Populations on Golf Course Fairways.* J.Scott McElroy, F. Yelverton, and Michael Burton, NC State University.

vii. Research Poster Contest - Paul Stachowski

Paul thanked the judging committee and indicated there were many excellent quality posters this year, which made it very difficult to judge. He presented the awards and checks to the Research Poster Winners.

1st. *Comparison of Two Methods to Estimate Weed Populations in Large-Scale Agricultural Research*, Robyn Stout, Michel Burton, and H. Linker, North Carolina State University, Raleigh NC.

2nd. *Diquat+Glyphosate for Rapid Symptom Vegetation Control in Turf*, Whitnee Barker, Shawn Askew, Joshua Beam and Domingo Riego, Virginia Tech, Blacksburg, VA.

viii. Photo Contest – Grant Jordan

Grant indicated their task was very easy this year because entries were received from only two people. The photo chosen was a printout of a digital photo. Grant recommended that the contest be expanded to accept a digital format on a CD or Zip disk. He thanked the committee for their work and asked others to consider serving on this committee. He then presented the award and check to the only Photo contest winner selected.

1st. Toni DiTommaso -Cornell University for *Anoda Cristata Flower Bud Closeup.*

5. Old Business

Tim Dutt the WSSA representative reported that the WSSA will meeting in New York City on 2006 for their 50th anniversary. He indicated the NEWSS met as the Northeast Weed Control Conference in New York City in 1956. The WSSA 50th anniversary board was not pushing for a joint meeting and we would have to initiate it if we wanted to meet with them. The meeting format and time would be different and could interfere with outreach programs. There was considerable discussion on the merits and disadvantages of a joint meeting. Tim indicated that all members present could vote their choice on a ballot at the meeting. The majority of the members declined a joint meeting with WSSA by written ballot.

6. Officer Changeover and Presentation of Gavel

Dave Mayonado indicated that he had enjoyed serving as president and that he was leaving the office in goods hands. He then passed the gavel to Scott Glenn, ending his term as president. Scott thanked David for doing a wonderful job and indicated it was the enduring friendships formed that kept the organization going. He then presented David with an engraved gavel plaque.

7. New Business - Scott Glenn

a. Resolutions Committee – John Jemison
John had none and asked for resolutions from the floor. None were put forth so John ended his report.

b. Nominating Committee Report - David Spak
David Spak (chair) indicated the committee nominated Tim Dutt and Renee Keese for Vice President and Brian Manley for Secretary/Treasurer elect.

c. Election of the Secretary Treasurer-elect and Vice President
David asked for nominations from the floor for Vice President or Secretary Treasurer. With none Brad Majek asked nominations be closed and Rich Bonnano seconded. Brian Manley was then elected Secretary Treasurer elect by unanimous acclamation. Ballots were distributed to all members present for Vice President and the count indicated that Tim Dutt had the majority of ballots and was elected Vice President.

d. Appointment and Election of 2003 Nominating Committee
Scott Glenn appointed Jerry Baron as chair, and Annamarie Pennucci to the nomination committee. Lane Heimer, Steve Hart and Hilary

Sandler were nominated from the floor. Joe Neal moved the nominations be closed, seconded by Rich Bonanno. Vote was unanimous for acceptance of the nomination committee.

e. Resolutions Committee appointment–
Scott appointed Dwight Lingenfelter as chair. Sarah Low and Rakesh Chandran were nominated from the floor. Gary Schnappinger moved the nominations be closed, seconded by Dave Vitolo. Vote was unanimous for acceptance.

f. Collegiate Weed Contest 2003
Syngenta, coordinated by Brian Manley, will host the contest at their Hudson, NY research farm on July 29, 2003.

g. 2004 Annual Meeting
Scott Glenn announced that the meeting site in 2004 will be at the Cambridge Marriott in Cambridge Massachusetts and will take place on January 5-8, 2004.

8. Presentation of 2003 Executive Committee

Scott Glenn (President) introduced the 2003 Executive Committee: Robin R. Bellinder - President-elect, Timothy Dutt- Vice-president, David E. Yarborough - Secretary/Treasurer, Brian Manley, (not present), Secretary/Treasurer elect, David J. Mayonado - Past President, Robert D. Sweet - CAST Representative, Mark J. VanGessel – Editor, Daniel Kunkel – Legislative, Brent Lackey - Public Relations, Art Gover - Research and Education Coordinator, Susan Rick - Sustaining Membership, Jeff Derr - WSSA Representative, and Caren A. Judge - Graduate Student Representative.

9. Adjournment:

President Glenn asked for a motion to adjourn the 57th Annual Business Meeting of the Northeastern Weed Science Society. Brian Olson moved, Jerry Baron seconded and the motion was unanimously approved to adjourn at 5:55 PM.

56th Annual Business Meeting of the
NORTHEASTERN WEED SCIENCE SOCIETY
Loews Philadelphia Hotel, Philadelphia, PA
January 9, 2002
(These were omitted from the 2003 Proceedings)

1. Call to Order
The annual business meeting was called to order by President Jeff Derr on January 9, 2002 at 4:32 p.m.

2. Approval of Minutes
A motion was brought forward by Brian Olson to accept the Minutes of the 55th Annual Business Meeting distributed to the membership at the meeting. Scott Glenn seconded, and without any further discussion, the minutes were approved by the membership.

3. Necrology report
Dave Yarborough reported that Robert Shipman passed away. Dave asked if there were any others to report. With none, Dave asked for a moment of silence for remembrance.

4. Executive Committee Reports
All of the executive committee reports were compiled in a handout and available to the membership.

a. Presidents Comments - Jeff Derr
   Jeff asked for comments about the hotel and apologized about the last minuet changes. He had some comments expressing disappointment that the spouses program was discontinued and asked for comments from the membership. He thanked the EC for their help with the meeting and the section chairs for their help in getting computer LCD projectors for their sections. Jeff expects that these projectors will be available for students in the future. He thanked Art Gover for his help in the invasives section that brought 50 to 60 more people to the meeting. The NEWSS wants to continue to reach out to other groups, and Jeff asked that if you know of other interested groups to let him or other members of the EC know. Jeff thanked Frank Himmelstein and Todd Mervosh for all of their work on the weed contest that was attended by over sixty students and 30 volunteers. He indicated that he had a letter from CAST that asked the membership to join as individuals, and encouraged all to do so. Jeff announced the 15th International Plant Protection Conference to take place on July 6-11, 2003 in Beijing, China. He indicated that information on tours and registration could be found at www.ipmchina.net/IPPC (note: this does not work yet). Jeff indicated a mixer would follow the business meeting in the hotel Millennium Hall.

b. Secretary/Treasurers Update - Dave Yarborough
   Dave indicated we had 126 members pre-registered for the meeting and 177 NEWSS members attending the meeting, which was down from previous years, but 19 people registered for the invasives session and 37 NEASHS members attended the concurrent Horticulture meetings. He reported our expenses for 2001 were $33,879.64 and our income was $33,850.07which gave us a net increase of $29.57. He reported our current net worth was $49,034.27.

c. Audit Committee Report - Dave Yarborough
   Dave reported that the books were audited and attested to be correct by members John Jemison, Jr. and Eric Gallant who signed the financial statement. John then confirmed that the audit was completed by him and was correct.

d. Archives Committee - Robin Bellinder
   Robin indicated that she had received the archives

e. Awards - Brian Olson
   i. Distinguished Member - Brian indicated that Brad Majek, Rutgers University and Tom Watschke, Penn State University were recognized as distinguished members.
   ii. Award of Merit - Brian announced that Gary Schnappinger, Syngenta Crop Protection was given the award of merit.
   iii. Outstanding Educator - Brian announced Scott Hagood, VA Tech. received the outstanding educator award.
   iv. Outstanding Researcher - Brian announced Jerry Baron, IR-4/Rutgers University had been chosen as outstanding researcher.
   v. Collegiate Weed Contest Winners - Brian announced the contest winners (below) and thanked Frank Himmelstein and Todd Mervosh for all of their work on the weed contest.

Undergraduate division
Teams:
1st: Penn State University, Randy Bowersox, Andy Heggenstaller, Shawn Heinbaugh, Sarah Rider
2nd: University of Guelph, Team A , Kara Lammers, Sharon Robertson, Garth Wilson 3rd: University of Guelph, Team B, Scott Gillespie, Robin Little

Individuals:
1st: Shawn Heinbaugh, Penn State
2nd: Sarah Rider, Penn State
3rd: Andy Heggenstaller, Penn State

Graduate division:
Teams:
1st: North Carolina State University, Team B Keith Burnell, Andrew McRae, Shawn Troxler
2nd Penn State University, Brian Clark, Matt Myers, Brad Park
3rd Virginia Tech, Andy Bailey, Steve King, Brian Trader, Corey Whaley

Individuals:
1st: Matt Myers, Penn State
2nd: Shawn Troxler, North Carolina State
3rd: Steve King, Virginia Tech

vi. Graduate student presentation awards - Rich Bonnano
Rich indicated 20 students had signed up for the contest and 18 had presented papers to be judged. Although he has seen considerable improvement over the years there were still a number of slides that were not readable, because of font size or color combinations.
He indicated to win there had to be a good story, explaining why they had done the research and how they would apply the results. He did not know yet if LCD projectors would be an option next year. He the presented the awards and checks to the graduate student contest winners.

1st G. Michael Elston & Prasanta C. Bhowmik– University of Massachusetts for
Biological activity of Xanthomonas campestris pv Poa annua as influenced by commonly used turfgrass products.

2nd Caren A. Judge & Joseph C. Neal – NC State University for
Concentration and dose-response of common nursery weeds to isoxaben, oryzalin, and trifluralin.

vii. Research Poster Contest - Ted Bean
Ted thanked the judging committee and indicated there were 26 posters this year and overall were very good. There were still posters that were too wordy and hard to see but he felt the quality was much higher than last year. He presented the awards and checks to the Research Poster Winners.

1st John Jemison Jr and A. Nejako, University of Maine for *The effect of Mesotrione on weed control in sweet corn.*

2nd William Bailey, Henry Wilson and Tom Hines, Virginia Tech *for Flufenacet plus metribuzin performance in Virginia wheat.*

viii. Photo Contest – Grant Jordan

Grant thanked the committee for their work and indicated that there were 39 entries, consisting of 37 slides and 2 photographs. He indicated that he felt the entries were of higher quality than last year. He presented the awards and checks to Photo contest winners.

1st Toni DiTommaso for his slide of the fall panicum seed head.

2nd Shawn Askew for his side of the seedling redroot pigweed.

3rd Joe Neal for his slide of the bur cucumber seed and flower.

Jeff Derr thanked BASF for their financial support of the graduate student contest and then awarded Steven King a plaque and a check for $ 250 for his work serving as webmaster for the NEWSS web site.

5. Old Business

NEWSS Committee on change – Joe Neal

Joe presented a written summary to the membership and a power point presentation on the results of the survey.

NEWSS Committee on Change topics: Joint or concurrent meetings, Annual meeting location & format, AV options, Outreach, NEWSS Web Site.

NEWSS Committee on Change members: Joe Neal, chair, Robin Bellinder, Rich Bonanno, Nancy Cain, Tracey Harpster, Garry Schnappinger.

Joint or concurrent meetings: Strong support for concurrent meetings, ASHS & regional pest management societies, Willing to change dates to do so.

Annual meeting location & format: Like metropolitan areas, Less support when costs increase, Strong support for resort location periodically Maintain the current format, We need to transition to computer projection, We should allow members to bring computer projection equipment.

Graduate Student Participation: Very strong support for both student presentation contest and participation at the annual conference.

Outreach: Continue outreach, Look for ways to expand outreach programs, Some support for sponsoring regional outreach programs.

Web site: This is an important resource. We need to maintain it.

Proceedings: Continue to publish, and, we should make an electronic version available.

What's Good? (about meeting): Interactions with peers, Staying current on research, Networking, Etc.

What could we do better? : More discussion, Meeting date too close to holidays, More "outside" participation in sessions and as presenters.

Recommendations: Continue concurrent meetings, A NE regional Pest Management conference seems to have interesting possibilities

Recommendations: Meeting site, Membership wants to meet in metropolitan areas but are very cost conscious, Consider a resort location (warm) once every 10 years, Survey membership.

Recommendations: Meeting format, The membership wants the format to remain essentially the same, Look for ways to increase discussion in sessions by focused themes or organized discussion within sessions.

Recommendations: Computer projectors, We need to move forward with implementing computer projection, Again, cost conscious membership – want to bring their own projectors.

Recommendations: Outreach, Continue with Outreach, Consider regional publications, Consider an Extension Weed Control Resource forum at the annual meeting.

Recommendations: Proceedings, The EC should make the proceedings available in electronic format, The most logical approach right now seems to post them on our web site.

NEWSS Collegiate Contest rules update – Todd Mervosh

Todd indicated the 10 people on the committee were considering a number of changes but no decisions had yet been made.

6. Officer Changeover and Presentation of Gavel

Jeff Derr indicated that he had enjoyed serving as president and that he was leaving the office in goods hands, he then passed the gavel to David Mayonado, ending his term as president. David indicated it was an honor to serve and he thanked Jeff for his time and leadership as president and presented him with an engraved gavel plaque.

7. New Business - Dave Mayonado

a. Resolutions Committee – Ted Bean
Ted read a resolution that encouraged increased interaction with other societies that have common interests. Todd Mervosh made a motion to accept the resolution and this was seconded by Bob Sweet.

b. Nominating Committee Report Andy Senesac
Andy Senesac (chair), Gary Schnappinger, Betty Marose, and Steve Hart and Dave Spak nominated Robin Bellinder for vice president.

c. Election of the vice president
Andy asked for nominations from the floor. With none Jeff Derr asked nominations be closed and Grant Jordan seconded. Robin Bellinder was then elected Vice president by unanimous acclamation.

d. Appointment and Election of 2001 Nominating Committee

Dave Mayonado appointed John Jemison and another to be named later to the nomination committee. Brian Manley, Kevin Bradley and Randy Prostak were nominated from the floor. Brian Olson moved the nominations be closed, this was seconded by Joe Neal. Vote was unanimous for acceptance of he nomination committee.

e. Resolutions Committee appointment –
Dave Mayonado indicated he would appoint members at a later date.

f. Collegiate Weed Contest 2002
No site had been found for the contest to date, Dave Mayonado asked for volunteers to host the contest.

g. 2003 Annual Meeting
Dave Mayonado announced that the meeting site in 2003 will be the Hyatt Regency in Baltimore, Maryland to take place on January 6-9, 2003.

h. other business: Dave Mayonado announced that Ted Bean would be the new board member for Sustaining Membership and Art Gover would be the new Research and Education Coordinator.

8. Presentation of 2002 Executive Committee

David J. Mayonado (President) introduced the 2002 Executive Committee: D. Scott Glenn President-elect; Robin R. Bellinder, Vice-president; David E. Yarborough, Secretary/Treasurer; Jeffery F. Derr, Past President; Robert D. S weet, CAST Representative, Mark J. VanGessel, Editor; Jerry J. Baron, Legislative; Todd L. Mervosh, Public Relations; Art Gover, Research and Education Coordinator; Ted Bean, Sustaining Membership; Timothy E. Dutt, WSSA Representative and Caren A. Judge, Graduate Student Representative.

9. Adjournment:

President Mayonado asked for a motion to adjourn the 56th Annual Business Meeting of the Northeastern Weed Science Society. Brian Olson moved, Betty Marose seconded and the motion was unanimously approved to adjourn at 5:50 PM.

NEWSS Financial Statement for 2002
November 1, 2001 to October 31, 2002

INCOME:	
Sustaining Membership	$2,125.00
Coffee Break support	$1,800.00
Individual Membership	$3,740.00
Annual Meeting Registration	$13,350.00
Invasive Weed Session	$ 520.00
Proceedings	$4,420.00
Meeting Travel	$ 250.00
Interest	$1,117.05
NEASHS	$ 487.00
Other Income	$ 50.00
Weed Contest	$3,050.00
Subtotal	*$30,909.05*
EXPENSE:	
Annual Meeting	$5,503.22
Programs	$1,285.00
Student Reimbursement	$2,905.88
Administration	$1,609.27
Proceedings	$3,302.79
Newsletter	$2,858.33
Annual Meeting Awards	$1,331.80
Meeting Travel	$ 250.00
CAST	$1,901.84
NEASHS	$ 487.00
WSSA Director of Science Policy	$4,000.00
Postage	$ 403.42
Weed Contest	$6,172.73
Refunds	$ 80.00
Subtotal	*$32,091.28*
Total Income/Expenses	*($1,182.23)*
October 31, 2001 Savings Certificate Accounts (IDS-American Express)	$20,531.99
October 31, 2001 UM Credit Union Savings	$27,941.08
October 31, 2001 UM Credit Union Checking.	$561.20
TOTAL NET WORTH October 2001	**$49,034.27**
October 31, 2002 Savings Certificate Accounts (IDS-American Express)	$21,220.70
October 31, 2002 UM Credit Union Savings	$26,351.42
October 31, 2002 UM Credit Union Checking.	$279.92
TOTAL NET WORTH October 2002	**$47,852.04**

The Northeastern Weed Science Society Checking Account, Savings Account and Money Market accounts were reviewed by the undersigned and are in order.

Chris Reberg-Horton

John Jemison Jr.

Executive Committee Report of the NORTHEASTERN WEED SCIENCE SOCIETY

PRESENTED AT THE 57TH ANNUAL MEETING HYATT REGENCY, BALTIMORE, MD JANUARY 8, 2003

PRESIDENT
David Mayonado

I would like to thank the Executive Committee members and NEWSS Officers for their dedication to the society and the many hours of time they volunteered during 2002. The quality of their effort made my time as President pleasant and rewarding. I'd like to thank Grant Jordon and his crew at ACDS for their intense effort at hosting the 2002 Collegiate Weed Contest. Thanks also go to Brain Olson and Robin Bellinder for their assistance with the contest as well. I'd like to express my gratitude to Shaw Askew for his many efforts at maintaining and improving the effectiveness of the NEWSS web site. The value this brings to the efficiency of putting together the annual meeting is truly remarkable.

I'd also like to acknowledge the efforts Jeff Derr has made in coordinating efforts with the Northeast Aquatic Plant Management Society (NEAPMS) for a joint symposium at the 2003 meeting. We share much in common with this group so continued collaboration may be of real value for both organizations. With the slow but steady decline in our numbers, it might be of value to consider joint meetings with the NEAPMS in a similar fashion as we do with the Northeast Region – American Society of Horticultural Science. We also need to strongly encourage our membership to be highly engaged in our meetings. With a small society, we need a very high participation rate to ensure that we fill the 3-day meeting format with quality information and interaction. We can no longer afford to expect someone else give all the papers.

PRESIDENT-ELECT
Scott Glenn

I received very favorable reviews on the 2002 meeting held at the Loews Hotel in Philadelphia. Thank you letters were sent to all speakers in the General Symposium. Appreciation letters were also sent to all section chairs. The list of all new Chair-elects were sent to the in-coming Vice President, Robin Bellinder. Robin was also sent an electronic version of the 2002 NEWSS program.

The Boston Marriott, in Cambridge, Massachusetts was chosen and approved as the site for the 2004 NEWSS meetings. The contract for the Boston Marriott was signed in July.

The Collegiate Weed Contest will be hosted by Brian Manley at the Syngenta Crop Protection Eastern Technical Center in Hudson, New York. The date has not been determined yet. Sue Rick has agreed to serve in the

Sustaining Membership position and Brent Lackey has agreed to serve in the Public Relations position on the NEWSS Executive Committee.

VICE PRESIDENT
Robin R. Bellinder

The program for the 57th annual meeting of the Northeastern Weed Science Society contained a general session, general symposium, invasive weed management symposium, poster session, and 9 paper sessions. The general session included the welcoming address by Mr. Ted Haas, Regional Agronomist, (ret.) University of Maryland, awards presentations by Dr. Jeffrey Derr, presidential address entitled " Stewards of the Truth" by Dr. David Mayonado, and the keynote address, "Needed: A New Paradigm for Technology Adoption in Developing Countries", by Dr. Peter Hobbs of CIMMYT/Cornell University.

The General Symposium, introduced by the Keynote Speaker, Dr. Peter Hobbs, included invited speakers Ms. J. D. Ranjit, Dr. R. K. Malik, and Dr. M. Haidar from Nepal, India, and Lebanon, respectively. These weed scientists shared with us their perceptions of the status of agricultural technology adoption in their countries. Additionally, two industry perspectives on international agricultural adoption were given by Drs. David Vitolo of Syngenta and Dr. Richard Schumacher, formerly with Monsanto. Generous contributions by several of our Sustaining Members supported the travel expenses of our speakers.

The Invasive Aquatic Plant Symposium was organized by Drs. Art Gover and Jeffery Derr. It began with an hour-long aquatic weed identification workshop and was followed by presentations by five specialists from Connecticut, New York, New Jersey, and Florida. A separate and informal group, organized by Dr. Joseph Neal, met on the first evening of the meeting to discuss management strategies for Japanese stiltgrass.

The total number of papers presented in 2003 was 116 (including symposia speakers). Graduate students gave 13 of these presentations, which is slightly less than in the past couple of years. The breakdown of papers presented in the different sessions was as follows: Poster (23), Agronomy (19), Conservation, Forestry, and Industrial (9), Turf and Plant Growth Regulators (19), Vegetables and Fruits (8), Ornamentals (17), Weed Biology and Ecology (10), General Symposium (6), and Aquatic Weed Management Symposium (5).

We again combined the NEWSS and NE-ASHS meetings. Carolyn DeMoranville organized the NE-ASHS meeting which consisted of two paper sessions with a total of 22 presentations and 8 posters.

Options for hotels for the 2005 meeting will be discussed at the Board Meeting with the new members on January 9th. Possibilities include returning to the present site, and exploring Williamsburg, VA options.

SECRETARY-TREASURER
David E. Yarborough

The annual meeting in Philadelphia, PA was attended by 185 members, and in addition,15 attended the invasive species session. The total Membership for 2001 stands at 192. Below is the financial statement for the NEWSS for the fiscal year November 1, 2000 to October 31, 2001

NEWSS Financial Statement for 2001
November 1, 2000 to October 31, 2001

INCOME:	
2001 Sustaining Membership and Coffee Break Support	$4,575.00
Individual Membership	$4,100.00
Annual Meeting Registration	$10,914.00
Proceedings	$4,990.00
Annual Meeting Awards	$300.00
Interest	$1,788.97
NEASHS	$1055.96
Other Income	$55.71
Weeds Contest	$6,100.00
Subtotal	*$33,879.64*
EXPENSE:	
Annual Meeting/Programs	$8,827.57
Student Reimbursement	$1,600.97
Administration	$679.42
Proceedings	$3,914.08
Newsletter	$2,853.20
Annual Meeting Awards	$1,075.00
CAST	$1,285.67
NEASHS	$148.40
WSSA Director of Science Policy	$4,000.00
Weed Contest 2000	$1,329.40
Weed Contest 2001	$7,420.36
Refunds/bad check	$217.00
Web site	$499.00
Subtotal	*$33,850.07*
Total Income/Expenses	$29.57
Balance Forwarded Savings Certificate Accounts (IDS-American Express)	$19,450.58
Balance Forwarded UM Credit Union Savings	$28,729.85
Balance Forwarded UM Credit Union Checking	$824.27
TOTAL NET WORTH October 2000	**$49,004.70**

October 31, 2001 Savings Certificate Accounts (IDS-American Express)	$20,531.99
October 31, 2001 UM Credit Union Savings	$27,941.08
October 31, 2001 UM Credit Union Checking	$561.20
TOTAL NET WORTH October 2001	**$49,034.27**

PAST PRESIDENT
Jeffrey Derr

The Awards committee for the 2003 annual meeting is Jeff Derr (chair), Brian Olson, Rich Bonanno, Dave Vitolo, and Joe Neal. We reviewed nominations in 2002 for Outstanding Researcher, Outstanding Educator, and Distinguished Member. Recommendations were submitted to the Executive Committee for approval at the October board meeting. There were no nominations for the Award of Merit. The student paper contest judges will be Brian Olson (chair), Rich Bonanno, Dave Vitolo, Joe Neal, and Jeff Derr. Paul Stachowski will chair the Poster Judging committee. Grant Jordan will chair the Photo Judging committee. An article was submitted for the November issue of the Newsletter requesting photo contest entries.

An archives package for my term as President was sent to Robin Bellinder. It contained the 2002 Program, Awards Presentation 56th annual meeting, 2001 letterhead, 2001 Membership Survey results – Change in the NEWSS, Revised draft resolution – approved at the 56th annual business meeting, Registration forms – 56th annual meeting and invasive plants symposium, Executive Committee reports - 56th annual business meeting, April, August, November 2001 newsletters, Minutes – January 5, 2001; March 28, 2001; August 1, 2001; October 24-25, 2001; and January 7, 2002 EC meetings, Minutes – January 9, 2002 annual business meeting, and the Manual of Operating Procedures - revised January 9, 2002.

I have prepared the awards brochure, revised the Manual of Operating Procedures (MOP), and prepared an electronic version of the Constitution. Copies of all three documents will be distributed at the annual meeting in January, 2003. The new MOP contains the revised student contest rules for the summer collegiate weed contest, as well as a proposed timetable for the host. I have ordered plaques for the awards winners and for the outgoing President.

I have worked with Gerald Adrian of the Northeast Aquatic Plant Management Society (NEAPMS) and Art Gover to develop an aquatic/invasives symposium for the annual meeting. I feel we have an excellent aquatic/ invasives session to promote. We need to thank NEAPMS for their help with this program and we need to develop plans for future interaction with this group, as well as other organizations in our region.

CAST
R.D. Sweet

CAST has had a productive year and perhaps more importantly, has been involved in activities quite different from its traditional ones. For example, the soybean organization paid CAST to do the publication on biotech vs. traditional beans, corn and cotton. As a member of CAST's editorial and publications committee, I can guarantee the content was exactly what the authors found, and was not modified to suit the donor.

Another example is the just completed national essay contest for middle school pupils on science and agriculture. For years CAST has tried to get more agricultural related science into the school system, but the efforts failed. The problem is that teaching materials have to go through an enormous amount of red tape from the State down to the individual schools. But each "system" is different. A contest avoids most of that red tape.

A third different activity is the gathering of research success stories from each member society. This should be a fine source of good information for anyone who is lobbying for agricultural related research support.

The single effort in biotech education is being evaluated. Is it worth the cost? Please let me or the NEWSS Executive Committee know your views.

The D.C. office for the EVP is working out well. Many more briefings, day to day contacts, etc. are happening. CAST's reputation for being a top notch source of accurate information on agricultural related issues continues to rise.

Funding continues to be a problem due to consolidations of agricultural related business. Their contributions are a major part of the income. Dues from member societies are a small part of the total income.

EDITOR REPORT
Mark VanGessel

Instruction to Authors was further updated this year in an attempt to make the proceedings more consistent for all abstracts. NEWSS website was used for electronic submission of titles and source of Keyword Form submission. Discussions with the Web Master have been ongoing to streamline the process and reduce the workload on the editor and program chairperson. Again, over 95% of those submitting abstracts used electronic submission.

Two publications were produced for 2003 Annual Meeting. The program was 47 pages long with 116 titles and 650 were printed. Approximately 400 copies were mailed by the editor with first-class postage. The proceedings were 239 pages and 230 were printed. The number of programs and proceedings was lower this year than in previous years since there is a considerable amount of carryover from the past few years. One hundred and eight abstracts and papers were published with an additional one abstracts and the Presidential Address published as a supplement to the 56th Volume.

GRADUATE STUDENT REPRESENTATIVE
Caren A. Judge

The 2002 Northeastern collegiate weed contest was a great success. Many thanks to Grant Jordan and his staff for hosting the contest at the A.C.D.S. research facility in North Rose, New York. Forty students were in attendance representing schools from North Carolina to Nova Scotia. Having also served on the collegiate weed contest committee, many important rule changes were made to reflect changes in our discipline and to help resolve past conflicts.

After the annual meeting and collegiate weed contest each year, the Graduate Student Resource List is updated. This list serves as a current compilation of graduate students in the Northeast region as well as their advisors. Email addresses are also compiled and periodic reminders and information are disseminated including annual meeting information, job opportunities, and important deadlines.

The 2003 annual meeting will feature a graduate student workshop entitled, "Opportunities in Washington and Beyond." Featured speakers include Rob Hedberg - Director of Science Policy, National and Regional Weed Science Societies, Tom Bewick - USDA CSREES/PAS, Neil Anderson - EPA, and Frank Murphy - APHIS. The speakers will discuss opportunities for weed scientists in their respective organizations and means by which to search and apply for jobs. Since Baltimore is so close to Washington, it seemed like an excellent time to discuss government employment opportunities.

2003 will be my third and last year as graduate student representative. Therefore, we are soliciting for a replacement representative to take over.

PUBLIC RELATIONS
Todd Mervosh

In January at the 56th NEWSS Annual Meeting in Philadelphia, I took photos of all award winners at the General Session and Business Meeting, people at the Poster Session, Past Presidents at their breakfast meeting, and speakers at the General Session, General Symposium, and Invasive Plants Symposium. I included these photos with an annual meeting report in the April 2002 issue of the NEWSS newsletter, and submitted an article and photos to the newsletter editors for WSSA and SWSS. The April newsletter included the nomination form for NEWSS awards. I was late getting the April newsletter out. Sir Speedy Printing of Bloomfield, CT printed 400 copies of the 16-page newsletter (plus one insert). The newsletter was mailed to approximately 350 people (all members, and attendees at the 2002 and/or 2001 annual meetings). The total cost of newsletter printing and mailing ($0.57 postage for U.S. addresses) was $871.03. Sir Speedy also printed 1000 copies of the NEWSS NEWS masthead in green ink at a cost of $146.67. These pages were used for subsequent newsletters. I sent Shawn Askew (NEWSS webmaster) files for the

November 2001 and April 2002 newsletters, as well as photos from the 2001 weed contest and 2002 annual meeting.

The August 2002 newsletter included the Call for Papers information, and forms for title submissions and award nominations. Sir Speedy printed 350 copies of the 8-page newsletter (plus two inserts). The newsletter was mailed to about 310 people on September 9. The total cost of newsletter printing and mailing ($0.60 postage) was $685.93.

I was unable to attend the 2002 Northeastern Collegiate Weed Contest held August 7 in North Rose, NY. Grant Jordan of A.C.D.S. Research, host of the event, sent me digital photos that his daughter took at the contest. The November 2002 newsletter contained a report and photos from the weed contest. Also, this newsletter contained forms for annual meeting pre-registration/membership and placement service, hotel reservation information, condensed meeting program, and other information for the upcoming annual meeting in Baltimore. Sir Speedy printed 350 copies of the 16-page newsletter (plus two inserts). The newsletter was mailed to about 310 people on November 25. The total cost of newsletter printing and mailing ($0.60 postage) was $716.74. I mailed some additional newsletters to invited speakers and non-member presenters at the 2003 annual meeting.

I sent a report and photos from the weed contest to the WSSA newsletter editor. To publicize the 57th annual meeting to be held January 6-9, 2003, I sent an announcement to newspapers in the Baltimore area. I am compiling the photos (and captions) from annual meetings and weed contests (1999-2002) for the NEWSS archives. I hope to have this done for the annual meeting in January. I will meet with Brent Lackey, the incoming Public Relations Representative, on January 6 to discuss the PR position and to divide photographic responsibilities at the meeting.

RESEARCH AND EDUCATION
Art Gover

Research & Education activities at the 2003 annual meeting include development of an invasive species registration track, and recertification opportunities for pesticide applicators and Certified Crop Advisors.

The invasive species programming features a symposium developed by the Northeast Aquatic Plant Management Society (NEAPMS) and Jeff Derr and co-sponsored by the Mid-Atlantic Exotic Pest Plant Council, and the inclusion of the Wednesday programming of the Weed Biology and Ecology and Industrial, Forestry, and Conservation sections. A reduced registration fee of $35/$45 (pre/on-site) was developed to attract an audience outside of the regular NEWSS attendees. Gerald Adrian, NEAPMS president, assembled the speakers and will moderate the symposium. To date, sponsorship has been pledged by Arborchem Products, BASF, Dow AgroSciences, DuPont, Monsanto, and Syngenta totaling $850.

Pesticide recertification credits have requested from ME, NH, VT, CT, RI, MA, NY, PA, NJ, DE, MD, WV, VA, OH, and NC; and CCA credits will be available. I will be attending the NEAPMS meeting in Sturbridge, MA on January 15 and 16, and will continue the efforts initiated by Jeff Derr to foster joint activities between the two societies.

WSSA REPRESENTATIVE REPORT
Tim Dutt

As NEWSS Representative to the WSSA, I attended the WSSA annual meeting held February 10-13, 2002 in Reno, NV. In conjunction with the annual meeting, I attended the WSSA Board of Directors (BOD) meetings on February 9-10 and on February 14 in Reno. I also attended the summer BOD meeting held July 20-21 in Jacksonville, FL. This is a summary of the year's highlights and activities.

2002 WSSA Meeting:

The meeting in Reno went extremely well with an attendance of 666, which was up slightly from the 2001 meeting attendance of 643 in Greensboro. Membership attendance has been stable over the last several years, with the slight increase in meeting attendance in 2002 due largely to registrations for the Invasive Species Workshop that exceeded expectations. Brad Majek and members of the Program Committee developed and executed an excellent program. Tom Lannini and members of the Local Arrangements Committee also helped in organizing a very successful meeting. A total of 250 posters and papers were presented. Symposiums and special sessions were held on weed ecology in long-term experiments, new developments in industry, vegetable roundtable discussion, weed science research funding, metabolic mechanisms conferring resistance to herbicides, and an invasive plant species workshop.

A new program format was implemented which included the General Session and award presentations to kick-off the meeting followed by an awardees reception and member social on Sunday evening. The meeting ended with a reception and social mixer replacing the traditional banquet on Wednesday evening. Paper submissions were on-line via the web site, and LCD projectors were used in all paper sessions. With all the new changes implemented, the meeting was a great success. Congratulations also go to NEWSS member awardees at the WSSA meeting. Dave Mortensen of Penn State received the Outstanding Teacher Award, and Shawn Askew of Virginia Tech received the Outstanding Graduate Student Award.

2002 WSSA Board of Directors:

President – Brad Majek (Rutgers University)
President Elect – Al Hamill (Agriculture Canada)
Vice President – Donn Thill (University of Idaho)
Past President – Charlotte Eberlein (University of Idaho)

Secretary – Laura Whatley (BASF Corporation)
Treasurer – Carol Mallory-Smith (Oregon State University)
Director of Publications – Mike Foley (USDA-ARS)
Director of Education – Leslie Weston (Cornell University)
Constitution and Operating Procedures Chair – Horace Skipper (Clemson University)
Member at Large – Phil Westra (Colorado State University)
Member at Large – Dale Shaner (USDA-ARS)
Member at Large – Jim Kells (Michigan State University)
Member at Large – Doug Buhler (Michigan State University)
APMS Representative – Greg MacDonald (University of Florida)
WSSC Representative – Jerry Ivany (Agriculture Canada)
NCWSS Representative – Jamie Retzinger (BASF Corporation)
NEWSS Representative – Tim Dutt (Monsanto Company)
SWSS Representative – Tim Murphy (University of Georgia)
WSWS Representative – Steve Miller (University of Wyoming)
Director of Science Policy – Rob Hedberg (Washington D.C.)
Executive Secretary – Joyce Lancaster (Allen Marketing and Management)

WSSA Board of Directors Annual Business Highlights:

The Executive Secretary reported that WSSA had 1,805 members in 2002. Membership was down about 10% from 1,990 in 2001. A goal of the membership committee is to put plans in place to increase membership. The Treasurer reported that WSSA was sound financially with a growing endowment fund. The increase in registration and membership fees was successful in getting the organization operating in the black again on an annual basis. With sustaining members continuing to decline, WSSA is making plans to operate with very few or no memberships at the sustaining level in the future.

The Director of Publications implemented on-line journal access in 2002. BioOne, a journal aggregator web site, will be handling electronic access to WSSA journals from 2001 volumes forward. No plans are in place for accessing older volumes on-line. Decision was also made to switch to electronic manuscript submission, which should result in faster publication. John Wilcut (North Carolina State University) became the new editor of *Weed Technology* replacing Larry Foy. Bob Blackshaw (Agriculture Canada) will become the new editor of *Weed Science* replacing Bob Zimdahl after the annual meeting in 2003.

Outreach activities (invasive species workshops) and web site enhancements are current priorities of the Director of Education. A special committee looked into the possibility of combining the Director of Publications and Director of Education positions. The committee recommended that WSSA seriously consider hiring an Executive Director to provide overall coordination of organizational activities.

Director of Science Policy priorities for 2002 included research funding, invasive weeds, and procuring a USDA/ARS job classification for weed scientists. The BOD also appointed Carol Mallory-Smith as WSSA's representative on EPA's Advisory Committee on Biotechnology. The five-year strategic plan was approved and posted on the WSSA web site. The plan indicates research as a key priority. The key service priorities indicated are meetings with more workshops, publications, and web site enhancements.

The 2003 meeting will be at the Adam's Mark Hotel in Jacksonville, FL. A schedule change will be implemented with the meeting running from Monday through Thursday instead of the traditional Sunday through Wednesday format. Of interest to the NEWSS is that the 50th anniversary meeting of the WSSA will be held in New York City in 2006. This meeting will have an historical theme and celebration since the first meeting of the WSSA was hosted by NEWSS and held in New York City in 1956. The WSSA 50th Anniversary Committee recommends coordination of this meeting with NEWSS for historical reasons, and suggested a possible joint meeting. There will be discussion on this at the 2003 NEWSS Business Meeting.

WSSA Future Meeting Sites:
2003 – Jacksonville, FL (February 10-13)
2004 – Kansas City, MO (February 9-12)
2005 – Honolulu, HI (February 7-10)
2006 – New York, NY (50th Anniversary Meeting)

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Agriculture & AgroAlimentaire Canada
Diane Benoit

American Cyanamid
John Dobson (retired)

AshGrow Crop Management
James Ashley

BASF
Kathie Kalmowitz
Kyle Miller
Gar Thomas

Bayer
John Isgrigg
Matthew Mahoney
Larry Norton
Thomas Plitt
David Spak
Prescott Towle

Connecticut Agricultural Experiment Station
John Ahrens (retired)
Todd Mervosh

Cornell University
Jacob Barney
Robin Bellinder
Daniel Brainard
Antonio DiTommaso
Jesse Dubin
Richard Dunst
Virender Kumar
Edith Lurvey
Andrew Miller
Rob Nurse
Heidi Rapp
Andrew Senesac
Paul Stachowski
Robert Sweet (retired)
Ashok Yadav

Crop Management Strategies, Inc.
Marc Pacciholi
Daniel Ramsdell

Deer Run Farm
Tim Durham

Delaware Dept. of Agriculture
Clifford Blessing
Todd Davis
Terry Van Horn

Dow AgroSciences, LLC
Daniel Loughner
Brian Olson

DuPont
Gregory Armel
David Baxter
Tom Blaesser
Dan Cotterman
Edison Hidalgo
Lewis Howell
Darrell LaShomb
William McCollum
Michael McComrick
Susan Rick
Marc Ruggiero

E.I. DuPont DeNemours & Co, Inc.
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Patrick Rardon

F. X. Browne, Inc.
Sarah Low

Fallbrook Research Group
Richard Bailey

Fingerlakes Agronomics
James Saik

FMC Corporation
Howard Guscar
John Long

Gowan Company
Paul David

Half Hollow Nursery, Inc.
Charles Scheer, Jr.

Imperial Nurseries
Sali Barolli

IR-4
J. Ray Frank
Dan Kunkel
Ely Vea

J. C. Ehrlich Co., Inc.
Jerry Kahl
Ross Phillips

LABServices
James Steffel

Maryland Dept. of Agriculture
Lane Heimer
Don Robbins
Leroy Sellman
Mark Smith
Robert Trumbule

Maryland Forest Service
Philip Pannill

Maryland Native Plant Society
Marc Imlay

Michigan State University
Robert Richardson

Monsanto
Robert DeWaine
Timothy Dutt
Jim Haldeman
David Mauonado
Domingo Riego

NCFAP
Leonard Gianessi

New Jersey Dept. of Agriculture
Jerry Baron
Floyd Yoder

North Carolina State University
Robin Stout
Michael Burton
Carrie Judge
Scott McElroy
Joseph Neal
Robert Wooten

Northeast Turf & Ornamental Research
Annamarie Pennucci

NYC Parks – Natural Resources Group
Tim Wenskus

Ohio State University
Luke Case
Doug Doohan
Sara Johansen
Hannah Mathers
Jenny Pope
Alison Stoven
Randy Zondag

Olympic Horticultural Products
Jeffrey Dobbs

PBI Gordon Corporation
S. Gary Custis

Penn State University
Jeffrey Borger
Brain Clark
William Curran
Mike Fidanza
Art Gover
Scott Guiser
Tracey Harpster
Jon Johnson
Quintin Johnson
Brian Jones
Larry Kuhns
Dwight Lingenfelter
David Mortensen
Wilbur Mountain
Matt Myers
Bradley Park
Jennifer Stingelin-Keefer
Thomas Watschke

Ridgetown College
Dave Bilyea
Darren Robinson

Rutgers University
Marija Arsenovic
Stephen Hart
Darren Lycan
Bradley Majek
Stanford Fertig (retired)
William Sciarappa

RWC, Inc.
John Roy

Springborn Smithers Laboratories
Debra Teixeira

Sprout-Less Vegetation Control Systems
Aboud Mubareka

St. John's University
Richard Stalter

Suny Cobleskill
Art Graves

Sygenta
Steven Cosky
Edward Higgins (retired)
Renee Keese
Brent Lackey
Chris Munsterman
Eric Palmer
Randy Ratliff
Rick Schmenk
Dan Smith
Mark Smith
Jeffrey Zelna
David Vitolo

The Scotts Company
Rene Scoresby

United Agri Products
Robert Herrick

University of Arizona
Kai Umeda

University of Connecticut
Richard Ashley
Donna Ellis

University of Delaware
Brian Hearn
Mark Isaacs
Barbara Scott
Andrew Skibo
Mark VanGessel

University of Georgia
Mark Czarnota

University of Maine
John Jemison
Chris Reberg-Horton
David Yarborough

University of Maryland
C. Edward Beste
Peter Dernoeden
Scott Glenn
John Kaminski
Betty Marose
Hiwot Menbere
Bill Phillips
Ronald Ritter

University of Massachusetts
Richard Bonanno
Prasanta Bhowmik
Randall Prostak
Hilary Sandler

University of New Hampshire
Michelle Martin

University of Rhode Island
Raymond Taylorson

USDA
Dana Berner
William Bruckart
Benjamin Coffman
Farivar Eskandari
Darryl Jewett
Hyesuk Kong
John Lydon
James Parochetti
Jay Radhakrishnan
Al Tasker

Valent USA Corporation
John Cranmer
Jason Fausey

Virginia Native Plant Society
Ruth Douglas

Virginia Tech
Shawn Askew
Whitnee Barker
Joshua Beam
Jeffrey Derr
Noureddine Hamamouch
Thomas Hines
Steven King
James Westwood
Cory Whaley

Waldrum Specialities, Inc.
Roy Johnson

Weeds Inc.
Brian O'Neill

West Virginia University
Rakesh Chandran
Roger Young (Prof Emeritus)

NEWSS PAST PRESIDENTS

Gilbert H. Ahlgren	1947-49	Richard J. Marrese	1976-77
Robert D. Sweet	1949-50	C. Edward Beste	1977-78
Howard L. Yowell	1950-51	James D. Riggleman	1978-79
Stephen M. Raleigh	1951-52	James V. Parochetti	1979-80
Charles E. Minarik	1952-53	M. Garry Schnappinger	1980-81
Robert H. Beatty	1953-54	Raymond B. Taylorson	1981-82
Albin O. Kuhn	1954-55	Stephan Dennis	1982-83
John Van Geluwe	1955-56	Thomas L. Watschke	1983-84
L. Danielson	1956-57	James C. Graham	1984-85
Charles L. Hovey	1957-58	Russell R. Hahn	1985-86
Stanford N. Fertig	1958-59	Edward R. Higgins	1986-87
Gordon Utter	1959-60	Maxwell L. McCormack	1987-88
E. M. Rahn	1960-61	Roy R. Johnson	1988-89
Lawrence Southwick	1961-62	Stanley F. Gorski	1989-90
Donald A. Shallock	1962-63	John B. Dobson	1990-91
Anthony J. Tafuro	1963-64	Prasanta C. Bhowmik	1991-92
Robert A. Peters	1964-65	Stanley W. Pruss	1992-93
Gideon D. Hill	1965-66	Ronald L. Ritter	1993-94
Richard D. Ilnicki	1966-67	Wayne G. Wright	1994-95
John E. Gallagher	1967-68	Bradley A. Majek	1995-96
John A. Meade	1968-69	Thomas E. Vrabel	1996-97
Homer M. Lebaron	1969-70	Joseph C. Neal	1997-98
John F. Ahrens	1970-71	David B. Vitolo	1998-99
George H. Bayer	1971-72	A. Richard Bonanno	1999-00
Arthur Bing	1972-73	Brian D. Olson	2000-01
Ralph Hansen	1973-74	Jeffrey F. Derr	2001-02
Walter A. Gentner	1974-75	David J. Mayonado	2002-03
Henry P. Wilson	1975-76		

AWARD OF MERIT

1971	Gilbert H. Ahlgren	Rutgers University
	Homer Neville	L.I. Ag. & Tech, Farmingdale, NY
	Claude E. Phillips	University of Delaware
	M. S. Pridham	Cornell University
	Stephen A. Raleigh	Penn State University
1972	Robert Bell	University of Rhode Island
	Stuart Dunn	University of New Hampshire
	Alfred Fletcher	NJ State Dept. of Health
	Frank N. Hewetson	Penn Fruit Res. Lab.
	Madelene E. Pierce	Vassar College
	Collins Veatch	West Virginia University
	Howard L. Yowell	Esso Research Lab.
1973	Moody F. Trevett	University of Maine
1974	Robert H. Beatty	Amchem Products, Inc.
	Arthur Hawkins	University of Connecticut
1975	Philip Gorlin	NY City Environ. Cont.
	Herb Pass	CIBA-GEIGY Corp.
	Robert D. Sweet	Cornell University
1976	C. E. Langer	University of New Hampshire
	Charles E. Minarik	US Dept. of Agriculture-ARS
	Herb Pass	CIBA-GEIGY Corp.
1977	L. L. Danielson	US Dept. of Agriculture-ARS
	Madelene E. Pierce	Vassar College
	Lawrence Southwick	Dow Chemical Company
	John Stennis	US Bureau of Fish & Wildlife
1978	None Awarded	
1979	Carl M. Monroe	Shell Chemical Company
	Charles Joseph Noll	Penn State University
	Jonas Vengris	University of Massachusetts
1980	Otis F. Curtis, Jr.	NY Agricultural Experiment Sta.
	Theodore R. Flanagan	University of Vermont
	Oscar E. Shubert	Virginia University
1981	Dayton L. Klingman	US Dept. of Agriculture-ARS
	Hugh J. Murphy	University of Maine
	John Van Geluwe	CIBA-GEIGY Corp.
1982	Robert D. Shipman	Penn State University
1983	Arthur Bing	Cornell University
	William E. Chappel	Virginia Tech
	Barbara H. Emerson	Union Carbide Agricultural Prod.
1984	William H. Mitchell	University of Delaware
	Roger S. Young	West Virginia University
1985	John A. Jagschitz	University of Rhode Island
1986	John R. Havis	University of Massachusetts
1987	None Awarded	

1988	J. Lincoln Pearson	University of Rhode Island
1989	Robert A. Peter	University of Connecticut
1990	Bryant L. Walworth	American Cyanamid Co.
1991	Don Warholic	Cornell University
1992	Robert Duel	Rutgers University
	Richard Ilnicki	Rutgers University
	William V. Welker	USDA/ARS
1993	None Awarded	
1994	John F. Ahrens	CT Agricultural Experiment Sta.
	John B. Dobson	American Cyanamid
	J. Ray Frank	USDA-ARS/IR-4
1995	Francis J. Webb	University of Delaware
1996	Robert M. Devlin	University of Massachusetts
	Wilber F. Evans	Rhone-Poulenc Ag. Co.
	Raymond B. Taylorson	University of Rhode Island
	S. Wayne Bingham	Virginia Tech
1997	Jean P. Cartier	Rhone-Poulenc Ag. Co.
1998	Stan Pruss	Novartis Crop Protection
	Max McCormack, Jr.	University of Maine
1999	None Awarded	
2000	Richard J. Marrese	Hoechst-NorAm
2001	Nathan L. Hartwig	Penn State University
	Edward R. Higgins	Novartis Crop University
2002	Garry Schnappinger	Syngenta Crop Protection
2003	None Awarded	

DISTINGUISHED MEMBERS

1979	George H. Bayer	Agway, Inc.
	Robert A. Peters	University of Connecticut
	Robert D. Sweet	Cornell University
1980	John F. Ahrens	CT Agricultural Experiment Sta.
	John E. Gallagher	Union Carbide Agric. Prod.
	Richard Ilnicki	Rutgers University
1981	Robert H. Beatty	Amchem Products, Inc.
	Arthur Bing	Cornell University
	John A. Meade	Rutgers University
1982	Walter A. Gentner	US Dept. of Agriculture-ARS
	Hugh J. Murphy	University of Maine
1983	L. L. Danielson	US Dept. of Agriculture-ARS
1984	Barbara H. Emerson	Union Carbide Agric. Prod.
	Henry P. Wilson	Virginia Tech
1985	None Awarded	
1986	Chiko Haramaki	Penn State University
	Dean L. Linscott	USDA-ARS/Cornell University
1987	Gideon D. Hill	E. I. DuPont DeNemours
	Williams V. Welker	US Dept. of Agric-ARS
1988	Wendell R. Mullison	Dow Chemical
	James V. Parochetti	US Dept. of Agriculture-CSRS
1989	None Awarded	
1990	Robert M. Devlin	University of Massachusetts
1991	John (Jack) B. Dobson	American Cyanamid
	Robert D. Shipman	Penn State University
1992	Gary Schnappinger	Ciba-Geigy Corp.
1993	Steve Dennis	Zeneca Ag. Products
	James Graham	Monsanto Ag. Co.
1994	Russell Hahn	Cornell University
	Maxwell McCormick	University of Maine
1995	Richard Ashly	University of Connecticut
	Richard Marrese	Hoechst-NorAm
1996	Roy R. Johnson	Waldrum Specialist Inc.
	Edward R. Higgins	Ciba Crop Protection
1997	Raymond B. Taylorson	UDSA-ARS
	Wayne G. Wright	DowElanco
	Stanley F. Gorski	Ohio State University
1998	Prasanta Bhowmik	University of Massachusetts
1999	C. Edward Beste	University of Maryland
2000	J. Ray Frank	IR-4 Project
	Stanley W. Pruss	Ciba Crop Protection
2001	Ronald L. Ritter	University of Maryland

Distinguished Members

2002	Bradley A. Majek	Rutgers University
	Thomas L. Watschke	Penn State University
2003	Nathan L. Hartwig	Penn State University

OUTSTANDING RESEARCHER AWARD

1999	Garry Schnappinger	Novartis Crop Protection
2000	Prasanta C. Bhowmik	University of Massachusetts
2001	Robin Bellinder	Cornell University
2002	Jerry J. Baron	IR-4 Project, Rutgers University
2003	Arthur E. Gover	Penn State University

OUTSTANDING EDUCATOR AWARD

1999	Douglas Goodale	SUNY Cobleskill
2000	Thomas L. Watschke	Penn State University
2001	C. Edward Beste	University of Maryland
2002	E. Scott Hagood	Virginia Tech University
2003	Andrew F. Senesac	Cornell University

OUTSTANDING GRADUATE STUDENT PAPER CONTEST

1979	1	Bradley Majek	Cornell University
	2	Betty J. Hughes	Cornell University
1980	1	John Cardi	Penn State University
	2	Timothy Malefyt	Cornell University
1981	1	A. Douglas Brede	Penn State University
	2	Ann S. McCue	Cornell University
1982	1	Thomas C. Harris	University of Maryland
	2	Barbara J. Hook	University of Maryland
	HM	L. K. Thompson	Virginia Tech
	HM	Timothy Malefyt	Cornell University
1983	1	Anna M. Pennucci	University of Rhode Island
	2	Michael A. Ruizzo	Ohio State University
	HM	I. M. Detlefson	Rutgers University
1984	1	Robert S. Peregoy	University of Maryland
	2	Ralph E. DeGregorio	University of Connecticut
1985	1	Stephan Reiners	Ohio State University
	2	Erin Hynes	Penn State University
1986	1	Elizabeth Hirsh	University of Maryland
	2 (tie)	Ralph E. DeGregorio	University of Connecticut
	2 (tie)	Avraham Y. Teitz	Ohio State University
1987	1	Russell W. Wallace	Cornell University
	2 (tie)	Daniel E. Edwards	Penn State University
	2 (tie)	Frank J. Himmelstein	University of Massachusetts
1988	1	William K. Vencill	Virginia Tech
	2	Lewis K. Walker	Virginia Tech
	HM	Scott Guiser	Penn State University
	HM	Frank J. Himmelstein	University of Massachusetts
1989	1	Frank S. Rossi	Cornell University
	1	Amy E. Stowe	Cornell University
1990	1	William J. Chism	Virginia Tech
	2	Russell W. Wallace	Cornell University

1991	1	Elizabeth Maynard	Cornell University
	2	Daniel A. Kunkle	Cornell University
1992	1	J. DeCastro	Rutgers University
	2	Ted Blomgren	Cornell University
	3	Fred Katz	Rutgers University
1993	1	Eric D. Wilkens	Cornell University
	2	Henry C. Wetzel	University of Maryland
1994	1	Jed B. Colquhoun	Cornell University
	2	Eric D. Wilkins	Cornell University
1995	1	Sydha Salihu	Virginia Tech
	2	John A. Ackley	Virginia Tech
	HM	Jed B. Colquhoun	Cornell University
1996	1	Dwight Lingenfelter	Penn State University
	2	Mark Issacs	University of Delaware
	HM	Jed B. Colquhoun	Cornell University
1997	1	David Messersmith	Penn State University
	2	Sowmya Mitra	University of Massachusetts
	HM	Mark Issacs	University of Delaware
1998	1	Dan Poston	Virginia Tech
	2	Travis Frye	Penn State University
	3	David B. Lowe	Clemson University
1999	1	Hennen Cummings	North Carolina State University
	2	John Isgrigg	North Carolina State University
2000	1	Matthew Fagerness	North Carolina State University
	2	Steven King	Virginia Tech
	3	Gina Penny	North Carolina State University
2001	1	Robert Nurse	University of Guelph
	2 (tie)	W. Andrew Bailey	Virginia Tech
	2 (tie)	Steven King	Virginia Tech

2002	1.	G. Michael Elston	University of Massachusetts
	2.	Caren A. Judge	North Carolina State University
2003	1.	Matt Myers	Penn State University
	2.	J. Scott McElroy	North Carolina State Univesity
	3.	Robert Nurse	Cornell University

COLLEGIATE WEED CONTEST WINNERS

1983 - Wye Research Center, Maryland

Graduate Team: University of Guelph
Undergraduate Team: Penn State University
Graduate Individual: Mike Donnelly, University of Guelph
Undergraduate Individual: Bob Annet, University of Guelph

1984 - Rutgers Research and Development Center, Bridgeton, New Jersey

Graduate Team: University of Guelph
Undergraduate Individual: D. Wright, University of Guelph
Graduate Individual: N. Harker, University of Guelph

1985 - Rhom and Haas, Spring House, Pennsylvania

Graduate Team: University of Maryland
Undergraduate Individual: Finlay Buchanan, University of Guelph
Graduate Individual: David Vitolo, Rutgers University

1986 - FMC, Princeton, New Jersey

Graduate Team:
Undergraduate Team: University of Guelph
Graduate Individual: R. Jain, Virginia Tech
Undergraduate Individual: Bill Litwin, University of Guelph

1987 - DuPont, Newark, Delaware

Graduate Team: University of Guelph
Undergraduate Team: University of Guelph
Graduate Individual: Lewis Walker, Virginia Tech
Undergraduate Individual: Allen Eadie, University of Guelph

1988 - Ciba-Geigy Corp., Hudson, New York

Graduate Team: Virginia Tech
Undergraduate Team: University of Guelph
Undergraduate Individual: Del Voight, Penn State University
Graduate Individual: Carol Moseley, Virginia Tech

1989 - American Cyanamid, Princeton, New Jersey

Graduate Team: Cornell University
Undergraduate Team: SUNY Cobleskill
Graduate Individual: Paul Stachowski, Cornell University
Undergraduate Individual: Anita Dielman, University of Guelph

1990 - Agway Farm Research Center, Tully, New York

Graduate Team: Virginia Tech
Undergraduate Team: SUNY Cobleskill
Graduate Individual: Brian Manley, Virginia Tech
Undergraduate Individual: Dwight Lingenfelder, Penn State University

1991 - Rutgers University, New Brunswick, New Jersey

Graduate Team: Virginia Tech
Undergraduate Team: University of Guelph
Graduate Individual: Carol Moseley, Virginia Tech
Undergraduate Individual: Tim Borro, University of Guelph

1992 - Ridgetown College, Ridgetown, Ontario, CANADA

Graduate Team: Michigan State University
Undergraduate Team: Ohio State
Graduate Individual: Troy Bauer, Michigan State University
Undergraduate Individual: Jeff Stackler, Ohio State University

1993 - Virginia Tech, Blacksburg, Virginia

Graduate Team: Virginia Tech
Undergraduate Team: SUNY Cobleskill
Graduate Individual: Brian Manley, Virginia Tech
Undergraduate Individual: Brian Cook, University of Guelph

1994 - Lower Eastern Shore Research and Education Center, Salisbury, Maryland

Graduate Team: Virginia Tech
Undergraduate Team: University of Guelph
Graduate Individual: Brian Manley, Virginia Tech
Undergraduate Individual: Robert Maloney, University of Guelph

1995 - Thompson Vegetable Research Farm, Freeville, New York

Graduate Team: Virginia Tech
Undergraduate Team: University of Guelph
Graduate Individual: Dwight Lingenfelter, Penn State University
Undergraduate Individual: Jimmy Summerlin, North Carolina State University

1996 - Penn State Agronomy Farm, Rock Springs, Pennsylvannia

Graduate Team: Michigan State University
Undergraduate Team: SUNY,Cobleskill
Graduate Individual: John Isgrigg, North Carolina State University
Undergraduate Individual: Mark Brock, University of Guelph

1997 - North Carolina State University, Raleigh, North Carolina

Graduate Team: Michigan State University
Undergraduate Team: University of Guelph
Graduate Individual: Brett Thorpe, Michigan State University

1998 - University of Delaware, Georgetown, Delaware

Graduate Team: Virginia Tech
Undergraduate Team: University of Guelph
Graduate Individual: Shawn Askew, North Carolina State University
Undergraduate Individual: Kevin Ego, University of Guelph

1999 - Virginia Tech, Blacksburg, Virginia

Graduate Team: North Carolina State University
Undergraduate Team: Nova Scotia Agricultural College
Graduate Individual: Rob Richardson, Virginia Tech
Undergraduate Individual: Keith Burnell, North Carolina State University

2000 - University of Guelph, Guelph, Ontario, CANADA

Graduate Team: Virginia Tech
Undergraduate Team: Ohio State University
Graduate Individual: Shawn Askew, North Carolina State University
Undergraduate Individual: Luke Case, Ohio State University

2001 - University of Connecticut, Storrs, Connecticut

Graduate Team: North Carolina State University
Undergraduate Team: Penn State University
Graduate Individual: Matt Myers, Penn State University
Undergraduate Individual: Shawn Heinbaugh, Penn State University

2002 - ACDS Research Facility, North Rose, New York

Gradaute Team: North Carolina State University
Undergraduate Team: North Carolina State University
Graduate Individual: Scott McElroy, North Carolina State University
Undergradaute Individual: Sarah Hans, North Carolina State University

2003 – Syngeta Crop Protection, Eastern Region Technical Center, Hudson, NY

Graduate Team: North Carolina State University
Undergraduate Team: University of Guelph
Graduate Individual: Andrew MacRae
Undergraduatge Individual: Jonathon Klapwik

RESEARCH POSTER AWARDS

1983 1. Herbicide Impregnated Fertilizer of Weed Control in No-Tillage Corn - R. Uruatowski and W. H. Mitchell, Univ. of Delaware, Newark

2. Effect of Wiper Application of Several Herbicides and Cutting on Black Chokeberry - D. E. Yarborough and A. A. Ismail, Univ. of Maine, Orono

HM. Corn Chamomile Control in Winter Wheat - R. R. Hahn, Cornell Univ., Ithaca, New York and P. W. Kanouse, New York State Cooperative Extension, Mt. Morris

1984 1. Herbicide Programs and Tillage Systems for Cabbage - R. R. Bellinder, Virginia Tech, Blacksburg, and T. E. Hines and H. P. Wilson, Virginia Truck and Ornamental Res. Station, Painter

2. Triazine Resistant Weeds in New York State - R. R. Hahn, Cornell Univ., Ithaca, NY

HM. A Roller for Applying Herbicides at Ground Level - W. V. Welker and D. L. Peterson, USDA-ARS, Kearneysville, WV

1985 1. No-Tillage Cropping Systems in a Crown Vetch Living Mulch - N. L. Hartwig, Penn State Univ., University Park

2. Anesthetic Release of Dormancy in *Amaranthus retroflexus* Seeds - R. B. Taylorson, USDA-ARS, Beltsville, MD and K. Hanyadi, Univ. of Agricultural Science, Keszthely, Hungary

2. Triazine Resistant Weed Survey in Maryland - B. H. Marose, Univ. of Maryland, College Park

HM. Wild Proso Millet in New York State - R. R. Hahn, Cornell Univ., Ithaca, NY

1986 1. Discharge Rate of Metolachlor from Slow Release Tablets - S. F. Gorski, M. K. Wertz and S. Refiners, Ohio State Univ., Columbus

2. Glyphosate and Wildlife Habitat in Maine - D. Santillo, Univ. of Maine, Orono

1987 1. Mycorrhiza and Transfer of Glyphosate Between Plants - M. A. Kaps and L. J. Khuns, Penn State Univ., University Park

2. Redroot Pigweed Competition Study in No-Till Potatoes - R. W. Wallace, R. R. Bellinder, and D. T. Warholic, Cornell Univ., Ithaca, NY

1988 1. Growth Suppression of Peach Trees With Competition - W. V. Welker and D. M. Glenn, USDA-ARS, Kearneysville, WV

2. Smooth Bedstraw Control in Pastures and Hayfields - R. R. Hahn, Cornell Univ., Ithaca, NY

1989 1. Burcucumber Responses to Sulfonylurea Herbicides - H. P. Wilson and T. E. Hines, Virginia Tech, Painter, VA
2. Water Conservation in the Orchard Environment Through Management - W. V. Welker, Jr., USDA-ARS Appalachian Fruit Res. Sta., Kearneysville, WV

1990 1. Reduced Rates of Postemergence Soybean Herbicides - E. Prostko, J. A. Meade, and J. Ingerson-Mahar, Rutgers Coop. Ext. Mt. Holly, NJ
2. The Tolerance of Fraxinus, Juglans, and Quercus Seedings to Imazaquin and Imazethapyr - L. J. Kuhns and J. Loose, Penn State Univ., University Park

1991 1. Johnsongrass Recovery from Sulfonylurea Herbicides - T. E. Hines and H. P. Wilson, Virginia Tech, Painter, VA
2. Growth Response to Young Peach Trees to Competition With Several Grass Species - W. V. Welker and D. M. Glenn, USDA-ARS, Kearneysville, WV

1992 1. Teaching Weed Identification with Videotape - B. Marose, N. Anderson, L. Kauffman-Alfera, and T. Patten, Univ. of Maryland, College Park
2. Biological Control of Annual Bluegrass (*Poa annua* L. *Reptans)* with *Xanthomonas campestris* (MYX-7148) Under Field Conditions - N. D. Webber and J. C. Neal, Cornell Univ., Ithaca, NY

1993 1. Development of an Identification Manual for Weeds of the Northeastern United States - R H. Uva and J. C. Neal, Cornell Univ., Ithaca, NY
2. Optimum Time of Cultivation for Weed Control in Corn - Jane Mt. Pleasant, R. Burt and J. Frisch, Cornell Univ., Ithaca, NY

1994 1. Herbicide Contaminant Injury Symptoms on Greenhouse Grown Poinsettia and Geranium - M. Macksel and A. Senesac, Long Island Horticultural Res. Lab, Riverhead, NY and J. Neal, Cornell Univ., Ithaca, NY
2. Mow-kill Regulation of Winter Cereals Grown for Spring No-till Crop Production - E. D. Wilkins and R R Bellinder, Cornell Univ., Ithaca, NY

1995 1. A Comparison of Broadleaf and Blackseed Plantains Identification and Control - J. C. Neal and C. C. Morse, Cornell Univ., Ithaca, NY
2. Using the Economic Threshold Concept as a Determinant for Velvetleaf Control in Field Corn - E. L. Werner and W. S. Curran, Penn State Univ., University Park

1996 1. Preemergence and Postemergence Weed Management in 38 and 76 cm Corn - C. B. Coffman, USDA-ARS, Beltsville, MD
2. Common Cocklebur Response to Chlorimuron and Imazaquin - B. S. Manley, H. P. Wilson and T. E. Hines, Virginia Tech, Blacksburg, VA

1997 None Awarded

1998
1. Weed Control Studies with Rorippa sylvestris - L. J. Kuhns and T. Harpster, Penn State Univ., University Park, PA
2. Postemergence Selectivity and Safety of Isoxaflutole in Cool Season Turfgrass - P. C. Bhowmik and J. A. Drohen, Univ. of Massachusett, Amherst, MA

1999
1. Winter Squash Cultivars Differ in Response to Weed Competition - E. T. Maynard, Purdue Univ., Hammond, IN
2. Effectiveness of Row Spacing, Herbicide Rate, and Application Method on Harvest Efficiency of Lima Beans - S. Sankula, M. J. VanGessel, W. E. Kee, and J. L. Glancey, Univ. of Delaware, Georgetown, DE

2000
1. Weed Control and Nutrient Release With Composted Poultry Litter Mulch in a Peach Orchard - P. L. Preusch, Hood College, Frederick, MD; and T. J. Tworkoski, USDA-ARS, Hearneysville, WV

2 (tie). The Effect of Total Postemergence Herbicide Timings on Corn Yield - D. B. Vitolo, C. Pearson, M. G. Schnappinger, and R. Schmenk, Novartis Crop Protection, Hudson, NY

2 (tie). Pollen Transport From Genetically Modified Corn - J. M. Jemison and M. Vayda, Univ. of Maine, Orono, ME

2001
1. Evaluation of methyl bromide alternatives for yellow nutsedge control in plasticulture tomato - W. A. Bailey, H. P. Wilson, and T. E. Hines, Virginia Tech, Painter, VA.
2. Evaluation of alternative control methods for annual ryegrass in typical Virginia crop rotations - S. R. King and E. S. Hagood, Virginia Tech, Blacksburg, VA.

2002
1. Effectiveness of mesotrione to control weeds in sweet corn. J. M. Jemison, Jr. and A. Nejako, Univ. Maine, Orono.
2. Flufenacet plus metribuzin for italian ryegrass control in Virginia wheat. W. A. Bailey, H. P. Wilson, and T. E. Hines, Virginia Tech, Painter.

2003
1. Comparison of two methods to estimate weed populations in field-scale agricultural research. R. D. Stout, M. G. Burton, and H. M. Linker, North Carolina State Univ.
2. Diquat plus glyphosate for rapid-symptom vegetation control in turf. W. L. Barker, S. D. Askew, J. B. Beam, Virginia Tech, Blacksburg; and D. C. Riego, Monsanto Co.,Carmel, IN.

INNOVATOR OF THE YEAR

1986	Nathan Hartwig	Penn State University
1987	Thomas Welker	USDA/ARS Appl. Fruit Res. Sta.
1988	None Awarded	
1989	John E. Waldrum	Union Carbide Agric. Prod.
1990	None Awarded	
1991	Thomas L. Watschke	Penn State University
1992	E. Scott Hagood	Virginia Tech
	Ronald L. Ritter	University of Maryland
1993	None Awarded	
1994	George Hamilton	Penn State University
1995	Kent D. Redding	DowElanco
1996	James Orr	Asplundh Tree Expert Co.
1997	George Hamilton	Penn State University
1998	None Awarded	
1999	Award Discontinued	

OUTSTANDING APPLIED RESEARCH IN FOOD AND FEED CROPS

1991	Russell R. Hahn	Cornell University
1992	Henry P. Wilson	Virginia Tech
1993	None Awarded	
1994	Robin Bellinder	Cornell University
1995	None Awarded	
1996	E. Scott Hagood	Virginia Tech
1997	Ronald L. Ritter	University of Maryland
1998	None Awarded	
1999	Award Discontinued	

OUTSTANDING APPLIED RESEARCH IN TURF, ORNAMENTALS, AND VEGETATION MANAGEMENT

1991	Wayne Bingham	Virginia Tech
1992	John F. Ahrens	CT Agricultural Experiment Sta.
1993	Joseph C. Neal	Cornell University
1994	Prasanta C. Bhowmik	University of Massachusetts
1995	Andrew F. Senesac	Long Island Hort. Research Lab
1996	Larry J. Kuhns	Penn State University
1997	Jeffrey F. Derr	Virginia Tech
1998	None Awarded	
1999	Award Discontinued	

OUTSTANDING PAPER AWARDS

1954 Studies on Entry of 2,4-D into Leaves - J. N. Yeatman, J. W. Brown, J. A. Thorne and J. R. Conover, Camp Detrick, Frederick, MD

The Effect of Soil Organic Matter Levels on Several Herbicides - S. L. Dallyn, Long Island Vegetable Research Farm, Riverhead, NY

Experimental Use of Herbicides Impregnated on Clay Granules for Control of Weeds in Certain Vegetable Crops - L. L. Danielson, Virginia Truck Expt. Station, Norfolk, VA

Cultural vs. Chemical Weed Control in Soybeans - W. E. Chappell, Virginia Polytechnical Institute, Blacksburg, VA

Public Health Significance of Ragweed Control Demonstrated in Detroit - J. H. Ruskin, Department of Health, Detroit, MI

1955 A Comparison of MCP and 2,4-D for Weed Control in Forage Legumes - M. M. Schreiber, Cornell Univ., Ithaca, NY

1956 None Awarded

1957 Herbicidal Effectiveness of 2,4-D, MCPB, Neburon and Others as Measured by Weed Control and Yields of Seedling Alfalfa and Birdsfoot Trefoil - A. J. Kerkin and R. A. Peters, Univ. of Connecticut, Storrs

Progress Report #4 - Effects of Certain Common Brush Control Techniques and Material on Game Food and Cover on a Power Line Right-of-Way - W. C. Bramble, W. R. Byrnes, and D. P. Worley, Penn State Univ., University Park

1958 Effects of 2,4-D on Turnips - C. M. Switzer, Ontario Agricultural College, Guelph, Canada

Ragweed Free Areas in Quebec and the Maritimes - E. E. Compagna, Universite Laval at Ste-Anne-de-la-Pocatiere, Quebec, Canada

1959 Yields of Legume-Forage Grass Mixtures as Affected by Several Herbicides Applied Alone or in a Combination During Establishment - W. G. Wells and R. A. Peters, Univ. of Connecticut, Storrs

Influence of Soil Moisture on Activity of EPTC, CDEC and CIPC - J. R. Havis, R. L. Ticknor and P. F. Boblua, Univ. of Massachusetts, Amherst

1960 The Influence of Cultivation on Corn Yields When Weeds are Controlled by Herbicides - W. F. Meggitt, Rutgers Univ., New Brunswick, NJ

1961 Preliminary Investigation of a Growth Inhibitor Found in Yellow Foxtail *(Setaria glauca* L.) - H. C. Yokum, M. J. Jutras, and R. A. Peters, Univ. of Connecticut, Storrs

1962 The Effects of Chemical and Cultural Treatment on the Survival of Rhizomes and on the Yield of Underground Food Reserves of Quackgrass - H. M. LeBaron and S. N. Gertig, Cornell Univ., Ithaca, NY

Observations on Distribution and Control of Eurasian Watermilfoil in Chesapeake Bay, 1961 - V. D. Stotts and C. R. Gillette, Annapolis, MD

1963 The Relation of Certain Environmental Conditions to the Effectiveness of DNBP of Post-Emergence Weed Control in Peas - G. R. Hamilton and E. M. Rahn, Univ. of Delaware, Newark

The Influence of Soil Surface and Granular Carrier Moisture on the Activity of EPTC - J. C. Cialone and R. D. Sweet, Cornell Univ., Ithaca, NY

The Determination of Residues of Kuron in Birdsfoot Trefoil and Grasses - M. G. Merkle and S. N. Fertig, Cornell Univ., Ithaca, NY

1964 Control of Riparian Vegetation with Phenoxy Herbicides and the Effect on Streamflow Quality - I. C. Reigner, USDA-Forest Service, New Lisbon, NJ; W. E. Sopper, Penn State Univ., University Park; and R. R. Johnson, Amchem Products, Inc., Ambler, PA

EPTC Incorporation by Band Placement and Standard Methods in Establishment of Birdsfoot Trefoil - D. L. Linscott and R. D. Hagin, Cornell Univ., Ithaca, NY

1965 1. Corn Chamomile *(Anthemis arvensis* L.) Responses to Some Benzoic Acid Derivatives - Barbara M. Metzger, Judity K. Baldwin and R. D. Ilnicki, Rutgers Univ., New Brunswick, NJ

2. The Physical Properties of Viscous Sprays for Reduction of Herbicide Drift - J. W. Suggitt, The Hydro-Electric Power Commission of Ontario, Canada

1966 1. Weed Control Under Clear Plastic Mulch - Carl Bucholz, Cornell Univ., Ithaca, NY

2. A Chemical Team For Aerial Brush Control on Right-of-Way - B. C. Byrd and C. A. Reimer, Dow Chemical Co

1967 1. Influence of Time of Seeding on the Effectiveness of Several Herbicides Used for Establishing an Alfalfa-Bromegrass Mixture - R. T. Leanard and R. C. Wakefield, Univ. of New Hampshire, Durham

2. Weed Competition in Soybeans - L. E. Wheetley and R. H. Cole, Univ. of Delaware, Newark

1968 None Awarded

1969 1. Weed and Crop Responses in Cucumbers and Watermelons - H. P. Wilson and R. L. Waterfield, Virginia Truck and Orn. Res. Sta., Painter

2. Effect of Several Combinations of Herbicides on the Weight and Development of Midway Strawberry Plants in the Greenhouse - O. E. Schubert, West Virginia Univ., Morgantown

1970 1. Effects of RH-315 on Quackgrass and Established Alfalfa - W. B. Duke, Cornell Univ., Ithaca, NY

1971 1. Activity of Nitralin, Trifluralin and ER-5461 on Transplant Tomato and Eggplant - D. E. Broaden and J. C. Cialone, Rutgers Univ., New Brunswick, NJ

2. Field Investigations of the Activities of Several Herbicides for the Control of Yellow Nutsedge - H. P. Wilson, R. L. Waterfield, Jr., and C. P. Savage, Jr., Virginia Truck and Orn. Res. Sta., Painter

1972 1. Study of Organisms Living in the Heated Effluent of a Power Plant - M. E. Pierce, Vassar College and D. Allessandrello, Marist College

2. Effect of Pre-treatment Environment on Herbicide Response and Morphological Variation of Three Species - A. R. Templeton and W. Hurtt, USDA-ARS, Fort Detrick, MD

1973 1. A Simple Method of Expressing the Relative Efficacy of Plant Growth Regulators - A. R. Templeton and W. Hurtt, USDA-ARS, Fort Detrick, MD

2. Agronomic Factors Influencing the Effectiveness of Glyphosate for Quackgrass Control - F. E. Brockman, W. B. Duke, and J. F. Hunt, Cornell Univ., Ithaca, NY

1974 1. Weed Control in Peach Nurseries - O. F. Curtis, Cornell Univ., Ithaca, NY

2. Persistence of Napropamide and U-267 in a Sandy Loam Soil - R. C. Henne, Campbell Institute for Agr. Res., Napoleon, OH

1975 1. Control of Jimsonweed and Three Broadleaf Weeds in Soybeans - J. V. Parochetti, Univ. of Maryland, College Park

HM. The Influence of Norflurazon on Chlorophyll Content and Growth of *Potomogeton pectinatus* - R. M. Devlin and S. J. Karcyzk, Univ. of Massachusetts, East Wareham

HM. Germination, Growth, and Flowering of Shepherdspurse - E. K. Stillwell and R. D. Sweet, Cornell Univ., Ithaca, NY

1976 1. Top Growth and Root Response of Red Fescue to Growth Retardants - S. L. Fales, A. P. Nielson and R. C. Wakefield, Univ. of Rhode Island, Kingston

HM. Selective Control of *Poa annua* in Kentucky Bluegrass - P. J. Jacquemin, O. M. Scott and Sons, and P. R. Henderlong, Ohio State Univ., Columbus

HM. Effects of DCPA on Growth of Dodder - L. L. Danielson, USDA ARS, Beltsville, MD

1977 1. The Effects of Stress on Stand and Yield of Metribuzin Treated Tomato Plants - E. H. Nelson and R. A. Ashley, Univ. of Connecticut, Storrs

HM. The Influence of Growth Regulators on the Absorption of Mineral Elements - R. M. Devlin and S. J. Karcyzk, Univ. of Massachusetts, East Wareham.

HM. Quantification of S-triazine Losses in Surface Runoff: A Summary - J. K. Hall, Penn State Univ., University Park

1978 1. Annual Weedy Grass Competition in Field Corn - Jonas Vengris, Univ. of Massachusetts, Amherst

HM. Metribuzin Utilization with Transplanted Tomatoes - R. C. Henne, Campbell Institute of Agr. Res., Napoleon, OH

1979 1. Herbicides for Ground Cover Plantings - J. F. Ahrens, Connecticut Agric. Expt. Station, Windsor

2. Weed Control Systems in Transplanted Tomatoes - R. C. Henne, Campbell Institute of Agr. Res. Napoleon, OH

1980 1. Integrated Weed Control Programs for Carrots and Tomatoes - R. C. Henne and T. L. Poulson, Campbell Institute of Agr. Res. Napoleon, OH

2. Suppression of Crownvetch for No-Tillage Corn - J. Carina and N. L. Hartwig, Penn State Univ., University Park

HM. Effect of Planting Equipment and Time of Application on Injury to No-tillage Corn from Pendimethalin-Triazine Mixtures - N. L. Hartwig, Penn State Univ., University Park

1981 1. Weed Control in Cucumbers in Northwest Ohio - R. C. Henne and T. L. Poulson, Campbell Institute of Agr. Res. Napoleon, OH

2. Prostrate Spurge Control in Turfgrass Using Herbicides - J. A. Jagschitz, Univ. of Rhode Island, Kingston

HM. Some Ecological Observations of Hempstead Plains, Long Island - R. Stalter, St. John's Univ., Jamaica, NY

1982 1. Differential Growth Responses to Temperature Between Two Biotypes of *Chenopodium album* - P. C. Bhowmik, Univ. of Massachusetts, Amherst

2. Chemical Control of Spurge and Other Broadleaf Weeds in Turfgrass - J. S. Ebdon and J. A. Jagschitz, Univ. of Rhode Island, Kingston

HM. Influence of Norflurazon on the Light Activation of Oxyfluorfen - R. M. Devlin, S. J. Karczmarczyk, I. I. Zbiec and C. N. Saras, Univ. of Massachusetts, East Wareham

HM. Analysis of Weed Control Components for Conventional, Wide-row Soybeans in Delaware - D. K. Regehr, Univ. of Delaware, Newark

1983 1. Comparisons of Non-Selective Herbicides for Reduced Tillage Systems - R. R. Bellinder, Virginia Tech, Blacksburg and H. P. Wilson, Virginia Truck and Orn. Res. Station, Painter

2. The Plant Communities Along the Long Island Expressway, Long Island, New York - R. Stalter, St. John's Univ., Jamaica, NY

HM. Effect of Morning, Midday and Evening Applications on Control of Large Crabgrass by Several Postemergence Herbicides - B. G. Ennis and R. A. Ashley, Univ. of Connecticut, Storrs

1984 1. Pre-transplant Oxyfluoufen for Cabbage - J. R. Teasdale, USDA-ARS, Beltsville, MD

2. Herbicide Programs and Tillage Systems for Cabbage - R. R. Bellinder, Virginia Tech, Blacksburg and T. E. Hines and H. P. Wilson, Virginia Truck and Orn. Res. Station, Painter

1985 1. Peach Response to Several Postemergence Translocated Herbicides - B. A. Majek, Rutgers Univ., Bridgeton, NJ

1986 1. Influence of Mefluidide Timing and Rate on *Poa annua* Quality Under Golf Course Conditions - R. J. Cooper, Univ. of Massachusetts, Amherst; K. J. Karriok, Univ. of Georgia, Athens, and P. R. Henderlong and J. R. Street, Ohio State Univ., Columbus

2. The Small Mammal Community in a Glyphosate Conifer Release Treatment in Maine - P. D'Anieri, Virginia Tech, Blacksburg; M. L. McCormack, Jr., Univ. of Maine, Orono; and D. M. Leslie, Oklahoma State Univ., Stillwater

HM. Field Evaluation of a Proposed IPM Approach for Weed Control in Potatoes - D. P. Kain and J. B. Sieczka, Cornell Univ., Long Island Horticultural Research Laboratory, Riverhead, NY and R. D. Sweet, Cornell Univ., Ithaca, NY

1987 None Awarded

1988 1. Bentazon and Bentazon-MCPB Tank-mixes for Weed Control in English Pea - G. A. Porter, Univ. of Maine, Orono; A. Ashley, Univ. of Connecticut, Storrs; R. R. Bellinder and D. T. Warholic, Cornell Univ., Ithaca, NY; M. P. Mascianica, BASF Corp., Parsippany, NJ; and L. S. Morrow, Univ. of Maine, Orono

2. Effects of Herbicide Residues on Germination and Early Survival of Red Oak Acorns - R. D. Shipman and T. J. Prunty, Penn State Univ., University Park

2. Watershed Losses of Triclopyr after Aerial Application to Release Spruce Fir - C. T. Smith, Univ. of New Hampshire, Durham and M. L. McCormack, Jr., Univ. of Maine, Orono

1989 None Awarded

1990 None Awarded

1991 Award Discontinued

HERBICIDE NAMES: COMMON, TRADE, AND CHEMICAL

Common And Chemical Names Of Herbicides Approved By The Weed Science Society Of America

Common Name	Trade Name	Chemical Name
acetochlor	Harness, Surpass, Topnotch	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl) acetamide
acifluorfen	Blazer, Status	5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid
alachlor	Intrro, Lasso, MicroTech, Partner, many	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl) acetamide
alloxydim	Clout, Fervin	methyl 2,2-dimethyl-4,6-dioxo-5-[1-[(2-propenyloxy)amino]butylidene]cyclohexanecarboxylate
ametryn	Evik	N-ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
amicarbozone	Dinamic	4-amino-N-(1,1-dimethylethyl)-4,5-dihydro-3-(1-methylethyl)-5-oxo-1H-1,2,4-triazole-1-carboxamide
asulam	Asulox	methyl[(4-aminophenyl)sulfonyl]carbamate
atrazine	Aatrex, many	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine
azimsulfuron	Gulliver	N-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-1-methyl-4-(2-methyl-2H-tetrazol-5-yl)-1H-pyrazole-5- sulfonamide
beflubutamid		2-[4-fluoro-3-(trifluoromethyl)phenoxy]-*N*-(phenylmethyl)butanamide
benefin	Balan	N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine
bensulfuron	Londax	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl] amino]sulfonyl]methyl]benzoic acid
bensulide	Bensumec, Betason, Prefar, Lescosan	O,O-bis(1-methylethyl)S-[2-[(phenylsulfonyl)amino]ethyl]phosphorodithioate
bentazon	Basagran	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide
benzfendizone		methyl 2-[2-[[4-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)pyrimidinyl)phenoxy]methyl]-5-ethylphenoxy]propanoic acid
bispyribac	Velocity, Regiment	2,6-bis[(4,6-dimethoxy-2-pyrimidinyl)oxy]benzoic acid
bromacil	Hyvar	5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H, 3H)pyrimidinedione
bromoxynil	Brominal, Buctril, Moxy	3,5-dibromo-4-hydroxybenzonitrile
butafenacil	Inspire	2-chloro-5-(3-methyl-2,6,dioxo-4-triflouromethyl-3,6-dihydro-2H-pyrimidyl)-benzoic acid 1-allylocycarbonyl-1-methyl-ethyl-ester
butralin	AMEX-820, TAMEX	4-(1,1-dimethylethyl)-N-(1-methylpropyl)-2,6-dinitrobenzenamine
butylate	Sutan+, Genate Plus	S-ethyl bis(2-methylpropyl)carbamothioate
cacodylic acid	Cotton-aide, Montar, Phytar 560	dimethyl arsinic acid

Common Name	Trade Name	Chemical Name
carfentrazone	Aim, Affinity, QuickSilver IVM, Stingray	α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl] -4-fluorobenzenepropanoic acid
chlorflurenol	Maintain, CF 125	2-chloro-9-hydroxy-9H-fluorene-9-carboxylic acid
chlorimuron	Classic	2-[[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoic acid
chlorsulfuron	Glean, Telar	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl] benzenesulfonamide
clethodim	Prism, Select	(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]- 3-hydroxy-2-cyclohexen-1-one
clomazone	Command	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone
clopyralid	Reclaim, Stinger, Transline	3,6-dichloro-2-pyridinecarboxylic acid
cloransulam	Amplify, FirstRate	3-chloro-2-[[(5-ethoxy-7-fluoro[1,2,4]triazolo[1,5-c] pyrimidin-2yl)sulfonyl]amino]benzoic acid
copper sulfate	Copper Sulfate	copper sulfate
cycloate	Ro-Neet	S-ethyl cyclohexylethylcarbamothioate
cyclosulfamuron	Ichiyonmaru, Nebiros	N-[[[2-(cyclopropylcarbonyl)phenyl]amino]sulfonyl]-N'-(4,6-dimethoxy-2- pyrimidinyl)urea
cyhalofop	Clincher	(R)-2-[4-(4-cyano-2-fluorophenoxy)phenoxy]propanoic acid
2,4-D	many	(2,4-dichlorophenoxy)acetic acid
dazomet	Basamid	tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione
2,4-DB	Butoxone, Butyrac	4-(2,4-dichlorophenoxy)butanoic acid
DCPA	Dacthal	dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate
desmedipham	Betanex	ethyl[3-[[(phenylamino)carbonyl]oxy]phenyl]carbamate
dicamba	Banvel, Clarity, Vanquish	3,6-dichloro-2-methoxybenzoic acid
dichlobenil	Barrier, Casoron, Dyclomec, Norosac	2,6-dichlorobenzonitrile
dichlorprop	Weedone 2,4-DP	(±)-2-(2,4-dichlorophenoxy)propanoic acid
diethatyl	Antor	N-(chloroacetyl)-N-(2,6-diethylphenyl)glycine
diclofop	Hoelon, Illoxan	(±)-2-[4-(2,4-dichlorophenoxy)phenoxy]propanoic acid
diclosulam	Strongarm	N-(2,6-dichlorophenyl)-5-ethoxy-7-fluoro[1,2,4]triazolo[1,5-c] pyrimidine-2-sulfonamide
difenzoquat	Avenge	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium
diflufenzopyr		2-[1-[[[(3,5-difluorophenyl)amino]carbonyl]hydrazono]ethyl]-3-pyridinecarboxylic acid
dimethanamid	Frontier	2-chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide
dimethanamid-P	Frontier X-2, Outlook	(S)-2-chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide
diphenamid	Enide	N,N-dimethyl-a-phenyl benzeneacetamide
diquat	Diquat, Reglone, Reward	6,7-dihydrodipyrido[1,2-a:2',1'-c]pyrazinediiumion

Common Name	Trade Name	Chemical Name
dithiopyr	Dimension	S,S-dimethyl 2-(difluoromethyl)-4-(2-methylpropyl)-6-trifluoromethyl)- 3,5-pyridinedicarbothioate
diuron	Karmex, Direx	N'-(3,4-dichlorophenyl)-N,N-dimethylurea
DSMA	Ansar, many	disodium salt of MAA
endothall	Aquathol, Accelerate, Desicate, H-273	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
EPTC	Eptam, Eradicane, Eradicane Extra, Genep, Genep Plus	S-ethyl dipropyl carbamothioate
ethalfluralin	Sonalan, Curbit, Edge	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)benzenamine
ethametsulfuron	Muster	2-[[[[[4-ethoxy-6-(methylamino)-1,3,5-triazin-2-yl]amino] carbonyl]amino]sulfonyl]benzoic acid
ethofumesate	Nortron, Progress	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
fenoxaprop	Acclaim, Horizon, Puma, Whip	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy]propanoic acid
flazasulfuron	Mission	*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(trifluoromethyl)-2-pyridinesulfonamide
florasulam	Primus, Boxer	N-(2,6-difluorophenyl)-8-fluoro-5-ethoxy[1,2,4]triazolo[1,5-c]pyrimidine-2-sulfonamide
fluazifop	Fusilade, Horizon, Ornamec, Tornado	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]-propanoic acid
flucarbazone	Everest	4,5-dihydro-3-methoxy-4-methyl-5-oxo-N-[[2-(trifluoromethoxy)phenyl]sulfonyl]-1H-1,2,4-triazole-1-carboxamide
flufenacet	Define	N-(4-fluorophenyl)-N-(1-methylethyl)-2-[[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl]oxy]acetamide
flumetsulam	Python	N-(2,6-difluorophenyl)-5-methyl[1,2,4]triazolo[1,5-a] pyrimidine-2-sulfonamide
flumiclorac	Resource	[2-chloro-4-fluoro-5-(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)phenoxy]acetic acid
flumioxazin	Broadstar, Flumizin, Sumisoya, Valor	2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]-4,5,6,7-tetrahydro-1H-insoindole-1,3(2H)-dione
fluometuron	Cotoran	N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]urea
flupoxam		1-[4-chloro-3-[(2,2,3,3,3-pentafluoropropoxy)methyl]- phenyl]-5-phenyl-1H-1,2,4-triazole-3-carboxamide
flupropacil		1-methylethyl 2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)-pyrimidinyl]benzoate
flupyrsulfuron		2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-6-trifluoromethyl)-3-pyridinecarboxylic acid
fluridone	Sonar	1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone
fluthiacet	Appeal	[[2-chloro-4-fluoro-5-[(tetrahydro-3-oxo-1*H*,3*H*-[1,3,4]thiadiazolo[3,4-a]pyridazin-1-ylidene)amino]phenyl]thio]acetic acid

Common Name	**Trade Name**	**Chemical Name**
fluroxypyr	Starane, Spotlight, Tomahawk, Vista	[(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid
fluthiacet	Action, Appeal	[[2-chloro-4-fluoro-5-[(tetrahydro-3-oxo-1*H*,3*H*-{1,3,4]thiadiazolo[3,4-a]pyridazin-1-ylidene)amino]phenyl]thio]acetic acid
fomesafen	Reflex, Flexstar	5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide
foramsulfuron	Option	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl] amino]sulfonyl]-4-(formylamino)-*N,N*-dimethylbenzamide
fosamine	Krenite	ethyl hydrogen (aminocarbonyl)phosphonate
glufosinate	Finale, Liberty, Rely	2-amino-4-(hydroxymethylphosphinyl)butanoic acid
glyphosate	Accord, Honcho, Ranger, Rodeo, Roundup, Touchdown	N-(phosphonomethyl)glycine
halosulfuron	Manage, Permit, Sandea, Sempra	3-chloro-5-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-1-methyl-1H-pyrazole-4-carboxylic acid
hexazinone	Pronone, Velpar	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
imazamethabenz	Assert	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-4(and 5)-methylbenzoic acid (3:2)
imazamox	Raptor, Odessey	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imiazol-2-yl]-5- (methoxymethyl)-3-pyridinecarboxylic acid
imazapic	Cadre, Plateau	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid
imazapyr	Arsenal, Chopper, Stalker	(±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid
imazaquin	Scepter, Image	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid
imazethapyr	Pursuit	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid
iodosulfuron	Husar	4-iodo-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoic acid
isoproturon		N,N-dimethyl-N'-[4-(1-methylethyl)phenyl]urea
isoxaben	Gallery	N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide
isoxaflutole	Balance, Balance Pro	(5-cyclopropyl-4-isoxazolyl)[2-(methylsulfonyl)-4-(trifluoromethyl)-phenyl]methanone
ketospiradox		2-[(2,3dihydro-5,8-dimethyl-1,1-dioxidospiro[4H-1-benzothiopyran-4,2'-[1,3]dioxolan]-6-yl)carbonyl]-1,3-cyclohexanedione ion(1-)
lactofen	Cobra	(±)-2-ethoxy-1-methyl-2-oxoethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
linuron	Lorox, Linex, Afolan	N'-(3,4-dichlorophenyl)-N-methoxy-N-methylurea
maleic hydrazide	Royal MH30, Royal Slo-Gro	1,2-dihydro-3,6-pyridazinedione
MCPA	many	(4-chloro-2-methylphenoxy)acetic acid

Common Name	Trade Name	Chemical Name
MCPB	Cantrol, Thistrol	4-(4-chloro-2-methylphenoxy)butanoic acid
mecoprop	Mecomec, Super Chickweed Killer	(±)-2-(4-chloro-2-methylphenoxy)propanoic acid
mefluidide	Embark, Vistar	N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino] phenyl]acetamide
mesotrione	Callisto	2-(4-mesyl-2-nitrobenzoyl)-3-hydroxycyclohex-2-enone
metamifop		(*R*)-2-[4-(6-chloro-1,3-benzoxazol-2-yloxy)phenoxy]-2′-fluoro-*N*-methylpropionanilide
metham	Vapam	methylcarbamodithioic acid
metolachlor	Dual, Pennant	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide
s-metolachlor	Cinch, Dual Magnum Pennant Magnum	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide, S-enantiomer
metosulam	Barko	N-(2,6-dichloro-3-methylphenyl)-5,7-dimethoxy[1,2,4] triazolo[1,5-a]pyrimidine-2- sulfonamide
metribuzin	Sencor	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
metsulfuron	Ally, Cimarron, Escort	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino] carbonyl]amino]sulfonyl]benzoic acid
molinate	Ordram	S-ethyl hexahydro-1H-azepine-1-carbothioate
MSMA	Ansar, Arsonate Liquid, Bueno, Daconate	monosodium salt of MAA
napropamide	Devrinol	N,N-diethyl-2-(1-naphthalenyloxy)propanamide
naptalam	Alanap	2-[(1-naphthalenylamino)carbonyl]benzoic acid
nicosulfuron	Accent	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino] sulfonyl]-N,N-dimethyl-3-pyridinecarboxamide
norflurazon	Evital, Solicam, Predict, Zorial	4-chloro-5-(methylamino)-2-(3-(trifluoromethyl)phenyl)-3 (2H)-pyridazinone
oryzalin	Surflan	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide
oxadiargyl	TopStar	3-[2,4-dichloro-5-(2-propynyloxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3*H*)-one
oxadiazon	Ronstar	3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one
oxaziclomefone		3-[1-(3,5-dichlorophenyl)-1-methylethyl]-2,3-dihydro-6-methyl-5-phenyl-4*H*-1,3-oxazin-4-one
oxyfluorfen	Goal	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene
paraquat	Boa, Cyclone, Gramoxone Extra, Gramoxone Max, Starfire	1,1'-dimethyl-4,4'-bipyridiniumion
pebulate	Tillam	S-propyl butylethylcarbamothioate
pelargonic acid	Scythe	nonanoic acid
pendimethalin	Pentagon, Pendulum, Prowl, many	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine

Common Name	Trade Name	Chemical Name
phenmedipham	Spin-Aid	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate
picloram	Tordon, Grazon	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid
primisulfuron	Beacon, Rifle	2-[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]amino] carbonyl]amino]sulfonyl]benzoic acid
prodiamine	Barricade, Factor, RegalKade	2,4 dinitro-N3,N3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine
prometon	Pramitol	6-methoxy-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4- diamine
prometryn	Caparol, Cotton Pro	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
pronamide	Kerb	3,5-dichloro (N-1,1-dimethyl-2-propynyl)benzamide
propachlor	Ramrod	2-chloro-N-(1-methylethyl)-N-phenylacetamide
propanil	Propanil, Stam, Superwham	N-(3,4-dichlorophenyl)propanamide
prosulfuron	Peak	*N*-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]-2-(3,3,3-trifluoropropyl)benzenesulfonamide
pyraflufen	ET-751	[2-chloro-5-[4-chloro-5-(difluoromethoxy)-1-methyl-1*H*-pyrazol-3-yl]-4-fluorophenoxy]acetic acid
pyrazon	Pyramin	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
pyribenzoxium		diphenylmethanone *O*-[2,6-bis[(4,6-dimethoxy-2-pyrimidinyl)oxy]benzoyl]oxime
pyridate	Lentagran, Tough	O-(6-chloro-3-phenyl-4-pyridazinyl) S-octyl carbonothioate
pyrithiobac	Staple	2-chloro-6-[(4,6-dimethoxy-2-pyrimidinyl)thio]benzoic acid
quinclorac	Drive, Facet, Impact	3,7-dichloro-8-quinolinecarboxylic acid
quizalofop	Assure II	(±)-2-[4-[(6-chloro-2-quinoxalinyl)oxy]phenoxy]propanoic acid
rimsulfuron	Matrix	N-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(ethylsulfonyl)-2-pyridinesulfonamide
sethoxydim	Poast, Vantage	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
siduron	Tupersan	N-(2-methylcyclohexyl)-N'-phenylurea
simazine	Aquazine, Princep, many	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine
sodium chlorate	Defol	sodium chlorate
sulcotrione	Galleon	2-[2-chloro-4-(methylsulfonyl)benzoyl]-1,3-cyclohexanedione
sulfentrazone	Authority, Spartan	N-[2,4-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl] phenyl]methanesulfonamide
sulfometuron	Oust	2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino] sulfonyl]benzoic acid
sulfosulfuron	Maverick, Outrider	*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-2-(ethylsulfonyl)imidazo[1,2-a]pyridine-3-sulfonamide
tebuthiuron	Spike	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea
terbacil	Sinbar	5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione
thiazafluron	Dropp	N,N'-dimethyl-N-[5-(trifluoromethyl)-1,3,4-thiadiazol-2-yl] urea

Common Name	Trade Name	Chemical Name
thiazopyr	Mandate, Visor	methyl2-(difluoromethyl)-5-(4,5-dihydro-2-thiazolyl)-4-(2-methylpropyl) -6-(trifluoromethyl)-3- pyridinecarboxylate
thifensulfuron	Cheyenne, Harmony	3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino] carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid
thiobencarb	Bolero	S-[(4-chlorophenyl)methyl]diethylcarbamothioate
tralkoxydim	Achieve	2-[1-(ethoxyimino)propyl]-3-hydroxy-5-(2,4,6-trimethylphenyl)-2-cyclohexen-1-one
triallate	Far-Go, Avadex, Showdown	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl) carbamothioate
triasulfuron	Amber	2-(2-chloroethoxy)-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl] benzenesulfonamide
tribenuron	Express	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)methylamino] carbonyl]amino]sulfonyl]benzoic acid
triclopyr	Garlon, Grandstand, Pathfinder, Remedy, Turflon	[(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid
trifloxysulfuron	Enfield	*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-3-(2,2,2-trifluoroethoxy)-2-pyridinesulfonamide
trifluralin	Treflan, Tri-4, Trilin, many	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine
triflusulfuron	UpBeet	2-[[[[[4-(dimethylamino)-6-(2,2,2-trifluoroethoxy)-1,3,5-triazin-2-yl]amino]carbonyl]amino]sulfonyl]-3- methylbenzoic acid
vernolate	Vernam	S-propyl dipropylcarbamothioate

Common Pre-packaged Herbicides

Common Pre-packaged Herbicides and Common Name of the Component Chemicals

Trade Name	Common Name of Individual Herbicides
Accent Gold	clopyralid + flumetsulam + nicosulfuron + rimsulfuron
Axiom	flufenacet + metribuzin
Backdraft	glyphosate + imazaquin
Basis	rimsulfuron + thifensulfuron
Basis Gold	atrazine + nicosulfuron + rimsulfuron
Betamix	desmedipham + phenmedipham
Bicep II Magnum	atrazine + s-metolachlor
Bicep Lite II Magnum	atrazine + s-metolachlor
Bison	bromoxynil + MCPA
Boundary	s-metolachlor + metribuzin
Bronate	bromoxynil + MCPA
Brushmaster	dicamba + 2,4-D + 2,4-DP
Buckle	triallate + trifluralin
Bullet	alachlor + atrazine
Camix	mesotrione + s-metolachlor
Canopy	chlorimuron + metribuzin
Canopy XL	chlorimuron + sulfentrazone
Celebrity	dicamba + nicosulfuron
Chaser	triclopyr + 2,4-D
Cheyenne	fenoxaprop + MCPA + thifensulfuron + tribenuron
Cimarron Max	dicamba + metsulfuron + 2,4-D
Cinch ATZ	atrazine + s-metolachlor
Command Xtra	clomazone + sulfentrazone
Confront	clopyralid + triclopyr
Cool Power	dicamba + MCPA + triclopyr
Crossbow	triclopyr + 2,4-D
Curtail	clopyralid + 2,4-D
Dakota	fenoxaprop + MCPA
Degree Xtra	acetachlor + atrazine
Dissolve	mecoprop + 2,4-D + 2,4-DP
Distinct	dicamba + diflufenzopyr
Domain	flufenacet + metribuzin
Eclipse	clopyralid + MCPA + 2,4-DP
Epic	flufenacet + isoxaflutole
Equip	mesosulfuron(AEF-130060) + iodosulfuron
Event	imazapyr + imazethapyr
Exceed	primisulfuron + prosulfuron
Extreme	glyphosate + imazethapyr
FieldMaster	acetochlor + atrazine + glyphosate
Finesse	chlorsulfuron + metsulfuron
Fire Power	glyphosate + oxyfluorfen
Fuego	dicamba + triasulfuron
FulTime	acetochlor + atrazine
Fusion	fenoxaprop + fluazifop
Gauntlet	cloransulam + sulfentrazone

Trade Name	Common Name of Individual Herbicides
Guardsman Max	atrazine + dimethenamid
Grazon P+D	picloram + 2,4-D
Harmony Extra	thifensulfuron + tribenuron
Harness Xtra	acetochlor + atrazine
Horizon 2000	fenoxaprop + fluazifop
Hornet	clopyralid + flumetsulam
Horsepower	dicamba + triclopyr + 2,4-D
Kansel Plus	oxadiazon + pendimethalin
Keystone	acetachlor + atrazine
Krovar	bromacil + diuron
Laddok S-12	atrazine + bentazon
Landmark II	chlorsulfuron + sulfometuron
Landmaster	glyphosate + 2,4-D
Lariat	alachlor + atrazine
Liberty ATZ	atrazine + glufosinate
Lightning	imazapyr + imazethapyr
Lumax	atrazine + mesotrione + s-metolachlor
Marksman	atrazine + dicamba
Millennium Ultra	clopyralid + dicamba + 2,4-D
Millennium Ultra Plus	clopyralid + dicamba + 2,4-D + MSMA
Momentum	clopyralid + triclopyr + 2,4-D
NorthStar	dicamba + primisulfuron + prosulfuron
Oasis	imazapic + 2,4-D
OH2 (Ornamental Herbicide)	oxyfluorfen + pendimethalin
Oustar	hexainone + sulfometuron
Oust Extra	metsulfuron + sulfometuron
Overdrive	dicamba + diflufenzopyr
Power Zone	carfentrazone + dicamba+ mecoprop + MCPA
PrePair	napropamide + oxadiazon
Preview	chlorimuron + metribuzin
Prompt	atrazine + bentazon
QuickPro	diquat + glyphosate
Ready Master ATZ	atrazine + glyphosate
Redeem R&P	clopyralid + triclopyr
Regal O-O	oxadiazon + oxyfluorfen
RegalStar	oxadiazon + prodiamine
Resolve SG	dicamba + imazethapyr
Rhino	atrazine + butylate
Rout	oryzalin + oxyfluorfen
Sahara	diuron + imazapyr
Salute	metribuzin + trifluralin
Shotgun	atrazine + 2,4-D
Simazat	atrazine + simazine
Snapshot	isoxaben + trifluralin
Speed Zone	carfentrazone + dicamba + mecoprop + 2,4-D
Spirit	primisulfuron + prosulfuron
Squadron	imazaquin + pendimethalin
Stampede	MCPA + propanil

Trade Name	Common Name of Individual Herbicides
Steadfast	nicosulfuron + rimsulfuron
Steadfast + ATZ	atrazine + nicosulfuron + rimsulfuron
Steel	imazaquin + imazethapyr + pendimethalin
Stellar	flumiclorac + lactofen
Sterling Plus	atrazine + dicamba
Storm	acifluorfen + bentazon
Strategy	clomazone + ethalfluralin
Stronghold	imazapyr + imazethapyr + mefluidide
Synchrony STS	chlorimuron + thifensulfuron
Team	benefin + trifluralin
Telone C17	chloropicrin + dichloropropene
Tiller	fenoxaprop + MCPA + 2,4-D
Tordon 101M	picloram + 2,4-D
Total	bromacil + diruon + sodium chlorate + sodium metaborate
Triamine	mecoprop + 2,4-D + 2,4-DP
Tri-Ester	mecoprop + 2,4-D + 2,4-DP
Trimec992	dicamba + mecoprop + 2,4-D
Trimec Classic	dicamba + mecoprop + 2,4-D
Trimec Super	dicamba + dichlorprop + 2,4-D
Tri-Scept	imazaquin + trifluralin
Trupower	clopyralid + dicamba + MCPA
Typhoon	fluazifop + fomesafen
Vengeance	dicamba + MCPA
Weedmaster	dicamba + 2,4-D
XL 2G	benefin + oryzalin
Yukon	dicamba + halosulfuron

EXPERIMENTAL HERBICIDES

Experimental Number	Common Name (proposed)/Trade Name, Company Name
AC-900001	picolinafen/Pico, BASF
AEF-130060	mesosulfuron/Osprey, Bayer
BAS 620	tepraloxydim/Aramo, Equinox, Honest, BASF
BAS 670	BASF
BAY MKH 6561	propoxycarbazone/Attribute, Olympus, Bayer or Rapsol, Sumitomo
BK-800	Uniroyal
CGA-184927	clodinofop-propargyl/Discover, Syngenta
CGA-277476	oxasulfuron/Dynam, Syngenta
KIH-485	Kumiai
MON-13900	furilazole, Monsanto
S-3153	flufenapyr, Valent
TM-435	Arvesta
	cinidon/Lotus, Bingo, BASF
	fluazolate (JV 485), Bayer, Monsanto
	fluzasulfuron/Mission, Katana, Syngenta
	penoxsulam, Dow AgroSciences
	pethoxamid/Koban, Successor 600, Tohunyama
	propyzamide/Rapsol, Sumitomo
	pyriftalid/Apriro Ace, Syngenta
	tritosulfuron/Corto, BASF

Common and Trade Names of Plant Growth Regulators

Common Name	Trade Name
ammonium thiosulfate	
aviglycine (AVG)	Retain
6-benzyl adenine	BAP-10
chlorflurecol	Maintain
chlormequat chloride	Cycocel
clofencet	Detasselor
copper ethylenediamine	Inferno
CPPU	
diethylamine	
diminozide	B-nine
diphenylamine	
1,2,6-DIPN	Amplify
ethephon	Florel
forchlorfenuron	
GA 4 7/G BA	Promalin, Rite Size
gibberellic acid	Release, Ryzup, Provide
glutamic acid	Auxigro
LPE 94T	
MBTA	Ecolyst
mepiquat chloride	Pix
NAA	
paclobutrazol	Bonzi, Clipper, Trimmet
prohexadione	Apogee
sodium nitrophenolate	Atonik
trinexapac	Palisade, Primo
uniconazole	Prunit, Sumagic
1-methyl cyclopropene (1-MCP)	Ethyl Bloc

COMMON AND CHEMICAL NAMES OF HERBICIDE MODIFIERS

Common name	Chemical name
benoxacor	(*RS*)-4-dichloroacetyl-3,4-dihydro-3-methyl-2*H*-1,4-benzoxazine
cloquintocet	(5-chloroquinolin-8-yloxy)acetic acid
cyometrinil	(Z)-α-[(cyanomethoxy)imino]benzeneacetonitrile
dichlormid	2,2-dichloro-N,N-di-2-propenylacetamide
dicyclonon	1-(dichloroacetyl)hexahydro-3,3,8a-trimethylpyrrolo[1,2-α]pyrimidin-6(2*H*)-one
dietholate	O,O-diethyl O-phenyl phosphorothioate
fenchlorazole	1-(2,4-dichlorophenyl)-5-(trichloromethyl)-1*H*-1,2,4-triazole-3-carboxylic acid
fenclorim	4,6-dichloro-2-phenylpyrimidine
flurazole	phenylmethyl-chloro-4-(trifluoromethyl)-5-thiazolecarboxylate
fluxofenim	1-(4-chlorophenyl)-2,2,2-trifluoroethanone *O*-(1,3-dioxolan-2-ylmethyl)oxime
furilazole	3-(dichloroacetyl)-5-(2-furanyl)-2,2-dimethyloxazolidine
isoxadifen	4,5-dihydro-5,5-diphenyl-3-isoxazolecarboxylic acid
mefenpyr	1-(2,4-dichlorophenyl)-4,5-dihydro-5-methyl-1*H*-pyrazole-3,5-dicarboxylic acid
mephenate	4-chlorophenyl methylcarbamate
naphthalic anhydride	1H,3H-naphtho[1,8-cd]-pyran-1,3-dione
oxabetrinil	α-[(1,3-dioxolan-2-yl)methoxyimino]benzeneacetonitrile

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