Proceedings

of the

Fifty-ninth Annual Meeting

of the

Northeastern Weed Science Society

Hilary A. Sandler, Editor
University of Massachusetts-Amherst Cranberry Station
East Wareham

SUSTAINING MEMBERS – 2005

BASF Corporation
Bayer CropScience
Crop Mgmt. Strategies
Dow AgroSciences
DuPont Crop Protection
FMC Corp.
For-Shore Weed Control
Gandy Company
Marbicon, Inc.
Monsanto Company
PBI Gordon Corporation
Reality Research
Syngenta Crop Protection
Valent USA Corporation
Weeds, Inc.

NORTHEASTERN WEED SCIENCE SOCIETY
Capital Hilton,
Washington DC

EXECUTIVE COMMITTEE

OFFICERS

President	**R. R. Bellinder** Cornell University Dept. of Horticulture Ithaca, NY 14853
President-Elect	**T. E. Dutt** 8482 Redhaven Street Fogelsville, PA 18051
Vice President	**W. S. Curran** Penn State University Dept. Crop and Soil Sciences University Park, PA 16802
Secretary/Treasurer	**B. S. Manley** Syngenta Crop Protection 67 Pinewood Road Hudson, NY 12534
Past President	**D. S. Glenn** University of Maryland Dept. of Natural Resources College Park, MD 20742

COMMITTEES

Editor	H.A. Sandler UMass Cranberry Station P.O. Box 569 East Wareham, MA 02538
Legislative	D.L. Kunkel IR-4 Headquarters, Rutgers Univ. 681 US Hwy #1 South North Brunswick, NJ 08902
Public Relations	B.A. Lackey Syngenta Crop Protection 410 Swing Road Greensboro, NC 27409
Research & Education Coordinator	A.E. Gover Penn State University Landscape Mgt. Res. Ctr. University Park, PA 16802
Sustaining Membership	S.K. Rick DuPont Crop Protection 2021 Gardenbrook Drive Raleigh, NC 27606
CAST Representative	R.D. Sweet Cornell University Dept. of Horticulture Ithaca, NY 14853
Graduate Student Rep.	J.N. Barney Cornell University Dept. of Horticulture Ithaca, NY 14853
WSSA Representative	J.F. Derr Virginia Tech Hampton Roads Res. Center Virginia Beach, VA 23455

SECTION CHAIRS

Agronomy	Chair: Sandra Shinn Chair-elect: Hiwot Menbere
Conservation, Forestry and Industrial	Chair: Todd Mervosh Chair-elect: R. Iverson
Ornamentals	Chair: Ammamarie Pennucci Chair-elect: Robert Richardson
Research Posters	Chair: John Jemison Chair-elect: Steve King
Turfgrass and Plant Growth Regulators	Chair: Peter Dernoeden Chair-elect: Michael Fidanza
Vegetables and Fruit	Chair: Marija Arsenovic Chair-elect: Chris Becker
Weed Biology and Ecology	Chair: Hilary Sandler Chair-elect: Eric Gallandt
Turfgrass Symposium	Moderator: Peter Dernoeden
General Symposium	Moderator: William Curran

AGRONOMY SECTION

CONSERVATION, FORESTRY, AND INDUSTRIAL

GENERAL SYMPOSIUM

INVASIVE SPECIES SYMPOSIUM

ORNAMENTALS

RESEARCH POSTERS

TURFGRASS AND PLANT GROWTH REGULATORS

TURFGRASS SYMPOSIUM

VEGETABLES AND FRUIT

WEED BIOLOGY AND ECOLOGY

REPORTS, AWARDS, MEMBERSHIP, HERBICIDE LISTS, AND INDICES

ACTIVITY OF PRIMISULFURON ON COMMON LAMBSQUARTERS AS AFFECTED BY SURFACTANTS. D. Sanyal and P.C. Bhowmik, Univ. of Massachusetts, Amherst.

ABSTRACT

Common lambsquarters (*Chenopodium album* L.) is one of the most important weeds in corn and soybean. Laboratory and greenhouse studies were conducted to measure the contact angle and spread area of primisulfuron droplets with and without surfactants and to examine the effect of two surfactants on primisulfuron activity in controlling common lambsquarters. Primisulfuron rates were used as 2X, 1.5X, 1X, and 0.5X, where 1X represented the recommended use rate (40 g ai ha^{-1}). Induce (non-ionic surfactant) and Silwet L-77 (organosilicone surfactant) was used at 0.25 and 0.10% (v/v), respectively. The contact angles of the 1-μl droplets of primisulfuron (with and without surfactants) were measured on the adaxial leaf surface of common lambsquarters using a goniometer. The activity of primisulfuron was assessed 3 wk after treatment (WAT) in terms of percent injury, plant height, and fresh weight. There was a drastic reduction (more than 90%) in contact angle of primisulfuron droplets with surfactants as compared to droplets without a surfactant. Highest spread of the droplets was achieved using Silwet L-77. Primisulfuron at 40 g ai ha^{-1} resulted in only 23% injury to common lambsquarters when applied without any surfactant. The same rate of primisulfuron when combined with Induce or Silwet L-77 resulted in 83 and 96% injury, respectively. Silwet L-77 enhanced the activity more than Induce at 20 and 40 g ai ha^{-1} rate of primisulfuron. There were no differences between primisulfuron activity when applied with Induce and Silwet L-77 at higher rates (60 and 80 g ai ha^{-1}). Our data demonstrate that the enhanced activity of primisulfuron with these surfactants in controlling common lambsquarters was related to the lower contact angle and higher spread of herbicide droplets on the leaf surface.

FREQUENCY AND DISTANCE OF POLLEN-MEDIATED GENE FLOW FROM GLYPHOSATE-RESISTANT CORN TO CONVENTIONAL CORN. V. Kumar, R.R. Bellinder, and R.R. Hahn, Cornell Univ., Ithaca, NY.

ABSTRACT

Corn (*Zea mays* L.) is a major field crop grown in New York and adoption of glyphosate-resistant varieties has been widespread. Although weedy relatives of corn are not found in the U.S., pollen flow with resultant contamination of organic fields is of major concern. Levels of contamination allowed in seed or grain corn by the EU and Japanese markets are 0.9 and 0%, respectively. There is a great deal of variability in the results of pollen dispersal studies. More information on pollen transport is needed to determine appropriate management strategies. Thus, in 2003 a study was conducted to determine the frequency and distance of gene flow from glyphosate resistant corn in New York States. A circular field design was set up to determine the effect of wind on pollen-mediated gene flow events. GM glyphosate-resistant corn, DKC 46-98-RR was planted in an area $58m^2$ (7.6m x 7.6 m) 15m from the western edge (direction of prevailing winds) of a field and was surrounded by its isoline (DKC 46-96). Hourly wind speed and direction, precipitation, air temperature, and relative humidity were collected for 2-wk beginning at pollen dispersal. At harvest, corn ears were collected in eight transects at seven sites from the edge of pollen source (2.5, 5, 10, 15, 25, 40, and 50m) in E, SE, and NE directions; at five sites (2.5, 5, 10, 15, and 25m) in N, SW, S, NW directions; and at four sites (2.5, 5, 10, 15m) in W direction. At each sampling site nine ears from separate plants were harvested, dried, and seeds removed. On four occasions 200 seeds were randomly selected from each sample and were grown in a greenhouse and then sprayed with glyphosate 1.12 kg ai/ha (Roundup) at the 2-4 leaf stage to test for herbicide resistance. Surviving plants were subjected to a second application and were counted 2 wk after the last application. Percent survival (% gene flow) was calculated by dividing total survival by total emergence. During the initial week of pollination, winds were predominantly from the S or SE. Wind speeds during the pollination period were low with the average speeds during the first 7 days being 2.3, 2.1, 1.8, 1.8, 1.1, 1.2, and 0.8 miles/hr, respectively. It was found that most gene flow occurred within 5m of the pollen source. Results also clearly indicated decline in gene flow frequency with increasing distance from the pollen source and that this decline was less in the direction of the prevailing wind. To determine the effect of distance, direction, and their interaction, the data were analyzed using SAS GENMOD to perform Poisson regression. The analysis showed that both variables were highly significant ($p<0.0001$) but their interaction was not significant. Greater gene flow frequencies were observed at 2.5m from the pollen source with the maximum occurring from NW (9.94%) followed by W and N (8.5 and 7%), respectively. A very low percent of gene flow events were found at 25m from pollen source (0.13%). Further then 25m, almost no survival was found. The GENMOD analysis indicated that N, NW, W differed significantly from E, NE, S, and SE. Data for these two groups of directions were pooled and it was found that the relationship between distance and % gene flow followed a quadratic pattern, i.e. frequency decreased with increasing distance from the pollen source. Percent gene flow increased in the direction of prevailing wind (NW, W, and N).

GLYPHOSATE-RESISTANT ALFALFA (*MEDICAGO SATIVA*) RESEARCH IN PENNSYLVANIA. B.L. Dillehay, W.S. Curran, M.H. Hall, and D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

Pennsylvania is the fourth largest dairy producer in the U.S. High quality alfalfa is essential to dairy production with Pennsylvania ranking 15th nationwide in alfalfa production. Weed management in alfalfa is complex because both interference and quality must be considered. In general, effective herbicides are available for grassy weeds, while broadleaf species remain more difficult to manage. The use of glyphosate in glyphosate-resistant Roundup Ready alfalfa potentially offers unprecedented weed control and crop safety, and is expected to be available commercially in the near future. However, with the introduction of any new agricultural technology, efficacy and management validation must be provided prior to its release. Experiments were initiated starting in 2002 in Pennsylvania examining weed control, crop tolerance, and alfalfa performance. Additional studies in 2004 examined control of Roundup Ready alfalfa in rotation to no-till corn, the potential for Roundup Ready alfalfa/grass mixtures, and weed competition in first year Roundup Ready alfalfa. These experiments aim to provide an understanding of the Roundup Ready alfalfa system and how it could be implemented in Pennsylvania. Herbicide tolerance studies showed good crop tolerance during the establishment year even at the highest rate applied; 3.0 lb ae/A of glyphosate applied four times during the establishment year. Alfalfa forage yield remained unchanged even at the highest glyphosate rate and weed control with glyphosate was equal or better than the competitive products. In first-year alfalfa/grass mixtures not treated with glyphosate, orchardgrass (*Dactylis glomerata*) dry matter was lower and weed dry matter was higher than when orchardgrass was seeded following a post-emergence glyphosate application. Preliminary results from the weed competition and critical period of weed control research show the benefit of timely weed control on alfalfa crop yield. In summary, initial observations appear to show that Roundup Ready alfalfa could be a successful addition to weed management for alfalfa in Pennsylvania.

STRATEGIES SUSTAINING GLYPHOSATE TOLERANT SOYBEAN: MANAGING AGAINST GLYPHOSATE RESISTANCE, AVOIDANCE AND TOLERANCE. B.P. Jones, D.A. Mortensen and W.S. Curran, Penn State Univ., University Park.

ABSTRACT

Soybean weed management is heavily reliant on herbicides that are efficacious and cost-effective. However, the onset of glyphosate resistant weeds, such as horseweed (*Conyza canadensis*), threatens to undermine the utility and practicality that transgenic crops, such as Roundup-Ready soybean have brought to production agriculture. This study was conducted to investigate conventional and alternative weed management strategies in a Roundup-Ready cropping system that minimize selection pressure for difficult to control weeds. This experiment is based on the assumption that in the face of changing management strategies, weed composition will shift over time resulting in a changed weed flora. Specifically, we hypothesize that the species composition will shift to a greater abundance of species capable of avoiding or tolerating glyphosate. Field studies were conducted in both the coastal plain and Appalachian ridge/valley physiographic regions of Pennsylvania. Artificial seedbanks were created by sowing a mixture of eight weed species representing common problem weeds into 3-m wide x 5-m long plots under both conventional and minimum tillage. Treatments consisted of a variety of glyphosate timings and combinations of glyphosate with other herbicide modes of action. The proportion of weeds emerging across treatments was very similar, indicating consistent weed populations prior to treatment applications. In 2003, early applications of glyphosate resulted in a number of weed species remaining, indicating that these species likely avoided the herbicide application by emerging after the herbicide treatment was applied. The conventional timing of glyphosate application, while effective on common ragweed, foxtail and wild buckwheat, was less effective on prickly sida, morningglory and velvetleaf. Similar results were observed from the late application of glyphosate, however greater weed densities were observed. Combining glyphosate with other modes of action was more effective on a number of species, but two particularly troublesome species, prickly sida and morningglory, remained at unacceptable densities. Removing glyphosate from the herbicide treatments, however, resulted in both the highest number and densities of weed species planted.

CONTROLLING GLYPHOSATE-RESISTANT ALFALFA. T.E. Dutt, Monsanto Company, Fogelsville, PA; W.S. Curran, B. Dillehay, Penn State Univ., University Park; and G.L. Jordon, A.C.D.S. Research, Inc., North Rose, NY.

ABSTRACT

Testing was conducted on established stands of glyphosate-resistant (Roundup Ready®)® alfalfa (*Medicago sativa*) to evaluate effective treatments for its control or removal in situations where tillage is not used. Treatments were applied during the spring/summer 2004 on alfalfa stands established April 2002 at locations in Pennsylvania and New York. Spring burndown treatments of 2,4-D LVE + dicamba (0.5 + 0.25-0.5 lb ai/A) prior to rotating into no-till corn (*Zea* mays) provided excellent control and were more effective than 2,4-D or dicamba treatments applied alone. Plants that escaped from preplant burndown treatments were effectively controlled by in-crop treatments of 0.19 lb ai/A clopyralid (Stinger®), 0.19 lb ai/A Hornet® (clopyralid/flumetsulam), 1 lb ai/A Marksman® (dicamba/atrazine), 0.17 lb ai/A Yukon® (dicamba/halosulfuron) or 0.15 lb ai/A NorthStar® (dicamba/primisulfuron/prosulfuron). However, escape plants were not effectively controlled by an in-crop treatment of 0.18 lb ai/A Distinct® (dicamba/diflufenzopyr). Testing was also conducted on glyphosate-resistant alfalfa stands that were cut about a week prior to planting no-till corn. Treatments of 2,4-D LVE + dicamba (0.25-0.5 + 0.25-0.5 lb ai/A) applied 3-5 days after planting on alfalfa regrowth (4-8 inches) did not provide complete control. A follow-up treatment of 0.19 lb ai/A clopyralid applied in-crop was necessary to provide effective control of alfalfa, and was best following a treatment of 0.5 lb ai/A 2,4-D + 0.5 lb ai/A dicamba. Hornet® at 0.17 lb ai/A was effective as an early postemergence treatment applied on 5-8 inch corn and 12-18 inch alfalfa. A test was also conducted in a grass meadow where glyphosate-resistant alfalfa was no-till seeded into the sward in August 2001. Treatments were applied May 2003 on alfalfa that was up to 24 inches tall. Dicamba (Banvel®) alone at rates of 0.5-2 lbs ai/A did not provide complete control or removal of alfalfa from the sward. Distinct® at rates of 0.18-0.26 lb ai/A was also ineffective for control. Treatments that provided complete removal of alfalfa from the sward were 0.5 lb ai/A dicamba + 2 lbs ai/A 2,4-D amine, 0.25 lb ai/A clopyralid, 1.19 lbs ai/A Curtail® (2,4-D/clopyralid) and 1.5 lbs ai/A Crossbow® (2,4-D/triclopyr). Testing shows that herbicide treatments are available to effectively control or remove glyphosate-resistant alfalfa in both crop and non-crop situations where tillage does not occur.

® Roundup Ready and Yukon are registered trademarks of Monsanto Company; Stinger, Hornet, Curtail and Crossbow are registered trademarks of Dow AgroSciences; Banvel, Marksman and Distinct are registered trademarks of BASF Corporation; NorthStar is a registered trademark of Syngenta Crop Protection.

WEED INTERFERENCE AND TIMING OF GLYPHOSATE APPLICATION AFFECT YIELD COMPONENTS OF CORN. R.R. Hahn, P.J. Stachowski, and W.J. Cox, Cornell Univ., Ithaca, NY.

ABSTRACT

Field experiments were conducted for 3 years near Aurora, NY to determine how timing of glyphosate application affects grain corn (*Zea mays* L.) yield components of glyphosate-resistant hybrids with different relative maturities. The experiments were established in fields that had moderate to heavy infestations of common ragweed (*Ambrosia artemisiifolia* L.), foxtails (*Setaria* spp.), wild mustard (*Brassica kaber* (D.C.) L.C. Wheelerl), other annual weeds, and in 2003 a moderate infestation of field bindweed (*Convolvulus arvensis* L.). Corn 'DKC42-70RR', a 92-day hybrid, and 'DKC53-33RR', a 103-day hybrid, were planted at 35,600 kernels/A May 11, 5, and 11 in 2002, 2003, and 2004 respectively. A randomized complete block design with a split plot arrangement and five replications was used. Hybrids were main plots and weed control treatments were subplots. Treatments were a weed-free check that received 2.25 lb ai/A of *S*-S-metolachlor/atrazine preemergence (PRE) followed by hand weeding or 0.75 lb ae/A of glyphosate, postemergence (POST) treatments of 0.75 lb/A of glyphosate applied early (EPOST), mid-(MPOST), or late (LPOST) at approximately the V4, V5, or V6 stages of corn development respectively, and a weedy check. In addition to plant populations and grain yields/A, the number of ears/plant, rows of kernels/ear, kernels/row, and kernel weight were recorded.

Although there was a difference in plants/A between the 92-day and 103-day hybrids, there were no differences in grain yield or in the yield components between hybrids when results were averaged over years and weed control treatments. There were however differences in these parameters among the weed control treatments and results are a summary for both hybrids over 3 years. Grain yields were similar for the PRE weed free check and for the EPOST glyphosate application, however there were differences in yields among the three POST glyphosate treatments. Grain yield for the weed free check was 136 bu/A while yields for the EPOST, MPOST, and LPOST glyphosate applications were 135, 105, and 78 bu/A respectively. The weedy check averaged only 33 bu/A. There were no differences in ears/plant among the PRE and POST weed control treatments. Each of these treatments averaged one ear/plant. There were no differences in number of rows of kernels/ear among the PRE weed free, EPOST, and MPOST treatments with an average of 15.2 rows/ear. The number of rows/ear was reduced to 13.7 when weed interference was removed LPOST and further reduced to 9.2 rows/ear in the weedy check. The PRE weed-free check averaged 30 kernels/row. This was not greater than the 29 kernels/row from the EPOST glyphosate treatment but was greater than the 25 kernels/row from the MPOST glyphosate treatment. There was another drop to 22 kernels/row with the LPOST glyphosate application. The weedy check averaged only 11 kernels/row. Finally, there were no differences in seed weight among the PRE weed free check and any of the POST glyphosate treatments but seed weight from the weedy check was reduced by 37%. These results suggest yield reduction that occurred between the EPOST (V4) and the MPOST (V5) applications was more closely related to a reduction in kernels/row rather than to a reduction in rows/ear.

SINGLE APPLICATION WEED CONTROL FOR NO-TILLAGE GLYPHOSATE-RESISTANT SOYBEANS. R.R. Hahn and P.J. Stachowski, Cornell Univ., Ithaca, NY.

ABSTRACT

Field experiments were conducted for 3 years near Aurora, NY to determine whether a single herbicide application can be used for burndown and postemergence (POST) weed control in no-tillage, glyphosate-resistant soybeans (*Glycine max* (L.) Merr.), and if so, the appropriate timing for this application. Experiments were established in fields that had been fallow the previous year with heavy populations of common ragweed (*Ambrosia artemisiifolia* L.), foxtails (*Setaria* spp.), wild mustard (*Brassica kaber* (DC.) L.C. Wheeler), and other annual weeds. A no-tillage planter was used to plant soybeans 'Pioneer 91B91' in 15-inch rows June 10, 9, and 9 in 2002, 2003, and 2004 respectively. Single applications of 0.75 lb ae/A of glyphosate or of 0.81 lb ai/A of glyphosate/imazethapyr premix as preemergence (PRE) burndown treatments, or as POST treatments 2, 3, or 4 weeks after planting (WAP) were compared with a standard two-pass program of 0.75 lb/A of glyphosate as a PRE burndown followed by 0.75 lb/A of glyphosate 4 WAP. Other treatments included PRE burndown applications of 0.75 lb/A of glyphosate plus 1.22 lb ai/A of *S*-S-metolachlor/metribuzin or of 1.8 oz ai/A of chlorimuron/sulfentrazone, and PRE burndown applications of 0.81 lb/A of glyphosate/imazethapyr alone or tank-mixed with 0.26 oz ai/A of chloransulam-methyl.

The standard two-pass program and single applications of glyphosate or glyphosate/imazethapyr 2, 3, or 4 WAP provided good to excellent annual weed control. The only PRE burndown treatment with residual herbicide(s) that provided good to excellent weed control all 3 years was the glyphosate/imazethapyr plus chloransulam-methyl tank mix. PRE burndown applications of glyphosate/imazethapyr alone did not control common ragweed adequately 2 out of 3 years. Soybean yields in 2002 and 2003 averaged 37 bu/A with single glyphosate applications 2 or 3 WAP, and with a single application of glyphosate/imazethapyr 2 WAP. These yields were not significantly less than the average of 40 bu/A from the standard PRE burndown glyphosate followed by glyphosate 4 WAP treatment. The single application of glyphosate alone 4 WAP averaged 31 bu/A and single applications of glyphosate/imazethapyr 3 or 4 WAP averaged 34 bu/A. PRE burndown treatments that included glyphosate plus residual herbicide(s) had an average yield of 34 bu/A. Although this was better than the yield from the PRE burndown application of glyphosate alone (26 bu/A), these PRE burndown treatments with residual did not yield as well as the standard two-pass program. Two-pass programs that involved a PRE burndown application of glyphosate with residual herbicide(s) followed by a glyphosate application 4 WAP had an average yield of 36 bu/A. In two-pass programs, there was no benefit from the addition of residual herbicide(s) to PRE burndown applications compared with PRE burndown with glyphosate alone. These results support the concept of a single application for burndown and POST weed control in narrow-row no-tillage soybeans if that application is made 2 to 3 WAP rather than 3 to 4 WAP, which is the recommended timing for conventional tillage systems.

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

ABSTRACT

A large portion of the soybean (*Glycine max)* 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*), 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.

Studies were conducted at the Wye Research and Education Center located in Queenstown, MD, to investigate the proper timing of postemergence applications of glyphosate to glyphosate-resistant corn and glyphosate-resistant soybean. Corn was studied in 2002-2004, with Asgrow RX 670 being planted April 23, 2002, and Asgrow RX 664 on April 30, 2003, and April 29, 2004. Soybean (Asgrow 4101 in 2001; Asgrow 4301 in 2002 - 2003; DeKalb 44-51 in 2004) was planted on May 21, 2001 and 2002, on June 30, 2003, and May 25, 2004. For both corn and soybean, glyphosate applications were made on a weekly basis starting 1 week after planting (WAP) and continuing until 12 WAP. 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*). Yields were obtained with a standard field combine.

In 2002, corn yield from plots where glyphosate applications were made 1 and 2 WAP were comparable to the untreated check. Corn yield increased when applications were made 3 WAP with highest yield obtained when applications were made at 3 and 4 WAP. 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 8, 9, 10, 11 and 12 WAP, yields were comparable to those obtained from the untreated check. In 2003, highest yields were obtained when applications were made 3 to 7 WAP. Yields declined sharply in 2003 when applications were delayed until 8 weeks or later after planting.

In 2001, soybean yield from plots where glyphosate applications were made 1 and 2 WAP were comparable to the untreated check. Soybean yield increased when applications were made 3 WAP, with highest yield obtained when applications were made 5 and 6 WAP. After the 6-week application, yield started to decrease. When applications were made 11 and 12 WAP, yields were comparable to those obtained from the untreated check. Similar results were obtained in 2002. However, in 2002, highest yields were obtained when applications were made 4, 5 and 6 WAP. In 2003, good yields were obtained when applications were made from 2 to 7 WAP. After the 7 week application, yields started to decrease.

Corn and soybean yields for 2004 are still being obtained.

ITALIAN RYEGRASS CONTROL IN WINTER WHEAT UTILIZING MESOSULFURON.
J.C. Sanders, C.M. Whaley, H.P. Wilson, and T.E. Hines, Virginia Tech, Painter.

ABSTRACT

Diclofop-resistant Italian ryegrass (*Lolium multiflorum* L.) has become a common and troublesome weed in winter wheat (*Triticum aestivum* L.). Until recently, diclofop was the only herbicide registered for consistent control of Italian ryegrass. Mesosulfuron-methyl, which has excellent activity on Italian ryegrass, was available for use in the 2003 to 2004 growing season in winter wheat. With the commercial release of mesosulfuron, diclofop-resistant ryegrass can now be effectively controlled in wheat. In the 2003 to 2004 growing season, field studies were conducted to evaluate the utility of mesosulfuron to manage Italian ryegrass in winter wheat. Mesosulfuron was applied at 0.0134 lb ai/A and was mixed with methylated seed oil (MSO) at 1.5 pt/A (0.75 % v/v) and urea ammonium nitrogen (UAN) at 4.0 pt/A (2.0 % v/v). Mesosulfuron treatments were applied postemergence (POST) either alone or in combinations or sequences with other herbicides. These studies were conducted in a randomized block design with four replicates. Visual control ratings and spike density of Italian ryegrass were collected just prior to wheat harvest, and wheat yields were collected using a small-plot combine. An additional study was conducted under weed-free conditions to evaluate cultivar tolerance to mesosulfuron. In this study nine different wheat cultivars were planted in a split plot design and treated POST with no mesosulfuron or mesosulfuron at either at 0.0134 lb ai/A or 0.0268 lb ai/A. Visual crop injury ratings and wheat yield were collected for the cultivar-tolerance study. All treatments were applied using a tractor-mounted sprayer with an application volume of 25.2 gpa. All mesosulfuron treatments controlled 2-leaf Italian ryegrass >97% and treated-wheat produced minimum yields of 102 bu/A; untreated checks produced 42 bu/A. Delaying the application of mesosulfuron to mid-March or early April resulted in reduced Italian ryegrass control. Though yields were low from these delayed applications, wheat lodging was eliminated and foreign matter content of harvested grain was greatly reduced when compared to the untreated checks. In conclusion, mesosulfuron controlled Italian ryegrass and wheat yields were significantly increased. All cultivars evaluated for mesosulfuron tolerance demonstrated excellent tolerance to this herbicide.

FIELD INVESTIGATIONS IN MARYLAND WITH KIH-485. R.L. Ritter and H. Menbere, Univ. Maryland, College Park, and P.J. Porpiglia, Kumiai America, White Plains, NY.

ABSTRACT

In 2003 and 2004, studies were established at the Wye Research and Education Center (WREC) located in Queenstown, MD to examine the preemergence (PRE) activity of KIH-485 in conventionally planted corn (*Zea mays*) and soybean (*Glycine max*). In 2003, the Carl Seiler farm, located outside of Westminster, MD was used to study PRE control of triazine-resistant common lambsquarters (*Chenopodium album)* and triazine-resistant giant foxtail (*Setaria faberi*) in no-till corn with KIH-485. In 2003, a study was established at the Central Maryland Research and Education Center located in Beltsville, MD, to examine the PRE activity of KIH-485 on Italian ryegrass (*Lolium multiflorum*) control in wheat (*Triticum aestivum*).

KIH-485 was included in three corn studies at WREC in 2003 and again in 2004. The first study compared all of the common PRE grass control herbicides for use in corn. No atrazine was tank-mixed with them. KIH-485 applied PRE at 0.18 lb ai/A provided equally effective giant foxtail control as the standards. In a second study at WREC in 2003, KIH-485 was applied PRE at 0.18 lb ai/A in combination with atrazine at 1.25 lb ai/A and compared to the standard pre-packaged herbicide mixes containing atrazine. In 2004, two different pre-packs of KIH-485 plus atrazine were applied PRE and compared to the standard pre-pack mixes. Excellent control of giant foxtail, jimsonweed (*Datura stromonium*) and velvetleaf (*Abutilon theophrasti*) was obtained with KIH-485 plus atrazine in 2003. In 2004, the pre-packs of KIH-485 were also very effective in providing excellent weed control. The third study at WREC compared a PRE rate titration of KIH-485 to a PRE rate titration of S-metolachlor (Dual II Magnum). Good to excellent control of giant foxtail, jimsonweed and velvetleaf was obtained with all rates of KIH-485 in 2003. Although some injury in the form of stunting and discoloration was observed early in the season, excellent corn yields were obtained with KIH-485 in 2003. In 2004, no injury was observed and excellent control of giant foxtail was obtained with KIH-485 and S-metolachlor. A similar PRE rate titration study was conducted at the Carl Seiler farm in 2003. Good to excellent control of triazine-resistant giant foxtail and triazine-resistant common lambsquarters was obtained through mid-season with KIH-485. However, from mid-July on, control of triazine-resistant common lambsquarters declined rapidly with rates less than 0.44 lb ai/A. Good to excellent control of triazine-resistant giant foxtail was observed with KIH-485 with rates at or above 0.18 lb ai/A. S-metolachlor provided early-season suppression of triazine-resistant common lambsquarters; however, by late June, control started to decline rapidly. KIH-485 provided better season-long control of triazine-resistant giant foxtail in comparison to S-metolachlor at most rates. At WREC in 2004, a PRE rate titration of KIH-485 was utilized in soybean. Minor injury was noted early in the season. Excellent giant foxtail, jimsonweed, ivyleaf morningglory (*Ipomoea hederaceae*), and velvetleaf control was observed at rates of 0.18 lb ai/A or higher. PRE applications of KIH-485 in 2003 provided excellent Italian ryegrass control in wheat. While early season wheat injury was noted, yields were not affected.

CONTROL OF SORGHUM SPECIES IN FIELD CORN WITH KIH-485. S.R. King, Virginia Tech, Blacksburg, R.L. Ritter, Univ. of Maryland, College Park, E.S. Hagood, Jr., Virginia Tech, Blacksburg, and H. Menbere, Univ. of Maryland, College Park.

ABSTRACT

Field experiments were conducted in Maryland and Virginia in 2004 to evaluate KIH-485 for the control of seedling johnsongrass (*Sorghum halepense)* and ALS-resistant shattercane (*Sorghum bicolor*), respectively. KIH-485 is an experimental herbicide that has shown preemergence control of many annual grasses, and excellent corn (*Zea mays*) tolerance applied as either a preemergence (PRE) or postemergence (POST) treatment. KIH-485 was applied to a glyphosate-tolerant corn hybrid at three rates (67.2, 84.6, and 101.2 g ai/A) and two timings (PRE and POST) and compared to standard rates of other currently registered corn herbicides including S-metolachlor, acetochlor, and pendimethalin. PRE treatments were applied alone, while POST treatments were combined with 1.0 lb ai/A of glyphosate. A single POST application of glyphosate was also evaluated. The experiment also included a non-treated and a weed-free control. Experiments were designed as randomized complete blocks with three replications. One-way ANOVA was utilized to compare between all treatments; however, 2-way factorial analyses were used to compare weed control and corn yield within an individual treatment between application times and within application timing among treatments. At 30 days after treatment (DAT) in Maryland, all rates of KIH-485 applied PRE controlled seedling johnsongrass 95% or greater and control was equivalent to that provided by S-metolachlor and acetochlor applied PRE. Seedling johnsongrass control at 75 DAT was 78, 93, and 85% with the three PRE treatments of KIH-485 and 80% with acetochlor compared to only 50 and 45% control with S-metolachlor and pendimethalin, respectively. In August, seedling johnsongrass was controlled 95% or greater when any POST treatment was combined with glyphosate or when glyphosate was applied alone. In Virginia, 1 month after treatment (MAT) shattercane was controlled 73, 86, and 93% with the three PRE treatments of KIH-485 compared to only 50, 49, and 48% control with S-metolachlor, acetochlor, and pendimethalin, respectively. At 4 MAT, shattercane control with all PRE treatments was less than 50%. However, POST applications of KIH-485 combined with glyphosate controlled shattercane 98% or greater compared to only 71, 86, 71, and 76% control with glyphosate applied alone, S-metolachlor plus glyphosate, acetochlor plus glyphosate, and pendimethalin plus glyphosate, respectively. In Virginia, corn yields with POST treatments of KIH-485 plus glyphosate were equivalent to yield from the weed-free control and greater than yield from any PRE treatment. Corn yield from the POST glyphosate alone treatment; however, was not different from corn yield from the POST treatment of KIH-485 applied in combination with glyphosate. Results from these experiments indicate that KIH-485 applied either PRE or POST is an effective treatment for the control of seedling johnsongrass. Early-season control of ALS-resistant shattercane was promising with KIH-485; however, season-long control only occurred when KIH-485 was applied POST in combination with glyphosate.

CORN AND WEED COMPETITIVE EFFECTS ON SOIL WATER DYNAMICS AND NUTRIENT UPTAKE. J.R. Teasdale, J.L. Starr, A.M. Sadeghi, and R.A. Rowland, USDA-ARS, Beltsville, MD.

ABSTRACT

Weed competition for soil water and its resultant impact on corn (*Zea mays* L.) growth has not been well documented. This research was conducted in continuous no-tillage corn to assess the impact of cover-crop residue (plus or minus hairy vetch) and weed competition (plus or minus weeds) on water use and crop growth over two growing seasons. Treatment impacts were studied in 32 one-m^2 sampling areas within replicated field plots during each of two droughty years. Soil water content was continuously monitored at 10-min intervals using multisensor capacitance probes located at the center of each sampling area. Probes were installed after corn emergence in the spring to monitor moisture centered at soil depths of 10-, 20-, 30-cm, and 40- or 50-cm. Vegetative biomass and nutrient content of weeds and corn was obtained for each sampling area at physiological maturity. Grain yield is not reported since grain fill was limited and erratic during these extremely dry seasons.

Total biomass (corn plus weeds) was higher by 9% in 1998 and by 12% in 1999 in weedy versus weed-free corn. Water use (evapotranspiration) was determined for the period following each rainfall event and was found to be higher in weedy than in weed-free corn, particularly early in the season. The increase in water use in weedy corn following early rain events in each year can be attributed to use of “free” water that was available early in the season before corn could access it. Corn was probably slower than weeds accessing this early water because there were 6 corn plants per m^2 compared to 39 to 70 weed plants per m^2, primarily fall panicum (*Panicum dichotomiflorum* Michx.) This free water accessed by weeds represented 28% in 1998 and 15% in 1999 of the total water used in weedy corn plots. Access to this early water by weeds may account for the higher total biomass achieved in weedy versus weed-free plots.

Although total biomass and water use was not affected by cover crop, the distribution of biomass among species was affected by cover crop. Corn biomass was similar in treatments with or without hairy vetch in the absence of weeds, but corn biomass was higher with than without a hairy vetch cover crop in the presence of weeds. Weed biomass and population showed an opposite response, lower levels were observed with than without hairy vetch. Analysis of covariance confirmed that there was a negative linear relationship between corn and weed biomass. There was no interaction between cover crop and weed biomass indicating that the slope of corn biomass loss per unit weed biomass was similar regardless of cover crop. These results demonstrated that the competitive relation between corn and weeds was unaffected by cover crop and that the observed corn differences due to cover crop could be explained entirely by the presence of fewer weeds and lower biomass with than without hairy vetch.

AN ALTERNATIVE FORAGE PRODUCTION SYSTEM FOR ORGANIC DAIRY PRODUCERS: QUALITY FEED AND FEWER WEEDS. J.M. Jemison, Jr. and S.C. Reberg-Horton, Univ. Maine, Orono.

ABSTRACT

The number of organic dairy farms has grown to almost 20% of all dairy farms in Maine. Many of the early conversions were small, grass-based farms. Facing an increasingly difficult market, many larger farms, with considerably more complicated crop production systems, have also started to convert to organic. Controlling weeds in crops like field corn is a growing problem. This year, we have initiated a study to evaluate weed management in an alternative cropping system that utilizes different planting timing and physical crop characteristics to determine if this system could provide a nutritionally sound, cost effective, and weed competitive cropping system compared to a standard corn-hay based forage production system. In this study, we compared a triple crop production system (spring barley, brown midrib sorghum sudan grass (BMRSS) and winter cereals) to organic field corn production. The rationale for the alternative forage system is simple. Spring barley is planted in late April or early May while the soil is still cold and most annual weeds have yet to start growing. Since barley is drilled in narrow rows, it should reach canopy closure prior to much annual weed growth. Following harvest in July, BMRSS is drilled into warm soils in narrow rows. Again, growth of BMRSS should be competitive with annual weeds. Finally, after BMRSS is harvested in September, winter cereals are drilled to reduce potential for fall annuals and provide soil cover. This study compares this alternative system to field corn cultivated twice with a tine cultivator and twice using row cultivators. Nutrients for these cropping systems were supplied by an addition of 20 tons/A cow manure in the spring. No additional N was applied to the BMRSS as it was assumed that the manure application was sufficient to meet double crop nitrogen (N) needs. Barley was drilled on 7 May 2004 and harvested 15 July 2004. Corn was planted 22 May 2004. Sorghum was drilled on 17 July 2004 and harvested on 21 September 2004. Two weed biomass samples were collected from the corn (canopy closure and silk), and weeds were collected just prior to barley and BMRSS harvest. Corn harvest yielded 4.3 tons dry matter (DM)/A, and the weed biomass produced in that systems yielded approximately 1.52 tons DM/A. Good early season growing conditions led to barley yields of 3.4 tons DM/A with only 0.056 tons DM/A weed biomass. Due to apparent N deficiency caused by the high barley N use efficiency, yields of BMRSS following barley were only 2.32 tons DM/ha. One experimental treatment where BMRSS did not follow barley yielded 5.4 tons DM/A, showing the promise of the system with more manure applied before the BMRSS. Again, we found weed biomass very low in the second crop at only 0.044 tons DM/A. Even with essentially a failed BMRSS crop, the barley and BMRSS out produced corn yield, and weed biomass generated with the alternative system was 15 times lower than in the field corn. Work on nutritional differences will also be covered. Overall, this triple crop system does hold promise for growers.

FATE OF SEED BANK POOLS DURING THE TRANSITION TO AN ORGANIC FEED GRAIN ROTATION IN PENNSYLVANIA. A. Hulting, C. Nardozzo, B. Jones, M. Barbercheck, and D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

Weed management in reduced herbicide and organic cropping systems is a priority for growers nationally. This project is focusing on weed management during the transition to an organic feed grain crop rotation (cover crop-soybean-corn) in support of the growing organic dairy industry in central PA. The 2.5 ha study site was established in the fall of 2003 at the Russell E. Larson Agricultural Experiment Station near Rock Springs, PA. Seed banks consisting of a mixture of three weed species, giant foxtail (*Setaria faberi*), common lambsquarters (*Chenopodium album*) and velvetleaf (*Abutilon theophrasti*), were established at three densities in permanently marked individual 2 m^2 subplots within the framework of the overall project design. The seeded weed densities were low, medium and high (60, 450, 2100 seeds/m^2). These species and seed densities were chosen with the goal of establishing a range of plant densities in the study that could be used to quantify thresholds of plant densities above which the success of a given organic weed management practice would be limited. Also in the fall of 2003, two cover cropping strategies were initiated and intensively managed over the spring and summer of 2004. The two cover crop treatments were rye (*Secale cereale*) (managed for grain production) and a mixture of red clover/timothy (*Trifolium pratense* / *Phleum pratense*) (managed for forage production).

Weed seedling densities were quantified in May and June in both the seed bank subplots as well as in the larger plots to quantify background weed densities. The three seeded weed species established in different proportions across the three seed densities and two cover crop treatments. In the rye treatment, foxtail establishment was higher than both velvetleaf and common lambsquarters. Foxtail seedling densities ranged from 60 seedlings/m^2 in the low subplot to near 150 seedlings/m^2 in both the medium and high subplots. Velvetleaf and common lambsquarters establishment was low in the rye treatment and averaged less than 10 seedlings/m^2 across all subplot densities for both species (except for the high velvetleaf density which was 60 seedlings/m^2). Conversely, foxtail establishment in the red clover/timothy treatment was very limited with less than 10 seedlings/m^2 establishing across all the subplot densities. Common lambsquarters established more than both foxtail and velvetleaf in the red clover/timothy treatment with 12-18 seedlings/m^2 quantified across the subplot densities. These established densities will be monitored over time to gauge the success of mechanical and cultural weed management practices (tillage induced germination, delayed seeding) on the dynamics of the weed populations in this organic system. As the crop rotation moves forward into soybean production it is apparent that perennial weed species such as Canada thistle (*Cirsium arvense*) and hedge bindweed (*Calystegia sepium*), which had patchy population distributions in this study, will need to be addressed. Weed management strategies identified through this project will support farmers transitioning to organic production and those interested in reducing herbicide inputs. These management tactics will enable farmers to produce high value organic crops, in this case organic feed grains, and may help growers provide sufficient income to support families on relatively small and medium-sized farms in the Northeast region.

PERENNIAL BROADLEAF CONTROL IN ORGANIC DAIRY PASTURES: AN ON-FARM RESEARCH ODYSSEY. R.J. Hoover, W.S. Curran, T. Murphy, A. Santini, R. Stout, and D. Williams, Penn State Univ., University Park, PA; and D. Johnson, Provident Farms, Liberty, PA.

ABSTRACT

One objective of the on-farm research program at the Pennsylvania State University is to work with farmers to develop and conduct research projects that seek answers to production questions. A project was initiated upon the request of a dairyman in early spring 2002 to investigate opportunities for reducing the invasion of buttercup (*Ranunculus* spp.) in mixed sward organic dairy pastures. The site consists of soils that are of medium to heavy texture and exhibit moderate to poor drainage. Due to proximity to the barns, the dairyman preferred to not till the area and rotate to another crop. Possible inputs for managing the weed problem are further reduced by the need to maintain the organic certification for the farm.

Several management practices were identified for their potential to reduce the weed population through increasing the competitive ability of the forage species relative to that of the buttercup. The two practices included in this study consisted of amending soil fertility (poultry manure and pH) and increasing soil aeration. The experimental design was a split block replicated four times. Three levels of fertility (control vs. poultry manure alone vs. poultry manure plus lime) were combined with two levels of aeration (no aeration vs. aeration.) Initial soil sample analyses determined phosphorus, potassium, and calcium were low to moderate and pH ranged from 5.8 to 6.0 (Penn State Ag Anal. Lab.). Approximately 4480 and 3800 lb/A of crushed limestone were applied to the manure plus lime treatment during the springs of 2002 and 2003, respectively. Two tons/A laying hen manure were spread to the two manure treatments during the summer of 2003. Soil aeration (Aer Way Equipment) was conducted on the designated plots twice during 2002 (summer and early fall) and once during 2003 (summer). Soil samples were extracted from the three fertility treatments during spring 2004 and analyzed for pH, phosphorus, potassium, and calcium levels.

Lime applications raised soil pH to 6.8 while the pH of the non-limed plots remained in the 5.8 to 6.0 range. Interestingly, the phosphorus and potassium levels in the manured plots were virtually identical to those in the non-manured plots. The string transect method of surveying the pastures for botanical composition was utilized during early September 2003 and July 2004. Of primary interest were differences in incidence of buttercup and desirable forage legumes (primarily white clover.) Buttercup incidence during September 2003 and July 2004 was not different for fertility treatments and the overall average measured 4.2 and 14.2 percent, respectively. However, aeration appeared to stimulate buttercup as measured in 2003 (3.6 and 4.7 percent for non-aerated and aerated) and in 2004 (13.0 and 15.5 percent for non-aerated and aerated.) However, the legume component measured in 2003 was reduced with aeration (44.7 and 38.0 percent for non-aerated and aerated.) This was most likely a result of damage to white clover stolons during aeration. Although application of poultry manure alone did not improve legume content of pastures, the use of lime to improve soil pH caused a marked improvement in legume content. Liming increased the legume fraction during 2003 and 2004 from 38.5 to 47.1 and 21.8 to 27.0 percent, respectively.

SELECTIVE HERBICIDE MIXTURES FOR CONTROL OF POISON HEMLOCK IN A CROWNVETCH GROUNDCOVER. A.E. Gover, J.M. Johnson, and L.J. Kuhns, Penn State Univ., University Park.

ABSTRACT

As part of an ongoing project sponsored by the Pennsylvania Department of Transportation, trials were established to compare herbicide mixtures to selectively remove the biennial poison hemlock (*Conium maculatum*, COIMA) from crownvetch (*Coronilla varia*, CZRVA). Two trials were established in the infield of the interchange of SR 79/SR 519, near Canonsburg, PA, featuring the same treatments and application methods, applied at different dates. The treatments[1] included hexazinone at 1.1 kg/ha, imazapic at 0.21 kg/ha, bentazon at 1.1 kg/ha, glyphosate at 1.7 or 3.4 kg/ha, hexazinone at 1.1 kg/ha plus glyphosate at 0.84 kg/ha or imazapic at 0.21 kg/ha, and imazapic at 0.21 kg/ha plus glyphosate at 0.84 kg/ha or bentazon at 1.1 kg/ha. The treatments were applied to 1.8 by 4.6 m plots arranged in a randomized complete block design with three replications, using a CO_2-powered, hand-held boom equipped with TeeJet XR8004VS tips, delivering 330 L/ha at 190 kPa. The first trial was established April 6, 2004, when COIMA rosettes were pre-bolt, new seedlings ranged between cotyledon and two-leaf stage, and new CZRVA growth was about 5 cm. Soil temperatures at 2.5 and 15 cm were 11 and 9 C. The second trial was established April 22, when COIMA rosettes were beginning to bolt, and CZRVA growth was up to 10 cm. Soil temperature at 2.5 cm was 17 C. After application, one replication of the April 22 trial was lost due to overspray. The April 6 trial was rated April 22 for COIMA injury, and both trials were rated May 11 for COIMA and CZRVA injury, and June 10 for percent total cover and cover by CZRVA and first- and second-season COIMA. Data were subjected to analysis of variance, and means compared using Fisher's Protected LSD (p=0.05). The untreated checks were assigned a zero value for percent injury, and were not included in the analysis of variance.

In the April 6 trial, treatment effect for percent injury to COIMA was not significant on April 22 or May 11. On June 10, the untreated plots averaged 90 percent vegetative cover, 37 percent cover from second-year COIMA, 4 percent from first-year COIMA, and 29 percent from CZRVA. Treatments that eliminated second-year COIMA and significantly reduced first-year COIMA ranged from 28 to 49 percent vegetative cover, and included imazapic alone or in combination with hexazinone, glyphosate, or bentazon, and hexazinone plus glyphosate. In the April 22 trial, total cover on June 10 for the untreated plots averaged 95 percent, with 57 percent cover from CZRVA, and 34 and 4 percent cover from second- and first-year COIMA. Treatments that eliminated COIMA and did not significantly reduce total cover or cover from CZRVA included hexazinone alone and in combination with glyphosate.

Application of hexazinone plus glyphosate provided effective control of COIMA and acceptable selectivity to CZRVA at both timings, while hexazinone alone was effective against COIMA only at the early-bolt timing, and the imazapic combinations were adequately selective only at the pre-bolt timing.

[1] Hexazinone or glyphosate alone included Freeway non-ionic surfactant at 0.1 percent v/v, and all other treatments included methylated seed oil at 2.3 L/ha.

Table 1: Response of poison hemlock (COIMA), crownvetch (CZRVA), and total cover on June 10, 2004 to herbicide treatments applied April 6 or April 22, 2004. COIMA was evaluated as second-year COIMA2 and first-year COIMA1 plants. Values for April 6 treatments are the mean of three replications, and the April 22 values are the mean of two replications.

Treatment[2]	Application rate	Applied Apr 6 Total cover	Applied Apr 6 CZRVA cover	Applied Apr 6 COIMA2 cover	Applied Apr 6 COIMA1 cover	Applied Apr 22 Total cover	Applied Apr 22 CZRVA cover	Applied Apr 22 COIMA2 cover	Applied Apr 22 COIMA1 cover
	kg ae/ha	%							
untreated	- -	90	29	37	4	95	57	34	4
hexazinone	1.1	78	54	11	1	93	92	0	0
imazapic	0.21	47	36	0	1	20	19	0	0
bentazon	1.1	96	56	12	6	90	63	20	5
glyphosate	1.7	78	32	0	10	48	36	1	9
glyphosate	3.4	72	27	0	16	4	3	0	0
hexazinone glyphosate	1.1 0.84	43	35	0	0	88	87	0	0
hexazinone imazapic	1.11 0.21	28	23	0	0	15	15	0	0
imazapic glyphosate	0.21 0.84	33	33	0	0	23	21	0	0
imazapic bentazon	0.21 1.1	49	29	0	0	23	21	0	0
Protected LSD (p=0.05)		n.s.	19	7	n.s.	18	37	n.s.	5

[2] Hexazinone or glyphosate alone included Freeway non-ionic surfactant at 0.1 percent v/v, and all other treatments included methylated seed oil at 2.3 L/ha.

EVALUATION OF HERBICIDES FOR CONTROL OF LONICERA SPECIES. J.M. Johnson, A.E. Gover, T.L. Harpster, and L.J. Kuhns, Penn State Univ., University Park.

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 herbicides and combinations for controlling exotic shrub *Lonicera* species.

This study was established along SR 322 near State College, PA. Thirteen treatments, including an untreated check, were applied on September 17 and 18, 2003 to 65 individual shrubs using a randomized complete block design with five replications. Treatments were mixed based on a target application volume of 935 L/ha and applied on a spray-to-wet basis. Treatments included metsulfuron alone at targeted rates of 0.021, 0.042, or 0.084 kg/ha; fosamine alone at 4.0 or 8.0 kg/ha; triclopyr at 1.7 kg/ha, alone or in combination with fluroxypyr at 0.84 kg/ha, dicamba at 2.2 kg/ha, or metsulfuron at 0.021 kg/ha; and glyphosate at 3.4 kg/ha, alone or in combination with triclopyr at 0.84 kg/ha or imazapyr at 0.14 kg/ha. A surfactant, CADCO 90, was added to all treatments at 0.25 percent v/v. The species targeted in this study were identified as Morrow's honeysuckle (*Lonicera morrowii*) and Tatarian honeysuckle (*Lonicera tatarica*). Treatments were made using a CO_2-powered backpack sprayer equipped with a single Spraying Systems #5500 Adjustable ConeJet nozzle with an X-12 tip. Operating pressure at the tank was 193 kPa. Canopy measurements taken at time of treatment were used to estimate an application volume between 951 and 1395 L/ha on a basal area basis.

Ratings of injury were taken October 14, 2003, 4 weeks after treatment (WAT). Injury ratings were taken on a scale from 0 to 10 where "0" indicates no observable effect and "10" = dead. Percent live crown reduction was rated on August 2, 2004, 45 WAT. Injury ratings taken 4 WAT ranged from 3.0 to 7.4. Increasing rates of metsulfuron or the addition of herbicides to triclopyr or glyphosate yielded higher initial injury ratings.

Metsulfuron and fosamine both showed improved efficacy with increasing rates by 45 WAT. Metsulfuron at a targeted rate of 0.021 kg/ha had only 20 percent crown reduction, while a rate of 0.084 kg/ha had 99 percent crown reduction. Fosamine demonstrated similar results. Fosamine at 4.0 kg/ha had 62 percent crown reduction, while fosamine at 8.0 kg/ha resulted in 88 percent crown reduction. Triclopyr alone, or in combination with fluroxypyr only provided 10 percent crown reduction. Adding dicamba and metsulfuron improved control over triclopyr alone, but neither resulted in satisfactory levels of control with 53 and 51 percent crown reduction, respectively. Glyphosate alone, or in combination with triclopyr or imazapyr provided excellent control with crown reduction between 95 and 99 percent.

Table 1: Response of a mixed stand of Tatarian and Morrow's honeysuckle to foliar herbicide treatments. Treatments were mixed assuming an application volume of 935L/ha, and applied on a spray-to-wet basis to individual plants on September 17 and 18, 2003. Injury was rated October 14, 2003, 4 weeks after treatment (WAT), on a scale of 0 to 10 with "0" = no observable effect and "10" = dead. Percent live crown reduction was evaluated August 2, 2004, 45 WAT. The untreated checks were assigned zero values for both ratings and were not included in the analysis of variance. Each value is the mean of 5 replications.

Treatment	Targeted application rate	Estimated[1] application rate	Oct 14, 2003 injury	Aug 2, 2004 live crown reduction
	(kg/ha)	(kg/ha)	(0-10)	(%)
untreated	---	---	0.0	0
metsulfuron	0.021	0.027	3.0	20
metsulfuron	0.042	0.051	6.2	53
metsulfuron	0.084	0.11	6.8	99
fosamine	4.0	4.3	4.8	62
fosamine	8.0	8.1	4.4	88
triclopyr	1.7	1.7	4.4	10
triclopyr fluroxypyr	1.7 0.84	1.7 0.86	5.6	10
triclopyr dicamba	1.7 2.2	1.8 2.3	7.4	53
triclopyr metsulfuron	1.7 0.021	2.02 0.025	6.2	51
glyphosate	3.4	3.6	5.4	95
glyphosate triclopyr	3.4 0.84	3.9 0.97	7.4	98
glyphosate imazapyr	3.4 0.14	5.1 0.21	6.6	99
protected LSD (p=0.05)		2.1	23	

[1]Application rates are based on actual spray volumes and canopy measurements used to estimate the basal area for each shrub.

F4113-A NEW CARFENTRAZONE-ETHYL PLUS GLYPHOSATE COMBINATION FOR VEGETATION MANAGEMENT. R.D. Iverson, FMC Corp., Philadelphia, PA.

ABSTRACT

F4113 is a package mix containing 0.1 lb ai/gal carfentrazone-ethyl plus 5.0 lb ai/gal of the isopropylamine salt of glyphosate. Field trials were initiated in 2004 to evaluate efficacy of the combination for non-crop weed control on industrial sites, such as railroads, and on forestry sites for site preparation. The speed of activity and efficacy was compared to tank mixes of QuickSilver IVM and glyphosate and to other standard tank mixes with glyphosate. F4113 generally provided quicker “brown-up” of target weeds including herbaceous broadleaves, wildling pine and arborescent woody broadleaved species than treatments with glyphosate alone. Observations on perennial weeds, including pine and hardwoods, from trials initiated in 2004 will be continued in 2005 to verify control and compare consistency with standard glyphosate mixes.

CONTROL OF JAPANESE STILTGRASS WITH EARLY-SEASON POSTEMERGENCE HERBICIDE APPLICATIONS. A.E. Gover, J.M. Johnson, and L.J. Kuhns, Penn State Univ., University Park.

ABSTRACT

As part of an ongoing project funded by the Pennsylvania Department of Transportation, a trial was initiated to compare the effect of herbicide treatments applied at an early postemergence timing to Japanese stiltgrass (*Microstegium vimineum*). 'Early' in this context was in comparison to previous work evaluating applications as late as seedhead emergence. The treatments were applied June 15, 2004, when stiltgrass was beginning to branch, with a canopy height of 15 cm. The study site was located on an underground cable right-of-way in a forested setting near State College, PA. The herbicide combinations included sulfometuron at 0.052 or 0.16 kg/ha; quizalofop-P at 0.029, 0.086, or 0.11 kg/ha[1]; the combination of quizalofop-P and sulfometuron at 0.086 plus 0.052 kg/ha; the premix of dicamba plus diflufenzopyr at 0.14 plus 0.056 kg/ha, alone or in combination with imazapic at 0.035 kg/ha; a premix of imazapic plus glyphosate at 0.013 plus 0.053 kg/ha, or 0.026 plus 0.11 kg/ha; and glyphosate alone at 0.42 kg/ha. All treatments included a non-ionic surfactant[2] at 0.25 percent, v/v. The treatments were applied to 0.9 by 4.6 m plots arranged in a randomized complete block design with three replications, using a CO_2-powered, hand-held sprayer equipped with a single TeeJet 9504E spray tip, delivering 187 L/ha at 190 kPa. A visual rating of percent stiltgrass reduction was taken July 20, 5 weeks after treatment (5 WAT), and a visual rating of vegetative cover and stiltgrass cover was taken September 24, 14 WAT. The untreated check plots were assigned a value of zero for the percent reduction rating and were not included in the analysis of variance.

At 5 WAT, plots treated with the premix of dicamba plus diflufenzopyr were rated at 82 percent stiltgrass reduction. All other herbicide treatments were rated between 95 and 100 percent reduction (Table 1). At 14 WAT, where stiltgrass was reduced, the most common species included clearweed (*Pilea pumila*, PILPU), garlic mustard (*Alliaria petiolata*, ALAPE), white snakeroot (*Eupatorium rugosum*, EUPRU), spreading dogbane (*Apocynum androsaemifolium*, APCAN), and unidentified sedge species. The untreated plots were rated at 100 percent vegetative cover and 97 percent stiltgrass cover. All herbicide treatments had significantly less cover in both categories. Total vegetative cover in the treated plots fell into three groupings: combinations including sulfometuron, and the high rate of the premix of imazapic and glyphosate were rated between 0 and 14 percent cover; the quizalofop-P alone treatments, glyphosate alone, the low rate of the imazapic plus glyphosate premix, and the dicamba plus diflufenzopyr plus imazapic treatment were rated between 23 and 40 percent cover; and dicamba plus diflufenzopyr was rated at 77 percent vegetative cover. The only plots rated with significantly greater stiltgrass cover than the best-rated treatments (sulfometuron treatments, 0 percent) were those treated with the premix of dicamba plus diflufenzopyr, with or without imazapic, at 21 and 75 percent, respectively. All other herbicide treatments were rated at 5 percent or less stiltgrass cover.

---

[1] Quizalofop-P, dicamba, imazapic, and glyphosate are reported as kg ae/ha.
[2] Activator 90, Loveland Industries, Inc., Greeley, CO.

Table 1. Response of Japanese stiltgrass to herbicides applied June 15, 2004. Percent stiltgrass reduction was visually rated July 20, 5 weeks after treatment (WAT), and percent total vegetative cover and percent stiltgrass cover was rated September 24, 14 WAT. The untreated check was assigned a value of zero for the rating of percent stiltgrass reduction, and was not included in the analysis of variance. Each mean is the value of three replications.

		5 WAT	---------------- 14 WAT ----------------	
product[3]	application rate[4]	stiltgrass reduction	vegetative cover	stiltgrass cover
	kg/ha	------------	%	------------
untreated	- -	0	100	97
sulfometuron	0.052	99	0	0
sulfometuron	0.16	100	0	0
quizalofop-P	0.029	97	23	1
quizalofop-P	0.086	100	40	1
quizalofop-P	0.11	100	35	2
quizalofop-P sulfometuron	0.086 0.052	100	1	0
dicamba + diflufenzopyr	0.14 0.056	82	77	75
dicamba + diflufenzopyr imazapic	0.14 0.056 0.035	95	38	21
imazapic + glyphosate	0.013 0.053	98	33	5
imazapic + glyphosate	0.026 0.11	99	14	1
glyphosate	0.42	100	28	1
Protected LSD (p=0.05)		3	23	20

[3] All herbicide treatments included a non-ionic surfactant, Activator 90, manufactured by Loveland Industries, Inc. Greeley, CO. A '+' between herbicides indicates a pre-mixed product.
[4] Quizalofop-P, dicamba, imazapic, and glyphosate are expressed as kg ae/ha.

RECLAIMING UTILITY RIGHTS-OF-WAY WITH ULTRA-LOW VOLUME APPLICATIONS OF PICLORAM AND IMAZAPYR. R.R. Johnson, Waldrum Specialties, Inc., Doylestown, PA.

ABSTRACT

Delayed or neglected maintenance of utility rights-of-way often necessitates the mechanical removal of tall-growing or access-restricting trees, brush, and woody vines. Mechanical removal of vegetation with one of several various devices provides immediate access and line clearance, but if a maintenance program is not established and followed, woody regrowth occupies the site within one or two years. Application of soil active woody plant herbicides became an accepted control method where soil type, terrain, and adjacent desirable vegetation made the technique practicable. Picloram became the treatment of choice because of its broad spectrum of species controlled, and its superior control of root-suckering species such as black locust (*Robinia pseudo-acacia* L.), sassafras (*S. albidum* Nutt.), and aspen (*Populus tremuloides* Michx.). Applications were made using conventional broadcast sprays at volumes of 15 to 50 gal/A. A labeled application rate of 2 lb/A was widely used and accepted. Regulatory requirements changed the labeled rate of picloram for this use to 1 lb/A, making it necessary to look for satisfactory herbicide combinations. Ultra low volume (ULV) foliage applications using a thin invert emulsion on a spray system mounted on an ATV at a spray volume of 5 gal/A had been shown to be effective for control of woody plants. As a cut-stubble application following mechanical brush removal, a mixture of picloram at 1 lb/A + imazapyr at 1/4 lb/A controlled 90% or more of typical brush on rights-of-way in the northeastern US. Commercial applications using this mixture and the ULV technique were made to utility transmission rights-of-way in 1999, 2000, 2001, 2002, and 2003. Evaluation of these applications in October of 2004 showed control as follows:

LOCATION	UTILITY	DATE Applied	Evaluated	CONTROL %
New Hope, PA	PECO	June 1999	October 2004	80
Conowingo, MD	PECO	May 2000	October 2004	85
Plumsteadville, PA	PECO	July 2003	October 2004	99+
Chalfont, PA	PECO	July 2003	October 2004	95

Species in the treated areas included various oaks (*Quercus* spp. L.), red maple (*Acer rubrum* L.), eastern redcedar (*Juniperus virginiana* L.), Sassafras, black locust, autumn olive (*Eleagnus umbellata* Thunb.), aspen, and black cherry (*Prunus serotina* Ehrh.).

PRE- AND POSTEMERGENCE CONTROL OF *POLYGONUM PERFOLIATUM* WITH HERBICIDES. A.E. Gover, J.M. Johnson, and L.J. Kuhns, Penn State Univ., University Park.

ABSTRACT

As part of an ongoing project sponsored by the Pennsylvania Department of Transportation, two trials were initiated to evaluate the effectiveness of pre- and postemergence herbicide applications for the control of the thorny, annual vine, *Polygonum perfoliatum*, commonly known as mile-a-minute, or Asiatic tearthumb. Mile-a-minute is a Noxious Weed in Pennsylvania, and by statute, is not to set seed. Both trials were established in the median of SR 70, near Claysville, PA. The preemergence trial was initiated April 7, 2004. Treatments were applied to 1.8 by 4.6 m plots arranged in a randomized complete block design with three replications, using a CO2-powered, hand-held boom equipped with TeeJet XR 8004VS tips, delivering 330 L/ha at 210 kPa. The soil surface was covered with 1 to 2 cm of residue from giant foxtail (*Setaria faberi*) and mile-a-minute from the previous season, and mile-a-minute plants at the cotyledon stage were observed. The herbicide treatments included hexazinone at 0.55 or 1.1 kg/ha, oxyfluorfen at 0.42 or 0.84 kg/ha, and imazapic at 0.035, 0.070, or 0.14 kg/ha. No surfactant was added to the treatments. The treatments were evaluated May 11, June 10, July 8, and August 4, 2004. Mile-a-minute cover was highest in the untreated plots on July 8, with a rating of 20 percent, and declined to 6 percent by August 4. On July 8, the low rate of oxyfluorfen was rated at 75 percent reduction of mile-a-minute, significantly lower than all other treatments, which were rated between 92 and 100 percent. After this date, mile-a-minute cover declined while giant foxtail cover increased. On August 4, imazapic at 0.035 kg/ha was rated at 65 percent reduction, significantly lower than the remaining treatments, which were rated between 93 and 100 percent.

The postemergence trial was initiated June 10, 2004. At this time, mile-a-minute vines were up to 1.2 m long, and ripe fruit was observed. The treatments were applied to 1.8 by 6.1 m plots arranged in a randomized complete block design with three replications, using the same spray apparatus as for the preemergence trial. The treatments[1] included triclopyr at 0.42 kg/ha, dicamba at 0.56 kg/ha, bentazon plus imazapic plus hexazinone at 1.1 plus 0.035 plus 0.26 kg/ha, imazapic at 0.070 kg/ha, a premix of dicamba plus diflufenzopyr at 0.14 plus 0.056 kg/ha, fluroxypyr at 0.21 kg/ha, and metsulfuron at 0.021 kg/ha. Visual evaluations of mile-a-minute control and plot composition were made July 8 and August 4, 2004. On August 4, mile-a-minute control was rated between 95 and 100 percent for dicamba, imazapic, dicamba plus diflufenzopyr, fluroxypyr, and metsulfuron. Plots treated with triclopyr, and the combination of bentazon plus imazapic plus hexazinone were rated at 88 and 86 percent control, which was significantly lower than the best rated treatments. Plots treated with imazapic at 0.070 kg/ha had significantly less vegetative cover than all other plots, due to reduction of giant foxtail cover.

---

[1] The bentazon plus imazapic plus hexazinone treatment included crop oil concentrate at 2.3 L/ha, imazapic alone included methylated seed oil at 2.3 L/ha, and all other treatments included Activator 90 non-ionic surfactant at 0.25 percent, v/v.

CONTROL OF JAPANESE KNOTWEED WITH FOLIAR HERBICIDE APPLICATIONS.

A.E. Gover, J.M. Johnson, and L.J. Kuhns, Penn State Univ., University Park.

ABSTRACT

As part of an ongoing project funded by the Pennsylvania Department of Transportation, a trial was initiated to compare several herbicides labeled for non-crop use for control of Japanese knotweed (*Polygonum cuspidatum*). The treatments were applied September 5, 2003, to a stand of knotweed along SR 405, near Watsontown, PA. The application was made using a CO_2-powered, hand-held sprayer equipped with a spray wand with a single Spraying Systems #5500 Adjustable ConeJet nozzle with an X-12 tip, applying 1870 L/ha to 3.0 by 6.1 m plots. The Japanese knotweed ranged from 1.5 to 3 m tall. The herbicide treatments included glyphosate at 3.4 kg/ha[1], metsulfuron at 0.042 or 0.084 kg/ha, triclopyr at 3.4 kg/ha, clopyralid at 0.42 kg/ha, fluroxypyr at 0.21 kg /ha, dicamba at 2.2 kg/ha, picloram at 1.1 kg/ha, fosamine at 4.0 or 8.1 kg/ha, imazapyr at 0.84 kg/ha, and the combination of glyphosate and imazapyr at 3.4 plus 0.14 kg/ha. All treatments included 'CADCO 90' non-ionic surfactant at 0.25 percent, v/v. Response evaluations included a visual rating of foliar injury on a 0 to 10 scale, where 0=no visible injury and 10=complete necrosis, on October 10, 2003, five weeks after treatment (WAT); and a visual rating of percent reduction on August 2, 2004, 47 WAT. Data were subjected to analysis of variance, and means were compared using Fisher's Protected LSD (p=0.05). The untreated checks were assigned zero values for each response variable, and were not included in the analysis of variance.

The highest rated foliar injury at 5 WAT was for plots treated with imazapyr, with a rating of 7.3. The ratings for the high rate of metsulfuron, glyphosate plus imazapyr, triclopyr, or dicamba were not significantly different. The ratings for both rates of fosamine, and for clopyralid were not significantly different than a rating of '0' (Table 1). Plots treated with glyphosate alone had the highest rating for percent reduction at 47 WAT with an average rating of 96 percent. The treatments that were not significantly different included glyphosate plus imazapyr at 89 percent, imazapyr alone at 89 percent, picloram at 85 percent, and dicamba at 73 percent. Plots treated with the low rate of metsulfuron, triclopyr, or clopyralid received reduction ratings of 0 percent, and both rates of fosamine were rated at 10 percent reduction. The 5 WAT injury ratings did not reliably predict percent reduction at 47 WAT, as triclopyr and the high rate of metsulfuron were rated high for initial injury but resulted in 0 and 43 percent reduction at 47 WAT.

---

[1] Glyphosate, triclopyr, clopyralid, fluroxypyr, dicamba, picloram, fosamine, and imazapyr are reported as kg ae/ha.

Table 1: Response of Japanese knotweed to herbicide treatments applied September 5, 2003. Foliar injury was evaluated October 10, 2003, five weeks after treatment (WAT) on a scale of 0 to 10, where 0=no injury and 10=complete necrosis. Percent reduction was visually rated August 2, 2004, 47 WAT. The untreated checks were assigned a zero value for each evaluation, and were not included in the analysis of variance. Each value is the mean of three replications.

treatment[2]	application rate	5 WAT foliar injury	47 WAT reduction
	kg ae/ha	0-10	%
untreated	- -	0.0	0
glyphosate	3.4	3.3	96
metsulfuron	0.042	4.3	0
metsulfuron	0.084	7.0	43
triclopyr	3.4	6.3	0
clopyralid	0.42	1.3	0
fluroxypyr	0.21	3.7	37
dicamba	2.2	5.3	73
picloram	1.1	5.0	85
fosamine	4.0	0.7	10
fosamine	8.1	2.0	10
imazapyr	0.84	7.3	89
glyphosate + imazapyr	3.4 0.14	6.7	89
Fisher's Protected LSD (p=0.05)		2.2	29

[2] All treatments included CADCO 90 non-ionic surfactant at 0.25 percent, v/v.

OPPORTUNITIES AND CHALLENGES FOR ENGAGING PRIVATE WOODLAND OWNERS IN INVASIVE PLANT MANAGEMENT. J. Steele and R. Chandran, West Virginia Univ., Morgantown.

ABSTRACT

The need for incentives to encourage private landowners to manage invasive plants has been widely recognized. Despite the significance of incentives given the practical and political limits of regulatory alternatives, there is very little information about what actually motivates landowners to undertake such activities. Landowners may be unlikely to respond to technical assistance or cost-share, for example, if they are unaware of invasive plants, do not view them as threatening their ownership objectives, or object to necessary management practices. The purpose of this research is to assess West Virginia woodland owners' attitudes and management behaviors related to invasive plants and their implications for targeting outreach strategies. Four objectives are addressed: 1) Determine the extent to which landowners are aware of invasive plants and to which they take actions to control them; 2) Identify factors that distinguish active and non-active landowners; 3) Assess landowner perceptions of their likelihood of undertaking management under alternative scenarios; and 4) Assess the outreach implications of these findings.

A number of plants that outcompete native vegetation and impede forest regeneration are found in West Virginia, including Japanese stilt grass (*Microstegium vimineum*), tree-of-heaven (*Ailanthus altissima*), Japanese knotweed (*Polygonum cuspidatum*), garlic mustard (*Alliaria petiolata*), and multiflora rose (*Rosa multiflora*). In this study, awareness is conceptualized as the extent to which landowners recognize some plants as weedy or undesirable in their woodlands rather than the extent to which they are familiar with these or any other particular species. This approach is based on the rationale that more can be learned about landowners' motivations by focusing on plants that concern them than by imposing a definition of "invasive."

Three study sites representing different ecological regions of the state were selected in order to maximize the efficiency of data collection while capturing possible geographic differences in experiences with invasive plants. Emphasis was given to selecting sites with similar land uses and population trends in order to minimize site-level differences in average tract sizes, ownership turnover rates, agricultural traditions, and other factors that may complicate the interpretation of findings. Data were collected in two phases. First, interviews were conducted with foresters and other natural resource professionals in each site. Results of these interviews, combined with insights from the literature, were then used to develop a landowner questionnaire. It was mailed to a random sample of 1,500 households (500 per site) owning at least 10 acres of woodland. Initial findings and their implications are presented.

HERBICIDE RESISTANCE: CURRENT STATUS AND OUTLOOK. C.A. Mallory-Smith, Oregon State Univ., Corvallis.

ABSTRACT

Herbicide resistance has emerged as one of the most important weed management issues of the past 25 years. The number of resistant biotypes has increased dramatically since the early 1980s. Worldwide there are at least 174 herbicide resistant weed species. Resistance is reported to most herbicide classes. The increase in the occurrence of weed biotypes with multiple resistance mechanisms makes management recommendations more complex. It is no longer possible to simply advise rotation to an herbicide with a different mechanism of action. In addition, herbicides with new and different mechanisms of action are not being introduced. The increase in the percentage of acres planted to herbicide-resistant crops has increased the selection pressure for the evolution of new resistant biotypes. Of particular concern are the reports of glyphosate-resistant weeds that have been identified in the glyphosate-resistant crops. Glyphosate resistant weeds will make conservation tillage much more difficult because of the dependence on glyphosate as a nonselective, broadspectrum herbicide in these systems. There is no other herbicide with all of the characteristics of glyphosate that can be substituted in conservation tillage. Herbicides should be considered as important resource that needs to be conserved for weed control in the future.

HERBICIDE RESISTANCE MANAGEMENT: WHAT HAVE WE LEARNED? B.D. Maxwell, Montana State Univ., Bozeman.

ABSTRACT

Herbicide resistance was initially regarded as a weed biology phenomenon of purely academic interest. Cases of weed resistance to the triazine herbicides became common, but were not regarded as a major management problem because there were alternative herbicides and the reduced fitness of the resistant phenotype prevented populations from expanding when triazine herbicides were not used. By the 1980s, cases of resistance to a wide array of herbicide modes-of-action raised the concern for managing the phenomenon. The severity of the issue was compounded because the resistance was primarily due to a single allele dominant trait with little fitness penalty. Development of management strategies was, and continues to be, hindered by two major problems. First, it is very difficult to experimentally select for resistance and follow its evolution, frequency and spread in populations under a range of management practices. Seeds from resistant weeds have been collected, screened for resistance and their progeny or pure-bred progeny lines created for experimentation. This empirical approach to understanding the basic physiology of resistance has been fruitful, but it provides little ecological context and has not been effective for understanding the population or community biology that is relevant for development of management strategies. Second, there is reluctance by the herbicide industry to admit that resistance to their products exists until it is well characterized and documented, and once resistance is established, management practices that include products from other companies or non-chemical practices have not been encouraged. Given these constraints to developing resistance management strategies, the discipline has largely turned to models to predict resistance evolution and spread and subsequent management strategies. Models have been used to examine preventative and reactive resistance management approaches. Results from simulation experiments generally suggest that prevention may best be accomplished by a reduction in selection intensity by reducing the efficacy on susceptible phenotype reproduction. Models used to investigate preventative strategies have showed that reduced herbicide efficacy and subsequent selection for resistance can be accomplished by reducing rates to non-lethal doses, not applying to the entire population (leaving susceptible refugia), and reducing the frequency of use over time through crop rotations where different modes-of-action herbicides can be rotated or non-chemical means can be used. Modeling of reactive management approaches (i.e. once resistance is at a high frequency in a weed population) has been limited to causing a weed species shift away from the resistant species by changing crops or production system (e.g. crops to grazing), or relying on differential fitness to select against the resistant phenotype when the selective agent (herbicide) is removed from the system. The models have demonstrated the benefit of some strategies over others and have been variously promoted in industry and extension literature.

PRODUCT STEWARDSHIP AND WEED RESISTANCE: BASIC MANUFACTURERS' PERSPECTIVE. J.L. Glasgow, Syngenta Crop Protection, Vero Beach, FL.

ABSTRACT

Herbicide resistance is an issue that affects all stakeholders and not least the companies that are discovering and developing new herbicides, the basic manufacturers. There are clear benefits to all for industry to promote product stewardship, including the use of integrated weed management practices.

The probability of development of resistance and its subsequent management are considered as part of the decision-making at every stage in the discovery, development and launch of a new herbicide. It is important to consider the potential for resistance development in a new herbicide, particularly when it has a novel mechanism of action. At the same time, it is essential for us to understand the behaviour of, and patterns of resistance to, commercial products following their widespread use and hence, wide exposure to genetically-diverse, weed populations.

Despite the development of resistant biotypes, many herbicides remain important tools for weed control in many crops, as components of a program, and continue to provide excellent control of a wide range of other species and susceptible biotypes. Individual companies have worked hard to develop guidelines for the use of their products and have provided support for their customers through determination of susceptibility of individual weed biotypes and advice on their control.

The development of weed resistance to herbicides prompted the formation of a Global Herbicide Resistance Action Committee (HRAC) with representation from basic manufacturers and with a clear mission: To facilitate the effective management of herbicide resistance by fostering understanding, co-operation and communication between industry, government and farmers. To achieve this, HRAC established the following goals:

- Promote an agreed and responsible approach to the proper use of herbicides, as part of an integrated weed management (IWM) strategy.
- Support and participate in research to increase our understanding and scientific knowledge of the causes, mitigation and economics of herbicide resistance management.
- Communicate the causes and consequences of herbicide resistance.
- Communicate herbicide resistance management strategies, including IWM, and to support their implementation through practical guidelines.
- Promote active collaboration between public and private researchers, especially in problem identification and development of agreed management strategies.
- Facilitate discussion of proper product stewardship among industry representatives.

The first case of herbicide resistance in weeds was identified 40 years ago and now there are 291 resistant weed biotypes in 59 countries worldwide. It is essential that all stakeholders including: growers, consultants, university extension scientists, dealers and manufacturers continue to work together to steward the currently available herbicides for years to come.

IS THE HORSE LEADING A STAMPEDE? M. VanGessel, B. Scott, and Q. Johnson, Univ. Delaware, Georgetown.

ABSTRACT

Glyphosate-resistant horseweed has received considerable attention in the past four years as the number of states and counties infested with this biotype continues to increase. At the same time, incidences of other glyphosate-resistant species are being reported. The wide-spread adoption and use of glyphosate-resistant crops has put heavy selection pressure on weed species. In addition, glyphosate-resistant crops have shifted the use patterns of glyphosate to favor resistance.

Is the experience with glyphosate-resistant horseweed a harbinger of things to come? The rate of increase of glyphosate-resistant horseweed has been tremendous, yet the increase has more to do with the characteristics of the species than of the herbicide. Wind dissemination has been a major factor for its spread, as well as adoption of no-till, and the species phenology. Wind dispersal is an unusual phenomenon that weed scientists and farmers have not had to contend with in the past for resistance management of weeds. Resistance management practices for an individual farm to control a wind-dispersed species can be superseded by practices of the surrounding farms. Field observations have revealed that horseweed in adjacent fields or lands is a serious threat to colonize, and in-field spread can be very rapid. This adds a new dynamic to management of a resistant species. A particular farmer can be practicing very stringent resistant management strategies, yet significant infestations can occur from areas beyond his/her control.

However, resistance management is going to be important to maintain the long-term viability of glyphosate herbicide, particularly in regards to species without long distance dispersal mechanisms. Occurrence of glyphosate-resistant biotypes comes at a time when herbicide development is drastically reduced, limiting the potential of additional herbicides to assist with resistance management. Furthermore, we can not focus solely on glyphosate resistance since resistance to other modes/sites of actions continues to increase. Grower education on resistance management to ensure that informed decisions are made is very important, particularly in this highly competitive environment.

INDUSTRY-AGENCY INTEGRATED VEGETATION MANAGEMENT PARTNERSHIPS.
R.A. Johnstone, Integrated Vegetation Management Partners, Inc., Newark, DE.

ABSTRACT

Utility rights-of-way corridors provide energy to run the nation's economy and are vital links for national security. Utilities must control tall growing vegetation to allow ready access for emergency repairs or routine maintenance and to prevent contact with high voltage conductors.

Many utilities control vegetation by routine cutting with mechanized mowers or chainsaws. This tends to encourage resprouting growth by the more aggressive plant species, many of which are non-native exotic plants.

Integrated Vegetation Management (IVM) is a method of controlling vegetation by identifying problem species and a threshold level of when control is necessary, and then choosing from an assortment of methods to eliminate the problem plants and encourage the desirable species. A trained Arborist should first inspect the site and schedule the appropriate management tool in a prescriptive fashion. Use of a GIS mapping program can merge land use and environmental information from government sources with the utility's facility locations and access points.

Controlling non-compatible trees and invasive plants allows more growing space for low-growing grass, forbs and shrubs. This permits more selective and lower disturbance rates as natural competition between plant species, and the activity of wildlife, result in cultural and biological controls. The result is a fairly stable meadow or shrub-scrub community that provides excellent wildlife food and cover, streamside riparian buffers and rare plant habitats. This has enabled some utilities to form Memoranda of Understanding (MOU) with government land management agencies, and to assist in the control of invasive plants and wildlife habitat improvements.

GOOD LUCK, HARD WORK, AND PERSEVERANCE WHERE LEAFY SPURGE AND ORCHIDS SHARE COMMON GROUND. R.G. Lym, A.M. Erickson, D.R. Kirby, and J. Sterling, North Dakota State Univ., Fargo.

ABSTRACT

The western prairie fringed orchid (WPFO) (*Platanthera praeclara* Sheviak and Bowles) is a native perennial plant of the tallgrass prairie and was once found in large numbers throughout areas west of the Mississippi River (Sheviak and Bowles 1986). With the conversion of prairie to cropland and urban development, there is little suitable orchid habitat remaining.

Various threats to the survival of the WPFO exist and include habitat invasion by leafy spurge (*Euphorbia esula* L.). Leafy spurge is a noxious perennial weed which is very difficult to control with methods other than herbicides. However, herbicides cannot be used in areas where the WPFO is located since the orchid is a federally listed threatened species. Biological control of leafy spurge with *Aphthona* spp. flea beetles has been quite successful in the region and would seem to be the least harmful approach within the WPFO habitat. However, control of leafy spurge with the use of *Aphthona* spp. has not yet been successful in areas where the orchid is found. *Aphthona* spp. usually do not survive well in habitats that are moist, shady, or contain very sandy soil, which are characteristics of the WPFO habitat.

An experiment to evaluate herbicides for leafy spurge control in North Dakota in the early 1990s had to be discontinued 2 yr after establishment because the WPFO appeared in areas treated with fall-applied herbicides. When the treatments were discontinued, leafy spurge reinvaded the area and the orchids disappeared. Once permission was received, research was conducted to evaluate the effect of various herbicides used alone and with *Aphthona* spp. biological control agents on the regrowth and fecundity of the WPFO.

In initial studies, quinclorac and imazapic were identified as the most likely candidates to control leafy spurge without harming the WPFO. Subsequent research found quinclorac the best tool to control leafy spurge in the habitat of the WPFO because orchids treated with quinclorac regrew as vigorously and were as fecund as untreated orchids. In contrast, orchids treated with imazapic tended to regrow as vegetative plants and were shorter, had shorter racemes, and produced fewer flowers and seed capsules than untreated orchids.

An integrated management program using herbicides and *Aphthona* spp. may provide the best long-term control of leafy spurge in orchid habitat. Imazapic and quinclorac did not affect *Aphthona* spp. adult emergence from soil. Additionally, leafy spurge density 1 yr after treatment was reduced 73% with *Aphthona* flea beetles alone compared to a reduction of 96% with herbicides alone and 99% with herbicides plus flea beetles. Leafy spurge control with *Aphthona* applied alone increased as time after introduction increased and averaged 81% and 75% 2 and 3 yr after release, respectively, which was similar to herbicides applied alone or with *Aphthona*. This is the first known establishment of a leafy spurge biological control agent in the habitat of the threatened orchid. Quinclorac alone or in combination with *Aphthona* spp. may be a valuable tool to control leafy spurge in the habitat of the WPFO and should contribute to the recovery and survival of this threatened species.

PRODUCTION AND INVASION OF BUTTERFLY BUSH. J. Ream and J. Altland, Oregon State Univ., Corvallis.

ABSTRACT

Butterfly bush (*Buddleja davidii*) is an ornamental crop commonly grown in nurseries, but is showing signs of invasiveness in Oregon's natural areas. The Oregon State Weed Board has placed *Buddleja davidii* on the noxious weed list; however, it may be years before quarantine status is assigned that would prohibit its production and sale. Even if production was prohibited, current plantings in home landscapes are so numerous that complete eradication is unlikely, and thus there will always be abundant seed source to cause further infestations.

Little is known about site characteristics that favor butterfly bush invasion. Butterfly bush is a perennial shrub native to river margins in central and west China. Literature from England suggests *Buddleja* inhabits soils with specific chemical properties (high pH) where other plants won't grow or only grow poorly. Its presence in the British Isles has been described as a colonist of disturbed and compacted sites, specifically areas such as railway beds, unused industrial areas, hard-rock quarries, and on old walls and buildings. Research in New Zealand indicates that butterfly bush is competitive in areas prone to frequent flooding and alluviation.

The objective of this research was to determine and describe site conditions that favor butterfly bush invasion. Plant, soil, and climate characteristics of current invaded areas were documented. Soil samples were collected to determine chemical properties of soils in which plants invade. Three sub-samples (each 1 pint) of soil were collected from each site and analyzed for potassium, calcium, magnesium, and soil pH. Physical characteristics of the soil were assessed by classifying the soil by its history of disturbance, flood history, hydrology and soil texture class (sand, silt, or clay). Nursery producers and retailers of butterfly bush were also surveyed and visited.

Butterfly bush was found growing in a wide variety of sites, from flood plains to mountain slopes. Areas of densest invasion were on burn sites in reforestation areas, and sites that receive frequent disturbance such as flood plains. Density of seedling occurrence was approximately 4 times higher in riparian areas (0.23 plants/m^2) than other natural sites, industrial sites, or roadsides. Density of seedlings at all sites tended to decrease with increased groundcover (living plants or dead plant debris).

Few escaped seedlings were found at production or retail nurseries. Production nurseries frequently cut plants back to encourage branching and more dense plant form. In the process, flowers are removed and not allowed to produce seed. Escaped seedlings were found at production nurseries that allowed plants in production or nearby landscape plantings to retain flowers over the winter.

Retail nurseries typically sell their stock before the end of the growing season. Plants not sold are cut back prior to over-wintering. Research from the United Kingdom reported that seed from butterfly bush are not released from the plant until the following spring. Because flower heads are almost always removed for one or more reasons throughout the growing season in both production and retail nurseries, the occurrence of escaped seedlings from these sites was low. It is not likely that production and retail sites are a source of escaped butterfly bush plants, although they might be a source of escaped seedlings once they are installed in home landscapes.

COMPARISON OF GRANULAR HERBICIDES FOR RESIDUAL WEED CONTROL IN CONTAINERS. T.L. Mervosh, Connecticut Ag. Exp. Sta., Windsor.

ABSTRACT

Six granular herbicides were compared for residual efficacy in nursery containers and their safety to the ornamental shrub Spiraea (*Spiraea* x *bumalda*). Two-gallon containers (9-inch diameter at top) were filled on June 1, 2004 with a mix consisting of 70% pine bark, 15% peat, 15% sand, by volume. Plugs of Spiraea were planted in half the containers, and the other half remained plantless. The experiment was arranged in a randomized complete block design with four plots per treatment. Each plot contained three containers of Spiraea and three plantless containers.

In addition to an untreated check, the following herbicide treatments were applied on June 10: Snapshot 2.5TG at 150 lb/A (isoxaben (0.75 lb ai/A) + trifluralin (3 lb ai/A)), Ornamental Herbicide 2 (OH-2) at 100 lb/A (oxyfluorfen (2 lb ai/A) + pendimethalin (1 lb ai/A)), Rout at 100 lb/A (oxyfluorfen (2 lb ai/A) + oryzalin (1 lb ai/A)), Regal O-O at 100 lb/A (oxyfluorfen (2 lb ai/A) + oxadiazon (1 lb ai/A)), Ronstar 2G at 200 lb/A (oxadiazon (4 lb ai/A)), and BroadStar 0.25G at 150 lb/A (flumioxazin (0.375 lb ai/A)). For each container, the amount of herbicide needed to achieve the proper dosage was weighed out and spread uniformly. For example, 0.45 g of granules per container was equivalent to an application rate of 100 lb/A. Treatments were applied to the plantless pots first. Once the Spiraea foliage was completely dry, treatments were applied over these containers. Thirty minutes after applications had been completed, all containers were watered by overhead sprinklers for 1 hour ($^1/_3$ inch of water). On June 11, seeds of the following weeds were spread in separate plantless pots in each plot: large crabgrass (*Digitaria sanguinalis*), Virginia pepperweed (*Lepidium virginicum*) and birdseye pearlwort (*Sagina procumbens*). Containers were then watered for 1 hr. On days without sufficient rainfall, containers were irrigated ($^1/_3$ to $^1/_2$ inch of water per day). In the first 3 weeks after treatment (WAT), only 0.4 inch of rain fell. Rainfall for July through September was above normal.

Relatively minor stunting of growth (1.5 on a scale of 0 to 10) was observed on Spiraea treated with flumioxazin at 4 WAT, but the plants recovered. No other treatment injured Spiraea. Weed control data (visual ratings based on weed numbers and size) and weed counts were collected at 6, 12 and 16 WAT. At 6 WAT, all treatments provided 95% or better control of crabgrass and at least 92% control of pepperweed. Nearly complete prevention of pearlwort was provided by treatments other than oxadiazon alone and oxyfluorfen + oxadiazon, both of which provided no control of pearlwort. Weeds were counted and removed, and the same weed seeds as before were sown in the plantless pots. At 16 WAT, containers treated with flumioxazin had the fewest weeds overall, with the following control ratings: crabgrass, 70%; pepperweed, 86%; and pearlwort, 100%. Weed control ratings for the other herbicides ranged from 15% (oxyfluorfen + pendimethalin) to 54% (oxadiazon) for crabgrass, 33% (isoxaben + trifluralin) to 65% (oxadiazon; oxyfluorfen + oxadiazon) for pepperweed, and 20% (oxadiazon; oxyfluorfen + oxadiazon) to 100% (oxyfluorfen + pendimethalin) for pearlwort. Overall, flumioxazin provided better residual control of the weeds present than did the other herbicides tested.

ROOT HARDINESS AND THE INFLUENCE OF DINITROALININE HERBICIDES IN OVERWINTERED CONTAINERS. M. Bigger and H.M. Mathers, Ohio State Univ., Columbus.

ABSTRACT

The nursery industry is continually increasing the production of woody ornamental landscape shrubs in containers. The limiting factor in container production is temperature. Containers offer no insulation for roots from the cold. A plant is only as hardy as its roots (Mathers, 2003). Young roots have been found to be significantly less hardy than their mature counterparts (Mityaga et al., 1971; Steponkus, 1976; Studer et al., 1978). The majority of roots that are found against the container walls are young roots; these roots are extremely susceptible to freeze damage. It is important for the grower to have a complete understanding of overwintering procedures to insure their plants have adequate protection from the cold and assure a viable crop in the spring. One of the common practices in overwintering is the application of preemergence dinitroaniline (DNA) herbicides prior to covering container stock. DNA herbicides work by root inhibition (Hayes et al. 1999). The objectives of this research were to: 1) determine young and mature root hardiness values for containerized plants not treated with herbicides; 2) determine young and mature root hardiness values for containerized plants that received various DNA herbicide formulations prior to overwintering; and, 3) investigate differences in growth potential between untreated and DNA herbicide treated containers one, two and six months after emergence from overwintering. Research began in June 2003. A replication in time began June 2004. Research presented here will be from the experiment June 2003.

Plants were exposed to freezer temperatures of, 0,-5,-10, -15, or –20°C and a herbicide treatment of 1X Surflan (oryzalin, 2.0lbs. ai/A), Barricade (prodiamine, 2.0lbs. ai/A), Pendulum (pendimethalin, 3.0lbs ai/A), Treflan (trifluralin, 2.0 lbs ai/A) or no treatment (control). Plants were subjected to freezing on, January 10, 2004 or March 3, 2004. After freezing they were placed in a heated greenhouse and evaluated for regrowth one, two and six months after freezing. Regrowth was evaluated two ways by a visual rating score (0-10), where 0 represents a dead plant, and plant live height. Results indicate that over combined sampling dates and evaluation times, Pendimethalin and Trifluralin significantly reduced (19.5% & 18.5% respectively) the hardiness of the four species and their regrowth potential after overwintering. Prodiamine provided a significant increase (10.5%) in growth potential over the control and Oryzalin had no effect over the control on reduction of hardiness or regrowth. Significantly more plants died during the March sampling date versus the January sampling and regrowth potential was also significantly reduced for March versus January. More plants died at the two-month evaluation versus the one-month evaluation, indicating root injury had occurred. *Cornus alba ‘Argenteo-marginata*’ (LT50 -20°C) was the hardiest plant material, followed by *Berberis thungbergii ‘Bailsel’* (LT50 -18°C), and *Spiraea bumalda ‘Magic Carpet*’ (LT50 -20°C), which were not significantly different in hardiness. *Viburnum trilobum ‘Bailey Compact’* (LT50 -17°C) was significantly less hardy than the other three species.

YELLOW NUTSEDGE CONTROL IN ORNAMENTALS WITH REGISTERED AND EXPERIMENTAL HERBICIDES. R.E. Uhlig, R.J. Richardson and B.H. Zandstra. Mich. State Univ., East Lansing.

ABSTRACT

Field and greenhouse studies were conducted to evaluate yellow nutsedge control with selected herbicides. Field treatments included preemergence (PRE) applications of S-metolachlor (1.9 lb ai/A), flumioxazin granular (150 lb/A), S-metolachlor plus flumioxazin granular (150 lb/A) or flumioxazin (0.25 lb ai/A); and postemergence (POST) applications of bentazon (1.0 lb ai/A), mesotrione (0.093 lb ai/A), bispyribac (0.063 kg ai/A), halosulfuron (0.062 lb ai/A) or trifloxysulfuron (0.0067 lb ai/A). *Hosta* spp. injury and weed control were evaluated visually in July 2004. S-metolachlor plus flumioxazin and flumioxazin (0.25 lb/A) treatments caused the highest injury rate (27 to 33%) followed by S-metolachlor (13 to 18%). Trifloxysulfuron, halosulfuron, and bentazon treatments resulted in the highest weed control rate (78 to 93%). In greenhouse studies, treatments included PRE applications of S-metolachlor, flumioxazin and S-metolachlor plus flumioxazin, and POST applications of imazaquin (0.5 lb ai/A), imazapic (0.063 lb ai/A), mesotrione, bispyribac, halosulfuron, trifloxysulfuron, bentazon, glyphosate (0.5 and 1.0 lb ai/A) and rimsulfuron (0.023 lb ai/A). In the first experiment, plants were grown in a highly organic potting mix. Halosulfuron, glyphosate (1.0 lb ai/A) and mesotrione treatments had the greatest control. In the second experiment, nutsedge was grown in a soil containing 50% sandy loam, 30% peat, and 20% sand. S-metolachlor plus flumioxazin, S-metolachlor, trifloxysulfuron and halosulfuron resulted in the best weed control and the lowest biomass; the first three treatments had the lowest number of nutsedge shoots.

EFFECTS OF DINITROANILINE HERBICIDES ON ROOT DEVELOPMENT IN CONTAINERS. L.T. Case and H.M. Mathers, Ohio State Univ., Columbus.

ABSTRACT

Preemergence herbicides are often used 3-5 times per season (Gilliam et al., 1990), and many of these are dinitroaniline (DNA) or contain DNA herbicides. Although DNA's are effective preemergence herbicides, they can also cause phytotoxicity to the crop (Hayes et al., 1999; Ashton and Crafts, 1981; Green et al., 1997). Two different studies were conducted at The Ohio State University in Columbus, Ohio in 2004. The first began April 21, 2004 with the objective to compare root inhibition of dinitroaniline herbicides when applied as granulars, directed sprays, or in combination with mulch on *Taxus* 'Everlow', *Azalea* 'Karen', and *Ilex* 'Compacta'. The granular formulations tested were prodiamine at 2.0 lbs (1X) and 4.0 lbs (2X) ai/A and trifluralin at 2.0 lbs (1X) and 4 lbs (2X) ai/A. The liquid formulations that were used as direct sprays and to treat the mulches were oryzalin at 2.0 lbs (1X) and 4.0 lbs (2X) ai/A and pendimethalin at 3.0 lbs (1X) and 6.0 lbs (2X) ai/A. The two mulches that were used were pine nuggets and cypress mulch. The objectives of the second study, which began January 12, 2004, were to examine herbicide movement and leaching potential using a bioassay between mulch sprayed with a DNA herbicide versus a direct spray. Oryzalin at 2.0 lbs ai/A was used as a direct spray and to treat pine nuggets.

In study one, evaluations of efficacy and phytotoxicity were taken at 30, 60, 90, and 120 days after treatment (DAT). Granulars and direct sprays were reapplied throughout the trial at 30-day intervals starting at the beginning of the experiment, which represents a typical herbicide routine for nurseries. Mulches were not reapplied. Evaluations of phytotoxicity were taken by visually evaluating the roots and shoots, taking dry weights of the roots and shoots, and leaf area. Visual ratings were based on a 1-10 scale with 1 being no phytotoxicity and 10 equals death. Pendimethalin 2X provided the highest root visual ratings (3.00 vs. 1.00 for control) at 60 DAT and shoot visual ratings (2.25 vs. 1.25 for control) at 30 DAT to *Ilex*. Oryzalin 2X provided significantly higher root visual ratings (2.75 vs. 1.50 for control) and shoot visual ratings (1.75 vs. 1.00 for control) to *Ilex* at 120 DAT. Oryzalin 2X also provided the highest root visual ratings (2.00 vs. 1.25 for control) at 60 DAT and 120 DAT (2.50 vs. 1.25 for control) and shoot visual ratings at 120 DAT (2.25 vs. 1.00 for control) for *Azalea*.

In study two, an oat (*Avena sativa*) bioassay was conducted at three pot levels (0-2 cm, 2-8 cm, and 8-15 cm) and leachate collected to determine herbicide presence at the different levels. There were six dates of evaluation: 0, 4, 8, 16, 32, and 64 DAT. Leachate water was kept from each day and stored at 4° C in silanized glass containers until the evaluation date. Pots that were treated with direct sprays showed more herbicide presence in the top 2 cm than the oryzalin-treated mulch pots at each of the evaluation dates. However, there is a significant increase in herbicide presence in the oryzalin-treated mulch pots at the 0-2 cm level from 0 to 4 DAT, suggesting that the mulch does retain the herbicide. Also, results indicate herbicide leaching into the 2-8 cm zone with the direct sprays compared to the oryzalin-treated mulch pots. There are no treatment differences in the bioassay with the leachates, suggesting that there is little, if any, herbicide leaching from the bottom of the oryzalin-treated mulch pots or direct spray pots.

CONTROL OF NORTHERN WILLOWHERB (*EPILOBIUM CILIATUM*) IN CONTAINER PRODUCTION. E. Cramer and J. Altland, Oregon State Univ., Corvallis.

ABSTRACT

Northern willowherb (*Epilobium ciliatum*) is a major weed species in the Oregon container nursery industry. Northern willowherb seeds are attached to a tuft of hairs that aid in wind dispersal. Sanitation is important for limiting the number of weeds in a container system. However, wind dispersal from neighboring sites makes sanitation alone impractical for providing complete control. Little is known about herbicidal control of this species. Research in the United Kingdom reported that only oxyfluorfen and bifenox prevented seedling emergence. Bifenox is not labeled for nursery production in the U.S., but oxyfluorfen is labeled and used in several herbicide formulations.

The objective of this experiment was to identify effective preemergence herbicides currently labeled in the U.S. for control of northern willowherb. Control was compared from spray-applied Surflan (oryzalin), Devrinol (napropamide), and Factor (prodiamine) alone, or in combination with Gallery (isoxaben). These spray-applied herbicides were compared to granular formulations of Ronstar (oxadiazon), RegalKade (prodiamine), and Rout (oxyfluorfen+oryzalin). All herbicides were applied at the maximum labeled rate.

Herbicides were applied to recently potted one-gallon containers filled with Douglas fir bark and amended per yd^3 with 3 lbs dolomite, 1.5 lbs Micromax micronutrients, and 16 lbs Osmocote 18-6-12. Seeds of northern willowherb were previously collected and counted. Twenty seeds were applied to each container. Northern willowherb number and height were measured at two week intervals, and shoot dry weight (SDW) was measured 60 days after treatment (DAT).

Ronstar prevented emergence of northern willowherb more effectively than all other herbicides or herbicide combinations. Surflan and Factor, with or without Gallery, also suppressed emergence compared to non-treated controls. Devrinol, with or without Gallery, did not reduce weed emergence (weed number, Table 1).

Ronstar reduced northern willowherb growth (SDW). RegalKade and Rout did not reduce weed growth compared to non-treated controls. Surflan and Devrinol, with or without Gallery, suppressed northern willowherb growth. Despite high emergence rates in pots treated with Devrinol, plants did not grow well beyond the cotyledon stage resulting in low SDW. Factor alone did not reduce growth below that of non-treated controls.

In summary, Ronstar is the only granular formulation in this study to provide effective preemergence northern willowherb control. Other research by the authors (data not published) has demonstrated that granular herbicide formulations containing oxadiazon consistently provide the most effective control. Gallery alone or in combination with other herbicides did not provide any meaningful control. Among sprayed formulations, only Surflan reduced weed emergence and subsequent shoot growth compared to non-treated controls.

DO FIRED CLAY AMENDMENTS TO PINE BARK AFFECT RESIDUAL PREEMERGENCE WEED CONTROL IN CONTAINER NURSERY CROPS? J.C. Neal, R.E. Wooten, C.A. Judge, and T.E. Bilderback, North Carolina State Univ., Raleigh.

ABSTRACT

Recent research has demonstrated that water and nutrient holding capacity of pine bark-based potting substrates can be improved by the addition of fired clay amendments. Resulting changes in container substrate physical and chemical properties may impact residual weed control with preemergence herbicides. Experiments were conducted in 2003 and 2004 to investigate the potential impacts of fired clay amendments to pine bark-based potting substrates on longevity of residual preemergence weed control in containers. Plastic pots (10L in 2003 and 4L in 2004) were filled with hammer-milled pine bark amended with either 11% (by vol.) fired clay or 12% (by vol.) coarse sand (the regional industry standard). Pots were treated with Scotts OH2 (oxyfluorfen + pendimethalin 2+1G) at 3 lb ai/A. Separate pots were surface-seeded 2, 4, 6, 8, 10 and 12 weeks after treatment with large crabgrass (*Digitaria sanguinalis*), hairy bittercress (*Cardamine hirsuta*), spotted spurge (*Euphorbia maculata*) and longstalked phyllanthus (*Phyllanthus tenellus*). The experiment was conducted in a randomized complete, split-block design with 4 replicates in 2003 and 8 replicates in 2004. Main plots were +/- herbicide treatment and potting substrate, and subplots were dates of seeding. Percent weed control was visually estimated compared to the non-treated pots 2 and 4 weeks after each seeding date. In 2003 the duration of preemergence control of spurge, bittercress and crabgrass with Scotts OH2 was significantly reduced by the addition of clay to the substrate (as compared to bark + sand substrates). Longstalked phyllanthus control was not affected by substrate type. In 2004 no significant differences in longevity of weed control were observed between substrates. It is unclear from this data why different results were obtained between years. However, the consistent reduction in longevity of weed control in the 2003 test is cause for continued observation if the addition of clay to potting substrates becomes a common practice in nursery crop production.

LIVERWORT CONTROL IN CONTAINERIZED HOSTA WITH SELECTED HERBICIDE TREATMENTS. R.J. Richardson, B.H. Zandstra, and T.A. Dudek, Mich. State Univ., East Lansing.

ABSTRACT

Studies were conducted in 2003 and 2004 to evaluate postemergence liverwort control in containerized hosta with selected chemical options. Treatments included quinoclamine (Mogeton, 1.7 and 3.4 lb ai/A), sodium carbonate peroxyhydrate (Terracyte, 0.04 and 0.12 lb ai/A), flumioxazin (Broadstar, 0.29 and 0.38 lb ai/A; SureGuard 0.25 lb/A), and oxadiazon (Ronstar G, 3 and 4 lb ai/A). In outdoor trials, liverwort control 1 month after treatment (MAT) was highest in 2003 with quinoclamine (3.4 lb/A), sodium carbonate peroxyhydrate (0.12 lb/A), and flumioxazin (0.25 lb/A) at 78 to 93%. Control in 2004 was greatest with quinoclamine (3.4 lb/A) and all flumioxazin treatments at 87 to 94%. Control 3 MAT was highest in 2003 with quinoclamine (3.4 lb/A) and flumioxazin (0.25 lb/A) at 82 and 95%, respectively, and in 2004 with quinoclamine (3.4 lb/A), sodium carbonate peroxyhydrate (0.12 lb/A), and flumioxazin (0.38 and 0.25 lb/A) at 73 to 100%. Hosta injury was greatest with flumioxazin treatments and hosta diameter was reduced only by flumioxazin treatments. In greenhouse trials, control 1 MAT was greatest with all flumioxazin treatments at 93 to 100%.

LONGEVITY OF WEED CONTROL WITH HERBICIDES FOR ORNAMENTAL CONTAINERS. S. Barolli, Imperial Nurseries, Granby; J.F. Ahrens, Connecticut Ag. Exp. Station, Windsor; and R. Gray, Imperial Nurseries, Granby, CT.

ABSTRACT

At Imperial Nurseries container weeds are managed by a non-crop program to prevent weed-seed dispersal in areas surrounding the containers, by periodic weeding, and by applying preemergence herbicides over the containers. With the current use of isoxaben + oryzalin, pendimethalin or prodiamine it has been necessary to spray at about 8-week intervals thorough the growing season, up to four applications per year. Experiments have led us to believe that with flumioxazin sprays or granules, the treatment intervals might be lengthened without increasing labor for weeding.

In 2004 an experiment was designed to test this theory, using plantless containers in which weeds were counted and removed at intervals of 8, 10 and 12 weeks after herbicide applications. The herbicides were sprays of flumioxazin 51 WDG at 0.25 and 0.375 lb ai/A and isoxaben 75 DG + oryzalin 4 AS at 0.93 + 2 lb ai/A, and granules of flumioxazin 0.25 G and oxyfluorfen + pendimethalin (OH-2) at 2.5 + 1.25 lb ai/A. Each plot had twelve 1-gal containers with a mix of 70% pine bark, 15% sand and 15% peat by volume, and slow release fertilizer incorporated. The herbicide treatments plus an untreated control at three weeding intervals were replicated four times in a randomized complete block design. Sprays were applied with a CO2 backpack with 8004 VS nozzles applying 50 gal/A. Granules were applied with a calibrated auger-feed applicator. No weeds were seeded because we wanted the experiment to represent the existing conditions in the nursery. After counting weeds at each interval we recorded times required to pull the weeds. The first herbicide applications were made May 11, 2004 and at the 12-week interval, weeds were removed and the same treatments were reapplied the next day (Aug 4, 2004). Counts and weeding times were again recorded at 8, 10, and 12 weeks, ending Oct 27, 2004. The experiment was conducted in the nursery and received irrigation as required for an adjacent crop of shrubs.

Weed populations were low, which we attribute to the sanitary measures in the nursery. In the first series, woody seedlings (*Poplar* spp. & *Salix* spp.) and crabgrass (*Digitaria* spp.) were most abundant. In the second series, common groundsel, (*Senecio vulgaris* L.) and horseweed (*Conyza canadensis* L.) were most abundant, as were liverwort (*Marchantia* spp.) and mosses (*Polytrichum* spp.).

Plots of flumioxazin sprays or granules had the fewest weeds and the lowest weeding times for both series. Control of liverwort, mosses and poplar was excellent with flumioxazin. Isoxaben + oryzalin gave better control of woody weeds than did OH-2 in the first series but this was reversed in the second series where groundsel was more abundant. In the first series, time for hand weeding controls at 8 weeks (26 hours/A) was about ten times that of flumioxazin (2.5 to 3.2 hours/A). In the second series weeding times for controls were 14, 17 and 70 hours/A for 8, 10 and 12 weeks respectively. Weeding times for flumioxazin treatments ranged from only 2.2 to 3.6 hours/A regardless of formulation, rate or time interval, which indicates that 12-week retreatment intervals should be adequate. Intervals longer than 12-weeks might also be possible, but require more research. Increasing treatment intervals from 8 to 12 weeks by using flumioxazin on tolerant plants can greatly reduce weed management costs.

TOLERANCE OF SEVERAL CONTAINER GROWN PERENNIALS TO HERBICIDES-A COOPERATIVE IR-4 PROJECT - A. Senesac, Cornell Coop. Ext., Riverhead, NY; J. Derr, Virginia Tech, Virginia Beach; and J. Neal, North Carolina State Univ., Raleigh.

ABSTRACT

Cooperative studies were undertaken in three locations to evaluate a number of container grown perennials for tolerance to three preemergence herbicides: Pendulum 2G (pendimethalin) Pennant Magnum 7.8 EC (S-metolachlor) and Snapshot 2.5G (isoxaben and trifluralin). The studies were conducted with the support of the IR-4 Project and standard protocols for the use of each herbicide were followed. These included applications of 1X, 2X and 4X rates applied twice at thirty-day intervals. Following treatment, the perennials were visually evaluated for injury for several weeks. The studies were conducted The species that were evaluated at each location were: in New York (NY): *Alchemilla mollis*, *Amsonia hubrichtii*, *Antennaria parvifolia, Chelone lyonii, Eupatorium purpureum, Lavendula angustifolia, Linum perenne, Nepeta x faassenii, Sempervivum arachnoideum, Solidago sempervirens*, and *Vernonia noveboracensis*; in North Carolina (NC): *Amsonia hubrichtii, Aubrieta deldoidea, Baptisia australis, Chelone lyonii, Chrysogonum virginianum, Helenium autmnale, Lavendula angustifolia, Linum perenne, Nepeta x faassenii, Solidago sempervirens Tiarella cordifolia*, and *Vernonia noveboracensis*; in Virginia (VA): *Alchemilla mollis, Baptisia australis, Chelone lyonii, Chrysogonum virginianum*, and *Nepeta x faassenii*.

The results of visual evaluations are as follows: Pendulum 2G, at all rates, was safe or cased only minor injury on all species (NY and VA) and all in NC except Nepeta and Tiarella. Pennant Magnum at the 1X or higher rates injured *Alchemilla*, *Amsonia*, *Baptisia*, *Chelone*, *Chrysagonum*, *Nepeta* and *Tierella* in at least one of the locations. Snapshot at the 1X rate was safe or cased only minor injury on all species (NY and VA) and all in NC except *Nepeta*. At the higher rates, Snapshot injured *Aubrieta*, *Chelone*, *Chrysogonum*, *Linum* and *Veronia* in at least one location. Although not all species were evaluated at all locations, with the exception of *Nepeta*, there was general agreement between locations where species commonality existed. In some cases, the level of injury observed at the higher rates was more severe in one location than the others.

THE EFFECT OF LANDSCAPE MULCH TYPE AND PLACEMENT ON THE EFFICACY OF PENDIMETHALIN FORMULATIONS. A. Senesac, Cornell Univ., Riverhead, NY; J. Derr, Virginia Tech, Virginia Beach, VA; and K. Miller, BASF Corp., Chesterfield, VA.

ABSTRACT

Field and greenhouse studies were conducted in New York and Virginia to evaluate the possible effect of landscape mulch types and placement on the efficacy of the preemergence herbicide pendimethalin. The two sprayable formulations evaluated (3.3 EC and 3.8 CS) were applied at 2 lb/A (ai) throughout the study.

In New York, five mulch types were applied to bare ground at a two-inch thickness on May 24, 2004. The mulches were pine needles, shredded pine bark, pine bark nuggets, shredded hardwood and cocoa hulls. The pendimethalin formulations were applied over the mulches and smooth crabgrass (*Digitaria ischaemum*) and redroot pigweed (*Amaranthus retroflexus*) seeded over the herbicide treatments and mulches and irrigated. The results of visual evaluations indicate that both formulations provided equally excellent control of these species for 60 days after treatment. No interaction was observed between any of the mulches and pendimethalin formulations.

In Virginia, both formulations were applied either over or under a two-inch layer of pine bark mulch. In this study, large crabgrass and yellow foxtail were evaluated for the level of control up to 57 days after treatment. The results indicate that both formulations at either placement, relative to the mulch, controlled both species equally well. In the absence of mulch, the CS formulation appeared to provide a slightly higher lever of control than the EC.

In the greenhouse, in Virginia, seven types of mulch were evaluated: pine bark, pine bark nuggets, shredded cypress, shredded cedar, shredded hardwood, red-dyed mulch and particularized rubber mulch. The results of weed counts 12 days after treatment indicate that in general, the CS formulation allowed more crabgrass to emerge through all the mulches than the EC did. However, by the 23rd day after treatment, this difference had been reduced to insignificance for all but the rubber mulch, which continued to allow for more emergence in the CS treated flats.

The results of the field studies indicate that either formulation of pendimethalin in concert with a variety of mulch types can provide excellent control of certain summer annual weeds for up to 60 days after treatment.

FIELD EVALUATION OF VARIOUS HERBICIDE AND MULCH COMBINATIONS FOR ORNAMENTAL WEED CONTROL. H.M. Mathers and L.T. Case, Ohio State Univ., Columbus.

ABSTRACT

Oliveira et al. (2000) found that the controlled release of herbicides using lignin as the matrix offered a promising alternative technology for weed control. Knight et al. (2001) found that the application of preemergence herbicides onto organic mulches reduced herbicide leaching by 35-74% compared with bare soil preemergence herbicide applications. This research project included two experiments and three objectives: 1) determine the efficacy and duration of weed control of 10 herbicide-mulch combinations; 2) assess the phytotoxicity of the 10 herbicide-mulch combinations on two ornamental plants; and 3) determine efficacy and phytotoxicity of three application methods for each herbicide-mulch combinations.

The two experiments conducted were efficacy (experiment 1) and phytotoxicity (experiment 2). Both experiments were started on May 1, 2004 and will be repeated in 2005 at the Ohio State University Waterman Farm, Columbus, OH. The plots in experiment one contain no crop plants. Evaluations of efficacy were conducted at 30, 60, 90 and 120 DAT using dry weights (Koncal et al. 1981) and visual ratings from 1 X 1 ft sections in the 3 X 3 ft (0.9 m) plots. Efficacy ratings were on a scale of 0 (no control) to 10 (complete control) and $\geq$ 7 (commercially acceptable). In experiment two, dogwood shrubs and crabapple tree liners were evaluated. A visual rating score of 1 (no injury) to 10 (complete kill) and $\leq$ 3 (commercially acceptable) will be used for the shoots. The herbicide treated mulches and herbicide-mulch application methods will be compared to sprays of the five chemicals applied directly to the surfaces of the plots, the two untreated mulches applied to the plots and a weedy check (no herbicide, no mulch). Mulches were applied untreated, over the top of soil surfaces sprayed with the different herbicides. Mulches were also applied untreated to untreated soil surfaces and then sprayed with the different herbicides in the field.

The five chemicals applied were oryzalin, (oryzalin) (AS) Surflan (aqueous solution) 2 (ai) lb/A, flumioxazin, (SureGuard WDG) 0.34 (ai) lb/A, acetochlor 76% (Harness 2.5 lbs ai/A, dichlobenil (Casoron CS) 4 (ai) lb/A and a combination of oryzalin and flumioxazin. Two bark types were evaluated, pine and hardwood. Pretreated bark mulch treatments were prepared by placing the mulches on a sheet of plastic, as a single layer thick and sprayed over the top with the different herbicide treatments and allowed to dry for 48 hr. Treated barks when dry and untreated mulches were applied directly to evaluation plots in varying amounts according to the mulch thickness. The mulches were applied as close as possible to a single layer.

Efficacy ratings and dry weights showed significant difference with treatment and date. Only dry weights had significant treatment X date interactions. Twenty of 38 treatments gave efficacy rating of $\geq$ 7, pooled over all evaluation dates. One was a direct spray, Surflan + SureGuard (7.6). Three were pretreated mulches, Surflan + SureGuard (8.2), Harness (7.8) and Surflan (7.4) treated pine. None of the pretreated hardwood barks provided ratings of $\geq$ 7. Nine were treatments with the herbicides applied under the bark. Seven of the nine provided ratings of $\geq$ 8 and only one involved

hardwood bark, Surflan + SureGuard under pine (9.1), Casoron under pine (8.9), Surflan under pine (8.7), Harness under pine (8.3), Harness under pine (8.0) and SureGuard under hardwood (8.0). Seven were treatments with the herbicides applied over the bark with only four providing ratings of $\geq$ 8 and only one involved hardwood bark, SureGuard over pine (9.1), Casoron over pine (9.0), Surflan over pine (8.3), Casoron over hardwood bark (8.0). The untreated pine (3.5) and untreated hardwood (1.5) provided significantly better efficacy than the control (0.15); however, these three treatments were three of the five less efficacious treatments in the trial. Casoron treated hardwood (3.5) provided statistically the same control as untreated pine. Casoron direct (1.8) provided statistically the same control as untreated hardwood. As expected date 1 (8.6) was more efficacious than dates 2 (7.7), 3 (6.8) and 4 (3.5). By weight Surflan + SureGuard-treated pine (2.0 g) and Surflan-treated pine (2.4 g) were statistically in the top eleven treatments all providing control to $\leq$ 3g per plot. Only two treatments had phytotoxicity > 3, Surflan under hardwood (3.3) and SureGuard pretreated hardwood (3.3) with crabapples. Phytotoxicity was highest with dogwood; however, this was not related to herbicide treatments as the control had a rating of (5.2) pooled over evaluation dates.

FURTHER INVESTIGATIONS INTO HERBICIDE TREATED MULCH. H.M. Mathers, J.A. Pope, and L.T. Case, Ohio State Univ., Columbus.

ABSTRACT

Herbicide treated bark has been studied for five years at Ohio State University (OSU), Columbus, OH. Studies have found a reduction in phytotoxicity and an increase and extension of efficacy. This research has lead to three questions regarding the properties of herbicide treated mulch. Two experiments were designed to address these questions. The objectives of the first study were to evaluate the extent and duration of efficacy of oryzalin applied at 2.0 lb ai/A onto pine nuggets stored in plastic bags for different periods of time (i.e. shelf-life) and whether storing the mulches wet or dry influenced shelf-life. The storage times were 48 hours, 3, 6, and 9 months. The study began on November 18, 2003, at OSU, Columbus, OH. The 9-month stored mulch has not yet been evaluated. Stored mulch was applied to one-gallon pots containing soilless media in a heated greenhouse after storing for the times indicated above and compared to a control (weedy check), direct spray, and untreated pine nuggets stored in plastic bags wet with water, spray or dry. The pots were seeded with groundsel and bluegrass for the 48-hour evaluation and just bluegrass for the 3, 6 and 9-month evaluation. Visual ratings and dry weights were evaluated for efficacy 35 and 115 days after treatment (DAT). Ratings of efficacy were based on a scale of 0-10; 0 represents no control, 10 represents complete control. There was no significant difference in efficacy between mulches stored wet or dry. The most efficacious treatments over the three storage dates were mulch sprayed with oryzalin stored wet (7.8) or dry (7.8), and direct spray of oryzalin (7.45). There were no significant differences in mulch stored for 3 or 6 months (8.1or 8.5, respectively). The shelf-life of bagged oryzalin mulch at 3 or 6 months is comparable to a direct spray.

The objective of the second study was to evaluate the influence of orientation of the herbicide treatments (acetochlor (3.0 lbs ai/A), flumioxazin (0.34 lbs ai/A), or oryzalin (2.0 lbs ai/A)) on pine nugget mulch (treated side up, no soil contact or treated side down, contact with soil) on the extent and duration of efficacy. The study began January 12, 2004. Herbicide treated pine nuggets treated side up or down, were compared to a control (weedy check), direct sprays of the three herbicides and untreated mulch. Again, one-gallon pots containing soilless media in a heated greenhouse were used seeded with bluegrass and crabgrass or groundsel. The two grasses and groundsel efficacies were evaluated separately. Visual ratings and dry weights were taken at 45 and 115 DAT as in first experiment. There was no effect to mulch orientation on groundsel control at 45 or 115 DAT with the three herbicides. There was, however, a significant orientation effect with oryzalin and acetachlor in the grass efficacy evaluations. Oryzalin treated mulch applied treated side up preformed significantly better than treated side down at 45 DAT but not at 115 DAT. Acetachlor treated mulch applied treated side up did significantly better at 115 DAT versus treated side down but not at 45 DAT. Further studies need to be conducted with mulch orientation in grass control as oryzalin and acetachlor had improved performance treated side up. Flumioxazin was not influenced by orientation.

EFFECTS OF THE PRE-MIX COMBINATIONS OF OUST EXTRA AND WESTAR ON DOUGLAS AND FRASER FIR. L.J. Kuhns and T.L. Harpster, Penn State Univ., University Park.

ABSTRACT

Combinations of sulfometuron and metsulfuron, sulfometuron and hexazinone, simazine and pendimethalin and flumioxazin and glyphosate were direct sprayed to Fraser (*Abies fraseri* (Pursh) Poir) and Douglas fir *(Pseudotsuga menziesii* (Mirb) Franco) in April 2004. Weed control ratings were made 8, 15, and 20 weeks after treatment (WAT). Injury ratings were made 15 WAT. All sulfometuron combinations provided excellent season long weed control in both species. Some trees receiving the high rates of the combinations were severely damaged, but the injury was sporadic. Healthy trees were growing next to severely injured trees in both species.

INTRODUCTION

This study was initiated to evaluate weed control provided by Westar and Oust Extra on two Christmas tree species and their tolerance to the herbicides. Westar contains 68.6% hexazinone and 6.5% sulfometuron. It is a preemergence or early postemergence herbicide labeled for use on Douglas fir (*Pseudotsuga menziesii* (Mirb) Franco) in forestry applications at 1.5 – 2 pounds of product per acre. Oust Extra contains 53.25% sulfometuron and 15% metsulfuron. It is a pre and postemergence herbicide labeled for use on Douglas fir in conifer plantations at 2.66 – 5.33 ounces of product per acre. Westar and Oust Extra, when applied as a spray, are absorbed by both the roots and foliage of plants.

Past experience from both growers and researchers of Christmas trees has shown that under certain circumstances, even at labeled rates, applications of sulfometuron and hexazinone can injure trees. The objective of this study was to determine the weed control provided by different rates of combinations of 1) sulfometuron and metsulfuron and 2) sulfometuron and hexazinone, and evaluate the tolerance of Fraser (*Abies fraseri* (Pursh) Poir) and Douglas fir to these herbicides.

MATERIALS AND METHODS

The study was conducted at Pinecrest Tree Farm, in Schuylkill County Pennsylvania. The soil was a well-drained shaly-loam. The herbicides listed in Table 1 were applied to Douglas fir and Fraser fir on April 9, 2004. The trees were 2-2 transplants planted in the spring of 2003. The Fraser firs were 12-18 inches tall, and the Douglas fir averaged 24-30 inches tall. The applications were direct sprayed with a CO_2 test plot sprayer, at 30 PSI at a rate of 20 GPA. An OC-02 nozzle was used and both sides of each row were sprayed, with the lower 6-12 inches of all trees intentionally covered. The air temperature was 55°F with winds at 3-5 miles per hour (MPH) with gusts up to 8 MPH. The soil temperature was 58°F. The Fraser fir plots had mostly annual weeds, while perennial weeds dominated the Douglas fir plots.

Weed control was evaluated on June 7, July 21, and August 25, 2004 - 8, 15, and 20 weeks after treatments (WAT). Injury ratings to the trees were evaluated on July 21, 2004, 15 WAT.

RESULTS AND DISCUSSION

In the block of Fraser Fir, the predominant weeds in the untreated control plots were daisy fleabane (*Erigeron annuus* (L.) Pers.); buckhorn plantain (*Plantago lanceolata* L.); yellow (*Setaria glauca* (L.) Beauv.), green (*Setaria viridis* (L.) Beauv.), and giant foxtail *(Setaria faberi* Herrm.); and clover (*Trifolium repens* L. and *Trifolium pratense* L.). All pre-emergent treatments provided excellent weed control in June and July. By August, treatments containing sulfometuron continued to provide excellent weed control with only a few annual grass seedlings and horsenettle (*Solanum carolinense* L.) breaking through in some areas. The simazine and pendimethalin, and flumioxazin and glyphosate treatments had significantly lower ratings than the sulfometuron combinations. Common dandelion (*Taraxacum officinale* Weber in Wiggers), clover and annual grasses dominated in these plots.

Plant injury was significantly higher on the trees receiving the high rates of sulfometuron. Injured trees had abnormal leaders, and poor color. Needle burn occurred on some of the trees receiving the high rates of sulfometuron and hexazinone. Not all the trees were injured. In fact, healthy trees sometimes grew next to severely injured trees within the same treatments.

The Douglas fir site was heavily populated with a wide variety of perennial weeds, and some annual weeds. The predominant weeds were Canada thistle (*Cirsium arvense* (L.) Scop.), clover, yellow nutsedge (*Cyperus esculentus* L.), common dandelion, and redroot pigweed (*Amaranthus retroflexus* L.). Other weeds found in the plots were common blue violet (*Viola papilionacea* Pursh), common mallow (*Malva neglecta* Wallr.), large crabgrass (*Digitaria sanguinalis* (L.) Scop.), and a mix of foxtails. Like the Fraser fir plots, all pre-emergent treatments provided excellent weed control in June. In both the July and August ratings, the sulfometuron combinations continued to provide excellent weed control. Canada thistle began to fill the plots with the simazine and pendimethalin mix, and the flumioxazin and glyphosate mix. The high thistle population resulted in poor weed control ratings. By August nutsedge, hemp dogbane (*Apocynum cannabinum* L.) and wild violets started to appear in the sulfometuron plots. Similar to the Fraser fir plots, plant injury was significantly higher on the trees receiving the high rates of the sulfometuron combinations. The addition of the high rate of hexazinone increased the injury. Injury consisted of stunted and curled needles, compact needles and yellowing of the new growth. Injury was also erratic in the Douglas firs. Healthy trees were growing next to severely injured trees.

Even though the sulfometuron combinations provide excellent weed control, the injury levels were unacceptable. Further studies will be conducted in which the rates of application will be lowered, and the ratio of sulfometuron to hexazinone will be adjusted.

Table 1. Weed control and plant injury evaluations on Fraser and Douglas fir. Weed control was rated on June 7, 8 weeks after treatment (WAT), July 21, 15 WAT and August 25, 2004, 19 WAT. Plant injury was rated on July 21. Treatments were direct sprayed on April 9, 2004. Each treatment was replicated three times. Weed control ratings are on a scale of 1 to 10, with 1 = no control and 10 = total control. Plant injury ratings are on a scale of 1-10 with 1 = no injury and 10 = dead plant.

		Fraser Fir[1/]				Douglas Fir[1/]			
Treatment	lbs/A	Weed Control			Plant Injury	Weed Control			Plant Injury
		June	July	Aug	July	June	July	Aug	July
Untreated		1.3 b	1.0 c	1.3 d	1.6 d	1.0 b	1.0 c	1.0 c	1.4 def
Sulfometuron Metsulfuron	0.035 0.009	9.9 a	9.9 a	9.3 a	2.7 c	9.4 a	7.5 b	9.2 a	2.1 cde
Sulfometuron Metsulfuron	0.07 0.02	10.0 a	10.0 a	9.6 a	3.0 bc	9.5 a	8.0 ab	9.5 a	2.4 bc
Sulfometuron Metsulfuron	0.14 0.04	10.0 a	10.0 a	9.8 a	4.9 a	9.9 a	9.7 a	9.8 a	3.1 ab
Sulfometuron Hexazinone	0.05 0.50	10.0 a	10.0 a	9.9 a	2.6 c	9.7 a	9.4 a	9.7 a	1.8 cdef
Sulfometuron Hexazinone	0.07 0.70	10.0 a	10.0 a	9.8 a	3.1 bc	9.9 a	9.7 a	9.6 a	2.3 bcd
Sulfometuron Hexazinone	0.08 0.84	10.0 a	10.0 a	9.8 a	3.6 b	9.8 a	9.8 a	9.7 a	2.1 cde
Sulfometuron Hexazinone	0.16 1.72	10.0 a	10.0 a	10.0 a	4.4 a	9.8 a	9.8 a	9.8 a	3.5 a
Simazine Pendimethalin	3.0 2.0	9.9 a	9.5 b	4.7 c	1.3 d	7.3 a	2.0 c	-	1.2 ef
Flumioxazin Glyphosate	0.38 0.25	9.9 a	9.8 a	6.7 b	1.2 d	6.8 a	3.7 c	-	1.1 f

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

EVALUATION OF SULFOMETURON COMBINATIONS FOR WEED CONTROL IN CHRISTMAS TREE PLANTATIONS. J.F. Ahrens, Connecticut Agric. Exp. Sta., Windsor.

ABSTRACT

Oust Extra is a combination of 0.56% sulfometuron + 0.15% metsulfuron labeled for forestry but not Christmas trees. Westar is a combination of 6.5% sulfometuron + 68.6% hexazinone, labeled for Douglas fir Christmas trees in Washington and Oregon. In 2004 we evaluated Oust Extra and the active ingredients in Westar in true firs *(Abies* spp.*)* in two field experiments. One was in a commercial stand of Fraser fir *(A. fraseri)* planted in April 2002 and the other was in an adjacent stand of a balsam x fraser hybrid *(A. balsamea* x *A. fraseri*) planted in 2003. Both were on silt loam soils with organic matter contents of 4.9 and 6.8% respectively. Plots were 3 or 4 trees long in rows spaced 6 ft apart. Treatments were arranged in randomized blocks with four replicates.

The herbicides were applied in April 30, 2004 over the conifers using a three-nozzle hand-held boom applying 30 gal/A over a 4.5-ft. swath. Seedling horseweed (*Conyza canadensis* (L.) Cronq.) was present in the balsam x fraser site at treatment. Rates of sulfometuron + metsulfuron ranged from 0.56 oz ai/A + 0.15 oz ai/A to twice and four times those amounts. Sulfometuron 75 DF + hexazinone 2L rates were 0.78 oz + 0.51 lb ai/A, 1.04 oz + 0.69 lb ai/A, 1.3 oz + 0.86 lb ai/A, and 2.6 oz + 1.72 lb ai/A. Also included were treatments of sulfometuron alone at 0.375, 0.75 and 1.5 oz ai/A and “standard” combinations of simazine plus oryzalin or pendimethalin, each at 2 + 3 lb ai/A, and flumioxazin at 0.375 lb ai/A.

The primary weeds in both experiments were horseweed, common ragweed (*Ambrosia artemisiifolia* L.) and large crabgrass (*Digitaria sanguinalis* L. Scop.). Weed control in late June was acceptable with all treatments but by August, excellent control was obtained only with the sulfometuron + hexazinone combinations. Injury to the conifers was evaluated in June and vigor was evaluated in September. None of the “standard” treatments injured the firs. The smaller balsam x fraser plants sustained more injury from sulfometuron alone and the sulfometuron combinations than the Fraser fir. Sulfometuron + metsulfuron caused unacceptable early chlorosis and reduced vigor of both conifers even at the lowest rate of 0.56 + 0.15 oz/A. Sulfometuron + hexazinone at 0.75 oz + 0.51 lb/A caused only slight early injury and vigor reductions, but over 50% reduction in vigor was obtained at the highest rates. Given the excellent long-season weed control with this combination, it may be possible to lower these rates to achieve acceptable control with lessened risk to the conifers.

PERENNIAL VINE CONTROL IN FRASER FIR WITH SELECTED HERBICIDE TREATMENTS. R.J. Richardson and B.H. Zandstra, Mich. State Univ., East Lansing.

ABSTRACT

Field studies were conducted in 2003 and 2004 near Greenville, MI, to evaluate control of troublesome perennial vines in Fraser fir (*Abies fraseri*) Christmas trees. Twelve herbicides or herbicide mixtures were applied as directed sprays in late summer of each year. Tree injury and weed control were visually rated on a 0 to 100% scale. Virginia creeper (*Parthenocissus quinquefolia*) and wild grape (*Vitis* spp.) were present in the 2003 trial, while both weeds plus poison ivy (*Toxicodendron radicans*) were present in 2004. Tree injury at 1 month after treatment (MAT) was greatest in 2003 with triclopyr (1.5 lb ae/A) plus halosulfuron (0.032 lb ai/A), triclopyr plus 2,4-D (1 lb ai/A), and triclopyr plus clopyralid (0.25 lb ai/A) at 12 to 16%. Injury in 2004 was greatest with 2,4-D, triclopyr plus halosulfuron, and triclopyr plus 2,4-D at 5 to 9%. Injury symptoms were predominantly needle necrosis or abscission with no observed long-term effects. Virginia creeper control in the 2003 trial at both 1 and 11 MAT was highest with herbicide mixtures containing triclopyr at 92 to 100%. Wild grape control at both ratings was greatest with triclopyr alone or in mixture at 93 to 100%, although 2,4-D was equivalent at 11 MAT with 83% control. In the 2004 trial at one MAT, Virginia creeper control was high with all triclopyr treatments, 2,4-D, and mesotrione (0.092 lb ai/A) plus hexazinone (0.5 lb ai/A) at 93 to 100%. Wild grape control was greatest with all triclopyr treatments, glyphosate (0.75 lb ae/A), hexazinone, and mesotrione plus hexazinone at 90 to 100%. Poison ivy control was greatest with all treatments containing triclopyr and mesotrione plus hexazinone at 92 to 95%.

EVALUATION OF OUST AND WESTAR FOR USE IN CHRISTMAS TREE SPECIES FOR SEASON-LONG WEED SUPPRESSION. L.A. Weston, Cornell Univ., Ithaca, NY, J. Barlow and D. Ganske, DuPont Crop Protection, Winchester, VA.

ABSTRACT

Oust XL (sulfometuron methyl) and Westar (hexazinone 68.6% and sulfometuron methyl 6.5%) are labeled for use in conifer production for grass and broadleaf weed suppression and provide both contact and residual activity. Interest in use of these products for long-term weed suppression in Christmas trees resulted in evaluation of these products in Christmas tree production sites across the Northeast. We evaluated early spring application of these products in Fraser fir (*Abies fraseri*), blue spruce (*Picea pungens*) and Eastern white pine (*Pinus strobus*) in a commercial Christmas tree operation located in Lansing NY. Herbicides were evaluated at rates of 253, 126 and 63 g/ha and were applied using a CO_2 pressurized back-pack sprayer at 127 liters L/ha on April 1, 2004 over the top of 8 year old plantings of Christmas trees which had not yet broken dormancy, as dormant trees are less susceptible to injury from these herbicides. The standard rate of Princep plus Surflan (simazine plus oryzalin) was used as a comparison (2.24 kg ai/ha plus 1.12 kg ai/ha). At one to two weeks after application, broadleaf weeds in particular, and some grasses were showing necrosis and deformation in treated Oust and Westar plots. By six weeks after application, most weeds including perennial ryegrass, marestail, white clover, dandelion and others were severely affected by application of all rates of Oust or Westar, with greater than 60% control obtained in all treatments. By 8-10 WAT, weeds were controlled by greater than 85% in these plots and by 12 WAT, greater than 95% control was observed in all Oust and Westar treatments. Control was maintained at this level throughout the fall months. In contrast, Princep plus Surflan control provided only limited preemergence control of germinating annual grasses and broadleafs. Phytotoxicity early in the season appeared limited and was restricted to some necrosis on blue spruce at the highest herbicide rates. This was not evident in mid-season. However, in early October, blue spruce at the highest rates of Oust and Westar showed considerable yellowing and discoloration throughout the tree, and leaders appeared stunted or injured. White pine and Fraser fir remained unaffected. In conclusion, lower use rates for these herbicides might be recommended to maintain adequate season-long weed control with limited phytotoxicity in these Christmas tree species evaluated.

TEST RESULTS IN EASTERN CHRISTMAS TREES WITH A NEW BLENDED PRODUCT OF SULFOMETURON-METHYL AND HEXAZINONE. S.K. Rick, M.J. Martin, D.D. Ganske, M.F. Holm, and R.G. Turner, DuPont Crop Protection, Raleigh, NC.

ABSTRACT

Westar™ herbicide, a water dispersible granular blend of sulfometuron-methyl and hexazinone, is labeled for weed control in non-crop sites and for the control of grass and broadleaf weeds in conifers grown for forestry. In 2004, Westar™ herbicide was labeled in Oregon and Washington for weed control in Christmas tree plantings at rates of 1.25 to 1.5 pounds per acre. In 2004, trials were initiated to test crop safety and spectrum of weed control of Westar™ herbicide in Christmas trees in the Northeastern US.

Seven trials across the Northeast were installed on several Christmas tree species such as Fraser fir, blue spruce and Douglas fir plantings. Rates of Westar™ herbicide tested ranged from 12 to 40 ounces of product. Application timing was targeted in the spring before bud break either preemergence or postemergence to the weeds.

Westar™ herbicide gave excellent control of several weed species including quackgrass (*Agropyron repens*), large crabgrass (*Digitaria sanguinalis*), yellow foxtail (*Setaria lutescens*), giant foxtail (*Setaria faberi*), Buckhorn plantain (*Plantago lanceolata*), Broadleaf plantain (*Plantago major*), field violet (*Viola tricolor*), common dandelion (*Taraxacum officinale*), mouseear chickweed (*Cerastium vulgatum*), and common ragweed (*Ambrosia artemisifolia*). Crop response was minimal at rates up 20 ounces.

Future testing in Christmas trees will examine a ratio containing lower rates of sulfometuron-methyl relative to hexazinone.

DEVELOPING AN HERBICIDE PROGRAM FOR CHRISTMAS TREES. L.J. Kuhns and T.L. Harpster, Penn State Univ., University Park.

ABSTRACT

Fall, and early and late spring, applications of preemergence herbicides were made with and without glyphosate to Fraser fir (*Abies fraseri* (Pursh) Poir) and Douglas fir (*Pseudotsuga menziesii* (Mirb) Franco). Weed control ratings were taken 10 and 15 weeks after spring treatments. The weed populations in the two tree species varied greatly. The most prevalent weeds in the Fraser fir were annual weeds, while perennial weeds dominated the Douglas fir plots. In the Fraser fir, there was reduced weed pressure in the spring where glyphosate, alone or in combination, was applied in the fall. Where flumioxazin was included with the glyphosate daisy fleabane (Erigeron annuus (L) Pers.) grew vigorously. Early spring treatments of flumioxazin that followed one of the fall treatments including glyphosate provided excellent weed control. Simazine alone allowed a dense stand of annual grasses to develop. Pendimethalin alone allowed many broadleaved weeds to grow. Late spring treatments of glyphosate plus flumioxazin alone or plus pendimethalin, and glyphosate plus simazine plus pendimethalin provided good control if they followed a fall application of glyphosate alone. If they followed a fall application of glyphosate plus simazine or flumioxazin they all provided excellent control. The glyphosate injured contacted foliage. The injury was enhanced when flumioxazin was included in the treatment. In the Douglas fir, the fall applications including glyphosate were needed to reduce the perennial weed population. However, the weeds were so dense that many survived the treatments. The preemergence herbicides applied in the spring could not be expected to provide good control of established perennial weeds, but treatments including flumioxazin, simazine plus pendimethalin plus oxyfluorfen, or the late spring applications including glyphosate usually provided marginally acceptable weed control. As in the Fraser fir, the May application of glyphosate caused a noticeable amount of damage to contacted foliage, which was enhanced by including flumioxazin in the treatment.

INTRODUCTION

Around 1977, the introduction of glyphosate revolutionized weed control in Christmas tree plantings. It allowed growers to safely and effectively eradicate perennial weeds from fields prior to planting, and allowed them to again eradicate weeds in existing plantings at the end of the growing season after the new growth of the trees had ‘hardened off’. However, winter annual and some biennial weeds that germinate in the fall after the glyphosate application can become serious problems the next season because spring applied preemergence herbicides don’t control them. For this reason it was recommended that simazine be combined with the glyphosate in the fall applications.

In plantings where triazine herbicides (atrazine, simazine, hexazinone) were used continually for many years, weeds resistant to these herbicides have developed into significant problems. Flumioxazin, a newly introduced herbicide labeled for use in Christmas tree plantings in many states has shown great promise for controlling many of the triazine-resistant weeds. When fall-applied with glyphosate it has eliminated most common annual and biennial weed problems, and provided control into the following spring longer than simazine has. This allows growers to delay their spring preemergence applications until the end of April without sacrificing weed control.

Flumioxazin is in the same chemical family as oxyfluorfen, but it has proven to be more effective than oxyfluorfen on many common weeds. Oxyfluorfen provides relatively short-term control of annual grasses, while flumioxazin has provided excellent control of them in our studies. Oxyfluorfen also provided limited control of the most common triazine-resistant weeds, such as common lambsquarters (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), tumble pigweed (*Amaranthus albus* L.), Pennsylvania smartweed (*Polygonum pensylvanicum* L.), and marestail (*Conyza canadensis* (L.) Cronq.). Flumioxazin has provided excellent control of these weeds in a series of studies over a four-year period.

The objectives of this study were to 1) demonstrate the effect of fall applications of glyphosate alone or in combination with simazine or flumioxazin on weed control the following season; 2) compare the effect of early spring applications of simazine or flumioxazin, alone or in combination with pendimethalin on weed control following the different fall applications; and 3) evaluate the safety and effectiveness of applications of combinations of a low rate of glyphosate plus preemergence herbicides applied in late spring, following bud break.

MATERIALS AND METHODS

The study was conducted at Pinecrest Tree Farm, in Schuylkill County Pennsylvania. The soil on the site is a well-drained shaly-loam. The herbicides listed in Table 1 were applied to Fraser fir (*Abies fraseri* (Pursh) Poir) and Douglas fir (*Pseudotsuga menziesii* (Mirb) Franco). The Fraser fir site had daisy fleabane (*Erigeron annuus* (L.) Pers.), some sheep sorrel (*Rumex acetosella* L.) and a mix of annual grasses. The Douglas fir site was heavily populated with a wide variety of perennial weeds, and some annual weeds. The predominant weeds were Canada thistle (*Cirsium arvense* (L.) Scop.), clover (*Trifolium repens* L. and *Trifolium pratense* L.), yellow nutsedge (*Cyperus esculentus* L.), common dandelion (*Taraxacum officinale* Weber in Wiggers), and redroot pigweed. Other weeds found in the plots were common blue violet (*Viola papilionacea* Pursh), common mallow (*Malva neglecta* Wallr.), large crabgrass (*Digitaria sanguinalis* (L.) Scop.), and a mix of foxtails (*Setaria faberi* Herrm., *Setaria glauca* (L.) Beauv., and *Setaria viridis* (L.) Beauv.).

Fall applications listed in Table 1, were made on September 16, 2003 with a Solo backpack sprayer in 14 gpa. An OC-02 nozzle was used and both sides of each row were sprayed, with the lower 12-18 inches of all trees intentionally contacted.

On April 8, 2004, preemergence treatments 2-7 were applied with a CO2 powered test-plot sprayer at 30 psi, through an OC-02 nozzle, in 18 gpa. Again, the foliage of the trees was intentionally contacted.

On May 11, 2004, treatments 8-11 were applied. Glyphosate at 0.25 lb/A was included in these treatments to control early-germinating weeds. Bud break had occurred in both species, and again, the foliage was intentionally contacted. Weed control was evaluated on July 21, 10 and 15 weeks after the April and May treatments, respectively. Observations were made regarding injury to the trees.

RESULTS AND DISCUSSION

In the block of Fraser fir, the predominant weeds in the plots that were untreated in the fall were daisy fleabane, buckhorn plantain (*Plantago lanceolata* L.), shepherd's purse (*Capsella bursa-pastoris* (L.) Medicus), and common chickweed (*Stellaria media* (L.) Vill.).There were very few grasses present in these plots.

Where glyphosate was applied alone in the fall, or with simazine, there were foxtails, fleabane, Virginia pepperweed (*Lepidium virginicum* L.), and buckhorn and broadleaved plantain (*Plantago major* L.). Where flumioxazin was included with the glyphosate in the fall, there were no grasses, but fleabane grew vigorously. Other studies have shown that flumioxazin provides excellent control of marestail, but this study showed it provides no control of fleabane.

The early spring treatments including flumioxazin provided excellent control if they followed one of the fall treatments including glyphosate. Flumioxazin at 0.38 lb/A alone provided such good control that adding pendimethalin to it did not contribute much to the weed control. It is labeled for use at 0.25 to 0.38 lb/A and the 0.25 lb/A rate should have been included in this study.

Simazine alone allowed a dense stand of annual grasses to develop. Some plots had what apparently was triazine resistant redroot pigweed. Pendimethalin alone allowed a lot of broadleaved weeds to grow. The most common weeds in pendimethalin treated plots were marestail, dandelion, fleabane and the plantains.

Simazine plus pendimethalin provided barely adequate weed control. There were very few grasses, but there was some fleabane, plantains, and dandelion. Adding oxyfluorfen to the mix significantly improved the weed control. About the only weeds left were dandelion and some Virginia pepperweed.

The late spring treatments made on May 11 that included glyphosate at 0.25 lb/A provided good control if they followed a fall application of glyphosate alone. If they followed a fall application of glyphosate plus simazine or flumioxazin, they provided excellent control. The glyphosate applied in May caused a noticeable amount of damage to contacted foliage. This damage was enhanced by including flumioxazin in the treatment.

Because the weeds in the Douglas fir plots were mostly established perennials, any treatments including glyphosate had the most effect on them. Flumioxazin again performed somewhat better than the simazine, but this was not a good site in which to evaluate the two products. Since a mixed stand of perennial weeds often grows in patches, the control ratings for the plots seemed to depend a lot on where they were located in the field. Also, the preemergence herbicides used in this study could not be expected to provide much control of the perennial species that were prevalent on this site.

The fall applications of the glyphosate did not eliminate the perennials for two reasons. The perennials in the block were very well established and they were very dense. The spray applied couldn't reach some of the plants, and others, like Canada thistle require more than one application for control to be effective.

The treatments made on May 11 that included glyphosate at 0.25 lb/A provided good control if they followed a fall application of glyphosate, alone or in combination. The glyphosate caused a noticeable amount of damage to contacted Douglas fir foliage. As with the Fraser fir, this damage was enhanced by including flumioxazin in the treatment.

A fall application of glyphosate plus simazine or flumioxazin is a key component of a weed control program for Christmas tree plantations. Where triazine-resistant weeds are not a problem, low-cost simazine could be used. Where triazine-resistant weeds are present, flumioxazin should be used. Preemergence herbicides should be applied in the spring to prevent the growth of summer annual weeds. Flumioxazin alone provided control as good as simazine plus pendimethalin plus oxyfluorfen. Delaying application until after bud break lead to injury to the trees by the glyphosate in the late spring application. The injury was enhanced by including flumioxazin in the mix. According to work done in North Carolina, the injury caused by the glyphosate could be reduced by lowering the rate of application or delaying application until mid-June.

Table 1. Weed control in Fraser and Douglas fir rated on July 21, 2004, 10 and 15 weeks after treatment. Fall applications were made on September 16, 2003. Preemergence treatments 2-7 were direct sprayed on April 8, 2004, and treatments 8-10 were direct sprayed after bud break on May 11, 2004. Each treatment was replicated two times. Ratings are on a scale of 1 to 10 with 1 = no control and 10 = total control.

		WEED CONTROL RATINGS[1/] Fall Applications							
		No Fall App		Glyphosate 1.5 lb/A		Glyphosate 1.5 Lb/A Simazine 1.5 lb/A		Glyphosate 1.5 lb/A Flumioxazin 0.25 lb/A	
Spring Treatments	lb per acre	Fraser	Douglas	Fraser	Douglas	Fraser	Douglas	Fraser	Douglas
1. Control		1.0 c	1.0 b	1.0 c	1.0 c	1.0 f	1.0 c	1.0 d	1.0 f
2. Simazine 4L	3	3.5 abc	1.0 b	2.5 c	2.0 c	2.5 e	2.0 bc	3.0 c	5.5 cd
3. Pendimethalin 3.3 EC	2	2.0 bc	2.0 ab	3.5 bc	2.0 c	6.5 c	3.0 bc	3.5 c	4.5 de
4. Simazine 4L Pendimethalin 3.3 EC	3 2	4.5 abc	4.0 ab	6.2 ab	5.5 b	3.5 d	3.5 bc	6.0 b	3.5 e
5. Simazine 4L Pendimethalin 3.3 EC Oxyfluorfen 2X	3 2 0.5	4.5 abc	3.5 ab	7.5 a	8.0 ab	8.5 b	5.0 abc	8.4 a	6.5 bc
6. Flumioxazin 50WDG	0.38	5.0 abc	3.0 ab	8.9 a	7.0 ab	9.8 a	4.5 abc	9.6 a	7.0 abc
7. Flumioxazin 50WDG Pendimethalin 3.3 EC	0.38 2	6.5 a	2.5 ab	8.9 a	8.2 a	10.0 a	4.0 bc	9.8 a	7.5 abc
8. Glyphosate 4L Simazine 4L Pendimethalin 3.3 EC	0.25 3 2	5.5 ab	3.0 ab	8.8 a	6.0 ab	9.2 ab	4.5 abc	9.9 a	7.0 abc
9. Glyphosate 4L Flumioxazin 50WDG	0.25 0.38	5.5 ab	5.0 a	8.0 a	6.0 ab	9.8 a	5.8 ab	9.9 a	8.0 ab
10. Glyphosate 4L Flumioxazin 50WDG Pendimethalin 3.3 EC	2 6 2	5.0 abc	5.5 a	8.0 a	7.0 ab	9.9 a	8.8 a	9.9 a	8.5 a

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

FLUMIOXAZIN USE IN NURSERY CROPS: OBSERVATIONS ON HERBICIDE PERFORMANCE AND CROP SAFETY. J.F. Derr, Virginia Tech, Virginia Beach.

ABSTRACT

Flumioxazin was registered for use in nursery crops in late 2003, with product available to growers in 2004. Two formulations were introduced by Valent U.S.A. Corporation, a granular form with the trade name BroadStar, and a sprayable form with the trade name SureGuard. BroadStar, containing 0.25% flumioxazin, was registered for use in container and field production, and can be applied to a wide range of shrub and tree species. SureGuard, a 51% water dispersible granule, can be used on many conifers and deciduous tree species. Flumioxazin provides preemergence and early postemergence control of annual grass and broadleaf weeds.

This discussion topic will address observations by researchers during this first season of use in the nursery industry. Tolerance of woody nursery crops will be discussed, along with possible explanations for the occurrence of damage in specific nursery species. Control of troublesome weeds in the nursery industry will be discussed.

TOLERANCES OF CONTAINER-GROWN PERENNIALS TO PREEMERGENCE HERBICIDES. T.L. Mervosh and J.F. Ahrens, Connecticut Agric. Exp. Sta., Windsor.

ABSTRACT

At the IR-4 Ornamental Horticulture Workshop in 2003, high priority was placed on obtaining data needed to expand labels for preemergence herbicides to include additional tolerant perennials. We conducted an experiment to evaluate four widely grown herbaceous perennials for their tolerances to herbicides not currently registered for use on these plants. The following herbicides were included: *S-metolachlor* (Pennant Magnum 7.62L), pendimethalin (Pendulum 2G), and isoxaben plus trifluralin (Snapshot 2.5TG). The plants evaluated were catmint (*Nepeta x faassenii* 'Walker's Low'), lavender (*Lavendula angustifolia* 'Munstead'), green & gold (*Chrysogonum virginianum* 'Springbrook'), and lady's mantle (*Alchemilla mollis*). (Note: Snapshot 2.5TG is already labeled for use in container and field plantings of *Lavendula*.)

All plants were potted in 1-gallon containers on June 11, 2004. The mix for *Nepeta*, *Chrysogonum* and *Alchemilla* contained 65% pine bark, 25% peat moss and 10% sand. The mix for *Lavendula* consisted of 90% southern pine bark and 10% sand. Each plot contained three plants of each perennial. Treatments were replicated four times in a randomized complete block design. Applied on June 17, treatments consisted of *S-metolachlor* sprays at 1, 2 and 4 lb ai/A, pendimethalin granules at 3, 6 and 12 lb ai/A, and isoxaben plus trifluralin granules at 2.5, 5 and 10 lb ai/A (0.5, 1 and 2 lb ai/A of isoxaben plus 2, 4 and 8 lb ai/A of trifluralin, respectively), and an untreated check. Sprays were applied in a volume of 50 gal/A with a CO_2-pressurized sprayer with two 8004VS nozzle tips. Treatments were sprayed over the top of plants still wet with morning dew. Twelve minutes after completion of spraying, plants were watered with overhead sprinklers for 15 min. After foliage had dried, granular treatments were applied with a calibrated auger-feed drop spreader, followed 15 min later with overhead irrigation for 20 min. For *Alchemilla*, many herbicide granules did not wash off the foliage but collected in large water droplets that remained on the cup-shaped leaves.

Visual evaluations of plant injury (0 = no injury; 10 = dead) were recorded on June 24, July 2 and July 30 (1, 2 and 6 weeks after treatment (WAT)). Plant vigor (0 = dead; 10 = most vigorous) was evaluated on August 26 and October 18 (10 and 18 WAT). The only significant injury was observed on *Chrysogonum* treated with isoxaben plus trifluralin at dosages of 5 and 10 lb ai/A. Injury was first observed at 2 WAT, when average injury ratings of 1.5 and 1.75, respectively, were assigned. Injury consisted of stunting and purple leaf coloration. Slight reductions in vigor (9.0 and 8.5, respectively) of these *Chrysogonum* plants were observed later in the growing season. The only other treatment effect was a slight reduction in flowering of *Lavendula* at 10 WAT with isoxaben plus trifluralin at the 10 lb ai/A rate. Otherwise, the perennials demonstrated excellent tolerance to the herbicides tested.

Very few weeds emerged in the containers, so no meaningful weed control data could be collected.

EVALUATION OF NEW HERBICIDES FOR WEED CONTROL IN PEPPER. D.E. Robinson, Univ. Guelph, Ridgetown, ON.

ABSTRACT

Trials were conducted in 2003 and 2004 to test for the effect of preemergence applications of S-metolachlor (1200 and 2400 g ai ha^{-1}), clomazone (420 and 840 g ai ha^{-1}), halosulfuron (25 and 50 g ai ha^{-1}), sulfentrazone (125 and 250 g ai ha^{-1}) and dimethenamid (750 and 1500 g ai ha^{-1}) on visual injury, height, fruit weight and marketable and total yields of peppers. Tank mixtures of S-metolachlor+sulfentrazone (1200+125 g ai ha^{-1}), clomazone+halosulfuron (420+25 g ai ha^{-1}) and dimethenamid+sulfentrazone (750+125 g ai ha^{-1}) were also included to determine tolerance and efficacy of broad-spectrum herbicide treatments. An untreated, weed-free check and a weedy check were included for comparison. Halosulfuron (50 g ai ha^{-1}) applied preemergence caused significant visual injury to pepper. Plants appeared chlorotic, stunted and wilted. The remaining treatments did not cause significant visual injury to pepper. Halosulfuron did not reduce marketable fruit size, but total yield was less than in the untreated, weed-free check. The remaining herbicide treatments did not reduce marketable fruit size or weed-free yield of pepper compared to the untreated check.

The tank mix of S-metolachlor+sulfentrazone (1200+125 g ai ha^{-1}) gave excellent control of common lambsquarters (*Chenopodium album* L.) good control of eastern black nightshade (*Solanum ptycanthum* Dun.) and green foxtail (*Setaria viridis* (L.) Beauv.), fair control of redroot pigweed (*Amaranthus retroflexus* L.) and lady's thumb (*Polygonum persicaria* L.), and poor control of purslane (*Portulaca oleracea* L.), velvetleaf (*Abutilon theophrasti* L.) and common ragweed (*Ambrosia artemisiifolia* L.). The tank mix of clomazone+halosulfuron (420+25 g ai ha^{-1}) gave excellent control of redroot pigweed and lady's thumb, good control of velvetleaf, fair control of common lambsquarters and lady's thumb, and poor control of eastern black nightshade, green foxtail and common ragweed. The tank mix of dimethenamid+sulfentrazone (750+125 g ai ha^{-1}) gave excellent control of redroot pigweed, common lambsquarters, and eastern black nightshade, good control of green foxtail and lady's thumb, and poor control of velvetleaf, common ragweed and purslane.

EVALUATION OF PRE AND POST-EMERGENCE HERBICIDE APPLICATIONS FOR WILD BLUEBERRIES IN MAINE. D.E. Yarborough and K.F. Lough, Univ. Maine, Orono.

ABSTRACT

Hexazinone has been the principle herbicide used in wild blueberry (*Vaccinium angustifolium)* fields since 1982. Its use has contributed to a four-fold wild blueberry yield increase over the past 20 years. Hexazinone, which is highly leachable and easily detectable, has been found in groundwater throughout the state in and adjacent to wild blueberry fields. In addition, annual grass populations and herbaceous weeds such as bunchberry (*Cornus canadensis*) have been increasing with the use of hexazinone. Several alternative herbicides have been evaluated for rotation with hexazinone, but materials have either been ineffective or not registered, as in the case of azafenidin. Alternative herbicides are needed to prevent build up of these weed populations and to reduce the reliance on hexazinone.

The trial experimental design was a randomized, complete block design with six replicates and was conducted at Blueberry Hill Farm Research Station in Jonesboro, Maine. Herbicides evaluated include hexazinone as the standard at 1 kg/ha, flumioxazin at 0.9 kg/ha and mesotrione at 148, 222 or 444 ml/ha as well as an untreated check plot. Hexazinone and flumioxazin were applied pre-emergence on 10 May. Mesotrione was applied preemergence on 13 May 2004 and post-emergence on 9 June 2004. Evaluation of blueberry cover, herbaceous weeds, grasses and ferns were made using a 1-6 Daubenmire cover class scale on 23 June and 18 August 2004. Data were transformed to percent cover and analyzed by the General Linear Model of SAS with significant means separated by a Duncan's multiple range test.

No significant reductions in cover or phytotoxicity of wild blueberries were noted for any of the treatments. Broadleaf cover averaged less than 20% (Figure 1) and although some treatments were less than the untreated or hexazinone standard, several were greater but none were statistically significant. Grass cover (Figure 2) appeared to be released, with the post flumioxazin and mesotrione treatments having an increase in cover. Fern cover also increased with the highest rate of both flumioxazin and mesotrione treatments but the effect was not significant (Figure 3). In all cases the hexazinone standard and check plot were not significantly different. Additional trials with larger plots on more locations are planed to further evaluate the potential of these herbicides.

Figure 1. Broadleaf Cover after Pre and Post-Emergence Flumioxazin and Mesotrione

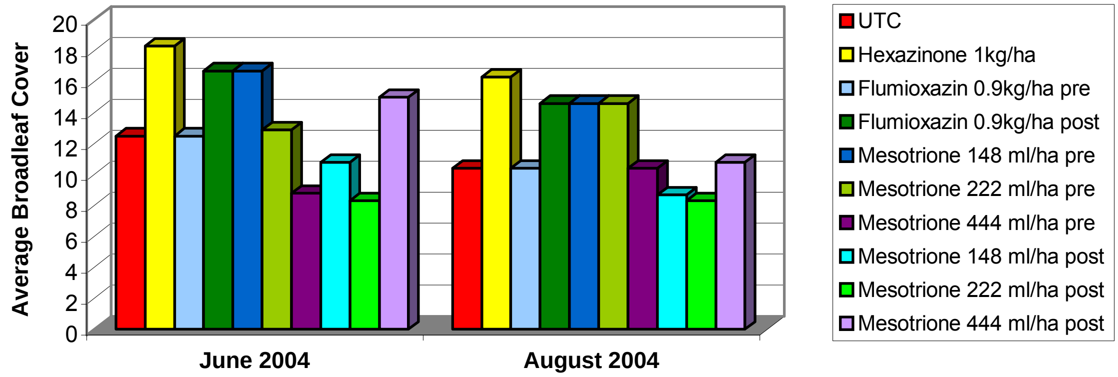


Figure 2. Grass Cover after Pre and Post-Emergence Flumioxazin and Mesotrione

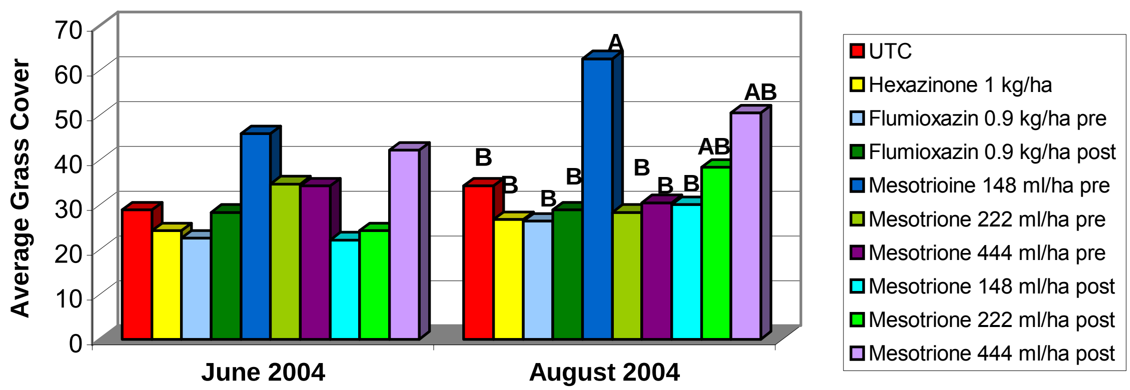
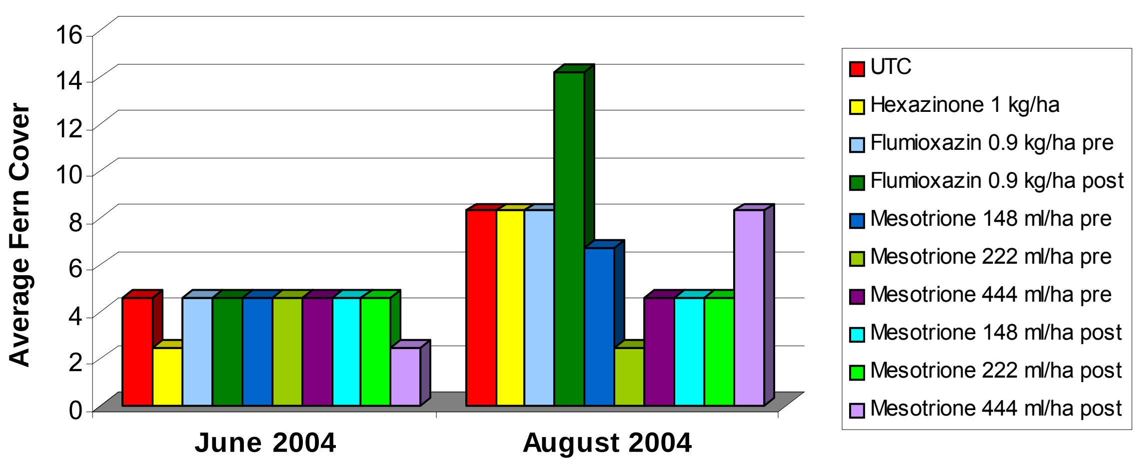


Figure 3. Fern Cover after Pre and Post-Emergence Flumioxazin and Mesotrione



CARFENTRAZONE, QUINCLORAC, AND TRIFLOXYSULFURON EFFECTS ON SEEDED BERMUDAGRASS ESTABLISHMENT AND CRABGRASS CONTROL. J.B. Willis, D.B. Ricker and S.D. Askew, Virginia Tech, Blacksburg.

ABSTRACT

In the transition zone and especially in the piedmont region of Virginia, cool-season grasses have been primarily used for sports turf due to poor winter survival of warm-season grasses. Until recently bermudagrass (*Cynodon dactylon* (L.) pers.) has not been an option in these areas. New seeded bermudagrass (SB) varieties have promise to replace cool-season turf in these areas. Improved bermudagrass cultivars such as 'Riviera' tolerate cold temperatures and have very desirable color and texture characteristics while maintaining good wear tolerance and outstanding wear recovery. The ability to reseed makes renovating damaged sports turf much easier than sprigging hybrid varieties. Previous studies have evaluated the use of various chemicals on sprigged bermudagrass establishment. Few studies provide herbicide options for control of troublesome weeds during SB establishment. This field study was conducted to evaluate 'Riviera' SB response to carfentrazone, quinclorac and trifloxysulfuron applied to seedling SB.

The study was conducted on a fairway at the Virginia Tech Golf Course in Blacksburg, VA. Existing Kentucky bluegrass (*Poa pratensis* L.) was controlled with multiple applications of glyphosate and land was prepared by core aerating and vertical mowing each in two directions. Riveria SB was sown on June 4, 2004 at 48.8 kg pure live seed/ha and treatments were applied at various timings thereafter. The experimental design was a randomized complete block with 4 replications. Treatments included a nontreated check, carfentrazone at 0.03 kg ai/ha, carfentrazone plus quinclorac at 0.84 kg ai/ha, carfentrazone plus trifloxysulfuron at 0.03 kg ai/ha, and trifloxysulfuron at 0.03 kg ai/ha. Treatments were arranged in a factorial design with the aforementioned herbicides applied each at three timings relative to SB emergence (7, 14, and 24 day after emergence (DAE)). SB emergence was noted on June 21 and treatments were made on June 28, July 05 and July 19.

Large crabgrass (*Digitaria sanguinalis* (L.) Scop.) control ratings were highly variable due to poor population. Treatments containing quinclorac and trifloxysulfuron applied before 14 DAE controlled large crabgrass greater than 70% 5 weeks after initial treatment (WAIT). Treatments that included trifloxysulfuron injured SB more than quinclorac or carfentrazone and trifloxysulfuron applications made at or before 14 DAE injured SB most. Trifloxysulfuron treatments injured SB greater than 50% 5 WAIT. This injury caused a 25% reduction in SB cover 11 WAIT. Quinclorac controlled large crabgrass without injuring SB. Trifloxysulfuron also controlled large crabgrass but caused unacceptable SB injury. To avoid SB injury trifloxysulfuron should not be applied until at least 28 DAE. When applied to young SB in any combination, carfentrazone and quinclorac did not cause injury at any timing.

MULTIYEAR PLANT GROWTH REGULATOR PROGRAMS FOR ANNUAL BLUEGRASS CONTROL. P.E. McCullough, S.E. Hart, and D.W. Lycan, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Plant growth regulators (PGRs) are commonly applied for *Poa annua* suppression but various PGR regimens may be more applicable in creeping bentgrass management than exclusive applications. Two field experiments were conducted from 2001 to 2004 in Riverton, NJ to investigate various regimens of paclobutrazol (PB) and trinexapac-ethyl (TE) for *Poa annua* control in creeping bentgrass golf course fairways. Over the four years, *Poa annua* coverage was 36% greater in the spring compared to summer and fall. In the first experiment, *Poa annua* coverage was 25 to 39% less in bentgrass treated with PGR regimens than untreated turf. Turf treated with regimens including PB had 19% less *Poa annua* coverage than exclusive TE treatments. In the second experiment, *Poa annua* coverage was reduced 20 to 37% when PB was included in the PGR regimen and overall population reductions were ≈ 80 to 120% greater than untreated turf. Applying PB at 0.14 kg ai ha^{-1} 3 wk^{-1} from spring to fall suppressed *Poa annua* populations similarly to applications at higher rates applied only in the spring or fall. Exclusive TE applications had best turf quality results but inconsistent *Poa annua* control over the two experiments. However, routinely applying TE with periodic PB applications controlled *Poa annua* similarly to PB applied exclusively. Turf receiving PB with and without TE had similar or reduced turf quality than the untreated but quality was always acceptable. Regimens with both PGRs may be advantageous for *Poa annua* management and bentgrass growth suppression.

CHLORIMURON-ETHYL PLUS TRIBENURON-METHYL: A NEW HERBICIDE FOR WEED COTNROL IN SOYBEANS. S.K. Rick, K.L. Hahn, M.J. Martin and D.W. Saunders, DuPont Crop Protection, Raleigh, NC.

ABSTRACT

Field studies were conducted in 2003 and 2004 to evaluate the control of emerged winter annual and perennial weeds as well as residual control of summer annual weeds in soybeans with a mix of chlorimuron-ethyl and tribenuron-methyl herbicides. Results from both university and in-house trials show excellent control of many weed species such as dandelion (*Taraxacum officinale*), common chickweed (*Stellaria media*), henbit (*Lamium amplexicaule* L.), and marestail (*Erigeron canadensis* L.).

Based on the results of both spring and fall tests, a new blended herbicide consisting of 22.7% chlorimuron-ethyl and 6.8% tribenuron-methyl will be marketed for burndown use prior to soybean planting. The new water-dispersible granular blend will be marketed under the trade name of Canopy EX™. Canopy EX™ may be applied after the fall harvest up to 45 days prior to soybean planting. Use rates of Canopy EX™ will range from 1.1 to 3.3 ounces product per acre. To broaden the spectrum of weed control, application with 2,4-D is recommended. The length of residual control of summer annuals is rate dependent.

DIFFERENTIAL SYMPTOMOLOGY ASSOCIATED WITH AN EXPERIMENTAL DUAL MODE OF ACTION HERBICIDE.

D.A. Baxter, G.R. Armel, T.M. Stevenson, L. Doricchi, L. Howell, P.A. Mauvais, E.G. Esrey, K.M. Patel, V.A. Wittenbach, and P.L. Rardon, E.I. Dupont Nemours, Newark, DE.

ABSTRACT

Studies were conducted in 2004 at the Stine-Haskell Research Center to evaluate the Dupont proprietary herbicide 4-chloro-2- (2-hydroxy-6-oxo-cyclohex-1-encarbonyl)-N,N-dimethyl-benzenesulfonamide, which is an inhibitor of both *p*-hydroxyphenylpyruvate dioxygenase (HPPD) and acetolactate synthase (ALS). Activity of this compound was compared to a commercial ALS inhibitor, chlorsulfuron, and a commercial HPPD inhibitor, mesotrione. The DuPont proprietary compound, mesotrione, and chlorsulfuron were each applied postemergence at 125 g ai/ha. Symptoms of bleaching, chlorosis, growth reduction, and reddening were evaluated separately for each compound approximately 1 week after treatment. A mixture of mesotrione at 125 g ai/ha plus chlorsulfuron at 125 g ai/ha was also included for comparative symptomology.

Slight bleaching symptomology (10 to 20%) was evident for the Dupont proprietary compound on several species, including barnyardgrass (*Echinochloa crus-galli),* corn (*Zea mays*), and red morningglory (*Ipomoea coccinea).* However, chlorosis was the predominant symptom (60 to 100%) observed on common cocklebur (*Xanthium strumarium)* and on velvetleaf (*Abutilon theophrasti).*

Mixtures of chlorsulfuron plus mesotrione displayed variable symptomology compared with either compound applied alone. Symptomology was greatly dependent on individual species susceptibility to either chlorsulfuron or mesotrione, and in general the more active herbicide masked the symptoms of the less active herbicide.

AQUATIC WEED PROPAGATION TECHNIQUES FOR USE IN HERBICIDE DISCOVERY RESEARCH. L. Doricchi, G.R. Armel, D.A. Baxter, S.E. Leva, T.L. Sloman, and C.D. Cotterman, E.I. DuPont Nemours, Newark, DE.

ABSTRACT

Greenhouse experiments were conducted at the DuPont Stine-Haskell Research Center in 2004 to assess propagation techniques for the following aquatic weed species: duckweed (*Lemna gibba*), water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriophyllum spicatum*), elodea (*Egeria densa*), *and* water spinach (*Ipomoea aquatica*).

Plastic bins (110 cm long X 72 cm wide X 60 cm deep) were filled with approximately 25.5 cm of tama soil and 75 liters of tap water. Water was adjusted to pH 7.0 and an electric air pump was used to aerate the water. Plant cuttings of Eurasian watermilfoil, elodea, water hyacinth, and hydrilla ranging from 15 to 40 cm in length, were planted approximately 2.5 cm below the soil surface. Once established in these plastic bins, plants were again harvested approximately 2.5 cm above the soil surface and planted in smaller pots suitable for greenhouse herbicide evaluations. Conversely, the free-floating plant duckweed was placed on top of the water and produced the most colonies when grown in de-ionized water, or in eutrophic rich pond water. Water spinach was established from seeds planted 2.5 cm deep in moist tama soil with 85% of the seeds germinating within 4 days after planting. All plants were grown in a greenhouse with day/night temperature settings of 29.5/26.7 C. Supplemental balanced lighting was provided to maintain a 16-hour photoperiod.

INFLUENCE OF MOISTURE-STRESS ON POSTEMERGENCE HERBICIDE PERFORMANCE. M.J. VanGessel, B.A. Scott, and Q.R. Johnson, Univ. Delaware, Georgetown.

INTRODUCTION

It is not uncommon for Delaware soybean producers to experience droughty conditions at times of postemergence herbicide application. There is anecdotal evidence that herbicide performance is dramatically reduced when weeds are under moisture-stress. Likewise, there are growers who are satisfied with their postemergence herbicide programs when applied under moisture-stress. A series of studies were conducted under field conditions in 2004 to examine variables that may explain some of these inconsistencies, specifically choice of herbicide and herbicide rate, as well as time of application.

MATERIAL AND METHODS

General methodology. The studies were conducted in the same field at the University of Delaware's Research and Educational Center. Corn and soybeans in the region were showing symptoms of severe drought stress when these studies were initiated. At forty days prior to the study, the experimental area had received about 1 inch of rain over a 6 day period. Precipitation of 0.43 and 0.35 inches of rain accumulated 36 and 31 days prior the study, respectively, followed by a total of 0.77 inches in eight separate rain events before applying the treatments. Soil samples were collected to determine levels of soil moisture at time the treatments were applied. Soil samples were collected to a depth of 5 to 8 inches depth which was the maximum depth that the soil probe could enter. Dried weight (72 hours at 150 F) compared to initial soil weight showed no change in soil moisture levels. The field had been cropped to winter wheat, harvested ten days prior to applying treatments, after the weeds had a chance to produce new leaf tissue. Approximately 50% common ragweed plants had been clipped during wheat harvest. In addition, common cocklebur, common lambsquarters, and morningglory species were present and all weed species were 6 to 10 inches in height. All herbicide treatments were applied with a CO_2 backpack sprayer calibrated to deliver 25 gpa with pressure at 25 psi. Plots were 6 feet wide and 20 feet long with 3 replications. Efficacy of treatments was rated as percent visual control 1 and 3 weeks after treatment (WAT).

Herbicide selection. The first study compared a contact herbicide with a translocated herbicide for relative effectiveness under drought conditions. Ultra Blazer (acifluorfen, a contact herbicide) plus non-ionic surfactant (NIS) at 0.25% v/v was compared with Roundup WeatherMax (glyphosate, a translocated herbicide). The rates for Ultra Blazer were 1, 1.5, 2, 2.5, and 3.0 pts/A. Roundup WeatherMax rates were 0.5, 0.75, 1, 1.25, and 1.5 qt/A. Roundup WeatherMax at 0.75 qt/A plus 4 lbs/A of ammonium sulfate was included as a comparison. Treatments were applied at 6:00 pm.

Time of application. The second study was designed to examine the impact of time of day on efficacy. Ultra Blazer (1.5 pts/A plus NIS) or Roundup WeatherMax (0.75 qt/A) was applied on the same day at 7:00 am, 5:00 pm and then 4 days later after a total of 1.1 inches of rain had fallen. The early morning timing was intended for application after plants had a chance to rehydrate as much as possible under the given environmental conditions. The afternoon timing was intended for application at maximum moisture deficient for that day. The application after the rainfall was intended for when the plants were no longer under moisture stress.

RESULTS

Herbicide selection. Overall, Roundup WeatherMax was superior for common ragweed control, while Ultra Blazer provided better control of morningglory species (although not commercially acceptable) (Table 1). For Ultra Blazer at 1 WAT, common ragweed control did not differ among the rates applied. By 3 WAT, there was a rate response observed with the highest level of control was observed with the 2.5 and 3.0 pts/A rate. For morningglory species, there was no difference between the Ultra Blazer rates at either 1 or 3 WAT. For Roundup WeatherMax, there was no difference between rates for common ragweed control at either observation date. No differences were observed for morningglory species at 1 WAT, but at 3 WAT treatment morningglory control was best with Roundup WeatherMax at 1.5 qt/A. There was no benefit for the addition of ammonium sulfate to glyphosate to improve weed control.

Time of application. At 3 WAT, there was no difference in timing of Ultra Blazer application for common cocklebur control (Table 2). For common ragweed, control was best when Ultra Blazer was applied after rainfall. Similarly, common lambsquarters was highest after rainfall, yet it was not commercially acceptable.

For Roundup WeatherMax, there was no difference for any of the application timings, with excellent control of common ragweed, common lambsquarters, and common cocklebur (Table 2).

Morningglory control with both Ultra Blazer and Roundup WeatherMax showed a trend for better control after the rainfall, but due to variability in the data, these differences were not significant. Ultra Blazer after rainfall resulted in 70% control while Roundup WeatherMax provided 50% control (data not presented).

In a non-replicated trial with FirstRate (cloransulam) plus NIS, was applied during the drought (morning timing) and post-rain. Common ragweed and common cocklebur control was improved by 10% after the rainfall with ratings from post-rain of 95 and 99% control, respectively (data not presented).

CONCLUSION

In summary, the translocated herbicide (Roundup WeatherMax) maintained its efficacy to a greater extent than the contact herbicide (Ultra Blazer). Timing of application was not a factor if the herbicide was highly effective on a particular species.

Table 1. Effect of contact or translocated herbicides and rates on effectiveness under drought conditions.

Weed code				AMBEL	IPOSPP	AMBEL	IPOSPP
Weed name				Common	Mornglry	Common	Mornglry
Weed name				Ragweed	Species	Ragweed	Species
Rating data type				Control	Control	Control	Control
Rating unit				%	%	%	%
Rating interval				1 WAT	1 WAT	3 WAT	3 WAT
Trt no.	Treatment Name	Rate	Rate unit				
1	Untreated check			0.0	0.0	0.0	0.0
2	Ultra Blazer	1.0	pts/A	69.3 a	77.5 a	56.7 e	40.0 a-d
	Nonionic surfactant	0.25	% v/v				
3	Ultra Blazer	1.5	pts/A	73.3 a	82.5 a	63.3 d	45.0 ab
	Nonionic surfactant	0.25	% v/v				
4	Ultra Blazer	2.0	pts/A	80.3 a	85.0 a	73.3 c	40.0 a-d
	Nonionic surfactant	0.25	% v/v				
5	Ultra Blazer	2.5	pts/A	79.0 a	82.0 a	76.0 c	30.0 d
	Nonionic surfactant	0.25	% v/v				
6	Ultra Blazer	3.0	pts/A	84.7 a	88.0 a	80.7 b	50.0 a
	Nonionic surfactant	0.25	% v/v				
7	Roundup WeatherMax	0.5	qts/A	81.7 a	65.0 a	99.0 a	30.0 d
8	Roundup WeatherMax	0.75	qts/A	80.0 a	72.7 a	99.0 a	30.0 d
9	Roundup WeatherMax	1.0	qts/A	83.0 a	73.3 a	99.0 a	36.7 bcd
10	Roundup WeatherMax	1.25	qts/A	85.7 a	78.3 a	99.0 a	31.7 cd
11	Roundup WeatherMax	1.5	qts/A	84.7 a	80.0 a	99.0 a	43.3 abc
12	Roundup WeatherMax	0.75	qts/A	87.3 a	79.3 a	99.0 a	36.7 bcd
	Ammonium sulfate	4	lb/A				
LSD (P=.05)				13.62	19.61	4.21	11.71
Standard deviation				8.00	11.02	2.47	6.58
CV				9.89	14.04	2.88	17.51
Treatment F				1.376	1.007	131.122	3.208
Treatment prob(F)				0.2602	0.4883	0.0001	0.0299

Table 2. Influence of time of day during drought conditions versus non-stressed conditions for performance of a contact and translocated herbicides.

Weed code				AMBEL	IPOSPP	XANST
Weed name				Common	Mornglry	Common
Weed name				Ragweed	Species	Cocklebur
Rating data type				Control	Control	Control
Rating unit				%	%	%
Rating interval				3 WAT	3 WAT	3 WAT
Trt no. Treatment name	Rate	Rate unit	Grow stage			
1 Untreated check				0.0	0.0	0.0
2 Ultra Blazer	1.5	pt/A	AM	46.7 d	26.7 a	29.6 b
Nonionic surfactant	0.25	% v/v	AM			
3 Ultra Blazer	1.5	pt/A	PM	63.3 c	25.0 a	34.7 b
Nonionic surfactant	0.25	% v/v	PM			
4 Ultra Blazer	1.5	pt/A	PO-Rain	76.7 b	70.0 a	24.7 b
Nonionic surfactant	0.25	% v/v	PO-Rain			
5 Roundup WeatherMax	0.75	qt/A	AM	94.7 a	20.0 a	98.8 a
6 Roundup WeatherMax	0.75	qt/A	PM	98.3 a	30.0 a	99.0 a
7 Roundup WeatherMax	0.75	qt/A	PO-Rain	99.0 a	50.0 a	99.0 a
LSD (P=.05)				11.75	32.89	10.56
Standard deviation				6.46	17.03	5.28
CV				8.1	46.1	8.22
Treatment F				33.247	3.820	155.688
Treatment prob(F)				0.0001	0.0547	0.0001

CURLY DOCK AND DANDELION CONTROL IN ALFALFA. S.R. King and E.S. Hagood, Jr., Virginia Tech, Blacksburg.

ABSTRACT

In 2004, experiments were conducted to determine the effect of a range of thifensulfuron-methyl rates applied in dormant alfalfa for the control of winter annual and biennial weeds, such as dandelion (*Taraxacum officinale*) and curly dock (*Rumex crispus*). Thifensulfuron-methyl was applied at five rates ranging from 0.014 to 0.095 lb ai/A. These treatments were compared to standard rates of other currently registered alfalfa herbicides including: imazethapyr, imazamox, metribuzin, terbacil, and paraquat. Two dormant treatment timings were evaluated. Experiments were designed as randomized complete blocks with a factorial arrangement of treatments with four replications. Factors within the factorial design included herbicide treatment and application timing. One-way ANOVA was used to evaluate within the early dormant application timing for the first rating period, because late-dormant treatments were not yet applied. Early dormant treatments of thifensulfuron-methyl controlled curly dock greater than 80% in late-March, and there was no difference in curly dock control among thifensulfuron-methyl rates. In May, curly dock control with all rates of thifensulfuron-methyl applied at either dormant timing was 90% or greater, with the exception of the early-dormant timing of thifensulfuron-methyl applied at 0.023 lb ai/A which controlled dock only 88%. All early-dormant thifensulfuron-methyl treatments controlled curly dock in May greater than the other herbicides evaluated at the early-dormant treatment timing. However, dandelion control in May was less than 20% with either application timing of thifensulfuron-methyl. Curly dock control with imazethapyr and imazamox was less than 80% in May. Imazethapyr and imazamox controlled dandelion 88 and 90% at the first rating timing, respectively. In May, greater dandelion control with imazamox occurred when comparing between application timings. Imazamox resulted in 85 and 97% control of dandelion in May with the early and late dormant treatment timings, respectively. Metribuzin, terbacil, and paraquat, regardless of treatment timing resulted in 60% or less control of curly dock and dandelion in May. Paraquat applied at the late dormant timing resulted in 14% alfalfa injury. All other treatments, regardless of treatment timing, did not cause alfalfa injury. Preliminary results of this experiment indicate that thifensulfuron-methyl is a safe and efficacious treatment for the control of curly dock in alfalfa. Control of dandelion, however, is more appropriate with other registered compounds such as imazethapyr or imazamox.

INFLUENCE OF PLANT RESIDUE AND RYE COVER CROP ON HORSEWEED EMERGENCE AND DEVELOPMENT. B.A. Scott and M.J. VanGessel, Univ. Delaware, Georgetown.

ABSTRACT

In order to make more effective glyphosate-resistant horseweed (*Conyza canadensis*) management decisions, it is important to determine what ecological factors impact spring and fall germination and winter survival. Two studies were established at two locations in DE to determine the influence of plant residue and a rye (*Secale cereale*) cover crop on horseweed emergence and development. All sites were no-till and non-irrigated and the studies were conducted for two years.

The rye cover study examined seeding rate and nitrogen rate, as a two-factor factorial, with four replications arranged as a randomized complete design. Rye seeding rates were 0, 33, 65, and 130 kg/ha with spring-applied nitrogen rates of 0 or 33 kg/ha. Emerged horseweed plants were counted in a $0.5m^2$ area and average size was noted on a monthly basis starting one month after rye planting. Horseweed biomass, average height and number of leaves were collected in June.

Horseweed dry weights were significantly higher with no rye, regardless of nitrogen application, at 3 out of 4 locations. At these locations, the presence of rye cover regardless of seeding rate reduced horseweed biomass by 84 to 100%. The fourth location had minimal horseweed emergence and resulted in no significant differences between the treatments. In 3 out of 4 studies, the presence of rye cover crop significantly decreased horseweed densities by a minimum of 62% compared to no rye treatment.

The plant residue study was a randomized complete block design with four replications. Plant residue treatments consisted of corn, soybean, weed, and wheat straw at high and low yielding levels; low levels of corn residue plus high weed residues; and bare-ground. Prior to trial initiation each site was sprayed with paraquat to eliminate emerged horseweed seedlings and cleared of previous crop residue if necessary. Horseweed biomass, average height and number of leaves were taken in June.

Studies in 2003 showed no significant differences in treatment. Results from the 2004 residue studies varied by location, however in general, there was an increase in horseweed biomass with all three corn treatments and both soybean treatments as compared to all other treatments. These five treatments resulted in a 67% or greater increase in horseweed biomass. A trend was observed where percentage of winter annual ground cover was higher in treatments with lower residue density (weed alone, straw, and no residue). In order to determine whether consistencies exist, these studies will be repeated in 2005.

AGRICULTURE AND FOREST MOSAIC EFFECTS ON EPIGEAL COLEOPTERAN ASSEMBLAGES. T. Leslie, A. Hulting, J. Kozak, S. Fleischer, and D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

One of the goals in the development of sustainable cropping systems is to reduce reliance on traditional inputs for pest management, thereby increasing the importance of cultural methods and biological controls for pest management. Recent evidence suggests that the activity of some seed feeding ground beetles may impact the population dynamics of several important agricultural weeds. However, little is known about the influence of landscape heterogeneity and crop management practices on these epigeal coleopteran species assemblages. The objective of this study was to characterize these species assemblages across different habitats and cropping system management types.

We quantified plant community characteristics and the activity/density of the epigeal coleopteran taxon over three habitat types/cropping systems at the Russell E. Larson Agricultural Experiment Station in Rock Springs, PA during the summer and early fall of 2004. These environments were a forest edge (FE), conventionally managed field corn (CC) located adjacent to the FE, and a nearby (~ 0.25 km) organically managed fields planted to small grain (Rye) or forage (Red Clover/Timothy). Pitfall trapping methods were used to quantify the activity/density of epigeal coleopteran in each of the environments and samples were collected on four dates. On each sampling date the pitfall traps were open for a total of 72 hrs.

The plant community characteristics varied greatly between cropping systems and environments. Plant species diversity was greatest in the FE and the organic cropping systems compared to the CC system. The percent canopy cover was highest in the CC, but this system also had the lowest percentage of litter cover on the soil surface of any of the environments. The Rye also had high canopy cover and low litter cover. The FE habitat had the highest percentage of soil surface litter cover followed by the Red Clover/Timothy mix.

Epigeal coleopteran abundance and diversity varied between these habitats. The organic systems contained the highest measures of coleopteran abundance (μ = 7.3 beetles / trap / 72 hours) and diversity (μ = 25.3 species caught / 72 hours) while abundance was lowest in the FE (μ = 2.3 beetles / trap / 72 hours) and diversity was lowest in the CC (μ = 16.7 species caught / 72 hours). The most abundant weed seed predator, *Harpalus pensylvanicus*, was found equally in CC and the organic systems. Staphylinidae were ubiquitous and numerous in all systems. Excluding Staphylinidae, a small number of species tended to represent a large proportion of total abundance in the CC while abundance was distributed more evenly in the FE and organic systems. *Agonum* spp. was the most abundant taxon in the organic systems.

The different habitat types and cropping systems exhibited a range of epigeal coleopteran species assemblages in this study. The systems with increased plant diversity and ground-level cover attracted a much more diverse assemblage of beetles. These data support other findings that suggest diverse plant communities within agroecosystems may serve as refuges for groups of insect species that may have potential to supplement conservation biological control efforts.

COVER CROP MANAGEMENT IMPACTS ON THE WEED SEED PREDATOR, *HARPALUS RUFIPES*. A. Shearin, S.C. Reberg-Horton, E. Gallandt, and F. Drummond, Univ. Maine, Orono.

ABSTRACT

Generalist seed predators, such as rodents and certain carabid beetles, may lead to a significant reduction in the weed seedbank. In Maine, one ground beetle species in particular, *Harpalus rufipes*, accounts for up to 78.5% of all invertebrate species in agricultural systems. *H. rufipes* is a denizen of disturbed habitats and is capable of consuming up to 90% of the epigeous seeds of certain weed species. The mechanism by which *H. rufipes* can be promoted in agricultural settings is not well understood. Two weed management techniques used widely by diversified vegetable growers in Maine (cover cropping and cultivation) were evaluated for their impact on *H. rufipes* in-field movement and abundance. A study was initiated during the summer of 2004 to determine the impacts of cover cropping on *H. rufipes*. *H. rufipes* individuals (n=200 plot^{-1}) were marked with paint and released into 180 m^2 plots that were either fallow (0% vegetative cover) or cover cropped (100% cover, oat/pea mixture). Pitfall traps were installed in each plot to recapture marked beetles. The recapture rate in fallow plots was 46% less than in cover crop plots. Furthermore, immigration rates of fallow beetles into cover crop plots were 48% higher than immigration of cover crop beetles into fallow plots. The presence of vegetation appears to prevent outmigration and encourage immigration of *H. rufipes*. A second study was conducted to evaluate the impacts of tillage on *H. rufipes*. Beetles (n=25 plot^{-1}) were marked and released into 9 m^2 plots surrounded entirely by 3 m rain gutters. Half of the plots were then tilled with a tractor-mounted rotovator to a depth of 15 cm while the others were left undisturbed. There was no significant difference between beetle recapture rates in tilled (32%) versus untilled (35%) plots, suggesting beetles are capable of surviving even intensive tillage events. Variation in the number of *H. rufipes* across farming systems may not be due to tillage, as widely postulated in literature, but is instead a product of vegetative cover. Further research into the impacts of weed management on other life stages of *H. rufipes* is needed before firm conclusions can be reached.

ALTERNATIVE ACID SCARIFICATION METHODS FOR IMPROVING WEED SEED GERMINATION. L.F. Houck, III and M.C. McComrick, E.I. DuPont Nemours, Newark, DE.

ABSTRACT

Concentrated sulfuric acid has been shown be an effective solution for scarifying seeds for improved germination. However, concentrated mineral acids can dissolve delicate seed coats rapidly and working with a concentrated acid requires prudent safety measures in order to avoid personal injury and environmental damage. Studies were conducted in 2004 at the Stine-Haskell Research Center to determine if the germination of common mallow (*Malva neglecta* Wallr.), prickly sida (*Sida spinosa* L.), commelina (*Commelina coelestis* Willd.), common groundsel (*Senecio vulgaris* L.), and guineagrass (*Panicum maximum* Jacq.) seed could be enhanced with naturally derived organic acid solutions like lime juice (pH 2.6), lemon juice (pH 2.7), vinegar (pH 3.3), and apple cider (pH 3.9). Improved germination of guineagrass was noted with seeds soaked 15 to 60 minutes in lime juice, lemon juice, and vinegar. However, percent germination of guineagrass never exceeded 20% with any treatment. Germination of other weed species was more erratic and appeared to be impacted less by various acid solutions.

CORN AND SOYBEAN RESPONSES TO BASAL APPLICATIONS OF VINEGAR. C.B. Coffman, J. Radhakrishnan, and J.R. Teasdale, USDA-ARS, Beltsville, MD.

ABSTRACT

Vinegar applications for in-row weed management in sweet corn *(Zea mays)* and vegetable soybean *(Glycine max)* in organic production systems have been investigated for several years at the Beltsville Agricultural Research Center and on an organic farm in Frederick County, Maryland. The effectiveness of 20% acetic acid vinegar for weed control has been reported at several previous conferences. Field studies in 2003 resulted in no visual differences between sweet corn and vegetable soybean plants treated with 20% vinegar and untreated control plants. However, yield of shelled soybean grain was less for vinegar treatments than for untreated controls. The objectives of our investigation in 2004 were to assess the tolerance of sweet corn and vegetable soybean plants to basal applications of 20% vinegar and to characterize weed responses to vinegar applications. Sweet corn was sown in 30 inch rows on 14 May, 2004, 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 6 weeks after sowing (WAS), and to the second group 9 WAS. Treatments consisted of 20% vinegar applications to the basal area of the corn plants in the center row to affect complete coverage to runoff of the within-row weeds, plus untreated controls, and were replicated 6 times. Weed flora was dominated by smooth pigweed (*Amaranthus hybridus*) in both groups. Visual injury ratings were on a scale of 0 to 100, where 0 = no effect of the vinegar and 100 = plant death, and were made 2 weeks after treatment (WAT) for both groups. Vegetable soybean was sown in 36-inch rows in a clean-cultivated field on an organic farm near Buckeystown, MD, on 12 May, 2004, 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 treated with vinegar 7 WAS. All treatments were replicated 6 times. Treatments were visually rated 6 WAT. Weed flora was dominated by redroot pigweed (*Amaranthus retroflexus*), giant foxtail (*Setaria faberi*), and field bindweed *(Convolvulus arvensis).*

Injury scores for sweet corn and vegetable soybean exposed to vinegar treatments ranged from 0 to 5, and did not differ from untreated controls. Corn plants treated 6 WAS produced 3% more biomass than untreated controls, and fresh ear weights were 7% higher. However corn treated 9 WAS produced 16 and 12% less biomass and fresh ear weights, respectively, than the untreated controls. Soybean biomass was the same for treated and untreated plants, but pod counts and pod yields were 1 and 3% higher, respectively, for untreated controls than treated plants. Mean visual weed cover ratings for corn treated with vinegar 6 and 9 WAS were 40 and 61%, respectively, whereas weed cover ratings in the corresponding untreated controls were 90 and 92%, respectively. There were no visual differences in weed cover between vinegar treated and untreated soybean due to timely cultivations and soybean canopy effect on weed growth.

EARLY DETECTION AND IMPROVING APHIS CAPACITY FOR EMERGENCY RESPONSE TO INVASIVE PLANTS. A.V. Tasker, USDA, APHIS, Riverdale, MD.

ABSTRACT

Some exotic plant pests leave immediate evidence of their presence. Signs of disease, crop damage, or weed growth may appear almost instantly. Other types of foreign pests, as well as seeds or other propagules, however, may go undetected for months or even years in the absence of proper surveillance. Without early detection, these insidious pests can become established in the United States and permanently damage agriculture and natural resources. The member Agencies of FICMNEW (Federal Interagency Committee for the Management of Noxious and Exotic Weeds) have been engaged in development of an Early Detection and Rapid Response (EDRR) plan to expand the national capacity to detect and respond to invasive plant infestations. The U.S. Department of Agriculture's (USDA), Animal and Plant Inspection Service is planning or expanding numerous programs to improve rapid response. These include the APHIS/WSSA weed Listing project, an APHIS Incident Command System, Department of Homeland Security liaison mechanisms, and a new Offshore detection program. These programs will be integrated with other new rapid response programs from other State and Federal Agencies.

UPDATED IMPACTS ON US AGRICULTURE OF BIOTECHNOLOGY-DERIVED HERBICIDE-RESISTANT CROPS PLANTED IN 2003. S. Sankula, National Center for Food and Ag Policy, Washington, DC.

ABSTRACT

Crops developed through biotechnology methods continue to be planted on more acres and continue to deliver more tangible impacts in the United States. In 2002, the National Center for Food and Agricultural Policy assembled a comprehensive report, "Plant Biotechnology: Current and Potential Impact for Improving Pest Management in U.S. Agriculture." The study documented higher yields, higher farm incomes, and reduced pesticide use due to extensive adoption of biotechnology-derived herbicide-tolerant crops in 2001. An update to this study using 2003 acreage and production information found that the positive impacts continued to increase as 14 million more acres were planted to herbicide-tolerant crops in 2003.

Similar to 2001, American growers planted four herbicide-tolerant crops in 2003. They include canola (*Brassica napus* L.), corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), and soybean (*Glycine max* L.). While soybean has been the most predominantly planted herbicide-tolerant crop (82%), corn has been adopted at a slightly slower pace (14%).

Case studies of these 4 biotechnology-derived varieties showed that they saved growers $1.5 billion by lowering production costs and reduced pesticide use by 39.2 million pounds. Based on reduced production costs, growers realized a net economic impact or savings of $1.5 billion. Compared with 2001, that represented a 51 percent greater reduction in production costs and economic returns in 2003.

Conservation tillage practices, no-till in particular, have increased significantly since the adoption of biotechnology-derived herbicide-tolerant crops. Herbicide-tolerant crops increased growers' confidence in their ability to control weeds without relying on tillage because herbicides used in biotechnology-derived crops are more effective than those used before. With that increased confidence, American growers planted 45, 14, and 300 percent more acres to no-till in soybean, corn, and cotton, respectively, in 2003, compared with years before their introduction.

Economic advantage to growers is the ultimate key factor that determines the adoption and success of biotechnology-derived crops. This study found that American growers planted 80 million acres with biotechnology-derived herbicide-tolerant crops in 2003 because improved weed control at lower cost improved their bottom lines.

FACTORS INFLUENCING RIGID RYEGRASS FITNESS. J. Izquierdo, Polytechnic Univ. Catalonia, Barcelona, Spain, C. Fernandez-Quintanilla, Center Environmental Sci., Madrid, Spain, and D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

Rigid ryegrass, *Lolium rigidum*, is a widespread and troublesome weed in the cereal fields of the Mediterranean region. With an increasing interest in site-specific management, farmers and researchers alike are assessing where and when such practices are effective and economical. Because of the importance of *L. rigidum* in cereals, work is underway to characterize its distribution and determine the extent to which site characteristics and the crop influence its success.

In order to study the effects of soil properties and crop on *L. rigidum* fitness, two experiments were conducted at Calaf (2002/03) and at Moia (2003/04), in the North East of Spain. Specifically, end of season biomass and reproductive fitness were assessed in three landscape positions, upper, medium and lower, in each field. At each landscape position *L. rigidum* was grown in monoculture and in mixed culture (*L. rigidum* + barley) in a naturally infested commercial barley field. Plots of 2.25 by 3.25 m^2 were replicated four times at each landscape position. Reproductive components and plant biomass and density were recorded for *L. rigidum* and plant density and biomass for barley at crop maturity in 0.5 by 0.5 m^2 quadrats. Soil cores were taken at each landscape position to characterize the soil. Data were analyzed using ANOVA.

When grown alone, *L. rigidum* biomass, number of spikes per plant and number of seeds per spike were greatest in the upper landscape position in both locations. While this larger biomass per plant resulted in higher seed production per unit area at Moia, no difference in seed production per unit area was observed at Calaf across landscape positions because of a lower seedling density.

Crop competition resulted in significant reductions in *L. rigidum* biomass at the upper landscape position at Calaf (81%) and in all positions at Moia (average of 56%). Pooled across landscape position, crop competition significantly reduced seeds per spike at both locations (26% at Calaf, 37% at Moia) and number of spikes per plant at Moia (68%). Crop competition also significantly reduced weed seed production at Moia (81%) but no effect was observed at Calaf. Generally, *L. rigidum* monoculture biomass and seed production was highest when the corresponding N, P, K and OM were also high. However, in mixture the relative competitive ability of barley was greater than *L. rigidum* resulting in significant suppression of *L. rigidum* at these same sites.

These findings indicate that *L. rigidum* growth and reproductive fitness in both locations were mostly driven by the resident seed bank and crop effect, rather than the landscape position by itself. An increase of the soil fertility will promote plant growth and will benefit the weed or the crop depending on their relative abundance. Good management practices leading to an increase of the crop fitness will decrease the weed seed bank at the long term and thus the density of the emerging weeds.

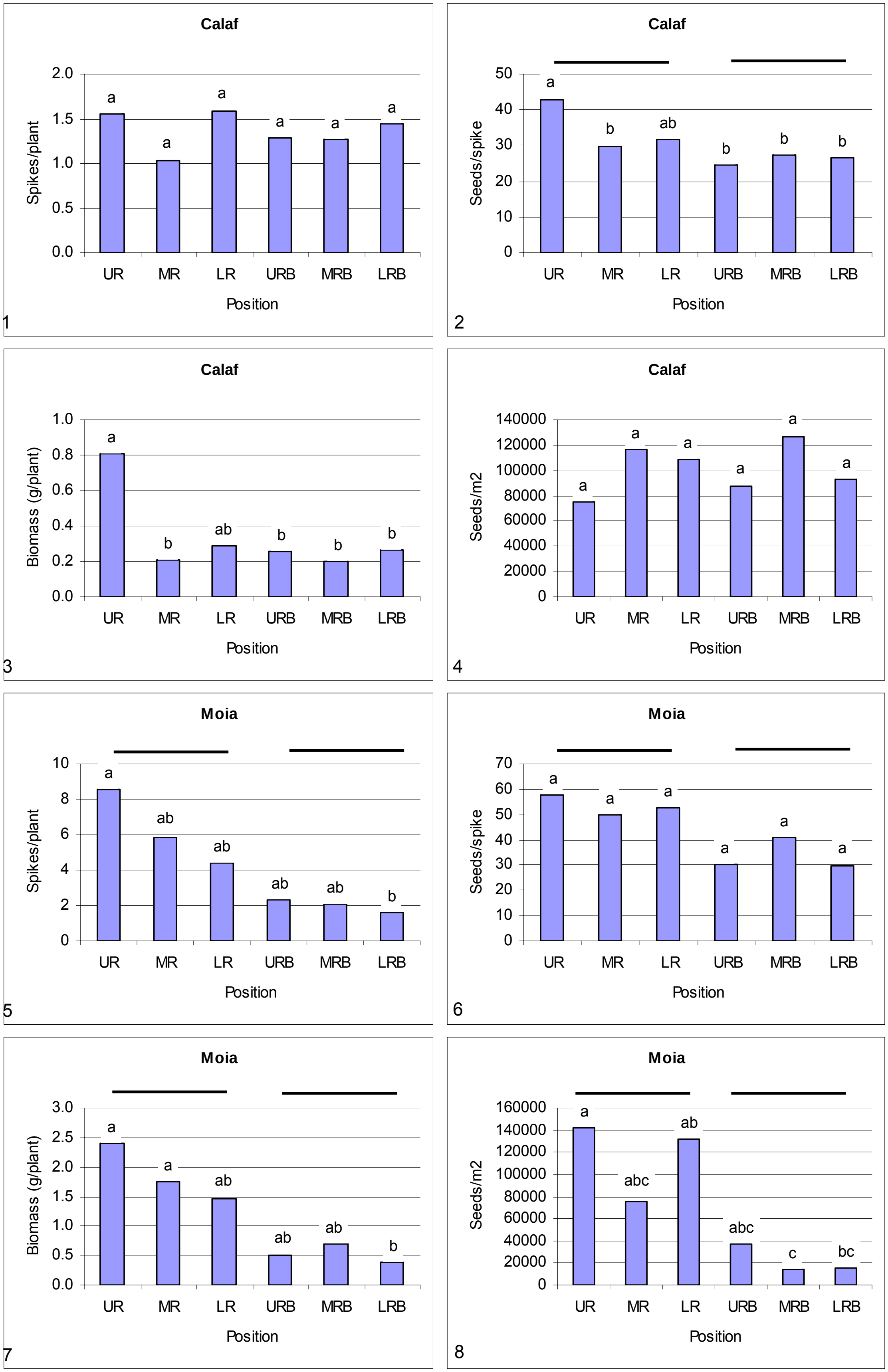


Figure 1. Effects of position (U: upper; M: medium; L: lower) and crop presence (R: monoculture, *L. rigidum*; RB: mixed, *L. rigidum* + barley) on *L. rigidum* fitness at Calaf and Moia. Bars with the same letter are not significantly different. Pooled R bars with line are significantly different from pooled RB bars.

ANNUAL BLUEGRASS CONTROL AND MORE. J.A. Borger and T.L. Watschke, Penn State Univ., University Park.

ABSTRACT

This study was conducted on a mature stand of 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 the efficacy of plant growth regulators, fungicides, fertilizer, and biostimulants alone, or in combination, to reduce annual bluegrass and suppress dollar spot (*Sclerotinia homeocarpa*). This study was a randomized complete block design with three replications. Treatments were applied on June 2, June 9, June 14, June 21, June 30, July 7, July 15, September 7, and October 5, 2004 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 11004 nozzles at 40 psi. There was no visual evidence of dollar spot infection present in the test site at the time of the June 2 application. The test site was maintained similar to that of a golf course fairway with respect to irrigation, fertilization and mowing. Dollar spot was rated weekly starting on June 7, 2004 and concluding on August 3, 2004 (seven rating dates). Dollar spot infection steadily increased to 35 percent coverage in the untreated turfgrass until the August 3 rating date. Treated turfgrass varied with respect to the level of dollar spot occurrence. Turfgrass treated with any rate of Trimmit 2SC and Rubigan 1AS alone or in combination with an 18-3-4 fertilizer or MacroSorb Foliar had significantly lower percent dollar spot occurrence on the August 3 rating date. Turfgrass that was not different from the untreated was treated with: Velocity 80WP at 60 g ai/A applied once in June, Velocity 80 WP at 10 g ai/A plus Aquathol K 4.23L at 0.2 lb ai/M applied once in June, Velocity 80WP at 45 g ai/A plus MacroSorb Foliar at 2 oz/M applied once in June, Velocity 80WP at 60 g ai/A plus 18-3-4 fertilizer at 0.2 lb N/M applied once in June, and Velocity 80WP at 60 g ai/A plus MacroSorb Foliar at 2 oz/M applied once in June. Preliminary results (data collected on September 29, 2004) for annual bluegrass reduction revealed that ten treatments that had significantly less annual bluegrass than untreated turfgrass. These treatments included: Velocity 80WP at 30 g ai/A applied twice in June, Velocity 80WP at 10 g ai/A applied six times, weekly starting in June, Velocity 80WP at 60 g ai/A applied twice in June, Trimmit 2SC at 0.66 lb ai/A alone or combined with an 18 – 3 – 4 fertilizer at 0.2 lb N/M applied in June and September, Trimmit 2SC at 0.66 lb ai/A or at 0.4 lb ai/A applied in June and September combined with applications of Rubigan 1AS at 0.75 oz/M applied in twice in June, once in July, and September, Trimmit 2SC at 0.4 lb ai/A applied twice in June, once in July and September alone or combined with an 18-3-4 fertilizer at 0.02 lb N/M, and Trimmit 2SC at 0.4 lb ai/A applied twice in June, once in July and September combined with an 18-3-4 fertilizer at 0.02 lb N/M and Rubigan 1AS at 0.75 oz/M.

POSTEMERGENCE CONTROL OF ANNUAL BLUEGRASS IN KENTUCKY BLUEGRASS. S.E. Hart and D.W. Lycan, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Field experiments were conducted in 2002 and 2003 in Adelphia, NJ to evaluate fall and spring applications of bispyribac, sulfosulfuron, and primisulfuron for postemergence control of annual bluegrass in Kentucky bluegrass. Studies were initiated on Oct. 2, 2002, May 30, 2003, Sept. 25, 2003, and June 1, 2004. Sequential applications were made 30 to 40 days after initial application. Primisulfuron at 45 g/ha and bispyribac at 148 g/ha were the most effective fall treatments and plots treated with these herbicides had 16 and 13% annual bluegrass ground cover respectively, the following spring while the untreated had 42%. Both fall bispyribac treatments resulted in significant Kentucky bluegrass injury (25 to 39%) by late November and injury persisted into the following spring. In the spring studies, plots treated with primisulfuron at 45 g/ha and bispyribac at 111 and 148 g/ha had an average of 7, 7 and 4% annual bluegrass ground cover, respectively, while the untreated had 27% by mid-august. Bispyribac resulted in the greatest amount of Kentucky bluegrass injury (21 to 56%) among spring treatments. Sulfosulfuron, at 11 and 22 g/ha was safe to use on Kentucky bluegrass but provided minimal control of annual bluegrass. These studies suggest that, while bispyribac can substantially reduce populations of annual bluegrass in Kentucky bluegrass, there is risk of unacceptable injury in the fall or spring. However, primisulfuron has the potential to consistently reduce annual bluegrass populations without significant injury to Kentucky bluegrass.

THE INFLUENCE TEMPERATURE HAS ON POA ANNUA CONTROL WITH BISPYRIBAC-SODIUM. J.C. Fausey, Valent USA Corp., Lansing, MI.

ABSTRACT

Managing *Poa annua* is a dilemma sod producers and golf course superintendents face. *Poa annua* is a genetically 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 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, Bispyribac-sodium, has been evaluated in creeping bentgrass and consistently displayed selectivity against *Poa annua* without disrupting creeping bentgrass growth. Valent U.S.A. Corporation is developing bispyribac-sodium, the active ingredient in Velocity herbicide, for use in sod farms and golf courses. Velocity herbicide has shown safety to cool season turfgrass and provides postemergence control of several aggressive weeds including *Poa annua* and *Poa trivialis*. Experiments were conducted throughout the United States the past five years evaluating the potential for using Velocity herbicide on actively growing creeping bentgrass. The objective of these trials was to evaluate the performance of Velocity herbicide when applied under different environmental conditions to determine the potential for this herbicide in the turfgrass market. In addition to evaluating Velocity herbicide at several locations, treatments included evaluation of different rates, timings and application intervals. Data from these trials confirmed Velocity herbicide provides a *Poa annua* management strategy for sod producers and golf course superintendents.

CONTROL OF KENTUCKY BLUEGRASS WITH POSTEMERGENCE HERBICIDES: A REGIONAL STUDY. P. McCullough, S. Hart, Rutgers Univ., New Brunswick, NJ; Z. Reicher, Purdue Univ., West Lafayette, IN; S. Askew, Virginia Tech, Blacksburg; P. Dernoeden, Univ. Maryland, College Park; and D. Weisenberger, Purdue Univ., West Lafayette, IN.

ABSTRACT

The introduction of herbicide resistant turfgrass warrants information regarding selective postemergence control of common turfgrass species. Field experiments were conducted in New Jersey, Indiana, Virginia, and Maryland in 2004 to evaluate the response of Kentucky bluegrass to postemergence herbicides. Herbicides tested included glyphosate, glufosinate, fluaziflop, clethodim, sethoxydim, foramsulfuron, trifloxysulfuron, and rimsulfuron. Initial applications were made in late July or early August with repeated applications after one month. Single applications of glyphosate and glufosinate at 1.5 and 1 lb ai/A, respectively, provided 100% control two to four weeks after initial treatments. Foramsulfuron, trifloxysulfuron, and rimsulfuron applied at 0.03 lb ai/A generally required two applications to provide complete bluegrass control. Single applications of fluaziflop at 0.38 lb ai/A provided minimal bluegrass reductions but repeated applications gave 65 to 100% control after 8 weeks. Single applications of clethodim and sethoxydim at 0.25 and 0.47 lb ai/A, respectively, had inconsistent results over the four locations but repeated applications gave 60 to 100% bluegrass control after 8 weeks. Results suggest glyphosate and glufosinate effectively control Kentucky bluegrass with single applications while other postemergence herbicides have variable control and may require repeated applications.

ROUGH STALK BLUEGRASS CONTROL IN CREEPING BENTGRASS WITH MON 44951 75WDG IN MIDWEST AND NORTHEAST U.S. D.C. Riego, D.H. Williamson, and J.C. Graham, Monsanto Co., Carmel, IN.

ABSTRACT

The chemical name for MON 44951 is sulfosulfuron. It belongs to the sulfonylurea urea class of herbicide chemistry, and works in the plants as an ALS or acetolactate syntase inhibitor of amino acids needed for plant growth. MON 44951, formulated as 75% water dispersable granule, is absorbed both by plant roots and shoots, and hence provides both pre- and postemergence weed control activity. Weed control symptomology is very slow - weed growth stops immediately after application, followed by growing points and leaves turning purple, and then followed by browning and desiccation of plant tissues. The process takes about 3-4 weeks.

Poa trivialis or roughstalk bluegrass has become a serious weed problem in golf course tees, fairways, roughs, in athletic fields, and in sod production fields. *Poa trivialis* infestation in golf courses and athletic fields results in unsightly look and poor turf quality. The weed alters mowing and irrigation schedule due to its aggressive and prolific growth habit. It does not mow well and does not respond to turf plant growth regulators (PGR) hence requiring a need to mow more frequently. It encroaches and dominates creeping bentgrass, browns in the summer resulting in very poor golf course turf quality. There is no current herbicide solution to control *Poa trivialis*. In sod production field, *Poa trivialis* infestation causes significant loss of quality and value of sod.

Various formulations of MON 44951 have been evaluated for *Poa trivialis* control as early as 1999 in various university trials. Results indicate that single to sequential application of MON 44951 at 0.01 lb ai/A + 0.25% v/v non-ionic surfactant applied in 20-40 GPA provides *Poa trivialis* control. It is not clear how much of the control can be attributed to either pre- or postemergence activity. In 2004, MON 44951 was evaluated in large plot trials under commercial use and end-user conditions using a federally approved label in various golf course fairways in the Midwest and Northeast US. Excellent *Poa trivialis* control was obtained from single or sequential treatments of MON 44951. Slight to pronounced discoloration of creeping bentgrass, in the form of yellowing or browning, was observed around 7-10 days after application, stayed approximately 7-14 days, and then the turf fully recovered. Discoloration is a typical effect of sulfonylurea products, and may also be due to heavy clay soil, to cool temperatures, and excessive moisture after application. Open areas also resulted due to *Poa trivialis* control of largely infested areas treated. Management of these areas could require overseeding or sodding in some cases.

MON 44951 will be commercialized under the trade name *Certainty*® herbicide. MON 44951 has shown excellent potential to control or manage *Poa trivialis* weed problem in golf courses, athletic, and sod production fields.

BERMUDAGRASS CONTROL WITH MESOTRIONE AND POTENTIAL SYNERGISTS.

J.B. Willis, D.B. Ricker, S.D. Askew, Virginia Tech, Blacksburg; and R.J. Keese, Syngenta professional Products, Carmel, IN.

ABSTRACT

In the transition zone, bermudagrass (*Cynodon dactylon* (L.) Pers.) is often grown in close proximity to Kentucky bluegrass (*Poa pratensis* L.) and perennial ryegrass (*Lolium perenne* L.). Inevitably, bermudagrass often becomes an invasive weed in neighboring cool-season grasses. Common bermudagrass is also a naturalized weed that is abundant in this area. Lack of selective herbicides makes it difficult to suppress or control this aggressive perennial weed in cool-season grasses. Field studies were conducted in Blacksburg, VA to evaluate several herbicides for selective bermudagrass control or suppression in Kentucky bluegrass and perennial ryegrass. Our objectives were to determine methods to suppress or selectively control bermudagrass without injuring cool-season turf and to investigate methods to increase effectiveness of mesotrione for bermudagrass control.

Treatments were applied at 280 L/ha and included the following: ethofumesate at 1.68 kg ai/ha, flurprimidol at 0.84 kg ai/ha, ethofumesate + flurprimidol, siduron at 13.44 kg ai/ha, fenoxaprop at 0.04, 0.06, and 0.08 kg ai/ha, fluazifop at 0.04, 0.07, and 0.1 kg ai/ha, mesotrione at 0.28 kg ai/ha, isoxaflutole at 0.28 kg ai/ha, triclopyr at 1.1 kg ai/ha, fenoxaprop at 0.06 kg/ha + ethofumesate, and fenoxaprop at 0.06 kg/ha + flurprimidol. Bermudagrass was green and growing when treated. In Kentucky bluegrass, the two higher rates of fenoxaprop, fenoxaprop + triclopyr, all rates of fluazifop, and isoxaflutole controlled bermudagrass greater than 90% at 18 weeks after initial treatment (WAIT). Ethofumesate + flurprimidol and the two higher rates of fluazifop caused unacceptable injury to Kentucky bluegrass. These studies concluded that mesotrione controlled bermudagrass greater than 80% 18 WAIT without significantly injuring Kentucky bluegrass or perennial ryegrass.

In an attempt to increase efficacy of mesotrione for bermudagrass control, another trial was conducted to determine any possible synergistic effects that carfentrazone and siduron could have on control of bermudagrass with mesotrione. This study compared mesotrione rates (0.11 and 0.22 kg ai/ha), intervals of application (1 and 2 week intervals) over a 6-week period, and tank mixes of potential synergist (none, siduron at 6.72 kg ai/ha, or carfentrazone at 0.03 kg ai/ha). While treatments applied weekly controlled bermudagrass greater than 70%, there was unacceptable injury to Kentucky bluegrass. Tank mixtures with siduron and carfentrazone did improve bermudagrass control by mesotrione. However, as bermudagrass control increased Kentucky bluegrass injury typically increased. Severe injury to Kentucky bluegrass caused a cover reduction of greater than 60% in several cases. Our data suggests that although bermudagrass control can be improved or quickened by mixing siduron or carfentrazone with mesotrione, such mixtures are not viable treatments where Kentucky bluegrass injury is unacceptable.

FORAMSULFURON FOR OVERSEEDED PERENNIAL RYEGRASS TO BERMUDAGRASS TRANSITION IN OPTIMAL AND SUBOPTIMAL ENVIRONMENTS.
D.B. Ricker, J.B. Willis, S.D. Askew, Virginia Tech, Blacksburg; and D.R. Spak, Bayer CropScience.

ABSTRACT

In northern climates, bermudagrass (*Cynodon dactylon* (L.) Pers.) often succumbs to cold temperatures during winter. When overseeded with perennial ryegrass (*Lolium perenne* L.), effects of perennial ryegrass competition combined with winter decline can diminish bermudagrass density over time. These effects are especially evident in areas of bermudagrass growing in suboptimal environments such as shaded or poorly drained sites. Thus, chemical transition of bermudagrass is paramount in these environments. Studies on transition of overseeded bermudagrass in different growing conditions have not been previously reported. A two-year field study was conducted in 2003 and 2004 to determine the value of chemical transition with foramsulfuron (Revolver ™) and characterize expected conditions when transitioning different areas of golf course fairways.

Field experiments were conducted as randomized complete block designs with a 2 x 2 factorial arrangement of foramsulfuron rates and application timings and four replications. Each study was conducted on adjacent sides of a 'Vamont' bermudagrass fairway at Goodyear Golf Club in Danville, Virginia. Foramsulfuron was applied at 0.13 and 0.026 lb ai/A in early May and middle June each year. The trial area was overseeded with perennial ryegrass in the fall and applications were made the following spring each year.

"Weak" stands, areas on a fairway that are thin in bermudagrass cover and are located under shade, and "strong" stands, areas located in full sun and thick in bermudagrass cover, were the two turf conditions tested on the fairway. Results indicated that foramsulfuron applied rate influenced perennial ryegrass control on "weak" stands of bermudagrass but not on "strong" stands. Reduced perennial ryegrass control forces 'Vamont' to compete with perennial ryegrass, thus limiting the growing season, growth habits, and overall health of bermudagrass. Bermudagrass reached 100% cover sooner when perennial ryegrass was treated in early May but reduced turfgrass quality resulted during the transition period. When treatments were applied in middle June, transition turf quality was improved but competition-free bermudagrass growing season was decreased. Data suggests that "stronger" stands of 'Vamont' bermudagrass can sustain a delay in foramsulfuron application without negative impact on midseason bermudagrass cover. "Weak" areas of bermudagrass have a better chance of recuperating from perennial ryegrass overseeding if treated early in the season but reduced transition aesthetics will result.

TOLERANCE OF KENTUCKY BLUEGRASS CULTIVARS TO BISPYRIBAC-SODIUM.

R.R. Shortell, S.A. Bonos, S.E. Hart, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Bispyribac-sodium is a newly emerging herbicide that can selectively control both *Poa annua* and *P. trivialis* in some cool-season turfgrass species. To date, bispyribac-sodium is locally labeled for use on creeping bentgrass (*Agrostis stolonifera* L.), however, there is evidence that bispyribac-sodium may have a broader utility. Kentucky bluegrass (*P. pratensis* L.) has exhibited unacceptable injury from applications of bispyribac-sodium however, these studies evaluated a limited number of cultivars. There are currently no herbicides that provide effective *Poa annua* control in Kentucky bluegrass. The objective of this study was to determine the effects of bispyribac-sodium herbicide on several diverse Kentucky bluegrass cultivars in both field and greenhouse experiments in order to determine if there is differential tolerance to bispyribac-sodium among Kentucky bluegrass cultivars. A greenhouse study consisting of 14 cultivars (America, Avalanche, Brooklawn, Baron, Cabernet, Gnome, Langara, Lakeshore, Livingston, Midnight, Moonshadow, P-105, RL 1, and Total Eclipse) was established in a randomized complete block design with 4 replications. Four bispyribac-sodium rates (0, 120, 240, and 480 g ai/A) were applied to 6wk old seedlings of Kentucky bluegrass grown in conetainers. Percent injury was evaluated at 21 and 28 DAT. Plants were harvested on day 28 and both fresh weights and dry weights were recorded. Bispyribac-sodium was also applied to a replicated mowed Kentucky bluegrass turf experiment established in the fall of 2001, consisting of 250 cultivars and selections. Two applications (60 and 90 g ai/A) were applied on June 9, 2004, and July 7, 2004, respectively. Percent injury was evaluated at 7, 14, 21, and 28 DAT. A wide range of injury levels to bispyribac-sodium treatments was observed among Kentucky bluegrass cultivars. Some cultivars, such as Lakeshore and Brooklawn, exhibited a high tolerance to bispyribac-sodium treatments and other cultivars, such as Baron and P-105, were completely killed. Cultivars replicated in both greenhouse and field experiments responded similarly to bispyribac-sodium in both environments. The dramatic differences between cultivars indicate that there may be some genetic resistance within the species. These results indicate that it may be possible to develop bispyribac-sodium tolerant Kentucky bluegrass cultivars through breeding. Blends of bispyribac-sodium tolerant Kentucky bluegrass cultivars could allow for the use of bispyribac-sodium for weed control with acceptable turfgrass safety.

POSTEMERGENCE CONTROL OF ANNUAL AND ROUGHSTALK BLUEGRASS IN CREEPING BENTGRASS WITH BISPYRIBAC. S.J. McDonald and P.H. Dernoeden, Univ. Maryland, College Park.

ABSTRACT

Annual bluegrass (*Poa annua* L.) and roughstalk bluegrass (*Poa. trivialis* L.) are problematic weeds for golf course managers. Creeping bentgrass (*Agrostis stolonifera* L.) is a desirable species for golf course fairways because it can be mowed low, has an aggressive horizontal growth habit, and exhibits improved disease resistance when compared to perennial ryegrass (*Lolium perenne L*.). Infestation of annual and roughstalk bluegrass in creeping bentgrass fairways can be damaging to overall turf quality and playability. The selective postemergence removal of these two *Poa* spp. from bentgrass fairways is greatly needed, and would be valued throughout the mid-Atlantic region. Velocity (bispyribac-sodium) is a new herbicide with potential for use on golf course turf. Two studies were conducted to assess the effectiveness and safety of Velocity on a stand of creeping bentgrass infested with *P. annua* and *P. trivialis.* In the first study, the establishment of *P. trivialis* occurred naturally in a golf course fairway seeded in 1998 to a 'Providence + SR1020' blend of creeping bentgrass. The effectiveness of Velocity 80WP for the control of *P. trivialis* was assessed using different timings and rates as follows: 2 applications on a 14 day interval at 30 and 45 gr. ai/A; 3 applications on a 14 day interval at 20 and 30 gr. ai/A; and 4 applications on a 14 day interval at 20 gr. ai/A. Plots were 5 ft by 5 ft and were arranged in a randomized complete block with four replications. In the second study, three 6-inch diameter *P. annua* plugs were planted into each 5 ft by 5 ft plot of established 'Southshore' creeping bentgrass. Because Velocity can elicit yellowing or chlorosis in bentgrass, two rates as described below were applied alone or tank-mixed with Lesco's Chelated Iron Plus Micronutrients (Fe +N; 6 fl oz/1000 ft^2) to determine if the Fe + N would mask the chlorosis. Treatments included: Velocity 80WP applied alone, three times on a 14 day interval at 20 or 45 g ai/A; and the same rates tank-mixed with Fe + N. Plots were arranged in a randomized complete block with three replications. Data were analyzed using SAS MIXED procedure and significantly different means were separated using Tukey's protected least significant difference test at $P<0.05$. Velocity, at all rates and timings evaluated, was effective in controlling both *P. annua* and *P. trivialis*. Velocity tank-mixed with Fe + N partially masked the discoloration elicited by Velocity. Bentgrass color, however, remained within an acceptable level in the Velocity-treated bentgrass turf throughout both studies. The Fe + N may have reduced the effectiveness of the lower rate of Velocity (20 g ai/A), because the reduction in *P. annua* (56 surviving plants/plot) was less than the same rate applied without Fe + N (7 surviving plants/plot); however, the difference was not significant. In both studies, injury to the creeping bentgrass was minimal and dissipated within 15 to 18 days.

LATERAL MOVEMENT OF SULFONYLUREAS IN A TURFGRASS SYSTEM. A.C. Hixson, L.S. Warren, and F.H. Yelverton, North Carolina State Univ., Raleigh.

ABSTRACT

Environmental fate and movement of pesticides used on golf courses, home lawns, and athletic fields is a critical issue facing the turfgrass industry. In the climatic transition zone where warm and cool-season grasses can be grown, herbicide decisions must be made carefully. Many herbicides, such as sulfonylureas are injurious to non-target cool-season grasses. Care must be taken when applying sulfonylurea herbicides to warm-season grasses neighboring cool-season grasses. Many sulfonylureas have proven to be effective on cool-season grass weeds, such as annual bluegrass (*Poa annua*), and many winter annual broadleaf weeds. Our objective was to determine the likelihood of sulfonylurea lateral movement in surface water when applied to warm-season turfgrass.

A field study was conducted on a sloped dormant bermudagrass (*Cynodon dactylon* (L.) Pers.) area adjacent to a golf course in Raleigh, NC. The experimental design was a randomized complete block with each treatment replicated four times. Herbicide treatments were trifloxysulfuron (Monument 75WG) at 17.35 g ai/ha and 29.45 g ai/ha, rimsulfuron (Tranxit GTA 25DF) at 35.06 g ai/ha, foramsulfuron (Revolver 0.19L) at 28.97 g ai/ha, metsulfuron (Manor 60WG) at 21.03 g ai/ha, pronamide (Kerb WSP 50WP) at 1.68 kg ai/ha, and an untreated check. Four 1.2 m wide strips of perennial ryegrass (*Lolium perenne* L.) were slit seeded on 26 Sept 2003, establishing alternating 1.2 m wide strips of perennial ryegrass and non-overseeded bermudagrass. Perennial ryegrass was chosen as an indicator species because it is known to be extremely susceptible to all herbicides used in this study. Treatments were applied on 16 Dec 2003 to dormant bermudagrass upslope from the actively growing perennial ryegrass. Two hr following application, 6.35 cm of water was applied to each plot to simulate a worst-case runoff scenario. One day after herbicide application (DAT), an additional 1.27 cm of water was applied to each plot. Weed species present included henbit (*Lamium amplexicaule* L.), Carolina geranium (*Geranium carolinianum* L.), white clover (*Trifolium repens* L.), and ivyleaf speedwell (*Veronica hederifolia* L.).

Metsulfuron provided 99-100% control of all weed species present and lateral movement was not detected. Trifloxysulfuron provided 100% control of all weed species present except for *Carolina geranium*, and at the higher application rate, moved 0.5 m into the perennial ryegrass causing 21% of the grass to be injured 65 DAT. Rimsulfuron and foramsulfuron provided excellent henbit control (±95%), but were not effective on any other weed species present. Very little lateral movement of rimsulfuron occurred, causing a maximum of 8% perennial ryegrass injury 65 DAT. Pronamide was 100% effective in controlling ivyleaf speedwell, and lacked activity on all other weeds present. Pronamide moved across the entire 1.2 m plot, causing 60, 77, and 78% injury to the perennial ryegrass at 65, 80, and 93 DAT, respectively.

In summary, pronamide is the most mobile of the herbicides evaluated, followed by trifloxysulfuron then rimsulfuron; foramsulfuron and metsulfuron did not cause noticeable injury to the perennial ryegrass buffer. Pronamide, trifloxysulfuron, and rimsulfuron are susceptible to lateral movement when intense rainfall events occur immediately following herbicide application. Results also indicate that perennial ryegrass injury symptoms may take up to 2 months (65 DAT) to become noticeable following winter applications.

TURFGRASS COVER AND WEED PRESSURE IN SUBSOIL AMENDED WITH COMPOSTED POULTRY LITTER. M. Mandal and R.S. Chandran, West Virginia Univ., Morgantown.

ABSTRACT

Turfgrass established in compacted and nutrient-deficient soils are weak and more prone to weed infestation. Commercial compost derived from poultry litter was tested for its suitability as soil amendment to establish Kentucky bluegrass from seed or sod. Field experiments were established in 2003 at West Virginia University to evaluate the effect of composted poultry litter on the establishment of turfgrass in disturbed soils. To simulate typical construction disturbance, existing topsoil was stripped off to a depth of 20 cm and the nutrient-deficient subsoil was exposed. Composted poultry litter was incorporated at a depth of 12.5 cm at 10, 20, and 40% (vol/vol). These treatments were compared to conventionally fertilized plots and untreated plots (control). Plots were seeded, at recommended rates, or sodded. Turf was maintained at a mowing height of 8 cm. Percent bare area was estimated using transect lines in April and Sep. 2004. Weed counts by species were also recorded.

In seeded plots, highest turfgrass cover (85%) recorded in April was in plots that received 20% compost followed by 76 and 64% cover in plots that received 40 and 10% compost, respectively. By Sep. 2004, all compost-treated plots exhibited 100% turf cover. Turf cover in fertilized plots increased from 11 to 76% while that in control plots increased from 26 to 67% at this time. The most dominant weed species were white clover (*Trifolium repens*) and dandelion (*Taraxacum officinale*) followed by buckhorn plantain (*Plantago lanceolata*), red clover (*Trifolium pratense*), yellow woodsorrel (*Oxalis stricta*), large crabgrass (*Digitaria sanguinalis*), and wild carrot (*Daucus carota*). No weeds were present in any of the sodded plots in April 2004 while seeded plots that received compost had <1 weed/plot. In Sep., seeded plots with 20 and 40% compost had 6 and 72% fewer total weeds, respectively, than control. However, plots that received 10% compost had twice the number of white clover compared to control whereas those that received 40% compost had 80% fewer white clovers. Interestingly, dandelion numbers in composted plots were higher than that of control. Fertilized plots had a weed pressure similar to control plots. Overall, compost treatments were able to maintain superior turf cover and quality compared to fertilized and control plots.

USE OF GPS TO EXAMINE CORRELATIONS BETWEEN PASPALUM SPECIES DISTRIBUTION AND EDAPHIC AND TOPOGRAPHIC FEATURES. G.M. Henry, M.G. Burton, and F.H. Yelverton, North Carolina State Univ., Raleigh.

ABSTRACT

Dallisgrass (*Paspalum dilatatum*) and bahiagrass (*Paspalum notatum*) 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, clayey soils. Currently, few post-emergent herbicide options exist for the effective, economical control of these weeds. Examination of their spatial distribution and population ecology may provide clues to improving management tactics. 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. Golf courses were 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. 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. Volumetric soil moisture content (theta probe) and soil penetration resistance (penetrometer) readings were taken on a 9-m grid. Characteristics used for initial correlation analysis consisted of mowing height, elevation, volumetric soil water content, and soil penetration resistance. Preliminary results indicate that dense patches of bahiagrass predominately occur in the rough, while dallisgrass occurs at both mowing heights. Compaction data suggest that bahiagrass may be more tolerant to compacted soil than dallisgrass. The effect of volumetric soil moisture content is unclear at this time. Elevation is unlikely a factor affecting *Paspalum* distribution.

PRE AND POST SMOOTH CRABGRASS CONTROL. T.L. Watschke and J.A. Borger, Penn State Univ., University Park.

ABSTRACT

In the first study, 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. All treatments were applied on April 8, 2004 and some treatments were applied on May 7, 2004 using a three foot CO_2 powered boom sprayer calibrated to deliver 80 gpa using two, flat fan, 11004 nozzles at 40 psi and a shaker jar. After application the entire test site received approximately 0.5 inch of water. On April 21, 2004, 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 where materials had been applied that did not contain any fertilizer. 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 April 26, 2004. Several materials provided commercially acceptable smooth crabgrass control. The CS formulation and the split application (1.5 plus 1.5 lbs ai/A) of the 3.3EC formulation of Pendulum; the Barricade 65WDG at 0.65, 0.75, and 0.38 plus 0.38 lbs ai/A; the Barricade 4FL at 0.75 and 0.38 plus 0.38 lbs ai/A split; and all Dimension 40WP treatments controlled smooth crabgrass greater than 85 percent. In the second study, pre and post emergence control of smooth crabgrass was evaluated 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 preemergence and pre/post combination herbicides for the control of smooth crabgrass. This study was a randomized complete block design with three replications. Treatments were applied on April 8 (PRE), June 3 (1-3 LEAF), and June 30, 2004 (4 WAT) 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 April 21, 2004, 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 where materials had been applied that did not contain any fertilizer. 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 April 26, 2004. Acceptable control of smooth crabgrass was provided by Dimension 40WP at 0.5 lb ai/A, and all combinations of Barricade and Mesotrione (except the PRE timing). It appeared that increasing the rate of Mesotrione or increasing the rate and reapplying the combination provided little improvement over a single combination application at the 1 to 3-leaf stage.

MARYLAND 2004 SMOOTH CRABGRASS CONTROL STUDIES IN TURF. P.H. Dernoeden and S.J. McDonald, Univ. of Maryland, College Park.

ABSTRACT

Two field studies were conducted to evaluate herbicides for smooth crabgrass (*Digitaria ischaemum*) control as follows: 1) a standard preemergence study; and 2) a pre- and early postemergence study involving mesotrione and Barricade (prodiamine) tank-mixes. Both studies were conducted in a perennial ryegrass (*Lolium perenne*) turf in College Park, and turf was mowed to a height of 2.5 inches. Soil was a Keyport silt loam with a pH of 5.9 and 3.4% OM. For the preemergence study, herbicides were applied initially on 25 March and sequentials were applied 7 May 2004. Mesotrione and Barricade treatments were mixed with a non-ionic surfactant (NIS) and applied at various timings as noted in the data table. Crabgrass seedlings first were observed on 16 April, but most germination occurred after mid-May. Crabgrass pressure was severe and uniform. Sprayable herbicides were applied in 50 GPA using a CO_2 pressurized (35 psi) backpack sprayer. Granulars were applied by shaker bottle. Study sites were irrigated within 48 hrs of each herbicide application. In both studies, plots were 5 ft by 5 ft and were arranged in a randomized complete block with four replications. Percent of plot area covered by smooth crabgrass was assessed visually on a 0 to 100% linear scale on 9 July and 17 August 2004. Treatments with a rating of ≤ 9% plot area covered by crabgrass were subjectively considered to have provided excellent control. Data were subjected to ANOVA and significantly different means were separated by Tukey's protected least significant difference test at $P \leq 0.05$. Two Pendulum (pendimethalin) formulations were evaluated for preemergence crabgrass control as follows: Pendulum 3.3EC at 2.0 + 1.5 and 1.5 + 1.5 lb ai/A; and Pendulum 3.8CS at 2.0 + 1.5, 1.5 + 1.5, and 1.5 + 2.0 lb ai/A. Among Pendulum treatments, only Pendulum 3.8CS (1.5 + 1.5 lb/A) was judged to have provided excellent (9% cover), season-long crabgrass control (data not shown). There were, however, no significant crabgrass cover (9 to 26%) differences among Pendulum treatments. Dimension 40WP (dithiopyr, 0.5 and 0.25 + 0.25 lb ai/A), Team Pro 0.86G (benefin + trifluralin, 1.5 + 1.5 lb ai/A), and Team Pro 0.86G + Dimension 40WP (1.5 + 0.25 lb ai/A) also provided excellent crabgrass control (5 to 9% cover). Two Barricade formulations were evaluated: Barricade 4F and 65WG at 0.75 and 0.5 + 0.25 lb ai/A. Crabgrass levels in all Barricade-treated plots were commercially unacceptable, although crabgrass levels in Barricade-treated plots (22 to 46% crabgrass cover) did not differ significantly from treatments providing excellent control. There was a non-significant trend suggesting that the 65WG formulation provided better crabgrass control than the 4F formulation. Uncharacteristically, there were no large differences between single and split applications of Barricade. Field notes state that mesotrione + Barricade elicited a yellowing and stunting of the perennial ryegrass for about three weeks following the application of the preemergence treatment. Plots treated 25 March with mesotrione + Barricade exhibited reduced quality on 11 May, but no reductions in quality were observed among the "Early Post" treatments thereafter (data not shown). Injury, however, was noted on 10 June immediately following the postemergence application of sequential treatments on 9 June. The ryegrass injury took the form of a chlorosis, which

dissipated rapidly. Smooth crabgrass cover was rated 9 July and 17 August, but only 17 August data are discussed. Barricade and mesotrione + Barricade applied preemergence significantly reduced crabgrass populations, when compared only to the untreated control (Table 1). Plots receiving the aforementioned preemergence treatments, however, had commercially unacceptable levels of crabgrass (44 to 60% cover). Barricade applied alone and early postemergence had reduced crabgrass levels more effectively than mesotrione + Barricade applied preemergence, but was not significantly different from Barricade alone. Hence, data indicate that Barricade has early postemergence activity on smooth crabgrass. Fair crabgrass control (14 to 19% cover) was provided by mesotrione + Barricade applied once in the early postemergence timing (Early post). Dimension, the standard for early postemergence crabgrass control in this study, provided excellent control when applied early postemergence. Mesotrione + Barricade Early post + sequential (both rates) and Barricade Early post + mesotrione + Barricade + sequential treatment (i.e., 9 June) provided equal and excellent season-long smooth crabgrass control.

Table 1. Mesotrione and Barricade tank-mixtures for smooth crabgrass control in turf, College Park, MD, 2004.

Treatment	Rate (lbs ai/A)	Timing*	Crabgrass cover 9 July	Crabgrass cover 17 Aug
			-------- %	--------
Barricade 4F	0.65	Pre	5 b**	44 bc
Mesotrione 4SC + Barricade 4F + NIS	0.187 + 0.65 + 0.1%v/v	Pre	7 b	60 b
Barricade 4F + NIS	0.65 + 0.1%v/v	Early post	2 b	27 cd
Dimension 40WP	0.50	Early post	0 b	6 e
Mesotrione 4SC + Barricade 4F + NIS	0.187 + 0.65 + 0.1%v/v	Early post	2 b	19 de
Mesotrione 4SC + Barricade 4F + NIS	0.25 + 0.65 + 0.1%v/v	Early post	1 b	14 de
Mesotrione 4SC + Barricade 4F + NIS	0.187 + 0.65 + 0.1%v/v +	Early post	0 b	2 e
	0.187 + 0.65 + 0.1%v/v	9 June		
Mesotrione 4SC + Barricade 4F + NIS	0.25 + 0.65 + 0.1%v/v +	Early post	0 b	2 e
	0.25 + 0.65 + 0.1%v/v	9 June		
Barricade 4F + NIS	0.65 + 0.1%v/v +	Early post	0 b	4 e
Mesotrione 4SC + Barricade 4F + NIS	0.25 + 0.65 + 0.1%v/v	9 June		
Untreated		--	65 a	96 a

* Preemergence treatments were applied 25 March. Early-postemergence treatments were applied 5 May when smooth crabgrass was in the 1 leaf stage. The sequential treatment for early postemergence regime (Early post) was applied 9 June when smooth crabgrass was in the 1 to 3 leaf stage.

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

GOOSEGRASS AND DALLISGRASS CONTROL IN BERMUDAGRASS. J.F. Derr and T.J. Serensits, Virginia Tech, Virginia Beach.

ABSTRACT

Goosegrass (*Eleusine indica* (L.) Gaertn.) and dallisgrass (*Paspalum dilatatum* Poir.) are common and troublesome weeds in bermudagrass turf. Few options exist for postemergence control. Several new herbicides, including foramsulfuron, trifloxysulfuron, and rimsulfuron, have been developed for use in this warm-season turf species, but most of the emphasis has been placed on these products as transitioning tools. These products may have utility for selective weed control during the summer.

In the first experiment, foramsulfuron at 0.026 lb ai/A and trifloxysulfuron at 0.022 lb ai/A were applied postemergence to tillered goosegrass in 'Yukon' and 'Princess 77' common bermudagrass (*Cynodon dactylon* (L.) Pers.) that had been seeded 21 and 27 days earlier, respectively. These herbicides were compared to atrazine at 1.0 lb ai/A and MSMA applied twice at 2.0 lb ai/A, with the second application occurring 5 days after the first. Foramsulfuron and trifloxysulfuron caused less than 10% injury to Princess 77 common bermudagrass at 14 days after treatment (DAT) but this injury disappeared by 24 DAT. Greater injury (18%) was seen in Yukon, but the injury was slight at 25 DAT. Trifloxysulfuron and atrazine did not control goosegrass, while foramsulfuron reduced goosegrass ground cover by 68% in Princess 77 and 80% in Yukon 43 DAT. MSMA reduced goosegrass ground cover by 86% in Princess 77 but only 18% in Yukon, perhaps due to the faster growth rate of Princess 77.

In another postemergence trial conducted in Yukon, foramsulfuron reduced goosegrass cover 54% 40 DAT, while a single application of metribuzin at 0.25 lb/A or trifloxysulfuron did not reduce goosegrass cover and MSMA applied twice at 2.0 lb ai/A reduced cover by 24%.

A postemergence trial containing tillered goosegrass was established one month after sprigging 'Tifsport' hybrid bermudagrass (*C. dactylon* (L.) Pers. x *C. trannsvaalensi* Burtt-Davys). A second application of each herbicide was made 11 days after the first. Foramsulfuron at 0.026 and 0.039 lb/A and foramsulfuron at 0.026 lb/A plus MSMA at 2.0 lb/A controlled goosegrass 97 to 99% 29 DAT. Diclofop at 1.0 lb/A gave 91% control, with metribuzin at 0.25 lb/A controlling 87%. MSMA applied alone controlled goosegrass 60%, while rimsulfuron at 0.031 lb/A did not control goosegrass. A similar trial was conducted in the greenhouse, with foramsulfuron at 0.013 lb/A replacing the foramsulfuron plus MSMA treatment. Only single applications of each herbicide were made. Foramsulfuron at 0.013, 0.026, and 0.039 reduced goosegrass shoot fresh weight by 95 to 98% while diclofop completely controlled goosegrass. MSMA at 2.0 lb/A reduced goosegrass shoot fresh weight by 60%, while rimsulfuron reduced shoot weight by 71% and metribuzin causing a 44% reduction in goosegrass shoot weight.

A postemergence trial evaluated foramsulfuron applied at rates ranging from 0.5 to 4 fl oz/gallon applied once or twice, spaced either 2 or 4 weeks apart, or 5 days after MSMA was applied at 2.0 lb/A. Single applications of foramsulfuron provided approximately 30 to 50% dallisgrass control. For plots receiving 2 applications of foramsulfuron, dallisgrass control increased as herbicide rate increased. Control appeared to be better when the second application was made 4 weeks compared to 2

weeks after the initial application. Maximum dallisgrass control (83% at 63 days after initial treatment) in this trial occurred when foramsulfuron was applied twice at 4 fl oz/gallon with the applications spaced one month apart. Applying MSMA 5 days prior to foramsulfuron resulted in control similar to 2 applications of foramsulfuron spaced 2 weeks apart.

Foramsulfuron applied once postemergence provides significant suppression of goosegrass, with two applications providing excellent control. It provides generally greater goosegrass control than metribuzin or MSMA, and equivalent control to diclofop. Trifloxysulfuron and rimsulfuron do not provide acceptable control of goosegrass. Two applications of foramsulfuron at 3 to 4 fl oz/gallon provide fair (approximately 60 to 80%) dallisgrass control, but further treatment would be required if excellent control was desired.

GOOSEGRASS CONTROL WITH FORAMSULFURON. D.B. Ricker, J.B. Willis, S.D. Askew, Virginia Tech, Blacksburg.

ABSTRACT

Goosegrass (*Eleusine indica)* is a problematic summer annual weed found on most golf courses and athletic fields. Seeded bermudagrass establishment is more likely to be infested with goosegrass than sprigged bermudagrass since oxadiazon can't be applied when seeding bermudagrass. Viable postemergence treatments are needed for goosegrass control during seeded bermudagrass establishment.

Field studies were conducted to evaluate foramsulfuron (Revolver ^{TM}) for postemergence control of goosegrass in bermudagrass (*Cynodon dactylon (L) Pers.*) turf. A field trial, conducted at the Virginia Tech Turfgrass Research Center using a nine treatment, three replications, randomized complete block test design, generated differences in goosegrass control using an assortment of herbicide combinations applied to Princess 77^{TM} bermudagrass. Foramsulfuron was applied at 0.052 lb ai/A once or twice at 2-week intervals, as a mixture with quinclorac at 0.6 lb ai/A, and as a mixture with urea ammonium nitrate at 2.5% v/v. In addition, foramsulfuron was applied at 0.026 lb ai/A sequentially at 2-week intervals. Comparison treatments included diclofop-methyl at 1.0 lb ai/A, MSMA at 2.0 lb ai/A applied twice at 2-week intervals, and MSMA plus Metribuzin at 0.25 lb ai/A applied twice at 2-week intervals.

The most effective treatment, MSMA tank mixed with metribuzin, controlled goosegrass 100% 3 WAT. Goosegrass was controlled by single and sequential fall applications of foramsulfuron, greater than 60%. Foramsulfuron rate did not significantly influence goosegrass control. Sequential MSMA applications controlled goosegrass less than other treatments. Bermudagrass was not injured by any treatment at 3 WAT.

GROUND IVY CONTROL. J.A. Borger and T.L. Watschke, Penn State Univ., University Park.

ABSTRACT

The first study was conducted on a mature mixed stand of perennial ryegrass (*Lolium perenne*), 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 broadleaf weed herbicides for the control of ground ivy (*Glechoma hederacea*). The study was a randomized complete block design with three replications. All of the treatments were applied on June 10, 2002 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 11004 nozzles at 40 psi. Ratings were taken on June 10, July 8, Aug 5, 2002, June 16, 2003, and June 4, 2004. Each plot was rated for ground ivy cover prior to treatment. The site was mowed at two inches with a rotary mower with clippings returned. The site was not irrigated. Ground ivy control was highly variable from treatment to treatment. Sprayed formulations provided better control than granular materials. Speed Zone, Drive plus 2,4-D and MSO, Confront and Trimec Classic tended to provide the best and most lasting control of ground ivy. On June 16, 2003 Lebanon Turf Herbicide 0.68G at 157 lbs/A, Speed Zone at 3 pt/A, and Power Zone at 3.5 pt/A provided less than 45 percent control of ground ivy. On the final rating date, June 4, 2004, almost two years after the single application of materials, the ground ivy population increased on most of the treated plots and the untreated plots. But, there was still greater than 55% reduction of ground ivy following the application of Drive plus 2,4-D plus MSO, Power Zone, Confront, and Trimec Classic. The second study was conducted on a mature mixed stand of perennial ryegrass, Kentucky bluegrass, and fine fescue on the same home lawn in Julian, Pa. The objective of the study was to determine the efficacy of broadleaf weed herbicides for the control of ground ivy. 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. Ratings were taken on Aug 25, 2003 and June 4, 2004. Each plot was rated for ground ivy cover on June 25 prior to treatment. All of the treatments, except Quicksilver provided excellent control of ground ivy (>90%) on the first rating date August 25, 2003. By the last rating date, June 4, 2004, almost one year after treatment application, almost no control of ground ivy was observed.

MESOTRIONE: A NEW HERBICIDE ACTIVE INGREDIENT FOR WEED CONTROL IN TURFGRASS. R.J. Keese, J. Driver, D. Cox, Syngenta Professional Products, Carmel, IN.

ABSTRACT

Mesotrione is a member of the Callistomone herbicide family (Triketones) and is an HPPD inhibitor, affecting carotenoid biosynthesis. Symptoms include bleaching and some necrosis within 3-5 days of application. In row crops it is used pre- and post-emergence for control of broadleaves and some grassy weed species.

Since 2001 testing has been underway to evaluate the potential for weed control and turfgrass phytotoxicity. Field studies were conducted across the US at different application timings including pre-emergence, early and late post-emergence, and against grassy weed species as well as broadleaf species. The fit for cool season turfgrass was readily apparent, with safety on bluegrasses and fescue documented early. Mesotrione has been evaluated as a stand-alone and as a tank mix partner with prodiamine.

Mesotrione provides excellent early-post emergence control of crabgrass (*Digitaria* spp.). When applied at rates of 210-280 g a/ha (0.187 – 0.25 lb a/A) and with a sequential LPOST treatment, greater than 80% of emerged crabgrass can be controlled. This same rate range will also control broadleaf weeds such as common purslane (*Portulaca oleracea*), clover (*Trifolium repens*), sowthistle (*Sonchus* spp.), swinecress (*Coronopus* spp.), black medic (*Medicago lupulina*), Verbena (*Verbena* spp.) and Florida betony (*Stachys floridana*). Difficult to control perennial species like nimblewill (*Muhlenbergia schreberi*) can also be controlled. A tank mix with prodiamine provides pre- and early post-emergence activity against many weed species.

Also of interest with the compound, is the potential for selective removal of bentgrass (*Agrostris* spp.) from Kentucky bluegrass and tall fescue turf. Sequential treatments will be required, and currently fall treatments appear more efficacious than spring; timing and intervals are still under evaluation and preliminary data will be presented.

OBSERVATIONS ON PYRAFLUFEN-ETHYL FOR WEED CONTROL IN TURFGRASS.

M.A. Fidanza, Penn State Univ., Reading, PA; J. Steffel, Lehigh Ag and Biological Services, Hamburg, PA; and K. Chisholm, Nichino America, Wilmington, DE.

ABSTRACT

Three field experiments were conducted at the Berks Campus of the Pennsylvania State University, Reading, PA, to evaluate the effects of applying pyraflufen-ethyl (ET Herbicide/Defoliant 0.208L) in a tank-mix with a three-way herbicide (2,4-D 2.44L, MCPP 1.3L, and dicamba 0.22L) or glyphosate (Roundup Pro 4L) or glufosinate-ammonium (Finale 1L). All experiments were conducted from May through July 2004, and all herbicide products were applied only once according to standard label rates. In all three test sites, the low maintenance turf stand consisted of a mixed population of Kentucky bluegrass (*Poa pratensis*), tall fescue (*Festuca arundinacea*), orchardgrass (*Dactylis glomerata*), and nimblewill (*Muhlenbergia schreberi*), and was mowed periodically to a height of 3.5 inches with a rotary mower and clippings were not removed. The target broadleaf weeds present at two of the sites were broadleaf plantain (*Plantago major*), common dandelion (*Taraxacum officinale*), and white clover (*Trifolium repens*). Therefore, two field experiments evaluated the three-way herbicide and pyraflufen-ethyl for broadleaf weed control, and the third field experiment evaluated glyphosate or glufosinate-ammonium and pyraflufen-ethyl for non-selective turf control. In each experiment, all treatments were repeated three times and arranged as a randomized complete block design. Individual plots measured 2.5 x 5 ft. All treatments were applied with a CO2 pressurized backpack sprayer calibrated to deliver 1.0 gal water per 1000 sq ft (44 gal water per acre) at 30 psi from a single 8004E flat-fan nozzle. Percent target weed or turf plot-area-cover, phytotoxicity, and control were determined on a visual 0 to 100% linear scale. Data were subjected to analysis of variance and treatment means were separated by Fisher's Protected Least Significant Difference test at $P \leq 0.05$. In the two broadleaf weed control experiments, no antagonism or decrease in weed control efficacy was observed in plots treated with pyraflufen-ethyl tank-mixed with the three-way herbicide. By 7 DAT, the broadleaf weeds were slightly injured from pyraflufen-ethyl but did recover by the end of the experiments at 56 DAT. By 14 DAT, broadleaf weeds treated with pyraflufen-ethyl plus the three-way herbicide exhibited a greater phytotoxicity response versus plots treated with the three-way herbicide alone. By 56 DAT, however, similar levels of broadleaf weed control were observed in plots treated with pyraflufen-ethyl plus the three-way herbicide or the three-way herbicide alone. In the non-selective turf control experiment, a slight but inconsistent improvement in turf control was observed in those plots treated with pyraflufen-ethyl in combination with glyphosate or glufosinate-ammonium versus plots treated with glyphosate alone or glufosinate-ammonium alone.

BROADLEAF WEED CONTROL. J.A. Borger and T.L. Watschke, Penn State Univ., University Park.

ABSTRACT

Broadleaf weed control was conducted on a stand of mature 'Jet Elite' perennial ryegrass (*Lolium perenne* L.) at the Valentine Turfgrass Research Center, Penn State University, University Park, Pa. The objectives of the study were to determine the efficacy of broadleaf weed herbicides for the control of dandelion (*Taraxacum officinale*) and white clover (*Trifolium repens*) in perennial ryegrass. All plots were rated for percent dandelion and white clover prior to treatment. The study was a randomized complete block design with three replications. All of the treatments were applied on May 25, 2004 and some re-applied on June 9, 2004 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 11004 nozzles at 40 psi. The perennial ryegrass was mowed at 1.5 inches twice weekly with a rotary mower with clippings returned to the site. The change in broadleaf weed (dandelion and white clover) population was rated four times (June 7, June 18, July 6, and July 20, 2004). Some level of control was found across all rating dates for most treated turfgrass. By the final rating date, July 20, only V-10142 at 0.25 and 0.5 lb ai/A plus MSO, Spotlight at 0.67 and 1.33 pt/A, alone or combined with MacroSorb Foliar, Spotlight at 1 pt/A alone or combined with 2,4-D Amine 4 at 0.5 lb ai/A, and Garlon EV at 4.5 pt/A combined with 2,4-D Amine 4 at 1 pt/A provided less than 70% reduction of the dandelion population. On July 20, 2004, only V-10142 at 0.25, 0.5 and 1.0 lb ai/A plus MSO, and 2,4-D Amine 4 at 1 and 2 lbs ai/A provided less than 70% reduction of the white clover population. Some complementary effects were found. For example, when Spotlight at 1 pt/A was combined with 2,4-D Amine 4 at 1 lb ai/A dandelions were reduced by 88.1% and white clover by 100%. Additionally, when V-10142 at 0.25 lb ai/A was combined with MSO at 0.25 % v/v and Drive at 0.75 lb ai/A near complete control of dandelions and white clover was achieved (98.2% and 100% respectively).

MICROSTEGIUM VIMINRUM SEEDHEAD SUPPRESSION WITH CHEMICALS AND EFFECTS ON SURROUNDING VEGETATION. S.D. Askew, J.B. Willis, D.B. Ricker, and D.S. McCall, Virginia Tech, Blacksburg.

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum*) (JSG) relies on seed production for continual infestation of invaded areas. JSG control is often stifled by negative impacts on surrounding vegetation. Reports on JSG seed viability in soil range from 3 to 7 years. Recent studies suggest that most seed germinate in the first year after production. Thus, sustained seedhead control should quickly reduce population levels and make overall management easier. Several researchers have investigated postemergence herbicides for JSG control but few studies have evaluated seedhead suppression with treatments that have minimal impact on surrounding vegetation. Our objective was to evaluate plant growth regulators used in the turfgrass industry for seedhead suppression and low rates of common herbicides to achieve maximum JSG seedhead reduction with minimal injury to surrounding grass and broadleaf plants.

Studies were conducted at two sites in 2004; one near Floyd, VA and the other near Blacksburg, VA. Randomized complete block experiments were established with 12 postemergence chemical treatments applied at various rates and timings prior to JSG seedhead production. Treatments included a 2 x 3 factorial arrangement of application timings (August 13 and 30) and chemicals (glyphosate at 0.1 lb ai/A, ethephon and mefluidide (both PGRs used in the turfgrass industry for seedhead suppression) at 2.0 lb ai/A and 0.07 lb ai/A, respectively). Additional treatments included imazapic at 0.09 lb ai/A, fluazifop at 0.05 lb ai/A, glyphosate at 0.25 lb ai/A, ethephon at 3.3 lb ai/A and mefluidide at 0.14 lb ai/A all applied on August 30. A nontreated control was included for comparison.

Initial JSG ground cover on August 13 was 63 to 88% in Blacksburg and 68 to 97% in Floyd and differences between plots were not significant. At Blacksburg, replicate 1 was located along a wood edge and replicates 2 and 3 were located inside a forest canopy. At Floyd, all replicates were located along a wood edge. When JSG was located along the wood edge and exposed to partial sunlight, plants began to produce seedheads sooner than plants inside the forest canopy. Many plants had already started to produce seedheads on August 30 at the time of late chemical treatment. To assess the ability of chemicals to arrest seedhead development, 15 panicles were collected from each plot and length from flag leaf to tip was measured. In addition, 100 seed weight was determined and total seed per 15 panicles was enumerated. Subsequent seed germination response will be measured after a 90-day incubation period.

When applied on August 13, mefluidide and glyphosate eliminated seedhead production. Only 1% of ethephon-treated JSG plants produced seedheads compared to 95% seedhead production by control plants on September 24. Only glyphosate completely eliminated seedhead production when applied on August 30. Ethephon, mefluidide, imazapic, and fluazifop all decreased JSG panicle length compared to nontreated plants and seed viability seems questionable from these plants. Seed weight was reduced by imazapic and fluazifop but not by ethephon and mefluidide.

SEEDHEAD SUPPRESSION ON PUTTING GREENS. T.L. Watschke and J.A. Borger, Penn State Univ., University Park.

ABSTRACT

This 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 20 and May 11, 2004 using a three-foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two 11004 flat fan nozzles at 40 psi. The first mowing of the green was conducted on March 24, 2004 and the second mowing on April 7, 2004. On April 7, 2004 the turf was at about 75% green-up. On April 20, 2004 the forsythia was in full bloom. On April 21, 2004 annual bluegrass was at the boot stage of development. On April 28, 2004 forsythia was at the petal drop stage. The turf was maintained using cultural practices for irrigation, mowing, and fertilization that would be typical for a putting green. Color was rated on April 27 and May 3. On the April 27 rating date, only turf treated with Velocity, Banner MAXX, Embark T&O plus 8 oz of MacroSorb Foliar, and Banner MAXX plus Primo MAXX had unacceptable color. By the May 3 rating date, Embark T&O alone, Embark T&O with MacroSorb Foliar (except when Ferromec was added), Embark T&O with GBJ2, Embark T&O with CoRon, Banner MAXX, and Banner MAXX plus Primo MAXX had unacceptable color. The unacceptable color rating found for turf treated with Velocity (April 27) improved to an acceptable level by May 3. Seedhead suppression rated on May 12 revealed that treatments that contained Embark T&O provided the best efficacy. However, only the combination of Embark T&O, Ferromec, and MacroSorb Foliar had acceptable phytotoxicity and quality. Treatments containing Proxy/Primo MAXX and various additives provided suppression from 65 to 80%. While this level of suppression was not as high as that provided by Embark T&O, phytotoxicity was lower which resulted in generally higher quality ratings. Some seedhead suppression was observed as a result of Banner MAXX and the combination of Banner MAXX and Primo MAXX, however, severe phytotoxicity was caused which resulted in unacceptable turf quality. By the May 18 rating date, seedhead suppression levels of turf treated with applications containing the Proxy/Primo MAXX combinations were generally less than 60%. The two exceptions were when the Proxy/Primo MAXX combination was supplemented with either MacroSorb Foliar (65%) or CoRon (68%). Embark T&O, with and without additives maintained relatively high (generally above 85%) seedhead suppression while the turf had acceptable levels of phytotoxicity and quality. The untreated turf had unacceptable quality on both rating dates because of the presence of seedheads. Again, turf treated with Banner MAXX and combinations of Banner MAXX and Primo MAXX had minimal seedhead suppression, and that combined with phytotoxicity resulted in turf with unacceptable quality. It did not appear that sequential application (3 WAT) provided significant improvement in suppression of seedheads.

CLIPPING MANAGEMENT. J.A. Borger and T.L. Watschke, Penn State Univ., University Park.

ABSTRACT

This study was conducted on a mature stand of 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 the efficacy of granular and liquid plant growth regulators alone or in combination with a fertilizer using color ratings and measurements of plant height and fresh weight foliar yield. Additionally, an application of a granular fertilizer was evaluated for growth effects. This study was a randomized complete block design with three replications. Treatments were applied on June 2, June14, and June 30, 2004 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 11004 nozzles at 40 psi and a shaker jar. The test site was maintained similar to that of a golf course fairway with respect to irrigation, fertilization and mowing. Turfgrass height was measured using a Turfcheck 1 prism. The most consistent and best color ratings were found for the 16-4-8 fertilizer. However, none of the treatments were found to reduce color ratings below that of acceptable. On June 15, turf treated with Trimmit at 8 oz/A in combination with Primo MAXX at 5.5 oz/A was significantly shorter than untreated while the fertilizer only treatment was significantly taller than the untreated. On June 29, July 6, and July13 turf treated with Cutless 0.175G at 214.3 lbs/A was taller than untreated. On July 20, turf treated with fertilizer, Cutless 0.175G at 214.3 lbs/A, and Velocity 80WP at 10 g ai/A was taller than untreated. On July 28 and August 5, only turf treated with Cutless 0.175G at 214.3 lbs/A was taller than untreated. On June 7, turf treated with Velocity 80WP at 10 g ai/A, Cutless 0.175G at 214.3 lbs/A, and the 16-4-8 fertilizer at 214.3 lbs/A had significantly higher fresh weight yield than untreated. On June 15, turf treated with Trimmit 2SC at 8 oz/A in combination with Primo MAXX at 5.5 oz/A and Cutless 0.33G at 113.6 lbs/A had less yield than untreated while turf treated with the 16-4-8 fertilizer continued to have higher yield than untreated. On June 24, turf treated with Cutless 0.33G at 113.6 lbs/A had less yield than untreated while turf treated with Cutless 0.175G at 214.9 lbs/A and fertilizer alone had greater yields than the untreated. On June 29, none of the treatments resulted in significantly less yield than untreated while turf treated with Cutless 0.175G at 214.3 lbs/A and fertilizer alone continued to out yield the untreated. None of the treatments significantly reduced yield compared to untreated on the July 20 and 28 and August 5 rating dates. However, some treatments resulted in significantly more yield than untreated on those dates as a result of fertility or rebound effect or both.

INCORPORATING A WRITING ASSIGNMENT ABOUT WEEDS IN AN INTRODUCTORY TURFGRASS SCIENCE COURSE. M.A. Fidanza, Penn State Univ., Reading, PA.

ABSTRACT

A recent trend in higher education is the “communications-across-the-curriculum” concept, where written and oral communication assignments are incorporated into undergraduate courses in addition to those traditional writing and speech communication courses. During the fall 2004 semester, undergraduate students enrolled in Turf 235, an introductory turfgrass science course at the Berks Campus of the Pennsylvania State University in Reading, Pennsylvania, were asked to complete communication-based assignments related to turfgrass weed management. The objective was to include both written and oral communication competency in the course. In the first assignment, each student prepared a one-page turfgrass weed fact sheet. Each student selected a weed common in turfgrass, and had to include information about the biology, ecology, and management of that weed in their fact sheet. Also, students had to incorporate both text and graphics elements in the fact sheet. In a second assignment, each student developed an informative newsletter on any topic related to turfgrass weed management. The assignment was to be completed in two formats: a one-page newsletter as a hard-copy, and that same newsletter as a single web-page. Again, students had to use both text and graphics in their newsletter. Also, students had to deliver an oral presentation about their newsletter topic. The students agreed that this was a worthwhile exercise and that both written and oral communication skills are necessary and valuable for a career in the green industry. Overall, students needed more focused instruction and guidance on how to produce a clear, concise, and well-written fact sheet and newsletter. As a result, one lecture was devoted to writing and communication, and students were given several examples of newsletters, fact sheets, and short articles on many current topics in turfgrass science for comparison and review. Future course assignments with communication elements may consider that students complete a mandatory visit to the campus writing center for supplemental instruction and review.

SEASONAL ANNUAL BLUEGRASS SEEDLING EMERGENCE PATTERNS. J.E. Kaminski, Univ. Connecticut, Storrs, and P.H. Dernoeden, Univ. Maryland, College Park.

ABSTRACT

Annual bluegrass (*Poa annua* spp. *annua*) is a chronic weed problem of golf course turf. Few studies have been conducted to monitor annual bluegrass (ABG, annual biotype) seasonal emergence patterns or environmental conditions influencing its germination. It generally is believed that variation in ABG seed dormancy and germination timings are dependent on geographic region and environmental conditions. In a California study conducted in a vegetable field, ABG seedlings were observed to emerge in highest and lowest numbers between October and November and March and July, respectively (Weed Sci. 51:690-695). Data from the aforementioned study indicated that seed dormancy state rather than temperature likely is the primary determinant of ABG seed germination. A greenhouse study revealed that ABG germination was greatest at day/night temperatures of 19/10^{o}C, when compared to higher temperature regimes (Weed Sci. 54:47-52). The aforementioned growth chamber study also showed that changing photoperiod had little impact on ABG seed germination. Between 1999 and 2003, ABG seedling emergence was monitored in bermudagrass (*Cynodon dactylon*) roughs at the University of Maryland Golf Club (UMGC) in College Park (1999-2003) and at Woodmont Country Club (WCC) in Rockville, MD (2002-2003). In August or September of 1999 to 2002, the turf in four circular spots about 0.09 m^2 in area was killed with glyphosate. Annual bluegrass seedlings were counted and removed weekly from inside each spot between September and May of each year. During this monitoring period, an average of 431 seedlings 0.09 m^{-2} $year^{-1}$ emerged. Between 1999 and 2002, the majority of ABG seedlings (63 to 78%) emerged during a 3 to 4 week period between September and mid-October, and 90% of all seedlings had emerged by early-December. Annual bluegrass seedlings emerged in small numbers between December and May in all three years. In the final year (2002-2003), peak ABG germination at both locations occurred between early-October and mid-November (64 to 68%), but seedlings continued to emerge in low numbers throughout the winter. The timing of peak germination appeared to be influenced by precipitation or irrigation. In the final year, when natural precipitation was minimal in September and October, peak germination occurred 2 to 3 weeks earlier at WCC (irrigated site), when compared to UMGC (non-irrigated site). Similar to the seedling emergence patterns observed in California, ABG germination in Maryland was greatest during the autumn months. Several factors influence the emergence of ABG. An after-ripening period was documented for the annual biotype of ABG (Weed Research 28:365-371). It is likely that following the after-ripening period in summer, elevated soil temperatures are a limiting factor for ABG seed germination. Upon after-ripening and in the presence of suitable temperatures and moisture, ABG seeds germinate in large numbers. Annual bluegrass seed, however, may germinate in low numbers over a wide range of environmental conditions in different regions and crops.

BASAMID FOR RENOVATION OF GOLF COURSE TURF. P.J. Landschoot, Penn State Univ., University Park and B.S. Park, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Fumigation of annual bluegrass (*Poa annua* L.)-infested putting greens and fairways prior to seeding creeping bentgrass (*Agrostis stolonifera* L.) prevents stand contamination due to annual bluegrass seedling emergence. Dazomet (Basamid Granular™) is a soil fumigant labeled for golf turf renovation; however, limited data are available on efficacy of annual bluegrass seedling emergence following surface applications. Studies were conducted in putting green and fairway turf in University Park, PA to determine the influence of rate and plastic covering of surface-applied dazomet on annual bluegrass seedling emergence and safe creeping bentgrass seeding intervals following applications of dazomet. The authors also worked with superintendents at two golf courses to observe results and potential problems with large scale dazomet applications.

Treatments in University Park studies were applied in late summer to the surface of annual bluegrass-infested creeping bentgrass maintained as a putting green and annual bluegrass-infested perennial ryegrass (*Lolium perenne* L.) maintained as a fairway. Plots were watered immediately after application and throughout each test period. Dazomet treatments covered with plastic sheets had fewer annual bluegrass seedlings than non-covered treatments in both putting green and fairway trials. In putting green trials, three plastic-covered dazomet treatments (291, 340, and 388 kg ha^{-1}) provided complete control of annual bluegrass seedling emergence, whereas none of the non-covered treatments provided complete control of annual bluegrass seedling emergence. In fairway trials, all plastic-covered dazomet treatments (194, 291, 340, and 388 kg ha^{-1}) provided greater than 98% reduction in annual bluegrass seedlings when compared with the plastic-covered controls. When not covered with plastic, the 388 kg ha^{-1} dazomet treatment provided 97% fewer annual bluegrass seedlings in 2000 and 92% fewer seedlings in 2001 than the noncovered controls.

Results of the seeding interval experiment on putting green turf revealed that creeping bentgrass ground cover and clipping yields were not inhibited, regardless of covering treatment, when seeded 8, 10, 13, and 16 d after 388 kg ha^{-1} dazomet was applied to the turf surface. Results of the fairway seeding interval experiment revealed that creeping bentgrass groundcover and yields were not inhibited when seeded 3, 6, 9, and 12 d after a surface application of dazomet at 388 kg ha^{-1}.

Excellent control of annual bluegrass was obtained following dazomet applications on two putting greens on one golf course and 18 fairways on another golf course. Some turf damage occurred in rough areas on one golf course as a result of surface runoff of dazomet from sloped fairways. Some application skips were noticed on some fairways following treatment, presumably as a result of dazomet particle bridging over outlet holes in the bottom of the spreader hopper.

MANAGEMENT OF *POA* SPECIES IN TURF - BAYER PRODUCT UPDATE. D.R. Spak and D.F. Myers, Bayer Environmental Science.

ABSTRACT

Revolver (foramsulfuron) is a newly registered herbicide for the control of grassy weeds in bermudagrass and zoysiagrass turf. Foramsulfuron is a sulfonylurea herbicide that provides postemergence control of *Poa annua* and *Poa trivialis* in dormant or actively growing turf. Foramsulfuron has little preemergence activity due to a short soil half-life. Foramsulfuron has shown excellent safety on bermudagrass turf, even in newly sprigged and seeded turf. However, foramsulfuron will severely injure or kill cool season turfgrass that it contacts, so care should be taken to avoid spray drift and tracking from treated areas.

Prograss (ethofumesate) has been a standard herbicide treatment for *Poa annua* control in cool-season turf and overseeded bermudagrass turf for many years. The performance of ethofumesate is dependent on environmental factors that can affect the level of *Poa annua* control and potential for turfgrass injury. For example, increased creeping bentgrass injury has been associated with poorly drained, compacted soils, and shady turf sites. Increased *Poa annua* control is associated with cold, hard winters, and it has been suggested that ethofumesate kills *Poa annua* by reducing winter survival through the depletion of the waxy cuticle. Ethofumesate works primarily as a post-emergence herbicide but does also have a short preemergence residual.

Ronstar (oxadiazon) is a pre-emergence herbicide that can be used in warm season turfgrass and some cool season turfgrass to prevent the establishment of annual grassy weeds. Ronstar is available as a granular or sprayable (WP) formulation and is also available through many distributors on fertilizer carriers. Ronstar WP should not be applied to cool season turf due to potential injury. Ronstar is most commonly used as a preemergence herbicide for goosegrass and crabgrass control in bermudagrass, but can be used in late-summer/early-fall to prevent the germination of *Poa annua*. In bermudagrass overseeded with perennial ryegrass, Ronstar should not be applied within 16 weeks of overseeding. Ronstar is noted for a lack of root pruning as is observed with traditional DNA herbicides, and therefore, is the standard for use in newly sprigged bermudagrass sites.

Proxy (ethephon) is a foliar active plant growth regulator labeled for the suppression of *Poa annua* and white clover seedheads and growth suppression of cool season turfgrass. Ethephon releases ethylene, a naturally occurring plant growth substance, in treated leaves. Proxy is often used in a tank-mix with Primo for enhanced turf color, quality, and seedhead suppression. Application should be made prior to expected emergence of seedheads and repeat applications may be necessary for acceptable control.

Acclaim Extra (fenoxaprop p-ethyl) is best known for its postemergence crabgrass and goosegrass control in cool season turf. However, research has been conducted which shows significant activity on *Poa trivialis* during the autumn and spring periods of the year. However, only perennial ryegrass and tall fescue express sufficient tolerance to applications of Extra during these time periods. **Acclaim Extra is currently not labeled for this use.**

PROMISING NEW HERBICIDES FOR ONIONS. G.J. Evans and R.R. Bellinder, Cornell Univ., Ithaca NY.

ABSTRACT

Onions (*Allium cepa* L.) are a valuable vegetable crop in New York State. Because they compete poorly with weeds, control is an important and expensive consideration. Although there are several herbicides registered for postemergence broadleaf and grass weed control in onions, there are still numerous weeds that significantly reduce yields. Of particular concern are field pennycress (*Thlaspi arvense* L.), pineapple-weed (*Matricaria matricariodes* L.), ragweed (*Ambrosia artemisiifolia* L.), and common purslane (*Portulaca oleracea* L.). With this in mind, new postemergence herbicides, known to have activity on one or more of these weeds, were evaluated for onion tolerance.

In the winter of 2003, the herbicides were screened in greenhouse trials and promising rates were field-tested in 2004. Trials were conducted in two farmers' fields in Genesee County, NY, and at the H. C. Thompson Research Farm, in Freeville, NY. Two rates of clopyralid and fluroxypyr (0.094, 0.188 lb ai/A), amicarbazone (0.056, 0.113 lb), prometryn (0.5, 1.0 lb), and flumioxazin (0.032, 0.048, 0.064 lb) were applied at two different times, approximately 2 wk apart at the different sites. A single application of sulfentrazone (0.05 lb) was applied at two timings at the Freeville site. Planting techniques and onion varieties varied with site. Onions (var. 'Bunker' ®) were direct seeded at one farm site, and the treatments were applied at 2-3 and 5-leaf stages. Transplanted bareroot onions (var. 'Empire Sweet' ®) were used at the second farm and treatments were applied at 3 and 5-7 new leaves. At the Freeville site, four varieties ('Millennium' ®, 'Red Zeppelin' ®, 'Empire Sweet' ®, 'Bastille' ®) were grown in 200-cell plug trays, and trimmed 3 times before being transplanted into the field. In this trial, treatments were applied 2 and 4 wk after transplanting.

Clopyralid and fluroxypyr at both 0.094 and 0.188 lb caused significant epinasty shortly after spraying in all onions. Epinasty was greater at the later applications. Fluroxypyr-induced epinasty was greater than with clopyralid. Despite initial epinasty, onions recovered and yields were not reduced compared to hand-weeded treatments. Amicarbazone at 0.113 lb caused minor stunting when applied to small onions however, yields were comparable to controls. Prometryn at 0.5 and 1.0 lb caused leaf tip necrosis, and was somewhat variable with site, but yields were not reduced. Flumioxazin at 0.048 and 0.064 lb caused some stunting at later leaf stages. Yields of 'Empire Sweet' onions were reduced while yields of the other three varieties were equivalent to the controls. Sulfentrazone applied at 0.05 lb caused little or no stunting and yields were unaffected. The results of these trials indicate good onion safety with clopyralid, fluroxypyr, amicarbazone, prometryn, sulfentrazone, and low rates of flumioxazin. Varietal response needs to be further assessed, as does the impact of crop stage at the time of application.

EVALUATING HERBICIDES FOR CRUCIFEROUS GREENS. R.R. Bellinder, Cornell Univ., Ithaca, NY.

ABSTRACT

Due to increasing interest in the health benefits of cruciferous crops, their production for niche markets is on the rise and questions about weed control have begun. To address these questions a trial was conducted at the H.C. Thompson Vegetable Research farm in Freeville, NY in 2004. The four crops evaluated were collards, kale (both *Brassica oleracea* var. acephala), mustard greens (*Brassica juncea*), and turnip greens (*Brassica rapa* spp. rapa). All were transplanted in the four- to five-leaf stage. Treatments included S-metolachlor (0.65 lb ai/A), dimethenamid (0.55 lb), pendimethalin H2O (1.0 lb), sulfentrazone (0.1 lb), KIH 485 (0.056 lb), oxyfluorfen (0.5 lb pre-transplant, 0.125 lb post-transplant), flumioxazin (0.03 lb), and clomazone (0.5 lb). With the exception of clomazone, all treatments were applied both pre-transplant and 48 hr post-transplant. In general, the crops exhibited different responses to the herbicides, with collards and kale tolerating more treatments than the greens. Collards and kale were extremely tolerant of S-metolachlor, sulfentrazone, oxyfluorfen, and clomazone. Pendimethalin response in the two crops varied where, when applied pre-transplant, collard yields were reduced but kale yields were not. Dimethenamid-p, and KIH 485 (applied POST) caused significant initial injury (>20%) but did not reduce yields. Flumioxazin caused unacceptable injury and reduced yields in both crops. With the two greens, S-metolachlor, pendimethalin, and sulfentrazone caused little or no injury and yields were equivalent to the controls. Dimethenamid-p and flumioxazin caused >25% initial injury and reduced early but not total yields. Unlike collards and kale, clomazone and oxyfluorfen severely injured and reduced yields of both greens. The predominant weeds in the trial were redroot pigweed (*Amaranthus retroflexus*), common lambsquarters (*Chenopodium album*), common purslane (Portulaca oleracea), hairy galinsoga (*Galinsoga ciliata*), and wild buckwheat (*Polygonum convolvulus*). In general, control of all species tended to be slightly lower when the herbicides were applied prior to transplanting than when applied after transplanting. At the end of the cropping season (6wk) overall weed control was greater than 90% with all treatments except the pre-transplant applications of S-metolachlor (80%) and pendimethalin (83%). Control of hairy galinsoga was the most variable and was poorly controlled by sulfentrazone, pendimethalin, and the lower rate (post-transplant) application of oxyfluorfen.

IMAZAMOX IN SNAP BEAN. C.M. Whaley, J.C. Sanders, H.P. Wilson, and T.E. Hines, Virginia Tech, Painter.

ABSTRACT

Field experiments were conducted in 2004 to evaluate snap bean (*Phaseolus vulgaris* L.) and weed response to various rates of imazamox alone and in combination with bentazon postemergence (POST). Experiments were arranged in a randomized complete block design with four replications. All plots received a preemergence (PRE) application of S-metolachlor at 0.6 lb ai/A. Treatments included imazamox POST at 0.016, 0.031, 0.047, and 0.062 lb ai/A alone and in combination with bentazon at 0.5 lb ai/A, bentazon POST alone at 0.5 lb/A, fomesafen POST alone at 0.25 lb/A, bentazon plus fomesafen POST at 0.5 plus 0.25 lb/A, respectively, and S-metolachlor PRE alone. POST treatments were applied to 3-trifoliolate snap bean approximately 3 weeks after planting. Snap bean response was evaluated 7 and 28 DAT and weed control was evaluated at 28 DAT. Snap bean response generally increased with increasing rates of imazamox from 9% with 0.019 lb/A to 26% with 0.062 lb/A at 7 DAT. At 28 DAT, snap bean response was less than 15% with all treatments. Common lambsquarters (*Chenopodium album* L.) control was greater than 92% with all POST treatments except with bentazon alone. Common ragweed (*Ambrosia artemisiifolia* L.) control was greater than 89% with all POST treatments except with bentazon alone. Morningglory species (*Ipomoea* spp.) control generally increased with increasing rates of imazamox. All treatments controlled smooth pigweed (*Amaranthus hybridus* L.) greater than 93%. Snap bean yields with imazamox alone at 0.031, 0.047, and 0.062 lb/A were generally improved when applied with bentazon.

COMPARISON OF NEW HERBICIDE PROGRAMS FOR WEED CONTROL IN SWEET CORN. D.D. Lingenfelter and W.S. Curran, Penn State Univ., University Park.

ABSTRACT

Compared to field corn (*Zea mays*), the number of herbicide options available for use in sweet corn (*Zea mays succharata*) is limited. Also, with the increasing incidence of herbicide resistant weed biotypes, rotational crop carryover concerns, and stricter environmental standards, newer herbicide options (namely POST) are necessary to manage weeds effectively, yet provide a level of safety to the crop and environment. Several herbicides have been introduced recently that may provide some alternatives to alleviate these concerns.

Field studies were conducted in 2002, 2003, and 2004 to evaluate some newer herbicide options for sweet corn. In 2003 and 2004, a number of herbicide treatments including, carfentrazone, glufosinate, halosulfuron, mesotrione, and pendimethalin (H2O formulation), were evaluated PRE, EPOST, POST, or in various combinations in sweet corn to determine their effectiveness against common annual weeds. In 2002 and 2003, mesotrione (0.094 and 0.187 lb ai/A), S-metolachlor (1.27 and 1.6 lb ai/A), and atrazine (0.75 lb ai/A) combinations were applied both PRE and POST to determine their injury potential to several varieties of sweet corn. Necessary adjuvants were included in the POST spray mixtures. Visual control and crop phytotoxicity ratings were taken periodically throughout the growing period.

In general, the treatment combinations that included the newer herbicides provided >90% control of yellow foxtail (*Setaria glauca*), fall panicum (*Panicum dichotomiflorum*), common lambsquarters (*Chenopodium album*), velvetleaf (*Abutilon theophrasti*), smooth pigweed (*Amaranthus hybridus*), and eastern black nightshade (*Solanum ptycanthum*). Lumax® (mesotrione, S-metolachlor and atrazine) always provided ≥97% control of these weed species. Prowl H2O® (pendimethalin) plus atrazine was more effective on yellow foxtail and fall panicum when combined with dimethenamid-P. Liberty ATZ® (glufosinate plus atrazine) applied POST was as effective as the combinations of glufosinate with atrazine, alachlor, or pendimethalin applied EPOST. Liberty ATZ® was more effective than glufosinate alone on all the weed species except for common lambsquarters. In the mesotrione tolerance experiment in 2002, the highest injury (25%) occurred to Kandy Korn, Kandy King, and Silver Queen when COC and UAN were included in the POST treatments. In 2003, POST mesotrione (0.187 lb ai/A), atrazine, and COC caused up to 33% injury initially on Dynamo but decreased to 8% by the late season evaluation. Legacy, Jubilee, HMX0395, and Excalibur, in that order, had decreasing sensitivity to mesotrione and injury was less than with Dynamo. Other treatments in this study caused negligible injury to the crop.

In summary, these new herbicide options could be a good fit for weed management programs in sweet corn. Though none of these herbicides alone can provide adequate control of a diverse weed spectrum, each can complement other product choices to provide effective weed management, while maintaining crop and environmental safety.

SWEET CORN TOLERANCE TO MESOTRIONE, FORAMSULFURON, HALOSULFURON, CARFENTRAZONE, AND CLOPYRALID. D.H. Johnson and T.E. Elkner, Penn State Univ., Manheim.

ABSTRACT

Tolerance of 16 sweet corn varieties to mesotrione, foramsulfuron, halosulfuron, carfentrazone, and clopyralid was evaluated in two experiments in 2004 in Lancaster County, PA. The varieties ranged in maturity from 68 to 84 days, and represented white, yellow, and bicolor kernels and se, sh-2, and triple-sweet genetics. Hybrids chosen were those most commonly used by PA sweet corn growers for fresh market or processing. The herbicides were applied at 2X rates to simulate an overlap situation in the field. Where needed, 2X rates of recommended adjuvants were also used. Post herbicides were applied when the sweet corn had two to four leaves. One experiment was planted on May 15, and a second was planted on June 10. The corn was rated for injury at 7, 14, and 28 DAT and harvested at approximately 21 days after silking. Harvest date varied for each variety. Bicep II Magnum and hand weeding were used over the entire experiment for weed control.

Mesotrione applied pre at 0.33 lb ai/A (to simulate the 2X rate of Lumax) did not cause injury to any sweet corn variety. Mesotrione applied post at 0.19 (plus 0.5 lb ai/A atrazine) caused slight (<7%) bleaching at 7 DAT, but no injury at the later plantings. Foramsulfuron applied at 0.066 lb ai/A caused the highest injury of the herbicides tested, mostly in the form of stunting. Up to 18% stunting injury occurred at 7 DAT, with highest injury on the shorter-season varieties such as Exstacy II and Temptation. Some stunting was still apparent at 28 DAT. Carfentrazone applied at 0.025 lb ai/A caused slight (7% or less) necrosis injury, with all varieties similarly affected. Halosulfuron and clopyralid, applied at 0.06 and 0.38 lb ai/A, respectively, did not cause any injury. Foramsulfuron caused yield reduction on a few varieties, especially the shorter-season varieties Temptation, Frosty, Luscious TSW, and Silver Princess. Although no injury was observed, halosulfuron reduced yield of Temptation and Frosty (both short-season varieties). Most herbicides did not affect ear length. Halosulfuron reduced ear length slightly on Frosty.

In summary, foramsulfuron caused the highest injury, mostly in the form of stunting, which resulted in yield loss on some varieties. Slight bleaching and necrosis was observed from mesotrione and carfentrazone, respectively, but this did not affect yield. Halosulfuron did not cause any observable injury but reduced yield of some early season varieties. Clopyralid did not cause any injury or yield response.

The herbicides halosulfuron, carfentrazone, and clopyralid are currently registered for sweet corn. These herbicides, plus mesotrione and foramsulfuron, once available for sweet corn growers, provide additional tools for weed control. However, sweet corn varietal tolerance varies, with shorter-season varieties tending to be more sensitive, and growers should work with their seed companies to ensure adequate crop safety prior to use.

THE PHYTOTOXICITY OF MESOTRIONE TO FRESH MARKET AND PROCESSING SWEET CORN VARIETIES.

B.A. Majek and A.O. Ayeni, Rutgers Univ., Bridgeton, NJ.

ABSTRACT

Fourteen sweet corn (*Zea mays* L.) varieties were evaluated for two years, and an additional four varieties were evaluated for one year for tolerance to mesotrione. Varieties were chosen were recommended in the mid Atlantic states, represented white, bi-color, and yellow varieties, and a range maturity groups. Genotypes included sugary enhanced (Se), super sweet (Sh), and normal (Su) varieties. Fresh market and processing sweet corn varieties were included. Crop tolerance was affected by variety, herbicide rate, and spray additives, and tank-mixing with other postemergence sweet corn herbicides. The mesotrione injury observed was a whitening of new leaves that emerged for a week to ten days after treatment. Some stunting was observed when whitening was severe. The injury was temporary, and did not appear to affect the yield potential or maturity date of sweet corn in most treatments. Five sweet corn varieties in 2002 and nine varieties in 2003 exhibited ten percent or greater injury following the application of mesotrione at 0.188 lb ai/A plus oil concentrate at 1% of the spray volume. 2002 was considered a severe drought year, when rainfall was below average in June July and August and weekly irrigation was needed to grow sweet corn. 2003 was a cloudy humid year with above average rainfall each month of the summer. ‘Argent’ and ‘Millennium’ were most severely injured both years. ‘Jubilee Plus’, ‘Silver Queen’, and ‘Zenith’ were moderately injured. ‘Stokes 382’, ‘Silver King’, ‘Polaris’, and ‘Prime Plus’ were least severely injured. ‘Ice Queen’, ‘Candy Corner’, ‘First Snow’, ‘Obsession’, ‘Temptation’, ‘Merlin’, ‘GSS 9299’, ‘Tahoe’, and ‘BSS 1690’ exhibited little or no injury either year. No trend was observed that related injury to kernel color, maturity date, or genotype. Certain sugary enhanced (Se), super sweet (Sh), and normal (Su) varieties were more susceptible to mesotrione plus oil concentrate than others with the same genotype. The symptoms observed increased in all injured varieties when the mesotrione rate increased from 0.094 to 0.188 lb ai/A.

THE EFFECT OF SPRAY ADDITIVES AND TANK MIXES ON THE PHYTOTOXICITY OF MESOTRIONE TO SWEET CORN. B.A. Majek and A.O. Ayeni, Rutgers Univ., Bridgeton, NJ.

ABSTRACT

Fourteen sweet corn (*Zea mays* L.) varieties were evaluated for two years, and an additional four varieties were evaluated for one year for tolerance to mesotrione. Varieties chosen were recommended in the mid Atlantic states, represented white, bi-color, and yellow varieties, and a range maturity groups. Genotypes included sugary enhanced (Se), super sweet (Sh), and normal (Su) varieties. ‘Argent’ and ‘Millennium’ were most severely injured in both years, therefore ‘Argent was chosen to evaluate the affects of spray additives and tank-mixing with other postemergence herbicides. The use of nonionic surfactant at 0.25 % of the spray solution instead oil concentrate reduced the injury observed. The addition of 28% nitrogen to mesotrione plus oil concentrate significantly increased the injury observed. The use of 28% nitrogen should be avoided when mesotrione is applied to sweet corn postemergence. Yield studies with ‘Argent’, the variety that was consistently most sensitive to mesotrione, and certain other varieties confirmed that yield and maturity date were not affected by the temporary injury observed after mesotrione application. Additional studies with ‘Argent’ indicated that tank-mixing mesotrione with atrazine, 2,4-D amine, clopyralid, or carfentrazone did not increase mesotrione injury. The tank-mix of mesotrione and bentazon did significantly increase the mesotrione injury observed. Mesotrione should not be tank-mixed with bentazon when treating sweet corn.

NEW HERBICIDE STRATEGIES FOR WEED CONTROL IN TOMATO. D.E. Robinson, University of Guelph, Ridgetown, ON; and A.S. Hamill, Agriculture and Agri-Food Canada, Harrow, ON.

ABSTRACT

Trials were conducted at two locations in southwestern Ontario in 2004 to compare the effect of several unregistered herbicides and tank mixes on weed control, tomato visual injury, and tomato yield to that of a weed-free check and the current industry standard (IS). Tolerance of tomatoes to the IS treatment of pre-plant incorporated (PPI) applications of S-metolachlor+metribuzin (1200+700 g ai ha^{-1}), preemergence (PRE) applications of sulfentrazone (125 and 250 g ai ha^{-1}), flumioxazin (52.5, 70 and 140 g ai ha^{-1}), mesotrione (25 and 50 g ai ha^{-1}), and PRE treatments of sulfentrazone, flumioxazin or mesotrione following the IS were determined. An untreated, weed-free check and a weedy check were included for comparison. Significant visual injury was observed in the flumioxazin and mesotrione treatments alone or when they followed the IS treatment. In the flumioxazin treatments, the injury appeared as leaf distortion, leaf burning and significant stem injury that led to complete death of some plants. In the mesotrione plots, injury included bleaching in bands across the leaves, leaf necrosis, stem injury, and plant death similar to what was observed in the flumioxazin treatments. The IS treatment gave excellent control (<90%) of velvetleaf (*Abutilon theophrasti* Medic.), redroot pigweed (*Amaranthus retroflexus* L.), common lambsquarters (*Chenopodium album* L.), lady's thumb (*Polygonum persicaria* L.), purslane (*Portulaca oleracea* L.) and green foxtail (*Setaria viridis* (L.) Beauv.), and good control (80-89%) of common ragweed (*Ambrosia artemisiifolia* L.) and eastern black nightshade (*Solanum ptycanthum* Dun.). Sulfentrazone alone gave excellent control of purslane, good control of lamb's-quarters and eastern black nightshade, fair control (60-79%) of redroot pigweed and poor control (<60%) of velvetleaf, ragweed, lady's thumb and green foxtail. Flumioxazin alone gave excellent control of lambsquarters and lady's thumb, good control of velvetleaf, redroot pigweed, ragweed, purslane and eastern black nightshade, and poor control of green foxtail. Mesotrione gave good control of velvetleaf and lambsquarters, fair control of purslane and eastern black nightshade, and poor control of redroot pigweed, ragweed, lady's thumb and green foxtail.

When PRE treatments of sulfentrazone, flumioxazin or mesotrione followed the IS application, excellent control of all weeds was observed. Red and total yield decreased as flumioxazin and mesotrione rate increased. However, despite the injury observed when either of these herbicides (at the low rate of each herbicide) followed the IS, no yield loss was observed. Red and total yields in both sulfentrazone treatments and when sulfentrazone followed the IS were not less than the untreated, weed free check.

EFFECTS OF DORMANT-SEASON AND SPRING-APPLIED HERBICIDES IN PACIFIC NORTHWEST MATTED-ROW STRAWBERRY. T.W. Miller and B.G. Maupin, Washington State Univ., Mount Vernon.

ABSTRACT

Strawberries (*Fragaria* x *ananassa* Duch.) in the Pacific Northwest (PNW) region of the United States are usually produced in a three-year cycle. The block is established the first year and berries are harvested during years two and three. Most producers train plants to a 15-in matted row, using tillage for weed and runner control between the rows and herbicides for weed control in the row. Because winters are mild in the maritime PNW, many annual weeds are able to grow twelve months a year, often resulting in extremely weedy conditions at the onset of strawberry growth in early March. So too, strawberries often do not enter full dormancy and may remain green through the winter. Since application of a residual herbicide in the fall or during the “dormant season” generally does not adequately control winter annuals for a full season of growth, sequential or combination treatments of PRE and POST herbicides may prove to be beneficial to growers in the PNW.

Field studies were conducted on established matted-row ‘Hood’ strawberries in northwestern Washington state during two growing seasons, 2002-03 and 2003-04, to determine the effect of several PRE herbicides applied during dormancy (December to January), and then followed by application of POST herbicides either during dormancy or after spring growth had begun (March to April). Crop injury and weed control was rated at one, two, and three months after the dormant-season treatment and at one month after the spring treatment. Berries were picked two times at commercially maturity (June to July) of both years, then counted and weighed.

Pronamide at 2 lb ai/A during dormancy of the first cropping year caused 21% foliar injury to strawberry by late March and 56% injury by early May, while 1 lb ai/A in the second cropping year did not cause significant injury. Glufosinate, paraquat, or flumioxazin applied at dormancy in 2002-03 caused 42 to 64% strawberry defoliation by late March, although plants treated with paraquat or flumioxazin had recovered by early May. In 2003-04, paraquat applied during dormancy caused 85% strawberry defoliation in February, while leaf burn after dormant-season application of flumioxazin, pelargonic acid, carfentrazone, oxyfluorfen, or paraquat ranged from 22 to 41% by early April. Applying paraquat, glufosinate, flumioxazin, or oxyfluorfen after onset of spring growth caused 12% to 60% injury to strawberry plants by May of both years. Sulfentrazone applied either during dormancy or after onset of spring growth did not cause significant strawberry foliar injury either year.

Dormant-season applications of pronamide or flumioxazin reduced berry yield in 2002-03, while dormant-season glufosinate or paraquat reduced yield in both years. When applied to spring growth, pronamide or flumioxazin reduced yield in 2002-03, while paraquat, carfentrazone, oxyfluorfen, or pelargonic acid reduced yield in 2003-04. Fruit size was significantly reduced only in 2002-03 and only if plants were treated by flumioxazin at dormancy or by paraquat or glufosinate in April. Sulfentrazone applied at either timing did not reduce yield or berry size either year. There was also no interaction between herbicides applied during the dormant-season or after onset of spring growth for strawberry growth during either year.

EFFECT OF FLUMIOXAZIN ON NEWLY PLANTED GRAPEVINES. R.M. Dunst, Cornell Univ., Fredonia, NY, A.F. Senesac, Cornell Coop. Ext. Riverhead, NY, and T.R. Bates, Cornell Univ., Fredonia, NY, and G.W. Kirfman, Valent USA Corp., Grand Rapids, MI.

ABSTRACT

Field studies were conducted at the Fredonia Vineyard Lab (FVL) and Long Island Horticultural Research and Extension Center (LIHREC) to evaluate the response of newly planted bare-root grapevines to applications of flumioxazin. Split plot designs were used at both locations. At FVL, all vines were 1-year #1 own-rooted ‘Concord’ (*Vitis labruscana*, L.). Half the vines had been stored at 32°F since January and were dormant at planting, the other half were stored in a cool cellar and had etiolated shoots at planting. At LIHREC half the vines were 1 year #1 ‘Concord’ and half were ‘Chardonnay’ (*Vitis vinifera*) Clone 96 grafted to C.3309 rootstock. Vines had been stored at 40°F and were beginning to break dormancy at planting. At both locations four rates of flumioxazin were applied, the labeled use rates 0.1875 and 0.375 lb ai/A, and the above-labeled use rates 0.75 and 1.5 lb ai/A. In half of the treatments, the vines were encased in protective “Blue-X Vine Shelter” grow tubes prior to treatment. Two additional treatments were also applied, a granular formulation of flumioxazin at 1.5 lbs ai/A and a “standard” treatment of oryzalin at 4 lb ai/A, both without grow tubes. All plots were hand weeded or hand hoed on a regular basis. One month after planting, the grow tubes were permanently removed and all shoots were measured. At FVL (Chenango gravelly loam, 2-3% SOM) glyphosate was applied in April, the soil was plowed to 12” depth and cultivated. Vines were transplanted on June 3, 2004, the soil was leveled using a rotary cultivator, and herbicides were applied on June 4. Shoot growth was measured approximately 30 and 60 days post-planting, and the numbers of nodes with ripe periderm were counted in late October. At LIHREC (sandy loam, 2% SOM) the soil was rototilled to 6” depth in April. Vines were planted with a spade and herbicides applied on May 12. The treatments were irrigated within one hour post-treatment to deliver 1 inch of water. Shoots were measured approximately 30 days post-planting, and in mid-October the vines were harvested at the soil line (or the graft union of the Chardonnay scion). Shoots were trimmed to the last node with periderm, nodes were counted, and the vines were oven dried and weighed.

At FVL there was a significant reduction in shoot growth and periderm formation associated with all rates of flumioxazin regardless of dormancy status at planting, with and without grow tubes. Growth reduction increased with increased herbicide rate (24 to 42% shoot growth reduction at 30 days post-planting and 16 to 43% reduction in periderm formation at the end of the growing season). At LIHREC there were no significant negative treatment effects associated with the labeled use rate range of 0.1875 to 0.375lb ai/A flumioxazin. At the highest rate (1.5 lb ai/A) ‘Concord’ shoot length and ripe node number were reduced both with and without grow tubes. No similar trend was apparent in the ‘Chardonnay’.

Our results suggest own-rooted ‘Concord’ vines may be more susceptible to flumioxazin injury than grafted ‘Chardonnay’ vines. Since injury occurs on both protected and unprotected vines we conclude the injury is caused via root uptake. Further research is needed to clarify the rootstock response to flumioxazin and to determine if allowing the soil to settle prior to flumioxazin application is an effective injury avoidance technique in newly planted ‘Concord’ vineyards.

IR-4 PROJECT: UPDATE ON WEED CONTROL PROJECTS IN SPECIALTY CROPS.
M. Arsenovic, F.P. Salzman, D.L. Kunkel, and J.J. Baron, IR-4 Project, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

The IR-4 Project is a publicly funded effort to support the registration of pest control products on specialty crops. The IR-4 Project continues to meet grower's needs for additional weed control options despite a climate in which fewer herbicides are available.

Herbicide petitions submitted to the EPA by IR-4 from October 2003 to September 2004 include: metribuzin on garlic; S-metolachlor on vegetable root subgroup, oriental radish, tuberous and corm vegetable subgroup, oriental radish, horseradish, dry bulb onion, head and stem *Brassica* subgroup, spinach and collards; flumioxazin on tuberous and corm vegetable subgroup, dry bulb onion, and mint; carfentrazone on multiple crops and crop groups; clethodim on herb subgroup; flumioxazin on strawberry; 2,4-D on potato (Pacific Northwest); dimethenamid on green onion; tribenuron-methyl on sunflower; and pronamide on Austrian pea, and phenmedipham on spinach.

From October 2003 through September 2004, EPA has published Notices of Filing in the Federal Register for: flumioxazin on the tuberous and corm subgroup and mint; DCPA on oriental radish, basil, chives, coriander, dill, marjoram, ginseng, celeriac, chicory, radicchio, and parsley; carfentrazone on multiple crops and crop groups; S-metolachlor on head stem *Brassica* subgroup, onion (dry bulb, and green), garlic, shallot; vegetable root subgroup (except sugarbeet), tuberous and corm vegetable subgroup, leaf petiole subgroup 4B, edible-podded legume vegetable subgroup, fruiting vegetable group, sweet corn, popcorn, dried shelled pea and bean subgroups, peanut, safflower, and grain sorghum; thifensulfuron on canola and flax.

EPA established tolerances from October 2003 to 2004 on: DCPA on basil, celeriac, chicory, chives, coriander, dill, ginseng, marjoram, parsley, radicchio, and oriental radish; flumioxazin on grape, almond; pistachio, sugarcane, mint, dry bulb onion, garlic, shallot, and tuberous and corm vegetable; dimethenamid on tuberous and corm vegetable subgroup, sugar beet, garden beet, horseradish, dry bulb onion, garlic, and dry bulb shallot; carfentrazone on multiple crops and crop groups.

CERCOSPORELLA ACROPTILI, A NEWLY DISCOVERED PATHOGEN CAUSING EPIDEMIC LEAF SPOT ON YELLOW STARTHISTLE. F.M. Eskandari and D.K. Berner. USDA, ARS, FDWSRU, Fort Detrick, MD.

ABSTRACT

Centaurea solstitialis L. (yellow starthistle, YST), family Asteraceae, an invasive weed in California and the western United States, is targeted for biological control. During the spring of 2004, an epidemic of dying YST plants was found near Kozani, Greece (40° 22' 07" N, 21° 52' 35" E, 634 m elevation). Rosettes of YST had small, brown leaf spots on most of the lower leaves. In many cases, these spots coalesced and resulted in necrosis of many of the leaves and death of the rosette. Along the roadside where the disease was found, >100 of the YST plants showed disease symptoms. Diseased plants were collected, air-dried, and sent to the quarantine facility of the Foreign Disease-Weed Science Research Unit (FDWSRU), USDA, ARS, Fort Detrick, MD. Diseased leaves were surface disinfested and placed on moist filter paper in petri dishes. Conidiophores and conidia were observed after 48 hours. The fungus was isolated from these diseased leaves and identified as *Cercosporella* spp.

Pathogenicity tests were performed by spray-inoculating the foliage of 20 4-week-old YST rosettes with an aqueous suspension of $1x10^6$ conidia/ml. Conidia were harvested from 2-week-old cultures grown on modified potato carrot agar (MPCA). Inoculated plants were placed in an environmental chamber at 23 C with 8 hr of daily light and continuous dew for 48 hr. Inoculated and control plants were moved to a 20 C greenhouse bench and watered twice per day. After 7 days, leaf spots were observed first on lower leaves. After 10-12 days, all the inoculated plants showed typical symptoms of the disease. No symptoms developed on control plants. The pathogen was consistently isolated from the symptomatic leaves of all inoculated plants. Koch's postulates were repeated two more times with 20 and 16 plants. To our knowledge, this is the first report of this genus of fungus parasitizing YST. Morphologically the fungus appears identical to *Cercosporella acroptili*, which is a promising biological control candidate on Russian knapweed (*Acroptilon repens*, ACREP). However, disease reactions of the two targets to the two *Cercosporella* isolates are significantly different (Table 1), indicating that this species of *Cercosporella* may be new on YST. Results of DNA sequence analyses will better elucidate the relationship between the two isolates. The results of host range tests will establish if this isolate of *Cercosporella* has potential as a biological control agent of YST in the USA.

Table 1. Comparisons of mean disease reactions of YST and ACREP to an isolate of *Cercosporella* from each weed.

	Leaf spots per plant		Proportion leaves with spots	
Cercosporella isolate	YST	ACREP	YST	ACREP
YST	7.8	0	.15	0
ACREP	0	15.0	0	.26
*analyses weighted for number of leaves per plant; all comparisons, except 0 vs. 0, for each variable are significantly different at P<0.02				

SMUTS: REMARKABLE DISEASES FOR CLASSICAL BIOLOGICAL CONTROL OF WEEDS. D.K. Berner and E.L. Smallwood, USDA, ARS, FDWSRU, Ft. Detrick, MD.

ABSTRACT

The mission of the weed science section of the Foreign Disease-Weed Science Research Unit (FDWSRU) is to discover, in the native range of target plants, exotic diseases of introduced invasive weeds in the U.S. If FDWSRU subsequently proves that the causative organisms (pathogens) are safe, for non-target plants in the U.S., the pathogens causing the diseases are released for classical biological control of the target invasive weed. Classical biological control entails the introduction of exotic natural enemies of the target plant without subsequent intervention, and the natural enemies are left to establish their own equilibrium and persistently control the target weed.

In the case of exotic pathogens, the obligate rust pathogens have, historically, been the most successful in classical biological control of weeds. This is due to the highly specific and damaging nature of the pathogens. However, some pathogens causing smut diseases are closely related to rusts and are also highly specific and very damaging to the target weed. Smut pathogens, like the rusts, are also obligate parasites, needing a living host to complete their life cycle. But, unlike the rusts, the monokaryotic haploid (sporidial) state of many smut pathogens can be grown on artificial medium, and sporidial cultures of individual mating types can be maintained separately on artificial medium. When cultures of individual mating types are combined, the sporidia mate and form the infectious stage of the fungus. This characteristic allows the rapid production of large volumes of inoculum.

Milk thistle (*Silybum marianum* (L.) Gaertn.) is an invasive weed in the U.S. and an annual plant that depends solely on seed production for re-establishment. The weed is present in 23 states in the U.S. and is noxious in three. Because it produces large amounts of viable seeds that fall near the parent plant, milk thistle can quickly develop dense impenetrable stands, which, when wilted, are toxic to livestock. The smut fungus (*Microbotryum silybum* Vánky & Berner) infects rosettes of milk thistle in the fall and overwinters in these rosettes. In the spring, the fungus grows with the growing point of the plant and establishes systemic infections. All flowers of infected plants become filled with teliospores of the fungus, and the plants do not produce any seeds. For an annual plant that reproduces solely by seeds, infection by *M. silybum* is catastrophic and can endanger populations of the weed. Although the fungus is rare in nature, it has been quickly developed, through artificial augmentation, for large-scale field tests in the country of origin. In this presentation, details on developing this model smut fungus for classical biological control of milk thistle are presented. Some other smut fungi with the potential for biological control of other invasive weeds in the U.S. are also discussed.

ECOLOGICAL WEED MANAGEMENT: THE ROLE OF GROUND BEETLES IN WEED SEED PREDATION. M. Murray, W. Curran, D.A. Mortensen, and M. Barbercheck, Penn State Univ., University Park.

ABSTRACT

Weed management in cropping systems is a constant challenge faced by farmers. Producers spend up to seven billion dollars each year on herbicides for weed control. Rising costs and the desire to reduce pesticide inputs has farmers experimenting with ecological weed management. Ecological weed management can be divided into two main categories that include mechanical and cultural practices. Cultural methods include using cover crops, intercropping, promoting weed seed predation and planning a crop rotation to reduce weed populations. Mechanical methods take advantage of flame weeding, mechanical weeders, different types of tillage, and adjusting tillage depths and timing.

Tillage systems can have a profound impact on weed management. For example, conventional tillage systems were found to have more broadleaf weeds in wheat and summer crops than low-input and no till systems. Shallow cultivation (0-2 cm) can reduce the viable weed seed bank by stimulating germination and increasing mortality. Deep tillage (30-45 cm) may increase weed problems as a result of bringing once buried viable seeds to the surface.

Implementing a cropping system that utilizes cultural control techniques such as resource competition, allelopathic interference, and targeted soil disturbance creates an unstable environment and reduces the chance for weed proliferation and species dominance. Cover crops can decrease weed populations by competing with weeds for resources, changing environmental factors, and possibly by releasing phytotoxins that inhibit the growth of weeds.

Enhancing the impact of seed predators on weed populations is another cultural tactic that has gained attention. *Harpalus pensylvanicus* is a granivorous beetle common to Pennsylvania and the Northeast. This beetle is believed to feed on a number of weed seeds frequently found in Pennsylvania farm fields. Pennsylvania State University is examining the presence of this insect in different cropping systems and trying to determine *H. pensylvanicus'* weed seed preference at different times during the growing season.

In preliminary experiments, *H. pensylvanicus* populations were observed from July to September 2004. Beetle populations peaked in August and were distributed throughout different cropping treatments. Preferred feeding trials showed that *H. pensylvanicus* will readily consume giant foxtail (*Setaria faberi)* and common lambsquarters (*Chenopodium album)* but not velvetleaf (*Abutilon theophrasti).* The trials also showed that there was no preference between giant foxtail and common lambsquarters; approximately the same amount of weed seeds were consumed for both species during the feeding preference trials.

EVALUATING EFFECTS OF INCREASING COVER CROP INTENSITY ON WEED SEED BANK DYNAMICS: A SYSTEMS APPROACH. S.B. Mirsky, W.S. Curran, D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

Reduced weed infestation levels are crucial to achieve acceptable weed control in alternative weed management systems (reduced or no herbicide inputs). Therefore, a component of these management programs must include a period of significant reduction in the weed seed bank and maintenance of these low weed seed populations once achieved. Our objective was to assess the impact of increasing cover cropping system intensity (disturbance, duration of cover, and biomass produced) on weed seed bank dynamics. The effects of varying initial weed seed population levels on efficacy of weed control in cover cropping systems and ensuing cash crop was also quantified. Synthetic weed seed banks of common lambsquarters (*Chenopodium album* L.), velvetleaf (*Abutilon theophrasti* Medicus), and giant foxtail (*Setaria faberi* Herrm.) were incorporated at four densities (0. 60, 450, and 2100 m^{-2}) in a split-split-plot design on a Hagerstown silt loam soil (fine, mixed, mesic, Typic Hapludalfs) in central Pennsylvania. Synthetic seed banks also included ceramic beads (equivalent in size to common lambsquarters) sown at 2100 beads m^{-2}.

We measured net seed bank changes from recruitment, mortality and fecundity in several cover crop or cash crop systems (fallow, oat cash crop-rye/vetch, oat/pea-rye/vetch, oats/clover, brassica-buckwheat-brassica, soybean cash crop-rye), all of which will be planted with sweet corn in the following season. Weed seed banks were sampled prior to initial cover crop planting and will be sampled prior to planting of the sweet corn. Greenhouse germination trials were used for soil samples taken prior to cover crop establishment. Future work will include elutriation and greenhouse germination trials for soil samples taken prior to cover crop and sweet corn establishment.

Results thus far with the greenhouse emergence data show that background populations of common lambsquarters and giant foxtail have prohibited us from distinguishing the density relationships targeted in the field. However, velvetleaf emergence data shows a strong relationship between seedling numbers and initial seed bank density. The soybean/rye and oats/clover systems were the only treatments where additions to the weed seed bank were observed. Recruitment and mortality tends to increase with increasing disturbance regimes and we have distinguished some differences in germinable weed seed across density treatments. A systems approach to identifying grower options for managing weed seed banks at varying weed seed densities will provide a greater understanding of how to integrate cover crops into farm-based weed management programs.

CORN AND SOYBEAN WEED INTERACTIONS IN A LONG TERM FARMING SYSTEM TRIAL. M.R. Ryan, D.A. Mortensen, A.G. Hulting, Penn State Univ., University Park, D.O. Wilson, R.M. Seidel, and P.R. Hepperly, The Rodale Institute, Kutztown, PA.

ABSTRACT

Organic farming has reached mainstream agriculture with the development of the USDA National Organic Program, and certified organic cropland in the US has more than tripled since 1992 accounting for 1.3 million acres in 2001. Organic producers have repeatedly stated that weed management is the number one production constraint they face. In order to address this need for effective non-chemical weed management, information about crop weed interactions and weed population dynamics over time is imperative.

Farming systems trials offer unique opportunities to characterize weed crop interactions between biomass accumulation and population dynamics. Although numerous system studies exist, few are long enough to adequately differentiate systems in terms of soil and weed seed bank characteristics. The Rodale Institute's Farming Systems Trial® (FST) was initiated in 1981, and compares a conventional mid-western corn-soybean cropping system to two organically managed farming systems. One organic system simulates a mixed crop and livestock operation with a corn-soybean-wheat-hay rotation using manure as a nitrogen source for corn. The other organically managed system represents a cash grain operation without livestock with a corn-soybean-wheat rotation using only legumes as a nitrogen source for corn. This 24-year trial has produced an extensive and significant database, providing insights needed for effective non-chemical weed control strategies and cultural practices that affect weed management.

Mechanical and cultural weed control methods are adequate to produce crops with high competitive yields. Nevertheless, weed biomass in the organic systems can be between two and six times greater than the herbicide treated system. Previous research shows that different management strategies cannot only affect weed population dynamics, but also their relative competitive ability. Preliminary analysis of the FST data indicates the relative competitive ability of organic soybean was greater than soybean in the conventional system. Linear regression analysis of crop yield and weed biomass revealed a slope of - 0.26 in the organic systems compared to - 0.51 in the conventional system, based on 10 year site environments. Furthermore, a threshold of 1500 and 2500 kg/ha of weed biomass in organic soybean and corn respectively was observed below which no discernable effects on yield occurred.

In summary, long term farming systems trials provide useful insights into the short and long term consequences of different management practices. Future analysis of the FST data will focus on assessing the correlation between years of excessive weed biomass and previous year weed infestations, weather conditions, manure application, and tillage and cultivation equipment. By learning about weed population dynamics and weed crop interactions, researchers will be better able to formulate optimized weed management programs for both organic and conventional farmers.

IS A ONE-DIMENSIONAL APPROACH USEFUL IN PREDICTING THE INVASION OF GLYPHOSATE-RESISTANT HORSEWEED? J.T. Dauer, D.A. Mortensen, and B.P. Jones, Penn State Univ., University Park.

ABSTRACT

The rapid spread of glyphosate-resistant horseweed, *Conyza canadensis*, continues to challenge the idea that seeds primarily disperse within a single field and that management should be limited to this scale. Horseweed can produce thousands of small, wind-dispersed seed which readily establish and are not controlled by the most commonly used soybean herbicide. Predicting the distance and direction of seed dispersal is important to farmers in the Northeast who want to reduce the likelihood of resistant populations infesting their fields. Experiments were conducted in 2003 to examine the long-distance dispersal of horseweed seed. Two seed sources were established in 8 and 10 ha fields with transects radiating from the source and ranged in length from 100 m to 500 m with longer transects oriented with the prevailing wind direction. Transects consisted of sticky seed traps located at 10 m intervals. Traps were exchanged six times during the dispersal season that lasted from mid-August to mid-October.

Seeds were consistently collected within the first 100 m in all directions yet small numbers traveled to 450 and 500 m in both fields. A 1-dimensional modeling approach found that a mechanistic and three phenomenological models could predict dispersal to 100 m, but all models failed to predict long distance movement. A small number of seed trapped at 400 – 500 m may be due to wind updrafts at the seed source resulting in longer seed movement. A 2-dimensional approach examined the association between wind velocity and the resulting seed distributions. Correlations varied during the dispersal season, but wind velocity generally matched seed distributions. Knowledge of spatial dispersal patterns is crucial for determining management practices that will slow the spread of glyphosate-resistant horseweed and other wind-dispersed invasive species. Farmers in adjacent fields that are likely to receive resistant seed can alter their management to decrease the likelihood of establishment. A 1-dimensional approach ignores variability in wind direction and therefore is not suitable for predicting the direction of spread of an invasive wind-dispersed species. Continued work to elucidate 2-dimensional spread as a function of wind stochasticity will allow more reliable predictive models which will enable farmers to better forecast the arrival of wind-dispersed weeds and adjust their management strategies.

HISTORIC DISTRIBUTION OF TWO INVASIVE SPECIES IN NORTH AMERICA: WHAT HAVE WE LEARNED? J.N. Barney and T.H. Whitlow, Cornell Univ., Ithaca, NY.

ABSTRACT

The historic phytogeographic distribution of Japanese knotweed (*Polygonum cuspidatum* Sieb. & Zucc.) and mugwort (*Artemisia vulgaris* L.) was investigated using herbaria collections. All herbaria listed in Index Herbariorum were solicited for their collections of both species. Of 422 total herbaria, 249 (59%) responded and sent either label information electronically, images of the specimen sheets, or the actual sheets for investigation. Label information was collected from 2015 individual sheets for Japanese knotweed and 1590 sheets for mugwort. Label information was collated based on the county of collection. Sheets representing duplicates and those missing information on collection date or location were removed leaving 1468 sheets for Japanese knotweed and 1245 sheets for mugwort. This database was entered into a geographic information system (ArcMap) in order to assess spatial patterns in distribution.

It is clear that multiple introductions resulted in the wide geographic distribution of these two invasive species. Since their initial herbaria collection, 1870s for Japanese knotweed and 1830s for mugwort, both species experienced a lag phase of 50-75 years of slow geographic spread followed by 50 years of exponential spread.

Collections were further cataloged based on the specific location or source: ship ballast, waterway, roadside, railroad right-of-way, cultivated or escape from cultivation. These collection locations comprised 66% of the sheets for Japanese knotweed and 57% for mugwort. Collections along waterways and roadsides comprised nearly 50% of the overall collections, which are the two major corridors for invasion of Japanese knotweed. An astonishing 11% mentioned the specimen as an escape from cultivation or under cultivation, many occurring before 1900. Cultivated specimen sheets are scattered randomly across the conterminous US showing no pattern, but likely being a primary vector for early distribution and subsequent translocation via waterways, roads, and railroads.

The majority of the mugwort herbaria sheets mentioned collection locations along waterways or roadsides, 15% and 23% respectively. Cultivation appears to be a less significant distribution source for mugwort than Japanese knotweed, accounting for only 5% of sheets. Nineteen sheets identified mugwort collection sites as ship ballast dumps on both the east and west coast and in the Great Lakes.

THE LEGACY OF INVASIVE WEED SUPPRESSION ON A FOREST ROADSIDE COMMUNITY. N. Peskin, B. Jones, and D.A. Mortensen, Penn State Univ., University Park.

ABSTRACT

Japanese stiltgrass (*Microstegium vimineum)* is a grass of Asian origin that has rapidly spread across the eastern US during the last century. It forms dense stands that out-compete native vegetation in forest environments, and can invade disturbed sites with remarkable success. Over the last few years, management of Japanese stiltgrass has become a growing concern due to its increasing expansion and the potential threat it poses both to forest regeneration as well as general ecosystem integrity. Management of forest invasives is complicated by concerns over herbicide use in sensitive environments and the need for low cost strategies. With these constraints in mind, we set out to determine if a single herbicide application could provide short and long term suppression of Japanese stiltgrass. With this primary goal, in 2003 a restoration study was established in a forest roadside heavily invaded with Japanese stiltgrass (Rothrock State Forest, PA, Appalachian ridge / valley physiography). The experiment assessed the efficacy of four different herbicides (Glyphosate: 1.1 kg/ha, Imazapic: 0.1 kg/ha, Fenoxaprop: 0.09 kg/ha and Sethoxydim: 0.31 kg/ha). A successful management treatment was defined as one that would control Japanese stiltgrass, and restore the community to higher diversity values (Simpson's diversity index) and species richness. Japanese stiltgrass was successfully suppressed by all herbicides, but they differed in their impact on the remaining community. The best treatments were those composed of selective grass herbicides (Sethoxydim and Fenoxaprop) and between these two, the most successful treatment was Sethoxydim, which eliminated Japanese stiltgrass and restored the community to high diversity values.

In 2004 these communities were revisited to see if the weed suppression from the previous year influenced Japanese stiltgrass recruitment, and if communities whose diversity had been increased were still as rich. Results show that the treatments had a lasting effect, however, Japanese stiltgrass stem, inflorescence and seed numbers in 2004 far exceed those observed in 2003. As regards the diversity and species richness values, these were quite homogenous this year as compared to the previous, and the control treatments had only slightly lower diversity values than the herbicide treatments. Although it is too soon to make long-term predictions, results are showing that the herbicide treatments are approaching the control treatment as time progresses, and that probably a single application of the herbicide is not sufficient to prevent the Japanese stiltgrass population from rebounding in the second year.

INFLUENCE OF ARBUSCULAR MYCORRHIZAL FUNGI ON THE INVASIVE VINE PALE SWALLOW-WORT (*Vincetoxicum rossicum*). L.L. Smith, A. DiTommaso, J. Lehmann, Cornell Univ., Ithaca, NY; and S. Griepsson, Troy State Univ., Troy, AL.

ABSTRACT

The invasive alien vine pale swallow-wort, *Vincetoxicum rossicum* (Kleopow) Barbar. (Asclepiadaceae) has become a major problem in the Great Lakes Basin in the Northeastern United States and Ontario, Canada. Pale swallow-wort forms dense monospecific stands causing habitat loss, a reduction in biodiversity, and damage to the rare and sensitive alvar systems. Previous work in our laboratory has shown that Arbuscular Mycorrhizal Fungi (AMF) colonization can be altered in central NY State sites newly invaded by pale swallow-wort. The objectives of this research were to determine dependency of pale swallow-wort on AMF symbiosis using several experiments. The growth and development of pale swallow-wort in the presence of AMF were monitored in greenhouse and field trials. In the greenhouse, overall biomass and growth rates were recorded over a period of four months. Results indicate that pale swallow-wort is highly dependent on AMF. Treatments with autoclaved native soils had seedling mortality of 83%, while non-autoclaved soils with native AMF had 100% survival rates. In field trials established at Henderson Harbor NY, the growth of pale swallow-wort in untreated control (i.e. AMF) plots was compared with growth in non-AMF plots, established by applying the fungicide benomyl to suppress the resident AMF populations. Over two growing seasons, biomass, growth rate, and reproductive development of pale swallow-wort were monitored every two weeks. Soil and tissue samples were taken to determine nutrient uptake. Root samples were analyzed for mycorrhizal colonization at the end of each growing season. Colonization data indicate a strongly active symbiosis between AMF and pale swallow-wort. However, growth differences between plants grown on benomyl-treated and untreated plots appear to be minimal or non-significant.

EVALUATION OF JAPANESE KNOTWEED CONTROL WITH SELECTED POST-EMERGENCE HERBICIDES. Z. Skibo and M. Isaacs, Univ. Delaware, Newark.

ABSTRACT

Japanese Knotweed (*Polygonum cuspidatum*, POLCU) is an invasive, herbaceous perennial plant that has become a major weed in riparian areas throughout Delaware. Greenhouse experiments were conducted over 2003-2004 to evaluate selected postemergence (POST) herbicides that translocate both apoplastically and symplastically. Vegetative buds were planted in 6-inch pots, grown for 30 days then and cut back once to normalize height, and allowed another 30 days growth 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 an 8001 even flat fan nozzle.

POST applications were made to plants at 4 to 6, 6 to 8, 10 to 12, and 12 to 14 inch heights. Treatments included: Clopyralid+Flumetsulam+Nicosulfuron+Rimsulfuron (Accent Gold 0.136 lb ai/A)+Dicamba (0.25 lb ai/A)+COC+UAN; Carfentrazone (0.0052 lb ai/A)+Atrazine (1 lb ai/A)+Dicamba (0.25 lb ai/A)+NIS; Atrazine+Dicamba (Marksman 1.2 lb ai/A)+NIS; Atrazine+Nicosulfuron+Rimsulfuron (Basis Gold 0.78 lb ai/A)+Dicamba (0.25 lb ai/A)+COC+UAN; Basis Gold (0.78 lb ai/A)+Mesotrione (0.094 lb ai/A) COC+UAN; Halosulfuron (0.061 lb ai/A and 0.045 lb ai/A)+Dicamba (0.375 lb ai/A and 0.5 lb ai/A)+NIS; Primisulfuron (0.0178 lb ai/A)+Dicamba (0.50 lb ai/A) alone and in combination with Atrazine (1 lb ai/A)+NIS; Primisulfuron+Prosulfuron (Exceed 0.0356 lb ai/A)+Dicamba (0.25 lb ai/A) alone and in combination with Atrazine (1 lb ai/A)+NIS; Mesotrione (0.094 lb ai/A)+Dicamba (0.25 lb ai/A and 0.50 lb ai/A)+Atrazine (0.1 lb ai/A)+COC+UAN; Dicamba+Diflufenzopyr+Nicosulfuron (Celebrity Plus 0.21 lb ai/A)+NIS+UAN; Mesotrione (0.166 lb ai/A)+Dicamba (0.25 lb ai/A)+Atrazine (0.63 lb ai/A)+COC+UAN; Mesotrione (0.20 lb ai/A)+Atrazine (0.63 lb ai/A and 0.75 lb ai/A)+COC+UAN; Glyphosate (Roundup WeatherMax 0.95, 1.65, and 2.75 lb ai/A); and Atrazine+Glyphosate (Readymaster ATZ 2 lb ai/A).

Data collected included percent visual control on an arbitrary scale of 0% (no damage) to 100% (complete plant death) at 7, 14, 21, and 28 DAT and fresh weights were collected 28 DAT. Data were subjected to analysis of variance (ANOVA) and treatment means separated using Fischer's Projected LSD Test at 5% level of significance.

The herbicide combination of mesotrione (0.094 lb ai/A) + Dicamba (0.50 lb ai/A) + Atrazine (1 lb ai/A) provided the best control (76%) of POLCU 28 DAT when applied to the third growth stage. All other herbicide combinations were ineffective in providing adequate single-season control, including the highest rates of glyphosate. Future research will entail evaluating additional mesotrione combinations as well as the POST-applied herbicides carfentrazone-ethyl (Aim) and triclopyr (Garlon) at various growth stages under field conditions and measuring current season and second year re-growth of this invasive weed.

PHOTOPERIOD REGULATION OF JAPANESE STILTGRASS FLOWERING AND IMPLICATIONS ON SEED MATURATION AND MANAGEMENT. C.A. Judge, J.C. Neal, and M.G. Burton, North Carolina State Univ., Raleigh.

Japanese stiltgrass is a nonnative invasive plant species in the eastern United States. As a summer annual grass, it reproduces only by seed. Thus, management strategies must attempt to reduce or eliminate seedbank inputs. Traditional management recommendations include hand-pulling, mechanical removal (e.g., mowing), or nonselective chemical application late in the growing season but prior to flowering. However, late-season management treatments must be timed appropriately to prevent flowering and subsequent seed production. Anecdotal evidence suggests that photoperiod affects flowering of Japanese stiltgrass. Understanding how photoperiod affects flowering may allow development of floral development models useful in predicting Japanese stiltgrass flowering and required timing for late season management programs. Therefore, an experiment was conducted to determine the effect of day length, temperature, and plant age on Japanese stiltgrass flowering. The experiment was conducted in growth chambers. Japanese stiltgrass seeds collected from a local research forest were surface seeded and germinated under long days (9 hr day + 3 hr night interruption) with 26/22 C alternating temperatures. Germination occurred within 7 days, and seedlings were thinned to one plant per pot. Six single-container replications were moved 2, 6, and 10 weeks after germination to short days (9 hr day) at either a 26/22 or a 22/18 C temperature regime. Plants of various ages were used to account for the effect of plant age on flowering. The experiment was repeated and each experimental repetition was viewed as replication for statistical analysis (i.e. 2 replications). Treatments were completely randomized in each growth chamber. After flowering occurred, but prior to seed maturation (approximately 6 to 8 weeks after moving to short days), terminal and axillary inflorescences (an inflorescence consists of a spike-like raceme with one to three branches) were counted on each plant and shoot dry weight was determined. All plants exposed to short days flowered, while under long days no plants flowered during the experiment. Within each plant age treatment, shoot dry weights were greater at 26/22 than at 22/18 C (P = 0.04); however, temperature did not affect inflorescence number (P = 0.79). Additionally, older (and therefore larger) plants moved to short days produced more inflorescences ($P \leq 0.0001$) and had greater shoot dry weights ($P = \leq 0.0001$) than younger and smaller plants moved to short days. Under short days at 26/22 C, inflorescence number averaged 557, 1166, and 1680 and at 22/18 C, inflorescence number averaged 749, 1127, and 1440 for plants moved to short days at 2, 6, and 10 weeks of age, respectively. In general, the more vegetative growth the plants obtained, the greater the reproductive output, in terms of inflorescence number. Thus, short days, higher temperatures (dry weight only), and greater plant age (and size) increased reproductive output of Japanese stiltgrass. These data confirm that Japanese stiltgrass flowers in response to reduced photoperiod (as simulated by the lack of a night interruption). For the last three years in central North Carolina, inflorescences have been observed on dates when photoperiod was between 11½ and 12 hours. To effectively make late-season management recommendations, further observations over a larger geographic region are necessary to develop a predictive model for flowering and seed development.

CHARACTERISTICS AND SIGNIFICANCE OF MILE-A-MINUTE: AN INVASIVE SPECIES. P.C. Bhowmik, N. Tharayil-Santhakumar, D. Sanyal, Univ. Massachusetts, Amherst.

ABSTRACT

Mile-a minute (*Polygonum perfoliatum* L.) is an invasive, herbaceous species belonging to family Polygonaceae. It is a native of Eastern Asia. It was introduced to U.S. from Japan in 1930, and has currently attained invasive weed status in Pennsylvania, Maryland, Ohio, West Virginia, Delaware, New Jersey, New York, and Connecticut. *Polygonum perfoliatum* is an annual trailing vine species. Under moderate climatic conditions it can survive many years. The plant has a shallow fibrous root system, but forms a deep taproot in perennial habitats. Stems are branched and trailing with reflexed prickles 1 to 2 mm long. In perennial habitats, stems can reach a diameter up to 1 cm and could be woody. Leaves are bright green, 4 to 7 cm long by 5 to 9 cm wide and are triangular shape with spiny long petioles. Nodes are encircled by a pale green ochera 1 to 2 cm in diameter. Flowers are inconspicuous, greenish white, and are born in clusters of 10 to 15 in terminal or axillary spike like raceme. Fruits are enclosed in a swollen, metallic blue, berry like perianth and are 4 to 6 cm in diameter. Fruit is a single seeded, shiny black, achene 3 mm long. Seeds may remain viable in soil up to four years and require a low temperature (10 C or below) for germination. In Northern U.S. *Polygonum perfoliatum* germinates during early spring in March-April. It generally colonizes in open as well as disturbed areas like railroads, roadsides and cleared woodlands. It prefers moist areas with good sunlight and are also found along stream banks and wet areas with poor soil structure. Its rapid initial growth enables the plant to suppress the native vegetation. Flowering begins in June and continues throughout the growing season. Flowers usually remain closed and are self-pollinated. Fruits are produced during early August in prolific amounts. Long distance dispersal of *Polygonum perfoliatum* seeds is by birds. Seeds are also dispersed by ants, mammals and by water currents. Plants die with the first mild frost. The plant can be successfully managed by both mechanical and chemical methods. Spot application of glyphosate offers a good control of this plant. However, due to dormant seeds, the established stands require sequential control measures. Japanese beetle (*Popillia japonica)* is a potent biocontrol agent causing extensive defoliation of this weed. This species has a negative impact on native ecosystem as it forms monoculture stands by smothering other native vegetation. The dense prickly stands of this species are a serious threat to reforestation programs and recreational areas. This invasive species should be monitored carefully for its future infestation in other habitats.

NON-NATIVE VASCULAR FLORA OF GREAT GULL ISLAND, NEW YORK. R. Stalter and A. Jung, St. John's Univ., Jamaica, NY, and E. Lamont, Botanical Garden, NY.

ABSTRACT

The non-native vascular flora of Great Gull Island, a 6.9 hectare site in eastern Long Island Sound, consists of 115 species, approximately 57% of the flora. Families with the greatest number of non-native species are Poaceae (20 species) and Asteraceae (22 species). Genera with the highest number of non-native species are *Trifolium* (5 species) and *Chenopodium* (4 species). Non-native species are a major component of the natural vegetation.

INTRODUCTION

Great Gull Island, encompassing 6.9 hectares is located in eastern Long Island Sound, New York (41o 12'07" N Latitude 72o 07'09" W Longitude.) The island has a long history of human habitation. A portion of the island was farmed by the Little Gull Island Lighthouse keeper in the early 1820's. The War Department occupied the island in 1896 and constructed Fort Michie, part of the United States' coastal defense system. Massive bunkers were constructed in the early 1940's as part of the United States defense against the Axis powers. The American Museum of Natural History acquired the island in 1949 as an ornithological preserve. The Museum's objective was to modify the island's substrate to create a favorable habitat for nesting terns. To manage the island for nesting birds, portions of the fort's military installation were leveled, vegetation removed, and tons of sand deposited. The sand was colonized by dune grass, *Ammophila breviligulata*. However, dune grass and terns were not a compatible combination so the dune community was bulldozed and destroyed. In recent years the island has been bush-hogged in early spring to clear vegetation from the ground, to create favorable nesting habitat. The tern population in 2000 was composed of approximately 10,000 pairs of Common Terns, *Sterna hirundo* and 125 pairs of Roseate Terns, *S. dougalli*.

The vascular flora of Great Gull Island was studied by Coulter from May 5 to September 3, 1979 and in the summer of 1980. Coulter identified 129 species of vascular plants and recorded the phenology of most of the taxa. Coulter listed four general communities: (1) a shrub community dominated by *Myrica pensylvanica* , (2) a meadow community dominated by non-native grasses, (3) a human disturbed ruderal community composed mostly by forbs, (4) an artificially created meadow community dominated by *Ammophila breviligulata.*

The primary objective of the present study was to identify the non-native vascular flora of Great Gull Island, and to identify the communities that supported the greatest number of non-native species.

METHODS

The vegetation at Great Gull Island was sampled monthly from April 2002 to October 2002. Herbarium voucher specimens for all species were prepared and are deposited at the University of South Carolina Herbarium. The Brassicaceae, Cyperaceae, Poaceae and Polygonaceae were mailed to specialists for verification and identification. Nomenclature follows Gleason and Cronquist (1991). The non-native status of vascular plants follows Gleason and Cronquist (1991).

RESULTS AND DISCUSSION

The vascular flora of Great Gull Island as recorded by this survey consists of 203 species in 147 genera and 55 families (Table 1). The Asteraceae with 33 species and 25 genera, and the Poaceae with 34 species and 24 genera, are the largest families in the flora; together they comprise 33% of the flora. These families also contain the largest number of non-native species with 20 species and 22 species, respectively. Families composed exclusively of non-native species are: Amaranthaceae, Apiaceae, Aquifoliaceae Araliaceae, Berberidaceae, Commelinaceae, Convolvulaceae, Elaeagnaceae, Hippocastanaceae, Liliaceae, Malvaceae, Molluginaceae, Oleaceae, Portulacaceae, Primulaceae, and the Ranunculaceae. Non-native species in seven of the above families, the Apiaceae, Aquifoliaceae, Araliaceae, Berberidaceae, Elaeagnaceae, Hippocastanaceae and Oleaceae were deliberately planted.

The most abundant non-native genera are *Trifolium* (5 species) and *Chenopodium* (4 species). *Amaranthus, Bromus, Hieracium*, and *Poa* are represented by 3 species each. One hundred fifteen species, nearly 57% of the flora are non-native (Table 1). Eighty eight dicots, 60% of the species, and twenty seven monocots, 51% of the monocot taxa, are non-native.

The most common species at Great Gull is the non-native radish, *Raphanus raphanistrum.* A second common non-native species is Oriental bitter sweet, *Celastrus orbiculatus,* which festoons buildings and abandoned fortifications in the center of the island. The greatest vascular plant diversity and greatest number of non-native taxa occur in the lawn and gardens to the west of the museum laboratories near the center of the island. Periodic maintenance throughout the island to create favorable habitat for nesting terns may provide fertile habitat for non-native species at Great Gull Island in the future.

Table 1. Summary of the vascular flora of Great Gull Island, NY.

	FERN ALLIES	FERNS	CONIFERS	DICOTS	MONOCOTS	TOTAL
Families	1	1	1	42	10	55
Genera	1	1	1	107	37	147
Species	1	1	1	147	53	203
Native Species	1	0	1	59	26	203
Non-native Species	0	0	0	88	27	115

ACKNOWLEDGEMENTS

We thank Dr. Helen Hayes, Director of the Great Gull Island Ornithology project for granting collecting permits and providing access to Great Gull Island, and for historical information; David Avery for providing boat transportation to the island, William Martin for assistance with identifying the grasses, Gordon Tucker for identifying the Cyperaceae, Richard Mitchell for identifying the Polygonaceae and Ihsan Al-Shehbaz for identifying the Brassicaceae.

A DISTANCE BASED REDUNDANCY ANALYSIS OF WEED SEED BANK CHANGES IN THE MAINE POTATO ECOSYSTEM PROJECT. S.C. Reberg-Horton, E. Gallandt and N. Taylor, Univ. Maine, Orono.

ABSTRACT

A distance-based redundancy analysis (db-RDA) was used to explore and conduct hypothesis testing in weed seed bank data from the Potato Ecosystem Project in northern Maine. Multivariate analysis of weed community data has been a challenge in agricultural experiments. Existing techniques have either conducted global tests of significance, with little means of interpreting a significant finding, or explored patterns in the data with no real tests of significance. The recent development of db-RDA promises to simplify analysis of complex weed datasets by allowing a partitioning of the variability similar to the process used in Analysis of Variance (ANOVA).

'Atlantic' potatoes were grown under three pest management strategies and two soil management systems from 1991 to 1998. The three pest management strategies consisted of a conventional (CONV) system, utilizing full rates of herbicides, a reduced input (RI) system that relied on 50% of standard herbicide rates plus cultivation and a biointensive (BIO) system that relied exclusively on cultivation. The soil management system was either unamended and totally dependent on synthetic fertilizer or amended with manure, compost and half the normal rate of synthetic fertilizer. The unamended system was rotated with a standard rotation of barley/red clover. The amended system was rotated with a peat/oat/hairy vetch cover crop.

Weed seed banks shifted substantially over the course of the experiment, with all systems increasing in weed seed abundance for the first few years. However, the germinable seed bank began to decline after 5 years in the BIO system, especially in plots receiving organic soil amendments. By year 7 of the project, the amended BIO system had similar total seed bank numbers as the amended CONV system with 1511 and 1723 seeds m^{-2} respectively. The same trend could be seen in the most abundant weed, common lambsquarters. BIO was the only pest management strategy where soil amendments resulted in lower seed bank density than unamended soils (1511 vs. 2800 seeds m^{-2} respectively). The decline in the amended BIO systems occurred despite the regular seed inputs supplied by the manure. Diversity of the weed community increased in the BIO system, largely through the decline of dominant weed species. The db-RDA analysis allowed us to determine how the community as a whole was shifting and that the interaction between pest management strategy and soil amendments was significant. We suggest that the benefits of a biointensive pest management strategy may take years to manifest themselves and that soil building practices are likely to interact positively with such an approach.

WEED DYNAMICS IN BROCCOLI AND WINTER SQUASH WITH CONTRASTING COVER CROP SYSTEMS. E.R. Gallandt and T. Molloy, Univ. Maine, Orono.

ABSTRACT

Strategies for weed management and soil improvement can become antagonistic on farms attempting to reduce or eliminate farm chemical use, as herbicides are replaced with repeated and intensive soil cultivation. Such soil disturbance regimes can badly damage soil structure, decrease soil organic matter levels, and decimate soil biological activity, thus pitting short-term non-chemical weed control against long-term soil health. Cover crops can substantially offset or reverse losses of soil quality by reducing the need for recurrent intensive cultivation, by adding crop residues to rebuild soil structure and organic matter, as well as by maintaining soil cover thus reducing erosion losses. Weed control from cover crops is derived from their competitive ability during growth, their function as a physical barrier or mulch when killed and left on the surface, as well as allelopathic properties of certain incorporated and surface residues.

Considering the multiple points at which cover cropping practices may contribute to these goals, we initiated a cropping systems comparison in 2001 featuring the following: (a) A conventionally-managed 2-year rotation of broccoli and winter squash ("Conv.); (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 ("Fall CC"); (c) an organic, 4-year rotation of broccoli, winter squash, cereal/red clover, and red clover sod ("2-Yr CC"); and (d) an organic, 4-year rotation including broccoli, cover crop/summer fallow/cover crop, winter squash, and cover crop/summer fallow/cover crop ("Alt. Yr. CC").

Since the experiment began, there has been a decline in the relative abundance of marsh yellow cress (*Rorippa islandica* (Oeder) Borbas) and a corresponding increase in common lambsquarters (*Chenopodium album* L.). Interestingly, this shift in the weed community was evident the Fall CC and 2-Yr CC systems, but not in the Conv. and Alt. Yr. CC systems. In the red-clover- based, 2-Yr CC system, despite efforts to preempt seed production by timely mowing, there is significant common lambsquarters seed rain in this system. Also, seeds are buried by tillage during establishment of the red clover cover crop; lack of subsequent soil disturbance, which is comparatively more frequent in the Alt. Yr. CC system, apparently encourages proliferation of common lambsquarters. Despite a decline in the total weed seed bank, common lambsquarters increased in the Conv, Fall CC, and 2-Yr CC Systems. This increase did not occur in the Alt. Yr CC system (contrast $P < 0.01$). The decline in the seedbank due to the disturbance-intensive cover cropping practices (Alt. Yr CC) was evident in comparison to the sod-based cover cropping system (2-Yr CC), with mean densities of 1200 and 4600 germinable *C. album* seeds m-2, respectively (contrast $P < 0.001$).

WEEDS AND WEED MANAGEMENT ON ELEVEN NORTHEASTERN ORGANIC FARMS. C.L. Mohler, Cornell Univ., Ithaca NY.

ABSTRACT

The Northeast Organic Network (NEON) intensively studied eight organic vegetable farms and three organic grain farms scattered throughout the Northeast. The farms were all well established operations that were nominated by farmers and organic certifying agencies as good examples of successful organic farms. During the 2002 and 2003 growing seasons, data on combined biomass of weed species, and weed abundance, size, and maturity by species were collected shortly before harvest in replicate fields of two to five different crops on each farm. In addition, management practices were tracked for each crop and field.

All of the farmers use highly integrated approaches to weed management that combines multiple tactics. All farms cultivate their crops for weed control. All three grain growers cultivate corn and soybean with rotary hoes and tine weeders for early in-row weed management. In contrast, none of the vegetable growers use in-row mechanical weeders, but instead rely on mulches, hoes and hand weeding for in-row weed control. Some of the vegetable growers use specialized tools to cultivate close to the row, but the sophistication of the equipment did not correlate with degree of weed control. Seven of the eleven farmers use periods of clean cultivated fallow for weed control, and three farmers consider clean fallow a critical part of their program. Six of the eight vegetable growers use plastic mulch to some extent but only two of these rely heavily on plastic. All the farmers use cover crops to suppress weeds during periods when no cash crop is present. All of the vegetable growers use transplants to increase the competitiveness of small seeded crops like lettuce and tomato, and to shorten the time until mechanical weeding. Various farms use straw mulch, sod strips, flame weeding and manipulation of planting times to improve weed control. Two of the vegetable farmers rogue out weeds to prevent seed production, even when the weeds are not competitive with a crop. Consequently, they have very low weed densities. Thus, although some practices are common to all farms of a type, the overall strategy for weed management varies greatly among farms

To summarize level of weed infestation in the 88 crop-years studied, degree of weediness was classified on a 5 category scale: (1) negligible weeds, (2) insignificant yield loss and no interference with harvest, (3) insignificant yield loss but interference with harvest likely, (4) probable minor yield loss, (5) probable moderate to severe yield loss. Some yield loss was likely in 25% of the crop years studied, which indicates that weed management could be improved on some farms. Only one crop on each of two farms suffered from an extreme weed infestation, however, and weeds do not appear to be limiting the profitability of any of the farms. The weeds recorded on the studied farms were typical of the agricultural weed flora of the region.

ECOTYPIC VARIATION IN SEED CHARACTERISTICS OF POWELL AMARANTH FROM HABITATS WITH CONTRASTING CROP ROTATION HISTORIES. D.C. Brainard, A. DiTommaso and C.L. Mohler, Cornell Univ., Ithaca, NY.

ABSTRACT

The objectives of this research were to characterize the extent of intraspecifc variation in seed characteristics of Powell amaranth (*Amaranthus powellii* S. Wats), and to test whether such characteristics evolve rapidly in response to crop rotation practices. Such information is critical for understanding the long term implications of different management practices as well as for interpretation of studies comparing traits of different weed species or biotypes (e.g. herbicide resistant vs. susceptible). We compared germination and emergence of Powell amaranth seeds originating from fields with a maize-alfalfa crop rotation history with those originating from fields with a history of intensive vegetable production. We hypothesized that 1) multiple years of perennial alfalfa would select for greater seed dormancy and longevity in seeds of the summer annual Powell amaranth, 2) earlier spring planting dates of maize and alfalfa compared with most vegetable crops would select for earlier emergence and 3) greater competition and lower soil moisture (lack of irrigation) in the maize-alfalfa rotation would select for greater seed size in Powell amaranth.

Seeds from 10-20 Powell amaranth plants from 10 farms from each habitat were collected in the fall of 2002 and 2003 in Central NY. To control for maternal effects on seed dormancy, seeds from a second generation of plants from each farm of origin were grown under common greenhouse conditions (26/13 C; 16 hr daylength). Second generation seeds were tested for germination in Petri dishes (30/25 C) following cold, dry storage. In addition, seeds from each farm of origin were a) buried in a field in October at a depth of 10 cm in soil enclosed in cylinders with nylon mesh end-covers, b) brought to a depth of 0-2 cm in late April, and c) monitored for emergence throughout the summer of 2004.

As hypothesized, viable seeds from vegetable farms had significantly higher germination in Petri-dishes than those from dairy farms. Total emergence following overwintering was significantly higher for seeds originating from maize-alfalfa rotations (56%) compared with those from vegetable rotations (41%). A strong negative correlation between germination in Petri dishes and emergence in the field suggests that seeds with lower primary dormancy (e.g. seeds from vegetable farms) had higher overwintering mortality. In contrast, the timing of emergence was not significantly different for seeds originating from the different habitats. Weed seed weight varied considerably (0.30 to 0.46 mg) based on farm of origin, but was not significantly different across habitat of origin. Our results demonstrate that after controlling for maternal environmental effects, intraspecifc variation in seed dormancy of Powell amaranth is large, and that some of that variation may be explained as an adaptive response to crop rotation practices. However, we found no evidence for the evolution of larger seed size or earlier emergence in response to crop rotation practices. Further testing of these hypotheses will be conducted in the field in 2005.

BURCUCUMBER SEEDLING ESTABLISHMENT AS INFLUENCED BY TILLAGE AND TIME. W.S. Curran, Penn State Univ., University Park.

ABSTRACT

A field study was initiated in central Pennsylvania to determine the effect of preplant tillage and crop residue on burcucumber (*Sicyos angulatus* L.) establishment. Burcucumber seeds were harvested on the fall and 150 seeds were placed in each plot in the field in mid-November. Four kg/plot of chopped corn stalks, an amount approximately equal to residue remaining from an average Pennsylvania corn crop, were deposited in half of all plots. A tractor-mounted rototiller was used to till the soil and incorporate seed up to a 13 cm depth in half of all plots immediately following seed deposition. The tilled plots were again disturbed using the rototiller the following April prior to burcucumber emergence. The experiment used a split-plot treatment arrangement in a randomized complete block design with six replications. Main plots consisted of tillage treatments with the subplot factor of crop residue being randomly arranged within each main plot. Individual plots measured 2.3 by 4.6 m.

Weekly counts of new burcucumber emergence were recorded starting at first emergence in May and continued until emergence ceased in August. Plants were removed prior to flowering and seed set. Tillage was repeated each spring in the tilled plots and burcucumber seedling emergence was monitored each summer for four seasons following initial seed deposition. All plots were tilled during the fourth year of the experiment. The experiment was repeated. Analysis of variance was used to analyze burcucumber emergence data to evaluate differences and interactions between treatments. Fisher's Protected LSD at the $p = 0.05$ level of significance was used to separate means. Regression analysis compared cumulative emergence differences between treatments.

Tillage and residue were significant for burcucumber seedling numbers with increased emergence in the tilled and +residue treatments. When averaged over residue, emergence in the no-till treatment was 36% less than in the tilled plots. When averaged over years, emerged plants in the no-till +no-residue treatment were 32% fewer than in the no-till +residue treatment and at least 47% less than the tilled treatments. Regardless of crop residue, burcucumber establishment was less in the no-till treatments.

When time was included in the ANOVA, tillage by time and residue by time interactions were significant. Cumulative burcucumber emergence followed a curvilinear response and clearly showed increased plant numbers in the tilled treatment, especially during the first four weeks. The periodicity of emergence was similar across treatments averaging almost 70% emergence in May, about 20% in June, with the remainder emerging in July and early August. Across the four years of the experiment, of the seed that emerged, about 74% came up in the first two years of the study with about 20% in the third year and less than 10% in the fourth year. Regardless of treatment, only 14 to 19% of the original 150 seeds/plot emerged during the 4-year study. Although we cannot account for unemerged seed, the emergence pattern over the three to four year period suggests that few viable seeds remain after four years.

Supplement

of the

Proceedings

Fifty-eighth Annual Meeting

of the

Northeastern Weed Science Society

Marriott Cambridge Center
Cambridge, MA
January 5-8, 2004

Hilary A. Sandler, Editor
University of Massachusetts-Amherst Cranberry Station
East Wareham, MA

Northeastern Weed Science Society
58th Annual Meeting

January 6, 2004
Marriott Cambridge Center, Cambridge, MA

Presidential Address

Scott Glenn
University of Maryland

TEACH AND REACH

Teach and Reach! A catchy title… at least I thought so when I turned it in, but then I realized I have to find some words to go along with this title. I thought about it for a while and then I decided to give you a 10-minute pep talk. No slides, no data, no stats... just a pep talk.

I love to teach … I love the results… I love reaching into some ones mind and lighting it up. Some light up like a Christmas tree… some just a flicker… but every time you teach some one you become a part of them … a piece of their knowledge.

Teaching and reaching is our profession. Our subject is weeds, but our purpose is to teach. We teach in the classroom, at grower meetings, and at venues like this one here, at the Northeast Weed Science Society. I remember early on in my graduate school program when I got that first data set together. I was proud of myself, but then my advisor, Charlie Rieck said something like this: Glenn, that data is worthless, unless you can teach it to somebody through the spoken or written word… Actually, if you knew Charlie it was more like: Glenn, it ain't worth a damn, unless you can sell it. That is exactly what we do here at the NEWSS meetings. We sell our ideas. We teach through the Proceedings, the paper and poster presentations, the resolutions, the graduate student contests. We may be stimulating that next research project or a student to go to graduate school. We teach and reach!

Many of us teach outside our jobs in the community. How many of you in the audience have volunteered to teach at local schools? Raise your hands. How many of you volunteer to teach in the community, such as in church or in youth sports? Raise your hands. I know that Mark and Ron have been youth soccer coaches.

Gary and Anne Schnappinger have been leaders of a 4H program in Queen Anne's County Maryland for years. Scores of kids have come through that program. I know! I have taught and advised several of them at the University of Maryland. They learned about agriculture from Mr. Gary and Miss Anne!

Many of you were students in Bob Sweet's program at Cornell or took a course from Bob. I will not call you former students, because I am sure he is not done with you yet. Did you know that Bob is still teaching? He has been on the Northeastern's Executive Board for years as the CAST Representative. The whole purpose of CAST is to teach and reach people throughout the world on issues pertaining to agriculture.

But what is my point? I promise I will get to one soon.

To teach… is a verb of action. It requires energy and hard work. If that is all we are doing it can be draining and wear you down. But, when we teach and reach, we need to think of that as a noun, because it is a fuel that can give us energy and keep us going. But all too often we look past the compliments, the smile of thanks, or the pride that comes when you see someone you taught turn it around and teach someone else. We say, "That's my job." And we fail to harvest the energy that comes from teaching and reaching… and teaching drains you.

You hear people say things like “I can’t teach”, “The students are too bored”, “The government is too big” and “The general public is just too damn dumb”.

I have heard professors say “It is not my job to make my class interesting. If they are not interested they shouldn’t have taken the class to begin with.”

How about the saying “Those that can do. Those that can’t teach”. That is ridiculous! Those that can … do what? To paraphrase Charlie Rieck, They haven’t done a damn thing unless they have taught it.

When you teach someone it is a very personal thing. You climb out on a limb and expose yourself. You are setting yourself up as the expert. But we all know that we don’t know all of the answers, so self-doubts creep into our thoughts. This can prevent us from reaping our rewards and harvesting the energy that comes from teaching and reaching.

We, in agriculture, cannot afford to have this happen. We have too many people to reach and too few of us doing the teaching!

We have to reach the youth of this country. That is something that agriculture use to do so well through 4H and FFA, but we are doing it poorly today. The young will not only be our future agriculturalists, but they will become a part of that dumb general public if we do not reach them.

We have to teach that dumb general public. They are not dumb. We just haven’t reached them yet. Too often we claim a lack of expertise, so we refuse to step forward and teach. Then we turn around and complain about whom the general public has chosen as their expert.

We have to reach the decision makers in government. If we continue to think of the government as too big and unchanging … it will be just that!

Most of you are teaching and reaching every day of your lives and you do it because you love it. My take home message to you is “Don’t forget to harvest the energy that comes from teaching and reaching into some ones mind and lighting it up with knowledge.”

There are many prestigious tiles in the world today... that of doctor and lawyer and CEO. But those of us that reach people carry the greatest title of all…. The title of teacher!

Minutes of the 58th Annual Business Meeting
of the
NORTHEASTERN WEED SCIENCE SOCIETY
Marriott Cambridge Center, Cambridge, MA
January 7, 2004

1) Call to order

President Scott Glenn called the annual business meeting to order at 4:55 pm on January 7, 2004.

2) Approval of Minutes

Jeff Derr moved that we accept the minutes of the 57th annual business meeting. Rakesh Chandran seconded the motion, and without further discussion, the motion passed unanimously.

3) Necrology Report

Dave Yarborough reported that the following associates have passed away since the last meeting: Dr. Hugh Murphy from the University of Maine, Dr. Kriton Hatzios from Virginia Polytechnic Institute & State University, Anthony Gambino with Amchem Products and Union Carbide, Harold Collins with Amchem Products, Ed Horahan with Amchem Products, and Dr. John Havis from the University of Massachusetts. There was a moment of silence in honor of these associates.

4) Executive Committee Reports

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

a) President's Comments – Scott Glenn
Scott offered thanks to the many people that helped him and the society. He thanked the society, the sustaining members, the executive committee, the past presidents for their guidance, and the membership. He discussed the many changes that had occurred during 2003 including moving to an electronic format for newsletters and for abstract and title submission. Scott commented that there were some difficulties in moving to this format as expected in such a big change, but indicated that they should help the society as we get the bugs worked out of the system. He also acknowledged that these types of changes can by difficult, but asked the membership for their continued patience as we improve the system.

b) Secretary / Treasurer Update – David Yarborough
Dave reported that 135 had pre-registered for the meeting. There were 199 NEWSS members and invited speakers attending the meeting, which was down from 216 at the 57th annual meeting. In addition, 8 people registered for the Microstegium workshop. Dave reported that our expenses for 2003 were $30,480.06 and our income was

$26,265.29 resulting in a net loss of $4,214.77. Our current net worth is $43,637.27, which is down from $47,852.04 in 2002.

c) Audit Committee Report – David Yarborough

Dave reported that members John Jemison, Jr. and Chris Reberg-Horton audited the books and signed the financial statement. John then confirmed that he had conducted the audit, and that the books were accurate and the financial statement was correct. He complimented Dave for his accurate and thorough record keeping. Scott Glenn then presented Dave with a plaque in recognition for his service to the society.

d) Archives Committee – Robin Bellinder

Robin reported that the archive records were being moved to IR-4 headquarters at Rutgers University. Dan Kunkel will be the new archivist. Robin also reported that she had obtained the old proceedings, and missing only 2 volumes of the proceedings.

e) Awards Committee – David Mayonado

Dave reported that he had made the primary portion of his presentations during the General Session.

i) Distinguished member – Dave announced that Dr. C. Benjamin Coffman, with the USDA, and Dr. Joseph Neal, Professor and Extension Specialist in Weed Science at North Carolina State University, were recognized as distinguished members.
ii) Award of Merit – Dave announced that Drs. C. Edward Beste, Professor Emeritus at the University of Maryland, and James C. Graham, retired from Monsanto, received Awards of Merit.
iii) Outstanding Educator – Dave announced that Dr. William S. Curran, Professor of Weed Science at Pennsylvania State University, received the Outstanding Educator Award.
iv) Outstanding Researcher – Dave announced that Dr. Mark J. VanGessel, faculty member in Weed Science at the University of Delaware was awarded the Outstanding Researcher Award.
v) Collegiate Weed Contest Winners – Dave announced the winners of the 2003 Collegiate Weed Contest. They are listed below

Undergraduate Division:

Teams:

First:	University of Guelph – team 1
	Jonathon Klapwik, Ryan Hoegy, Cain Templeman
Second:	State University of New York at Cobleskill
	Aaron Lewis, Andre Samuel
Third:	University of Guelph – team 2
	Rod Crinklaw, Jeff Jacques, Greg Wilson

Individuals:

First:	Jonathon Klapwik, Univ. of Guelph team 1
Second:	Andre Samuel, SUNY Cobleskill
Third:	Ryan Hoegy, Univ. of Guelph team 1

Graduate Division:

Teams:

First: North Carolina State University – team 1
Ian Burke, Hennen Cummings, Andrew MacRae

Second: Virginia Tech
Corey Whaley, Josh Beam, Whitnee Barker

Third: Pennsylvania State
Shaun Heinbaugh, Joe Dauer, Bryan Dillehay

Individuals:

First: Andrew MacRae, NC State Univ.

Second: Cheryl Corbett, Univ. of Guelph

Third: Josh Beam, Virginia Tech

vi) Graduate Student Presentation Awards – Jeff Derr

Jeff thanked the other judges: Joe Neal, Brian Olson, Dave Mayonado, and Dave Vitolo. He also commented on the quality of the presentations, and indicated that there only 18 points separating the first place from the last place presentation. He thanked all of the contestants for their efforts. While the quality of the presentations continues to improve, Jeff offered the following suggestions to help improve them in the future. Presenters should include a greeting for the audience. Presentations should include a justification for the research, a literature review, hypothesis, and slides should only include highlights – not detailed text. Presenters should avoid jargon, fine print, and extraneous photographs. Presenters should understand the equipment they are using, make sure that bars in a graph are labeled, be able to explain everything on each slide, and offer recommendations on what should change as a result of their research. Jeff thanked BASF for once again sponsoring the awards. Kathy Kalmowitz from BASF presented the awards.

1st place:

Prevention and Remedial Treatments for Injury in Mower Tracks Caused by Dislodged Rimsulfuron. Whitnee L. Barker, Shawn D. Askew, and Joshua B. Beam. Virginia Polytechnic Institute & State Univ.

2nd place:

Japanese Stiltgrass Seed Dormancy Characteristics and Germination Requirements. Caren A. Judge and Joseph Neal. North Carolina State University.

3rd place:

How do Brassica Cover Crop Residues Help Manage Weeds? Effects on Seedling Recruitment and Plant Growth. Erin R. Haramoto, Eric Gallandt, and Thomas Molloy. University of Maine.

vii) Research Poster Contest – Paul Stachowski

Paul thanked the other judges – Rick Dunst, Sandra Shinn, and Rick Schmenk - for their assistance in judging a large number of posters. He commented that quality of the posters continues to improve as technology evolves.

1st place:

Biology of the Invasive Plant Pale Swallow-Wort. Larissa Smith, S. Greipsson, and Antonio DiTommaso. Cornell University.

2nd place:

Evaluating Perennial Groundcovers for Weed Suppression: Roadside Trials and Demonstrations. Andrew F. Senesac, Irene Tsontakis-Bradley, Jennifer Allaire, and Leslie Weston. Cornell University.

viii) Photo Contest – Grant Jordan

Grant commented on the quality of the photos, and how it has improved over the years. He mentioned that there 16 photographs submitted by 4 contestants, and that the photos would displayed at the mixer.

1st place:

Malva moschata (Musk Mallow) Flower close up. Zak Skibo, University of Delaware.

2nd place:

Close up of seed head with field background. John Kaminski, University of Maryland.

3rd place:

Teasel w/ bee on the flower. Rakesh Chandran, West Virginia University.

Dave Mayonado also presented plaques to Shawn Askew and Dobroslav Kolev and a monetary award of $400.00 to Dobroslav in recognition of their hard work in maintaining and upgrading the NEWSS website. Scott Glenn seconded Dave's comments and offered his appreciation for their hard work.

5) Old Business

a) **XID Software Sales – Jeff Derr**: Jeff recognized Wynn John for his efforts in promoting this software to the society. Jeff reported that there were 37 copies sold prior to and at the meeting.
b) Mark VanGessel announced that the 2004 Cumulative Index was available for sale at the desk for $20.00.

c) Joe Neal commented that our abstracts are not indexed by CAD and other search tools.
d) Andrew Senesac commented that they are scanning the old proceedings to obtain digital copies of them.
e) Dave Mortensen thanked the section chairpersons for plugging the membership for papers.

6) Officer Changeover and Presentation of the Gavel

Scott Glenn commented before passing the gavel about the fear he had going into the position. He thanked the past presidents for their advice, which helped him get through. He especially recognized Dave Mayonado, who is rotating off of the executive committee, and Jeff Derr for their guidance. He thanked the membership for volunteering to help keep the society going. He thanked Brian Manley and Syngenta for hosting the Collegiate Weed Contest. He then recognized and thanked the executive committee members that are rotating off of the committee including Carrie Judge, graduate student representative, and Mark VanGessel, editor, for their efforts. Scott also thanked Tim Dutt for his hard work in building the program for the 58th annual meeting. Scott then passed the gavel to incoming President, Robin Bellinder. Robin then presented a plaque to Scott Glenn in recognition for his service to the society.

7) New Business – Robin Bellinder

a) **Resolutions Committee – Dwight Lingenfelter**: Dwight presented a resolution proposing to limit the contest during the NEWSS Poster Session to only students. Paul Stachowski commented that the award was originally initiated to encourage posters. Posters were should be concise and be used for topics that don't fit into a paper format. The poster session has been growing, and our paper sessions shrinking until this year. The proposal was, in part, to encourage more papers. Bill Curran asked whether there should be a minimum number of students in order to give an award included as part of the change. He also questioned whether this would discourage papers from the students. Scott Glenn commented that he did not feel that this would be a problem because there would likely not be room reimbursement associated with this contest. Leslie Weston commented that the committee should develop strict rules for the judges to follow in evaluating these posters. Grant Jordan asked how many students competed in the poster contest. There was not a clear answer to this question, but there were 17 students participating in the paper contest. Mark VanGessel asked if students would be allowed to compete in both the paper and poster contest. They likely would be allowed to compete in both. Leslie Weston asked if the comments from the judges are given back to the students. Paul Stachowski indicated that they were. Joe Neal asked if there was a trend for the number of posters increasing over the last several years – the answer was yes it has been. Dave Johnson commented on the method used by the NCWSS for limiting the number of posters. Dave Johnson then moved that the resolution be approved as proposed. Jeff Derr seconded the motion and it passed unanimously.
b) **Nominating Committee – Steve Hart on behalf of Jerry Baron**: Steve presented Bill Curran as the sole candidate for Vice President.

c) **Election of Vice President**: Scott Glenn, hearing no nominations from the floor, moved that nominations be closed and Joe Neal seconded the motion. The motion passed unanimously making Bill Curran the new Vice President.

d) **Appointment (2) and Election (3) of the 2004 Nominating Committee**: Robin Bellinder appointed, on condition that they were willing to accept the appointment, Rick Schmenk to chair the committee and John Jemison. Both agreed to appointments. Dave Johnson, Jack Dobson, and Tracey Harpster were also nominated from the floor. Scott Glenn moved to close nominations and Jeff Derr seconded the motion. The motion was approved unanimously making Dave, Jack and Tracey members of the Nominating Committee.

e) **Resolutions Committee Appointments**: Chris Becker, Paul David and Russ Hahn were appointed by Robin Bellinder and all accepted the appointments.

f) **2004 Weed Contest**: Robin announced that Dave Monks at North Carolina State University would host the 2004 weed contest.

g) **Meeting Site for 2005**: Robin announced that 2005 annual meeting would be held at the Capital Hilton in Washington, D.C. She asked the membership to consider staying at the hotel so that the society could avoid a penalty for not meeting the room night requirement like we had the last time we stayed there.

h) **2006 Meeting site – Tim Dutt**: Tim announced that we were considering a joint meeting with the Northeast Aquatic Plant Management Society for 2004. They typically meet the 3rd week of January, so we may have to consider meeting the 2nd week of January to compromise with them. He asked for input from the membership on this concept. Dave Mortensen commented that classes start the second week of January at many schools, and that may limit student participation. Joe Neal commented that we should push to keep the meeting early in January. Tim asked for a show of hands of those willing and unwilling to meet the second week of January. There were 37 that indicated that they were willing to meet the second week and 15 opposed to meeting the second week. Tim commented that, given there was a significant portion of the membership opposed to meeting the second week and given that the membership was largely in favor of meeting late during the first week of January, that he would push to have them join us during the first week of January.

8) Presentation of the 2004 Executive Committee

The 2004 Executive Committee was presented by President Robin Bellinder.

President Elect, Timothy Dutt

Vice President, William Curran

Secretary/Treasurer, Brian Manley

Past President, Scott Glenn

CAST representative, Robert Sweet

Editor, Hilary Sandler

Graduate Student representative, Jacob Barney

Legislative representative, Dan Kunkel

Public relations, Brent Lackey

Research & Education, Art Gover

Sustaining membership, Susan Rick

WSSA representative, Jeffrey Derr.

9) Adjourn

Joe Neal moved to close the meeting and Dave Vitolo seconded the motion. The meeting was closed at 6:05 pm.

Executive Committee Report of the
NORTHEASTERN WEED SCIENCE SOCIETY

PRESENTED AT THE 58th ANNUAL MEETING MARRIOTT CAMBRIDGE CENTER, CAMBRIDGE, MA JANUARY 7, 2004

PRESIDENT
Scott Glenn

The society started 2003 with another successful annual meeting in Baltimore Maryland at the Hyatt Regency Hotel. The Executive Committee did a very commendable job developing and implementing the program. Dave Mayonado chose a fine site for the meeting and Robin Bellinder organized an excellent program and symposium. The Section Chairs and Chair-elects were the keys to keeping the sections running smoothly and on time. Through elections and appointments a new 2003 Executive Committee was established. The 2003 Nominations Committee and Resolutions Committee were developed as well. Thanks for all of you that volunteered your time and efforts.

At the end of the 2003 meeting we discussed and evaluated the meeting and started the process of directing the 2003 Executive Committee so that the society could be well served. We set many goals for ourselves at this meeting. We set a goal of improving the website so that titles and abstracts could be more readily received and incorporated into the Program and Proceedings. We set a goal to have our Newsletter be available electronically. We also vowed to be more proactive in encouraging participation at the annual meeting, so that attendance and paper and poster presentations would increase. Thanks to some very dedicated NEWSS members all of these goals were reached in 2003.

Shawn Askew offered a dedicated server for the NEWSS. He and his students developed a program for submission of titles and abstracts that streamlined the process between author and publication. Thanks Shawn for all your efforts.

In August, Brent Lackey published the first NEWSS electronic newsletter. This not only saves the society printing and mailing costs it allows for easier links to our website and more rapid communication with our members. Our fears of losing communication with some members appeared unsubstantiated, since our members responded in record numbers to our request for titles in that very first electronic newsletter. Thank you Brent for all your hard work moving us forward in this area.

On July 29, 2003, Syngenta hosted the NEWSS Collegiate Weed Contest in Hudson, New York. The Contest was well attended by graduate and undergraduates from Universities throughout the region. There were also a great number of volunteers from our membership and company sponsors that helped make the Contest a success. I truly appreciate the Syngenta staff who was a great host and of course to Brian Manley who coordinated the Contest.

The 2004 annual meeting at the Boston Marriott in Cambridge, Massachusetts appears destined for success. Tim Dutt and his Section Chairs have done a tremendous job encouraging participation at this meeting. It appears that we have a record number of papers and posters being presented at this meeting. We will be meeting jointly with the Northeastern Branch of the American Society of Horticulture again. This has been a very successful liaison for both societies and we hope to continue with joint meetings in the future. Tim Dutt has developed an excellent symposium on Weed Management in the Future and Jeff Derr has an interesting Japanese Stiltgrass Work Shop scheduled.

I believe that the NEWSS Executive Committee set some very challenging goals for 2003 and have thus far been very successful in meeting those goals. Many dedicated, hard-working people and a membership that is receptive to new ideas and change were responsible for the 2003 successes. It has been a joy to serve as your President this past year and I will always be a proud NEWSS member.

PRESIDENT – ELECT
Robin Bellinder

HOTEL SELECTION. In discussions with the Executive Board and members of the Society during the Baltimore meeting in January 2003, it became apparent that many people would like to see a change of venue for the 2005 meeting of the Society. Washington, DC and Colonial Williamsburg were the two sites most frequently identified as preferred sites. Dr. Steve Reiners, President – Elect of the NEASHS group informed me that Virginia is not in their region and that the trip to Williamsburg would be outside the travel allowances for some of their members. On the basis of that, I decided to concentrate on the DC area, including hotels in Arlington, Alexandria, and Baltimore. Surprisingly, the room costs were relatively similar. Arlington as a site was substantially vetoed by the Executive Board who felt that it was not well situated in terms of getting in and out of DC and had little to offer in terms of amenities. The Alexandria site was really a nice one but had also the problem of being a 6 mile drive to downtown areas. Eventually an agreement was reached with the DC Capital Hilton, the site of the 1998 NEWSS Meeting. NEWSS members who attended that meeting spoke highly of the facilities, the closeness to activities (one block from the White House), and transportation. Thus, we are holding the 2005 NEWSS Meeting at the DC Capital Hilton. The room rate for members will be $116 for both single and double occupancy. There is one potential problem with this choice of hotels, namely assuring that we fulfill our room night occupancy commitment. In 1998, we failed to do so and paid a significant penalty. We were not meeting with the NEASHS group at the time so this may improve our ability to meet our room nights. However, I would like to ask that our members who live in the DC environs, consider occupying rooms, to help us meet this goal, rather than participate only during the day sessions.

GRADUATE STUDENT WEED COMPETITION. After combing the region to find a site for the 2004 competition, the folks at North Carolina State, under the supervison of Dr. David Monks, have agreed to host the event. Many thanks are due to the group. The contest will be held on July 27, 2004.

REPLACING BOARD MEMBERS ROTATING OFF THE EXECUTIVE BOARD. Mark VanGessel, editor of the Proceedings, is stepping down and will be replaced by Hilary Sandler from the UMass-AMherst Cranberry Station. Thanks, Hilary and welcome to the Board.

VICE PRESIDENT
Tim Dutt

The program for the 58th annual meeting of the Northeastern Weed Science Society was planned around the theme “Weed Management in the Future.” A planning group of members (Tim Dutt, Bill Curran, Dave Mortensen, Hilary Sandler, and Mark VanGessel) was formed to develop a general symposium around this theme. The program committee consisted of the following members:

- Program Chair – Tim Dutt;
- Agronomy Section – Susan Rick (Chair) and Eric Palmer (Chair-elect);

- Conservation, Forestry and Industrial Section – Tracey Harpster (Chair) and Todd Mervosh (Chair-elect);
- Ornamentals Section – Kathie Kalmowitz (Chair) and Annamarie Pennucci (Chair-elect);
- Turfgrass and Plant Growth Regulators Section – Shawn Askew (Chair) and Pete Dernoeden (Chair-elect);
- Poster Section – Rakesh Chandran (Chair) and John Jemison (Chair-elect);
- Vegetables and Fruit Section – Bill Sciarappa (Chair) and Marija Arsenovic (Chair-elect);
- Weed Biology and Ecology Section – Dan Brainard (Chair) and Hilary Sandler (Chair-elect).

In addition, Jeff Derr organized an ecology and management workshop on Japanese Stiltgrass (*Microstegium vimineum*). I want to thank all these members for their work and help in developing the program for the meeting.

The general session included a welcoming address from Dr. Cleve Willis, Dean of the College of Natural Resources and the Environment, University of Massachusetts-Amherst. Award presentations were made by Dave Mayonado. Scott Glenn delivered his Presidential Address entitled "Teach and Reach." Michael Richard and Bruce Yergler from The Hale Group, a strategic consulting firm specializing in the food and agribusiness industries, gave the Keynote Address on "Forces Shaping the Future of the Agricultural and Food Industries".

The general symposium topic was developed around the meeting theme. Invited speakers looked into the future on where we are going with weed management tools (herbicides, herbicide-resistant crops, and biological control), how the biology and ecology of weeds can effect how we manage weeds in the future, and how developing information technology could change the way we make management decisions about weeds in both natural and agricultural systems. Dr. Randy Ratliff, Syngenta Crop Protection, presented on the future of herbicide development. Dr. Claire CaJacob, Monsanto Company, presented on future developments in herbicide-resistant crops. Dr. Barbara Booth, University of Guelph, presented on the incorporation of ecological principals into weed management. Dr. Toni DiTommaso, Cornell University, presented on developments in biological weed control. Dr. Gordon Thomas, Agriculture Canada – Saskatoon, presented on weed management from a landscape perspective. Dr. Dave Mortensen, Penn State University, presented on the use of information gathering systems in weed management. Dr. Alex Martin, University of Nebraska, presented on decision tools for weed management. The symposium emphasis was to help determine the direction of future weed management opportunities.

The ecology and management workshop on Japanese stiltgrass was developed as a continuation of our outreach efforts with invasive species groups that began several years ago. Eleven papers were presented on the ecology of Japanese stiltgrass, control programs, and funding sources for management programs. A reception was also held after the workshop for members of the various groups to interact.

The total number of member volunteered papers and posters presented in the sectional breakout sessions was 143. Numbers by section was as follows:

- 32 Posters;
- 28 Agronomy;
- 25 Turfgrass and Plant Growth Regulators;
- 18 Weed Biology and Ecology;
- 17 Ornamentals;
- 16 Vegetables and Fruit;
- 7 Conservation, Forestry and Industrial.

Total papers and posters increased by 36% over the previous 3-year average of 105 (105 in 2003, 106 in 2002, and 103 in 2001). This was also the highest number recorded in the last ten years of meetings.

A total of 18 graduate students participated in the student paper contest. This compares to 13 in 2003, 19 in 2002, and 17 in 2001. Breakout of papers presented by section was 7 in Weed Biology and Ecology, 5 in Turfgrass and Plant Growth Regulators, 2 in Agronomy, 2 in Ornamentals, 1 in Vegetables and Fruit, and 1 in the Ecology and Management Workshop. NEWSS and NE-ASHS held a joint graduate student mixer and discussion session at the meeting.

Site selection for the 60th annual meeting in 2006 will soon be initiated. We will need to poll the membership concerning the dates of the meeting since our traditional timing of the first week in January would directly follow New Years day (January 2 – 5, 2006). Discussions also began with the Northeast Aquatic Plant Management Society about the possibilities of a joint meeting in 2006. They are a group of about 100-150 members and have been meeting in the New England area around the third week in January. Decisions around a joint meeting and the timing will need to be made to begin selection of the appropriate site and hotel.

SECRETARY-TREASURER
David E. Yarborough

The annual meeting in the Hyatt Regency Hotel in Baltimore, MD was attended by 216 members and invited speakers. In addition, 11 people registered for the invasives session and 31 NEASHS members attended the concurrent Horticulture meetings. The total Membership for 2003 stands at 201. Below is the financial statement for the NEWSS in the fiscal year 2003.

NEWSS Financial Statement for 2003

November 1, 2002 to October 31, 2003

INCOME:	
Sustaining Membership	$1,375.00
Coffee Break support	$600.00
Individual Membership	$ 3,980.00
Annual Meeting Registration	$10,515.00
Invasive Weed Session	$850.00
Proceedings	$4,620.00
Interest	$690.79
NEASHS	$584.50
BASF & Perdue	$350.00
Weed Contest	$2,700.00
Subtotal	$26,265.29
EXPENSE:	
Annual Meeting	$10,035.28
Programs	$1,235.00
Student Reimbursement	$1,846.39
Administration	$1,057.40
Proceedings	$3,299.72
Newsletter	$1,595.08
Annual Meeting Awards	$917.00

CAST…………………………………………………………………..............	$1,249.41
NEASHS…………………………………………………………………………	$584.50
WSSA Director of Science Policy..………………………………………………	$4,000.00
Weed Contest.………………………………………………………………………	$4,660.28
Subtotal ………………………………………………………………. …….	*($30,480.06)*
Total Income/Expenses……………………………………………….. ……	(*$4,214.77*)
October 31, 2002 Savings Certificate Accounts (IDS-American Express)..	$21,220.70
October 31, 2002 UM Credit Union Savings (Oct 31, 2002)...……………..	$26,351.42
UM Credit Union Checking..…………………………. ……………………………	$279.92
TOTAL NET WORTH October 2002…………………………………………	**$47,852.04**
October 31, 2003 Savings Certificate Accounts (IDS-American Express) ..	$21,713.94
October 31, 2003 UM Credit Union Savings (Oct 31, 2003)………………..	$21,623.47
UM Credit Union Checking…………………………………………………………	$299.86
TOTAL NET WORTH October 2001..…………………………………………	**$43,637.27**

PAST PRESIDENT
David Mayonado

The Awards committee for the 2004 annual meeting is Dave Mayonado (chair), Jeff Derr, Brian Olson, Rich Bonanno, and David Vitolo. We reviewed nominations in 2003 for Outstanding Researcher, Outstanding Educator, Distinguished Member, and Award of Merit. Recommendations were submitted to the Executive Committee for approval at the October board meeting. The student paper contest judges will be Jeff Derr (chair), Brian Olson, David Vitolo, Joe Neal, and David Mayonado. Paul Stachowski will again chair the Poster Judging committee and Grant Jordan will again chair the Photo Judging committee.

An archives package for my term as President was sent to Dan Kunkle. It contained the 2003 Program, Awards Presentation 57th annual meeting, 2002 letterhead, Executive Committee reports - 57th annual business meeting, April, August, November 2002 newsletters, Minutes – January 2002; March 2002; August 2002; October 2002; and January 2003 EC meetings, Minutes – January 8, 2003 annual business meeting, and the Manual of Operating Procedures - revised January 8, 2003.

I have prepared the awards brochure, and revised the Manual of Operating Procedures (MOP). Copies of both documents will be distributed at the annual meeting in January 2004. The new MOP contains the revised Editors procedures and updated student paper contest information. I have purchased plaques for the awards winners, the outgoing Secretary-Treasurer and for the outgoing President.

CAST
R. D. Sweet

The most important issue for CAST this year has been budget red ink. This is due to the smaller total contributions from agriculture related companies. The decrease is due to mergers, consolidations, etc. among the larger companies. The smaller more local companies have not been contributors to CAST. They are much more likely to support local or regional organizations like NEWSS.

Many professional organizations, 37 at last count, are CAST members but their dues are only 20-25% the size of company contributions. Two significant steps are being taken. The budget and finance committee is obtaining detailed costs for the publications, workshops, symposium, etc. which CAST does. Second the entire board is involved in evaluating these activities in relation to CAST's mission and goals as well as their costs. The board got a good start on the evaluation at our September meeting and we hope to complete the task at the March meeting.

EDITOR
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, abstract submission, and source of Keyword Form submission. Shawn Askew and his students were the ones who put in countless hours to develop this system. Discussions with the Web Master are needed to examine the current system and modify it for the future. All but one abstract was submitted electronically.

Three publications were produced for 2004 Annual Meeting. The program was 60 pages long with 162 titles and 550 were printed. Approximately 350 copies were mailed by the editor with first-class postage. The proceedings were 270 pages and 230 were printed. One hundred and forty-six abstracts and papers were published with the Presidential Address from the 2003 meeting published as a supplement to the 57th Volume. The Cumulative Index to the Proceedings and Supplements of volumes 52 to 57 (1998 to 2003) was printed. This was 48 pages long. The Cumulative Index was made available as both as booklet and electronically on a CD. One hundred and twenty-five copies of the booklet were printed and an initial thirty CD's were produced.

GRADUATE STUDENT REPRESENTATIVE
Caren A. Judge

I am approaching the end of my 3-yr term as graduate student representative for the NEWSS. It has been an honor and a privilege to serve on the executive committee and to have a role in this society. The volunteer efforts of many people operate this organization at an extremely professional level, and the skills from having been part of it will be with me for the rest of my career.

To summarize the year's activities that I have been involved in; I have continued to maintain and update semi-annually the graduate student resource list, which contains contact and advisor information of weed science graduate students in the northeast region. It is updated based on information collected at the annual meeting and the weed contest each year.

The 2003 graduate student professional development workshop at the 2003 meeting in Baltimore was a success. The theme was employment for weed scientists within the government sector. Thanks to all of the speakers including Tom Bewick, Neil Anderson (EPA), Al Tasker, Rob Hedberg, and Jerry Baron. Students responded to a questionnaire about the program, and indicated that the program was very beneficial.

The 2003 collegiate weed contest was held in July, 29 at the Syngenta Crop Protection, Inc. Eastern Regional Technical Center near Hudson, NY. Thirty-five students from seven schools including Cornell University, North Carolina State University, Nova Scotia Agricultural College, Penn State University, SUNY-Cobleskill, Virginia Tech, and The University of Guelph. Thanks to all the volunteers and participants for a very successful weed contest. The day after the contest, Brian Manley arranged for a tour for students of the Syngenta Research Facility. Thanks to him for coordinating this effort. The 2004 collegiate weed contest will be held July 27 in Raleigh, NC, coordinated by North Carolina State University.

At the 2004 annual meeting in Cambridge, the graduate student professional development workshop will be held Tuesday, January 6, 6:45 to 8:00 pm. The topic is Contract Negotiating and Interviewing Tips. The speakers are Dr. Justine Vanden Heuvel, Extension Assistant Professor, University of Massachusetts – Amherst, Cranberry Experiment Station and Dr. Brian Manley, Eastern Regional Technical Center, Syngenta Crop Protection, Inc., Hudson, NY, representing both academia and industry, respectively. We are holding the event Tuesday night in hopes of attracting graduate students from the NE-ASHS.

Jacob Barney, Ph.D. student at Cornell University, will replace me as graduate student representative at the end of the 2004 annual meeting in Cambridge.

PUBLIC RELATIONS
Brent Lackey

I assumed responsibilities for the post of Public Relations Chair at the 57th annual meeting in Baltimore, MD, and photographed most of the events (general symposium, awards ceremony, business meeting, poster session, etc.) for the April newsletter. Submitted article on the 57th annual meeting to WSSA and SWSS for publication in their respective newletters. The April newsletter represented our final hard-copy edition of the NEWSS News, with the first electronic issue provided to the membership in August.

The April NEWSS NEWS was mailed to the membership around April 10th, and I heard of no problems concerning receipt from our members. As you are all aware, I notified the Society via the April newsletter that we would be changing to an electronic format by August 2003, so the upcoming August newsletter will be available strictly on the website, and/or through e-mail, with a listserve-style notification of it's availability sent out by e-mail to all those who signed up on the web site.

Sean Askew has detailed for me his capabilities for supporting such electronic transfer/acess of the newsletter, and I believe he will be attending the EC board meeting in Hudson, where he will be able to provide details. When he and I last spoke (early April), there remained some formatting and assorted server issues to be dealt with which I am sure have been worked out. Much more discussion on this topic during our meeting.

REMINDER: Please send to me any articles you would liked published in the August 2003 newsletter – the deadline was July 22, and I have yet to receive anything. Granted, prep time will be much faster as we take the electronic route for dissemination, but the sooner the better.

The first completely electronic NEWSS NEWS was published in August 2003 - credit to Sean Askew for his help in reaching this milestone. I personally received no comments (either good or bad) concerning the newsletter from the membership, but perhaps no news is good news! I would like to receive feedback from the EC concerning the format and content of the electronic NEWSS NEWS.

Forms for title and keyword submission were mailed out to the membership the first week in August. Although we had some initial hiccups with the on-line submission, it seems that overall the electronic submission was successful, suggesting that our days of using the postal service for communication with the membership are all but over. I am currently working on the

November edition of the NEWSS NEWS, which will be available for posting to the NEWSS web site before November 15.

The November 2003 edition of the NEWSS News was successfully published electronically in mid-November. Registration forms were included as part of the newsletter and posted to the NEWSS web site. I printed and mailed one copy each of the August and November newsletters to one member who contacted mark VanGessel and claimed to have no computer and access to e-mail. Communicated with Shawn Askew to request several e-mail alerts for the Annual Meeting.

RESEARCH AND EDUCATION
Art Gover

Recertification Summary from 2003 Annual Meeting: Table 1 summarizes the recertification credit requests at the 2003 meeting, by certifying entity and NEWSS Program Section. Recertification credits from the same entities have been requested for the 2004 meeting. Due to lack of requests for 2003, the certifying agencies for Ohio and Virginia did not pre-approve the meeting and assign credits, but will respond to post-meeting requests.

With repetition, providing recertification credits for the Society is a straightforward process, and I recommend that this service be continued, at least during my tenure. Most states have approved generic certificates and rosters generated by NEWSS, so this greatly simplifies the process by limiting the number and type of forms that need to be prepared.

Table 1. Requests for recertification credits by certifying entity and NEWSS Program Section for the 2003 annual meeting in Baltimore.

ENTITY	7-Jan AGR	7-Jan ORN	7-Jan VEG	7-Jan AQ	8-Jan WBE	8-Jan IFC	8-Jan TRF	9-Jan AGR	9-Jan ORN	9-Jan TRF	TOT
CCA	3	0	0	4	5	0	1	7	2	0	22
CT	0	0	0	0	0	1	0	0	3	0	4
DE	3	1	0	0	0	4	0	1	0	0	9
MA	0	0	0	0	0	0	0	0	0	0	0
MD	4	1	0	3	0	3	0	3	1	0	15
ME	0	0	0	0	0	0	0	0	0	0	0
NC	0	1	0	2	0	1	0	0	1	0	5
NH	0	0	0	0	0	0	0	0	0	0	0
NJ	0	0	0	1	0	1	0	0	0	0	2
NY	8	0	2	1	0	1	0	3	1	0	16
OH	0	0	0	0	0	0	0	0	0	0	0
PA	3	0	0	3	0	4	0	2	0	1	13
RI	0	0	0	0	0	0	0	0	0	0	0
VA	0	0	0	0	0	0	0	0	0	0	0
VT	0	0	0	0	0	0	0	0	1	0	1
WV	0	0	0	2	0	2	0	1	0	0	5
TOTAL	21	3	2	16	5	17	1	17	9	1	**92**

Invasive Species Programming Track, 2003 Annual Meeting:

Through the initial efforts of Jeff Derr, Gerald Adrian, President of the Northeast Aquatic Plant Management Society assembled a symposium on invasive aquatic species.

<u>-Positives:</u>
•NEAPMS programming was well attended, due to content and no concurrent sessions.
• Good opportunity to work with several of the principals of the NEAPMS
• Able to generate $1000 in corporate sponsorship

<u>-Negatives:</u>
• Only 9 'one-day' registrants - aquatic topic may not be a significant draw for outreach purposes.
• The two-day format proved cumbersome. Future outreach programming should be one-day to simplify registration and improve the attractiveness to commuters.

Future Efforts with Northeast Aquatic Plant Management Society (NEAPMS):
The Board of Directors of NEAPMS has agreed in principle to a joint meeting with NEWSS in 2006 in the Boston area. A working group has been convened, consisting of Tim Dutt, Jeff Derr, and Art Gover from NEWSS, and Jim Sutherland, President, NEAPMS.
The intent is to provide joint programming and social opportunities, while allowing each society to conduct their meeting in a format that largely resembles their traditional format - much like our arrangement with NEASHS. There is very little membership overlap between the societies. NEAPMS members would increase total attendance by 100-120.

Extracurricular Programming for 2004 Meeting:
The original intent was to host an outreach-oriented session focusing on invasive species management in riparian corridors. The *Microstegium* workshop assembled by Jeff Derr was a parallel development, but due to the interest shown, the inherent outreach value, and the efficiency with which Jeff assembled the workshop, we elected to defer the riparian corridors session to a future meeting. From a programming standpoint, Tuesday afternoon is the most logical block of time for extracurricular sessions, and it would not be prudent to have competing sessions.
During my tenure as REC chairman, my direct efforts towards extracurricular sessions will focus on invasive species topics. If you have other special programming you wish to pursue, please let know and I will assist however I can, particularly in the scheduling of such sessions with the Executive Committee.
One aspect of extracurricular programming that the REC Committee needs to improve, particularly outreach-oriented content, is timing of notification. Our traditional timetable corresponds with development of the programming of voluntary papers in established NEWSS Sections. If we wish to increase attendance to outreach sessions, particularly from agency personnel, we need to move our schedule development up one meeting in the Executive Committee meeting cycle. Our November timing of the program newsletter does not provide enough time for people working in government agencies get the necessary approvals by our registration deadlines. The REC needs to make an effort to develop extracurricular programming so that it can be scheduled - at least to the date - at the Executive Committee meeting held in conjunction with the Weed Science Contest. This way we can take advantage of the August newsletter, as well as other channels, to provide a more timely notification to potential attendees.

WSSA REPRESENTATIVE
Jeffrey Derr

The 2003 WSSA meeting in Jacksonville had 553 attendees and under 1,600 room nights. This was less than the 620 attendees expected. There were 134 posters, up from about 85 a year ago. Oral presentations were down 18, counting cancelled talks. There were 333 total abstracts. Approximately $20,000, not counting alcohol, was spent on the Thursday reception. There was a small profit from the Jacksonville meeting. Although WSSA did not reach its room block, more was spent on food/catering than was called for in the contract. So the hotel did not charge any penalty. The next 3 annual meetings will be: 2004 – Kansas City, 2005 – Honolulu, Hawaii (February 7-10, 2005), 2006 – New York City. Rich Bonanno and Brad Majek will serve as local arrangements co-chairs for the New York meeting, which will be held at the Marriott Marquis.

The 2004 WSSA meeting will be at the Westin Crown Center in Kansas City, Mo. February 7-11, 2004. The hotel should be an excellent site for the annual meeting. The symposia and workshops selected for the annual meeting are: Remote Sensing and Site-Specific Weed Management, Fate of Agrochemicals in the Environment and Implications on Water Quality, Sustainability of Glyphosate and Glyphosate-Resistant Crops, Second Generation Crop Biotechnology and Predicted Effects on Weed and Pest Management, an Invasive Species Workshop, and Weed Seedling Recruitment. A vegetable roundtable is planned. A roundtable is also planned as part of the business meeting to give the membership an opportunity to discuss issues with the board.

Everyone should check their address, etc. on the WSSA membership directory. Information can be updated by members. There has been a loss of about 200 in WSSA membership, to about 1700. WSSA has made gains in the General Fund and Endowment Fund so far this year. The feeling was that the Endowment Fund was too low (about $270,000) for a society that size. The two areas where revenues are falling short of budget projections are in journal subscriptions and special publications sales. The lower journal subscription revenue is probably attributable to the Divine Rowecom bankruptcy filing as there were a number of subscribers who had already paid Divine and couldn't afford to pay for their subscriptions twice. While sales of the Handbook are steady, they aren't at the projected sales levels.

Gerry Stephenson was appointed the new Director of Education for the society. The board is looking into the possibility of digitizing back issues of Weed Science, Weed Technology, and Weeds prior to 2000. A national graduate student organization is being developed with Cody Gray of Mississippi State as the first representative to the WSSA board.

Rob Hedberg has developed a poster on WSSA and would appreciate any comments you have or if you have better photographs. Rob, along with Nelroy Jackson, spent a lot of time on the WSSA/ESA invasives conference - Invasive Plants in Natural and Managed Systems: linking Science and Management, which was held November 3-7, 2003 at the Wyndham Bonaventure Resort, Ft. Lauderdale, FL.

WSSA is partnering with XID Services Inc. to sell an inexpensive, comprehensive, and interactive key of 1,000 common weeds in the United States and Canada. This CD will be expanded in phase two of the collaborative effort. I requested that NEWSS and the other regional societies be allowed to sell the program on consignment at each society's annual meeting, which was approved by the WSSA board.

WSSA received a proposed contract from Flora ID Northwest to market compact discs of all known native and introduced plant species in 13 western states and British Columbia. Alex Ogg is handling discussions with this group and is also leading the development of the XID weed identification program. WSSA is pursuing support for a CD on Invasive Plant impact on rangeland and wildland. It will have 16 weeds and WSSA would sell the CD. WSSA will consider advertising publications from the regional and state societies.

WSSA was contacted by APHIS about conducting a literature review on impacts of glyphosate and glufosinate-resistant bentgrass. Phil Banks will chair the committee that will complete this project on behalf of WSSA.

I sent a note to Al Hamill and Don Thill, questioning the early deadline for WSSA title and abstract submission. The NEWSS annual meeting is one month before the WSSA meeting, yet the deadline for NEWSS title submission is the same week as WSSA's deadline. NEWSS abstracts are due October 31, which is 7 weeks later than WSSA's deadline. I asked for a later date for title and abstract submission. This matter may be discussed at a WSSA board meeting.

I have developed a microstegium (Japanese stiltgrass) symposium for the NEWSS annual meeting in Cambridge. I will chair judging of the student contest at the annual meeting. The committee will judge 8 students on Tuesday and 10 on Wednesday at the Cambridge meeting. The judging criteria was updated and sent out to the students in the contest in December and was also sent to Dave Mayonado for the MOP's.

SUSTAINING MEMBERSHIP
Susan K. Rick

Sustaining memberships and support for coffee breaks at the annual meeting for 2003 were down due to the replacement of the chairperson mid-term, time required to get contact list updated, etc. In May 2003, thirty letters were sent to those who had not paid resulting in a total of 11 sustaining members for 2003.

Letters requesting support for the NEWSS summer weed contest were sent in early August. BASF, DuPont and Monsanto contributed $2500 while other members contributed their time. Syngenta hosted the contest and provided support in many ways including financial, time, use of facilities, etc.

Sustaining membership dues for 2004 requests were sent early September and follow up letters were sent to those we had not heard from in late November. To date we have sixteen paid members for 2004 and received support for coffee breaks at the annual meeting from six companies. Sustaining members and those supporting the coffee breaks will be acknowledged in the program and at the annual meeting.

We are in the process of building the membership address list and updating it with email addresses and new contacts. We encourage the membership to help recruiting new sustaining members.

Placement Service: NEWSS forms (both positions desired and position announcements) were taken to the WSSA in Jacksonville, FL and placed in the notebooks with others from the various societies.

Members of the Northeastern Weed Science Society

As of October 2004

John Ahrens
Connecticut Agriculture Exp. Station
PO Box 248
Windsor, CT 06095
Tel: (860) 683-4985
Fax: (860) 683-4987
Email: jpahrens@worldnet.att.net

Gregory Armel
DuPont
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19714
Tel: (302) 366-5067
Email: gregory.r.armel@usa.dupont.com

Marija Arsenovic
Rutgers University IR-4 Project
681 US Highway No 1, South
North Brunswick, NJ 08902-3390
Tel: (732) 932-9575
Fax: (732) 932-8481
Email: arsenovic@actb.rutgers.edu

James Ashley
AshGrow Crop Management
11913 Simsbury Place
Glen Allen, VA 23059
Tel: (804) 747-7148
Fax: (804) 747-7249
Email: jeashley@ashgrow.com

Richard Ashley
University of Connecticut
Department of Plan Science, Unit 4067
Storrs, CT 06269-4067
Tel: (860) 486-3438
Fax: (860) 486-0682
Email: Richard.Ashley@ucomm.edu

Shawn Askew
Virginia Tech
Glade Road Research Facility
435 Old Glad Road
Blacksburg, VA 24061-0330
Tel: (540) 231-5807
Fax: (540) 231-5807
Email: saskew@vt.edu

Mark Barczewski
E. I. DuPont DeNemours Co., Inc.
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19714
Tel: (302) 366-5590
Fax: (540) 231-5755
Email: wbarker@vt.edu

Whitnee Barker
Virginia Tech
Glade Road Research Facility
435 Old Glade Road
Blacksburg, VA 24061-0330
Tel: (540) 231-3360

Jacob Barney
Cornell University
20 Plant Sciences
Ithaca, NY 14853
Tel: (607) 255-0884
Fax: (607) 255-9998
Email: jnb22@cornell.edu

Sali Barolli
Imperial Nurseries
90 Salmon Brook Street
PO Box 120
Granby, CT 06035-0120
Tel: (860) 653-1509
Fax: (860) 844-8609
Email: sbarolli@mail.insy.com

Jerry Baron
New Jersey Agriculture Experiment Station
Rutgers University
88 Lipman Drive
North Brunswick, NJ 08902-3390
Tel: 732-932-9000x501
Fax: 732-932-8481
Email: jbaron@aesop.rutgers.edu

David Baxter
DuPont
Stien-Haskell Reseach Center
1090 Elkton Road, PO Box 30
Neward, DE 19714
Tel: (302) 366-5065

Joshua Beam
Virginia Tech
Glade Road Research Facility
435 Old Glade Road
Blacksburg, VA 24061-0330
Tel: (540) 231-5807
Fax: (540) 231-5755
Email: jbeam@vt.edu

Chris Becker
6374 Rt 89
Romulus, NY 14541
Tel: (607) 869-9511
Email: becker89@fltg.com

Robin Bellinder
Cornell University
Dept. of Horticulture
164 Plant Science Bldg
Ithaca, NY 14853
Tel: (607) 255-7890
Fax: (607) 255-0599
Email: rrb3@cornell.edu

Diane Benoit
Agriculture & AgroAlimentaire Canada
430 Govin Blvd
Saint-Jean-sur-Richelieu, QB J3B 3E6
Tel: (450) 346-4494
Fax: (450) 346-7740
Email: benoitdl@agr.gc.ca

Dana Berner
USDA ARS FDWSRU
1301 Ditto Avenue
Fort Detrick, MD 21702
Tel: (301) 619-7316
Fax: (301) 619-2880
Email: dberner@fdwsr.ars.usda.gov

C. Edward Beste
University of Maryland
27664 Nanticoke Road
Salisbury, MD 21801
Tel: (410) 742-8788
Fax: (410) 742-1922
Email: cb20@umail.umd.edu

Prasanta Bhowmik
University of Massachusetts - Amherst
Stockbridge Hall
Amherst, MA 01003-7245
Tel: (413) 545-5223
Fax: (413) 545-3958
Email: pbhowmik@pssa:umass.edu

Dave Bilyea
Ridgetown College - University of Guelph
120 Main Street East
Ridgetown, ON N0P 2C0
Tel: (519) 674-1638
Fax: (519) 674-1600
Email: dbilyea@ridgetownc.uoguelph.ca

Tom Blaesser
DuPont Crop Protection
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19714
Tel: (302) 366-6102
Email: Thomas.P.Blaesser@usa.Dupont.com

Clifford Blessing
Delaware Dept. of Agriculture
2320 S. Dupont Highway
Dover, DE 19901-5515
Tel: (302) 698-4500
Fax: (302) 697-4468
Email: Paul.Blessing@state.de.us

A. Richard Bonanno
University of Massachusetts
255 Merrimack Street
Methuen, MA 01844
Tel: (978) 682-9563
Fax: (978) 685-6691
Email: rbonanno@umext.umass.edu

Jeffrey Borger
Penn State Univ, Valentine Res. Ctr.
University Drive Extension
University Park, PA 16802
Tel: (814) 865-3005
Fax: (814) 863-1613
Email: jab267@psu.edu

Daniel Brainard
Cornell University
Dept. of Crop & and Soil Science
905 Bradfield Hall
Ithaca, NY 14853
Tel: (607) 255-4747
Email: dcb15@cornell.edu

Melissa Bravo
RD5 Box 17A
Wellsboro, PA 16901
Tel: (570) 723-0987
Email: bravomelissa@yahoo.com

William Bruckart
USDA - ARS FDWSRU
1301 Ditto Avenue
Ft. Detrick, MD 21702
Tel: (301) 619-2846
Fax: (301) 619-2880
Email:wbruckart@fdwsr.ars.usda.gov

Michael Burton
North Carolina State University
Crop Science Dept.
Box 7620, 4401 Williams Hall
Raleigh, NC 27695-7620
Tel: (919) 513-2860
Fax: (919) 515-5315
Email: mike_burton@ncsu.edu

Luke Case
Ohio State University
2001 Fyffe Ct.
Columbus, OH 43210
Tel: (614) 292-0209
Fax: (614) 292-3505
Email: case.49@osu.edu

Rakesh Chandran
West Virginia University
1076 Agricultural Sciences Bldg
PO Box 6108
Morgantown, WV 26506
Tel: (304) 293-6131
Fax: (304) 293-6954
Email: rschandran@mail.wvu.edu

Brian Clark
Penn State University
Crop & Soil Sciences
116 ASI Building
University Park, PA 16802
Tel: (814) 863-7607
Fax: (814) 863-7043
Email: bjc159@psu.edu

Benjamin Coffman
USDA-ARS
10300 Baltimore Avenue, Bldg. 001, Rm. 124
Beltsville, MD 20705
Tel: (301) 504-5398
Fax: (301) 504-8370
Email: coffmanc@ba.ars.usda.gov

Steven Cosky
Sygenta Crop Protection Inc.
PO Box 18300
Greensboro, NC 27419-8300
Tel: (336) 643-5561
Fax: (336) 643-2653
Email: steve.cosky@syngenta.com

Dan Cotterman
E. I. DuPont Crop Protection
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19714
Tel: (302) 451-4855
Fax: (919) 481-3599

John Cranmer
Valent USA Corporation
110 Iowa Lane
Suite 201
Cary, NC 27511-2400
Tel: (919) 467-6293
Fax: (814) 863-7043
Email: jcran@valent.com

William Curran
Penn State University
Dept. Crop & Soil Sciences
116 ASI Building
University Park, PA 16802
Tel: (814) 863-1014
Email: wsc2@psu.edu

S. Gary Custis
PBI Gordon Corporation
1217 W. 12th Street
Kansas City, MO 64101
Tel: (816) 460-6215
Fax: (816) 460-3715
Email: gcustis@pbigordon.com

Mark Czarnota
University of Georgia
1109 Experiement Street
Griffen, GA 30223
Tel: (770) 228-7398
Fax: (770) 412-4764
Email: mac@griffin.peachnet.edu

Paul David
Gowan Company
343 Rumford Road
Lititz, PA 17543
Tel: (717) 560-8352
Fax: (717) 560-9796
Email: pdavid@gowanco.com

Todd Davis
Delaware Dept. of Agriculture
2320 S. Dupont Highway
Dover, DE 19901-5515
Tel: (302) 698-4500
Fax: (302) 697-4468
Email: Todd.Davis@state.de.us

Peter Dernoeden
University of Maryland
Dept. of Natural Resource Sciences & LA
1112 H.J. Petersen Hall
College Park, MD 20742
Tel: (301) 405-1337
Fax: (301) 314-9041
Email: pdg@umail.umd.edu

Jeffrey Derr
Virginia Tech
Hampton Roads AREC
1444 Diamond Springs Rd
Virginia Beach, VA 23455
Tel: (757) 363-3912
Fax: (757) 363-3950
Email: jderr@vt.edu

Robert DeWaine
Monsanto
505 W. Noyes Blvd.
Sherrill, NY 13461
Tel: (315) 363-3903
Fax: (315) 363-3903
Email: bob.dewaine@monsanto.com

Antonio DiTommaso
Cornell University
903 Bradfield Hall
Dept. of Crop & Soil Sciences
Ithaca, NY 14853
Tel: (607) 254-4702
Fax: (607) 255-3207
Email: ad97@cornell.edu

Jeffrey Dobbs
Olympic Horticultural Products
1095 Applecross Dr.
Roswell, GA 30075

John Dobson
American Cyanamid (Retired)
2815 Lake Road
Williamson, NY 14589
Tel: (315) 589-8940
Fax: (315) 483-8890
Email: crispjack@aol.com

Doug Doohan
Ohio State University
1680 Madison Avenue
Wooster, OH
Tel: (330) 202-3593
Email: doohan.1@osu.edu

Ruth Douglas
Virginia Native Plant Society
108 Wildflower Drive
Charlottesville, VA 22911
Tel: (434) 293-6538
Email: ruthd@cstone.net

Jesse Dubin
Cornell University
Dept. of Horticulture
164 Plant Science Bldg
Ithaca, NY14853
Tel: (607) 255-7890

Richard Dunst
Cornell University
412 East Main Street
Vineyard Research Lab
Fredonia, NY 14063
Tel: (716) 672-6464
Fax: (716) 679-3122
Email: rmd7@cornell.edu

Tim Durham
Deer Run Farm
Bellport, NY 11713
35 Bieselin Road
Tel: (631) 286-2584
Email: tcd8@cornell.edu

Timothy Dutt
Monsanto Company
8482 Redhaven Street
Fogelsville, PA 18051
Tel: (610) 285-2006
Fax: (610) 285-2007
Email: timothy.e.dutt@monsanto.com

Donna Ellis
University of Connecticut
Dept. of Plant Science-Unit 4163
Storrs, CT 06269
Tel: (860) 486-6448
Fax: (860) 486-0534
Email: donna.ellis@uconn.edu

Farivar Eskandari
USDA-ARS-FDWSRU
1301 Ditto Ave
Fort Detrick, MD 21702
Tel: (301) 619-2333
Fax: (301) 619-2890

Jason Fausey
Valent USA Corporation
Office Park West
530 South Creyts, Suite C
Lansing, MI 48917
Tel: (517) 321-7380
Fax: (517) 321-7216
Email: jason.fausey@valent.com

Stanford Fertig
Rutgers University (Retired)
16919 Melbourne Drive
Laurel, MD 20707
Tel: 301-776-2527
Email: tfertig@iopener.net

Mike Fidanza
Penn State University
Berks Campus
Tulpehocken Road
Reading, PA 19610
Tel: (610) 396-6330
Fax: (610) 396-6024
Email: maf100@psu.edu

J. Ray Frank
IR-4
6916 Boyers Mill Road
New Market, MD 21774
Tel: (301) 898-5332
Fax: (301) 898-5937
Email: jrayfrank@earthlink.net

Leonard Gianessi
NCFAP
1616 P St. NW
Washington, DC 20036
Tel: (202) 328-5048
Fax: (202) 328-5133
Email: gianessi@ncfap.org

Scott Glenn
University of Maryland
0115 HJ Patterson Hall, NRSL Dept.
College Park, MD 20742
Tel: (301) 405-1331
Fax: (301) 314-9041
Email: dg11@umail.umd.edu

Art Gover
Penn State University
LMRC Orchard Road
University Park, PA 16802
Tel: (814) 863-1184
Fax: (814) 863-1184
Email: aeg2@psu.edu

Art Graves
Suny Cobleskill
2237 West Fulton Road
Warnerville, NY 12187
Tel: (518) 234-7496
Email: gravesas@cobleskill.edu

Scott Guiser
Penn State Coop. Extension
1282 Almshouse Road
Doylestown, PA 18901
Tel: (215) 345-3283
Fax: (215) 343-1653
Email: sxg6@psu.edu

Howard Guscar
FMC Corporation - APG
4270 W. Charleston
Tipp City, OH 45371
Tel: (937) 667-5162
Fax: (937) 667-5939
Email: howard_guscar@fmc.com

Jim Haldeman
Monsanto
269 Pine View Lane
York, PA 17403
Tel: (717) 747-9923
Fax: (717) 747-9844
Email: jim.haldeman@monsanto.com

Noureddine Hamamouch
Virginia Tech
406 Price Hall
Blacksburg, VA 24060
Tel: (540) 231-7604
Fax: (540) 231-7477
Email: nhamamou@vt.edu

Tracey Harpster
Penn State University
102 Tyson Road
University Park, PA 16802
Tel: (814) 865-3190
Fax: (814) 863-6139
Email: tlh8@psu.edu

Stephen Hart
Rutgers University
Plant Science Dept. Furan Hall
59 Dudley Road
New Brunswick, NJ 08901
Tel: (732) 932-9711
Email: hart@aesop.rutgers.edu

Brian Hearn
University of Delaware
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-1997
Fax: (302) 856-1994
Email: bhearn@udel.edu

Lane Heimer
Maryland Dept. of Agriculture, Weed Control
50 Harry S. Truman Parkway
Annapolis, MD 21401
Tel: (410) 841-5871
Fax: (410) 841-5914
Email: notfoot60@aol.com

Robert Herrick
United Agri Products
11 Wolfpack Court
Hamilton, NJ 08619-1156
Tel: (609) 586-8843
Fax: (609) 586-6252
Email: bob.herrick@uap.com

Edison Hidalgo
DuPont
Stine-Haskell Res. Center
1090 Elkton Rd, PO Box 30
Neward, DE 19714
Tel: (302) 366-6109
Email: EdisonH@msn.com

Edward Higgins
Syngenta (Retired)
3511 Normandy Hills Circle
Greensboro, NC 27410
Tel: (336) 288-6422
Fax: (336) 288-8915
Email: ed.higgins@syngenta.com

Thomas Hines
Eastern Shore AREC VPI
33446 Research Drive
Painter, VA 23301
Tel: (757) 414-0724
Fax: (757) 414-0730
Email: thhines@vt.edu

Lewis Howell
DuPont Crop Protection
Stine-Haskell Res. Center
1090 Elkton Rd, PO Box 30
Newark, DE 19714
Tel: (302) 366-6104
Email: Lewis.S.Howell@usa.dupont.com

Marc Imlay
MD Native Plant Society
2321 Woodberry Drive
Bryans Road, MD 20616-3255
Tel: (301) 283-0808
Fax:
Email: ialm@erols.com

Mark Isaacs
University of Delaware
Research & Education Center
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-1997
Fax: (302) 856-1994
Email: isaacs@udel.edu

John Isgrigg
Bayer Environmental Sci.
12001 Hadden Hall Drive
Chesterfield, VA 23838
Tel: (804) 796-3246
Email: izzy3@worldnet.att.net

Dr. J. A. Ivany
Agriculture & Agri-Food Canada (Retired)
Crops & Livestock Research Centre
440 University Avenue
Charlottetown, PE C1A 4N6
Tel: (902) 566-6835
Fax: (902) 566-6821
Email: ivanyj@agr.gc.ca

John Jemison
University of Maine Cooperative Extension
495 College Avenue
Orono, ME 04473-1294
Tel: (207) 581-3241
Fax: (207) 581-1301
Email: jjemison@umext.maine.edu

Darryl Jewett
USDA Forest Service
320 Green Street
Athens, GA 30602-2044
Tel: (706) 559-4283
Fax: (706) 559-4287

Sara Johansen
Ohio State University
Dept. of Horticulture
2001 Fyffe Ct.
Columbus, OH 43210
Tel: (614) 247-6823
Email: johansenn.11@osu.edu

Quintin Johnson
Penn State University
Research & Education Center
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-7303
Fax: (302) 856-1845
Email: quintin@udel.edu

Jon Johnson
Pennsylvania State University
LMRC, Orchard Road
University Park, PA 16802
Tel: (814) 863-1184
Fax: (814) 863-1184
Email: jmj5@psu.edu

Roy Johnson
Waldrum Specialities, Inc.
4050A Skyron Drive
Doylestown, PA 19002
Tel: (215) 348-5535
Fax: (215) 348-5541
Email: rjoh834880@aol.com

Brian Jones
Penn State University
Dept of Crop & Soil Sciences
116 ASI Building
University Park, PA 16802
Tel: (814) 865-6679
Fax: (814) 863-7043
Email: bpj2@psu.edu

Grant Jordan
A. C. D. S. Research, Inc.
9813 Glenmark Road
North Rose, NY 14516
Tel: (315) 587-2140
Fax: (315) 587-2145
Email: acdsgj@computer-connection.net

Carrie Judge
North Carolina State University
Box 7609
Raleigh, NC 27695-7609
Tel: (919) 515-3178
Fax: (919) 515-2505
Email: caschmid@unity.ncsu.edu

Jerry Kahl
J. C. Ehrlich Co., Inc.
500 Spring Ridge Drive
Reading, PA 19612
Tel: (610) 372-9700
Fax: (610) 378-9744

Kathie Kalmowitz
BASF Corporation
26 Davis Drive
Research Triangle Park, NC 27709
Tel: (919) 547-2642
Fax: (919) 547-2410
Email: kalmowk@basf.com

John Kaminski
University of Maryland
Dept. of Natural Resource Sciences
1112 H.J. Patterson Hall
College Park, MD 20742
Tel: (301) 405-1336
Fax: (301) 314-9041
Email: kaminski@umd.edu

Renee Keese
Syngenta Crop Protection
985 Arrowwood Drive
Carmel, IN 46033
Tel: (317) 846-8812
Fax: (317) 846-8832
Email: renee.keese@syngenta.com

Steven King
Virginia Tech
Glade Rd Res. Ctr Dept. PPWS
Blacksburg, VA 24061
Tel: (540) 231-2463
Fax: (540) 231-5755
Email: stking4@vt.edu

Hyesuk Kong
USDA/ARS/SASL
Building 001, Room 245
Beltsville, MD 20705
Tel: (301) 504-6846
Fax: (301) 504-6491
Email: kongh@ba.ars.usda.gov

Larry Kuhns
Penn State University
103 Tyson Bldg
University Park, PA 16803
Tel: (814) 863-2197
Fax: (814) 863-6139
Email: ljk@psu.edu

Virender Kumar
Cornell University
146A Plant Science
Ithaca, NY 14853
Tel: (607) 255-9085
Fax: (607) 255-0599
Email: amj8@cornell.edu

Dan Kunkel
IR-4
681 US Hwy #1 South
North Brunswick, NJ 08902-3390
Tel: (732) 932-9575
Fax: (732) 932-8481
Email: kunkel@aesop.rutgers.edu

Brent Lackey
Syngenta Crop Protection
6128 Eddy Ridge Road
Williamson, NY 14589
Tel: (315) 589-4880
Fax: (315) 589-4999
Email: brent.lackey@syngenta.com

Darrell LaShomb
DuPont
Stine-Haskell Res.Center
1090 Elkton Rd, PO Box 30
Neward, DE 19714
Tel: (302) 366-6103

Dwight Lingenfelter
Penn State University
Dept. of Crop & Soil Sciences
116 ASI Bldg
University Park, PA 16802
Tel: (814) 865-2242
Fax: (814) 863-7043
Email: dxl18@psu.edu

Henry Lohmann
PO Box 22
Bellport, NY 11713
Tel: (631) 286-1078
Fax: (631) 286-1078
Email: halohmann@aol.com

John Long
FMC
1735 Market Street
Philadelphia, PA 19103
Tel: (215) 299-6967
Fax: (215) 299-6100
Email: John_Long@fms.com

Daniel Loughner
Dow AgroSciences, LLC
497 Leonard Road
Huntington Valley, PA 19006
Tel: (215) 947-0721
Fax: (215) 947-1921
Email: dloughner@dowagro.com

Sarah Low
F.X. Browne, Inc.
1101 South Broad St., PO Box 401
Lansdale, PA 19446
Tel: (215) 362-3878
Fax: (215) 362-2012
Email: sclow@fxbrowne.com

Edith Lurvey
Cornell University IR-4
Dept. of Food Sciences
630 West North St.
Geneva, NY 14456
Tel: (315) 787-2308
Fax: (315) 787-2397
Email: ell10@cornell.edu

Darren Lycan
Rutgers University
Dept. of Biology & Pathology
59 Dudley Road, Foran Hall
New Brunswick, NJ 08901
Tel: (732) 932-9711
Fax: (732) 932-4293
Email: lycan@aesop.rutgers.edu

John Lydon
USDA/ARS/SASL
Building 001, Rm. 227
Beltsville, MD 20705
Tel: (301) 504-5379
Fax: (301) 504-6491
Email: LydonJ@ba.ars.usda.gov

Matthew Mahoney
Bayer Crop Science
4773 Sailors Retreat Road
Oxford, MD 21654
Tel: (410) 822-5215
Fax: (410) 819-0286
Email: matt.mahoney@bayercropscience.com

Bradley Majek
Rutger University
Rutgers A.R.E.C.
121 Northville Road
Bridgeton, NJ 08302
Tel: (856) 455-3100
Fax: (856) 455-3133
Email: majek@aesop.rutgers.edu

Betty Marose
University of Maryland
Dept. of Entomology
Plant Science Bldg
College Park, MD 20742
Tel: (301) 405-3929
Fax: (301) 314-9090
Email: bm7@umail.umd.edu

Michelle Martin
Univ. of New Hampshire
Plant Biology Dept
Spaulding Life Sciences G28
Durham, NH 03824
Tel: (603) 862-3209
Fax: (603) 862-4757
Email: michelle@littlelit.com

Hannah Mathers
Ohio State University
248C Howlett Hall
2001 Fyffe Ct.
Columbus, OH 43210-1096
Tel: (614) 247-6195
Fax: (614) 292-3505
Email: mathers.7@osu.edu

David Mayonado
Monsanto Company
6075 Westbrooke Drive
Salisbury, MD 21801
Tel: 410-726-4222
Fax: 410-219-3202
Email: david.j.mayonado@monsanto.com

William McCollum
Dupont/Pioneer
31601 Maryland Ave
Galena, MD 21635
Tel: (410) 648-9991
Email: bill.mccollum@pioneer.com

Michael McComrick
DuPont
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19714
Tel: (302) 366-6950

Scott McElroy
North Carolina State University
4401 Williams Hall, Dept of Crop Science
Raleigh, NC 27695-7620
Tel: (919) 515-5654
Email: scott_mcelroy@ncsu.edu

Hiwot Menbere
University of Maryland
H.J. PatTerson Hall Rm 1112
College Park, MD 20742
Tel: (301) 405-1334
Fax: (301) 314-9014

Todd Mervosh
Connecticut Agriculture Experiment Station
153 Cook Hill Road, PO Box 248
Windsor, CT 06095
Tel: (860) 683-4984
Fax: (860) 683-4987
Email: Todd.Mervosh@po.state.ct.us

Kyle Miller
BASF
14000 Princess Mary Road
Chesterfield, VA 23838
Tel: (804) 739-6044
Fax: (804) 739-7498
Email: millerkj@basf.com

Andrew Miller
Cornell University
146A Plant Science Building
Ithaca, NY 14853
Tel: (607) 255-9085
Fax: (607) 255-0599
Email: ajm8@cornell.edu

David Mortensen
Pennsylvania State University
DepT of Crop and Soil Sciences
116 ASI Building
University Park, PA 16802
Tel: (814) 865-1906
Fax: (814) 863-7043
Email: dmortensen@psu.edu

Wilbur Mountain
Pennsylvania Dept. of Agriculture
5906 Jonestown Road
Harrisburg, PA 17110
Tel: (717) 772-5209
Fax: (717) 783-3275
Email: wmountain@state.pa.us

Aboud Mubareka
Sprout-Less Vegetn Control Sys
1125 Power Road
St. Jsph de Madawaska, NB E7B 2M3
Tel: (506) 739-6447
Fax: (506) 735-7033
Email: samco@sprout-less.com

Chris Munsterman
Syngenta Crop Protection
102 Larkspur Lane
Martinsburg, WV 25401
Tel: (304) 754-6247
Email: chris.munsterman@syngenta.com

Matt Myers
Penn State University
Dept of Crop & Soil Sciences
116 ASI Bldg
University Park, PA 16802
Tel: (814) 863-6172
Fax: (814) 863-7043
Email: mwm133@psu.edu

Joseph Neal
North Carolina State University
Dept. Horticultural Science
Box 7609
Raleigh, NC 27695-7609
Tel: (919) 515-9379
Fax: (919) 515-7747
Email: joe_neal@ncsu.edu

Larry Norton
Bayer Environmental Science
739 Blair Road
Bethlehem, PA 18017
Tel: (610) 814-6220
Fax: (610) 814-6221
Email: larry.norton@bayercropscience.com

Rob Nurse
Cornell University
Department of Crop and Soil Sciences
905 Bradfield Hall
Ithaca, NY 14850
Tel: (607) 255-4747
Email: ren8@cornell.edu

Brian Olson
Dow AgroSciences LLC
PO Box 753
Geneva, NY 14456-0753
Tel: (315) 781-0140
Fax: (315) 781-0387
Email: bdolson@dowagro.com

Brian O'Neill
Weeds Inc.
250 Bodley Road
Aston, PA 19014
Tel: (610) 358-9430
Fax: (610) 358-9438

Marc Pacciholi
Crop Management Strategies, Inc.
PO Box 510
Hereford, PA 18056
Tel: (610) 767-1944
Fax: (610) 767-1925
Email: cms-glp@fast.net

Eric Palmer
Syngenta
67 Pinewood Road
Hudson, NY 12534
Tel: (518) 851-2122
Fax: (518) 851-9790
Email: eric.palmer@syngenta.com

Philip Pannill
Maryland Forest Service
1260 Maryland Avenue
Hagerstown, MD 21740
Tel: (301) 791-4010
Fax: (301) 791-0173
Email: ppannill@dnr.state.md.us

Bradley Park
Penn State University
116 ASI Building
University Park, PA 16802
Tel: (814) 863-0139
Email: bsp109@psu.edu

James Parochetti
USDA-CSREES
Mail Stop 2220
14th & Independence Ave SW
Washington, DC 20250
Tel: (202) 401-4354
Fax: (202) 401-4888
Email: jparochetti@reeusda.gov

Annamarie Pennucci
Northeast Turf & Ornamental Research
4 Englewood Drive
Raymond, NH 03077
Tel: (603) 895-8480

Ross Phillips
J.C. Ehrlich Co., Inc.
500 Spring Ridge Drive
Reading, PA 19612-3848
Tel: (610) 372-9700

Bill Phillips
University of Maryland
0117 H. J. Patterson Hall, NRSL
College Park, MD 20740
Tel: (301) 405-8152

Thomas Plitt
Bayer Environmental Sciences
9 Meadow Lark Lane
Epsom, NH 03234
Tel: (603) 736-6045
Fax: (603) 736-6046
Email: sprays@metrocast.net

Jenny Pope
Ohio State University
248A Howlett Hall
2001 Fyffe Ct.
Columbus, OH 43210
Tel: (614) 292-0209
Fax: (614) 292-3505
Email: pope.71@osu.edu

Randall Prostak
Univ. Massachusetts – Ext.
Dept. Plant & Soil Sciences
Amherst, MA 01033
Tel: (413) 577-1738
Fax: (413) 545-3075
Email: rprostak@pssci.umass.edu

Jay Radhakrishnan
USDA-ARS
Bldg. 001 Room 10A
10300 Baltimore Avenue
Beltville, MD 20795
Tel: (301) 504-6105
Email: yadhakrj@ba.ar.usda.gov

Daniel Ramsdell
Crop Management Strategies, Inc.
PO Box 510
Hereford, PA 18056
Tel: (610) 767-1944
Fax: (610) 767-1925
Email: cms-glp@fast.net

Heidi Rapp
Cornell University
146A Plant Science
Ithaca, NY 14853
Tel: (607) 255-9085
Fax: (607) 255-0599
Email: hsr6@cornell.edu

Patrick Rardon
E. I. DuPont De Nemours & Co., Inc.
191 Ash Lane
Elkton, MD 21921
Tel: (302) 366-5546
Email: Prardon@comcast.net

Randy Ratliff
Syngenta Crop Protection, Inc.
PO Box 18300
Greensboro, NC 27419
Tel: (336) 632-2549
Fax: (336) 632-6950
Email: randy.ratliff@syngenta.com

Chris Reberg-Horton
Univ. of Maine Coop Ext.
495 College Ave
Orono, ME 04473
Tel: (207) 581-2942
Email: chrisrh@umext.maine.edu

Robert Richardson
Michigan State University
432 Plat & Soil Science Bldg.
East Lansing, MI 48824-1325
Tel: (517) 432-3630
Fax: (517) 432-2242
Email: richa462@msu.edu

Susan Rick
DuPont
2021 Gardenbrook Drive
Raleigh, NC 27606
Tel: (919) 854-0806
Fax: (919) 854-0806
Email: susan.k.rick@usa.dupont.com

Domingo Riego
Monsanto Company
1307 Cottonwood Ct
Carmel, IN 46033
Tel: (317) 575-8769
Fax: (317) 574-9157
Email: domingo.c.riego@monsanto.com

Ronald Ritter
University of Maryland
12901 North Point Lane
Laurel, MD 20708-2343
Tel: (301) 405-1329
Fax: (301) 490-3754
Email: rr24@umail.umd.edu

Don Robbins
Maryland Dept. of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401
Tel: (410) 841-5871
Fax: (410) 841-5914
Email: robbindr@mda.state.md.us

Darren Robinson
Ridgetown College, Univ. Guelph
120 Main Street East
Ridgetown, ON N0P 2C0
Tel: (519) 674-1604
Fax: (519) 674-1600
Email: drobinso@ridgetownc.uoguelph.ca

John Roy
RWC, Inc.
PO Box 876
248 Lockhouse Rd
Westfield, MA 01085
Tel: (413) 562-5681
Fax: (413) 568-5584

Marc Ruggiero
DuPont
Stine-Haskell Research Center
1090 Elkton Road, PO Box 30
Newark, DE 19711
Tel: (302) 366-5513
Email: Marc.Ruggiero@usa.Dupontlcom

James Saik
Fingerlakes Agronomics
4467 Jordan Road
Skaneateles, NY 13152
Tel: (315) 952-9955
Email: saikj@aol.com

Hilary Sandler
University of Mass - Cranberry Station
PO Box 569
E Wareham, MA 02538
Tel: (508) 295-2212
Fax: (508) 295-6387
Email: hsandler@umext.umass.edu

Charles Scheer, Jr.
Half Hollow Nursery, Inc.
PO Box 536
Laurel, NY 11948
Tel: (631) 298-9183
Fax: (631) 298-5722
Email: hhn2@optonline.net

Rick Schmenk
Syngenta Crop Protection, Inc.
111 Tilghman Neck Road
Centreville, MD 21617-1811
Tel: (443) 262-9962
Fax: (443) 262-9444
Email: rick.schmenk@syngenta.com

M. G. Schnappinger
930 Starr Road
Centreville, MD 21617
Tel: (410) 758-1419
Fax: (410) 758-0656
Email: schnapg@toadmail.com

William Sciarappa
Rutgers Cooperative Extension
20 Court Street
Freehold, NJ 07728
Tel: (732) 431-7260
Fax: (732) 409-4813
Email: sciarappa@aesop.rutgers.edu

Rene Scoresby
The Scotts Company
14278 Eldon Drive
Mt. Vernon, OH 43050
Tel: (937) 644-7563

Email: rene.scoresby@scotts.com

Barbara Scott
University of Delaware
Research & Education Center
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-7303
Fax: (302) 856-1845
Email: bascott@udel.edu

Leroy Sellman
Maryland Dept. of Agriculture
50 Harry S. Truman Parkway
Annapolis, MD 21401
Tel: (410) 841-5871
Fax: (410) 841-5914

Andrew Senesac
Cornell Coop. Ext. - LIHREC
LIHREC, 3059 Sound Ave
Riverhead, NY 11901
Tel: (631) 727-3595
Fax: (631) 727-3611
Email: afs2@cornell.edu

Andrew Skibo
University of Delaware
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-1997
Fax: (302) 856-1994

Mark Smith
Maryland Dept. of Agriculture
5703 47th Avenue
Riverdale, MD 20737
Tel: (410) 841-5920

Dan Smith
Syngenta
21 Chatham Drive
Bedford, NH 03110
Tel: (603) 624-7596
Email: Dan.Smith@syngenta.com

Mark Smith
Syngenta Crop Protection
50 Harry S. Truman Parkway
Annapolis, MD 21401
Tel: (410) 841-5871
Fax: (410) 841-5914
Email: www.mda.state.md.us

David Spak
Bayer Environmental Science
113 Willow Ridge
New Holland, PA 17557
Tel: (717) 355-2822
Email: david.spak@aventis.com

Paul Stachowski
Cornell University
Dept. CSS, Leland Field House
Caldwell Road
Ithaca, NY 14853
Tel: (607) 255-7701
Email: pjs16@cornell.edu

Richard Stalter
St. John's University
Dept. of Biology
8000 Utopia Parkway
Jamaica, NY 11439
Tel: (718) 990-6288
Fax: (718) 990-5958
Email: biosju@stjohns.edu

James Steffel
LABServices
342 South Third Street
Hamburg, PA 19526
Tel: (610) 562-5055
Fax: (610) 562-5066
Email: labs@labservices.com
Email: jls227@psu.edu

Jennifer Stingelin-Keefer
Pennsylvania State Univ.
School of Forest Resources
248 Toftrees Avenue, Apt 108
State College, PA 16803
Tel: (814) 867-6242

Robyn Stout
North Carolina State University
4401 Williams Hall
Box 7620
Raleigh, NC 27695-7620
Tel: (919) 513-1283
Fax: (919) 515-5315
Email: Robyn_Stout@nscu.edu

Alison Stoven
Ohio State University
526 Howlett Hall
2001 Fyffe Ct.
Columbus, OH 43210
Tel: (614) 292-3766
Fax: (614) 292-3505
Email: stoven.1@osu.edu

Robert Sweet
Cornell University (Retired)
Dept. Horticulture
167 Plant Science Bldg.
Ithaca, NY 14853
Tel: (607) 255-4593
Fax: 607-255-0599
Email: sdt1@cornell.edu

Al Tasker
USDA APHIS
4700 River Road, Unit 134
Riverdale, MD 20782
Tel: (301) 734-5708
Email: Alan.V.Tasker@usda.gov

Raymond Taylorson
University of Rhode Island
Department of Plant Sciences
Kingston, RI 02881
Tel: (401) 874-2106
Fax: (401) 874-2494
Email: raymondtaylorson@msn.com

John Teasdale
USDA _ ARS
Bldg. 001, Room 245
Beltville, MD 20705
Tel: (301) 504-5504
Fax: (301) 504-6491
Email: teasdale@ba.ars.usda.gov

Debra Teixeira
Springborn Smithers Laboratories
790 Main Street
Wareham, MA 02571-1037
Tel: (508) 295-2550
Fax: (508) 295-8107
Email: dteixeira@springbornsmithers.com

Gar Thomas
BASF Corporation
1002 Bethel Road
Chesapeake City, MD 21915
Tel: (410) 885-5920
Fax: (410) 885-5975
Email: thomasgg@basf.com

Prescott Towle
Bayer Environmental Sci.
9 Meadow Lark Lane
Epsom, NH 03234
Tel: (603) 736-6045
Fax: (603) 736-6046
Email: sprays@metrocast.met

Robert Trumbule
Mayrland Dept. Of Agriculture, Weed Control
50 Harry S. Truman Parkway
Annapolis, MD 21401
(410) 841-5871
Fax: (410) 841-5914

Kai Umeda
University of Arizona
4341 East Broadway
Phoenix, AZ 85040
Tel: (602) 470-8086
Email: kumeda@ag.arizona.edu

Mark Van Gessel
University of Delaware
Research & Education Ctr
16684 County Seat Hwy
Georgetown, DE 19947
Tel: (302) 856-7303
Fax: (302) 856-1845
Email: mjv@udel.edu

Terry Van Horn
Delaware Dept. of Agriculture
2320 S. Dupont Highway
Dover, DE 19901-5515
(302) 698-4500
Fax: (302) 697-4468
Email: Terry.VanHorn@.state.de.us

Ely Vea
IR-4
308 Aston Forest Lane
Crownsville, MD 21032
Tel: (410) 923-4880
Email: elyvea@aol.com

David Vitolo
Syngenta
Schutzenmattstrasse 31
4051 Basel CH
Tel: (79) 672-1179
Fax: (61) 323-6855
Email: david.vitolo@syngenta.com

Thomas Watschke
Penn State University
425 ASI Bldg
University Park, PA 16802
Tel: (814) 863-7644
Fax: (814) 863-7043
Email: tlw3@psu.edu

Tim Wenskus
NYC Parks - Natural Resources Group
1234 Fifth Avenue Rm 233
New York, NY 10029
Tel: (212) 360-1427
Email: timberwolf@parks.nyc.org

James Westwood
Virginia Tech
Plant Path., Physi & Weed Sci.
410 Price Hall
Blacksburg, VA 24061-0331
Tel: (540) 231-7519
Fax: (541) 231-7477
Email: westwood@vt.edu

Cory Whaley
Virginia Tech
334466 Research Drive
Painter, VA 23420
Tel: (757) 414-0724
Email: cwhaley@vt.edu

Robert Wooten
North Carolina State University
Dept. of Horticulture Science
Box 7609
Raliegh, NC 27695-7609
Tel: (919) 515-2650
Fax: (919) 515-7747
Email: rob_wooten@ncsu.edu

Ashok Yadav
Cornell University
146A Plant Science
Ithaca, NY 14853
Tel: (607) 255-9085
Fax: (607) 255-0599
Email: ajm8@cornell.edu

David Yarborough
University of Maine
5722 Deering Hall Rm 414
Orono, ME 04469-5722
Tel: 207-581-2923
Fax: 207-581-2941
Email: davidy@maine.edu

Floyd Yoder
New Jersey Dept. of Agriculture
PO Box 330
Trenton, NJ 08625
Tel: (609) 292-5443
Fax: (609) 292-4710
Email: floyd.yoder@ag.state.nj.us

Roger Young
West Virginina Univ. (Prof. Emeritus)
PO Box 128, Cottage 302-D
Quincy, PA 17247
Tel: (717) 749-3979
Email: rsyoung@mail.cvn.net

Jeffrey Zelna
Syngenta Crop Protection
4598 Reliant Road
Jamesville, NY 13078
Tel: (315) 498-4259
Fax: (315) 498-4259
Email: jeff.zelna@syngenta.com

Randy Zondag
Ohio State University
99 E Erie Street
Painesville, OH 44077
Tel: (440) 350-2269
Fax: (440) 350-5928
Email: zondag.1@osu.edu

NEWSS Past Presidents

Gilbert H. Ahlgren	1947-49
Robert D. Sweet	1949-50
Howard L. Yowell	1950-51
Stephen M. Raleigh	1951-52
Charles E. Minarik	1952-53
Robert H. Beatty	1953-54
Albin O. Kuhn	1954-55
John Van Geluwe	1955-56
L. Danielson	1956-57
Charles L. Hovey	1957-58
Stanford N. Fertig	1958-59
Gordon Utter	1959-60
E. M. Rahn	1960-61
Lawrence Southwick	1961-62
Donald A. Shallock	1962-63
Anthony J. Tafuro	1963-64
Robert A. Peters	1964-65
Gideon D. Hill	1965-66
Richard D. Ilnicki	1966-67
John E. Gallagher	1967-68
John A. Meade	1968-69
Homer M. Lebaron	1969-70
John F. Ahrens	1970-71
George H. Bayer	1971-72
Arthur Bing	1972-73
Ralph Hansen	1973-74
Walter A. Gentner	1974-75
Henry P. Wilson	1975-76
Richard J. Marrese	1976-77
C. Edward Beste	1977-78
James D. Riggleman	1978-79
James V. Parochetti	1979-80
M. Garry Schnappinger	1980-81
Raymond B. Taylorson	1981-82
Stephan Dennis	1982-83
Thomas L. Watschke	1983-84
James C. Graham	1984-85
Russell R. Hahn	1985-86
Edward R. Higgins	1986-87
Maxwell L. McCormack	1987-88
Roy R. Johnson	1988-89
Stanley F. Gorski	1989-90
John B. Dobson	1990-91
Prasanta C. Bhowmik	1991-92
Stanley W. Pruss	1992-93
Ronald L. Ritter	1993-94
Wayne G. Wright	1994-95
Bradley A. Majek	1995-96
Thomas E. Vrabel	1996-97
Joseph C. Neal	1997-98
David B. Vitolo	1998-99
A. Richard Bonanno	1999-00
Brian D. Olson	2000-01
Jeffrey F. Derr	2001-02
David J. Mayonado	2002-03
D. Scott Glenn	2003-04

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	
2004	C. Edward Beste	University of Maryland-Emeritus
	James C. Graham	Monsanto (retired)

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
2004	C. Benjamin Coffman	USDA
	Joseph C. Neal	North Carolina 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
2004	Mark J. VanGessel	University of Delaware

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
2004	William S. Curran	Pennsylvania State 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 University
	3	Robert Nurse	Cornell University
2004	1	Whitnee L. Barker	Virginia Poly Inst. & State Univ.
	2	Caren A. Judge	North Carolina State University
	3	Erin R. Haramoto	University of Maine

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

2004 – North Carolina University, Raleigh, NC

Graduate Team:
Undergraduate Team:
Graduate Individual:
Undergraduate Individual:

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 S-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.

2004 1. Biology of the invasive plant pale swallow-wort. Larissa Smith, S. Greipsson, and Antonia DiTommaso. Cornell University.

2. Evaluating perennial groundcovers for weed suppression: Roadside trials and demonstrations. Andrew Senesac, Irene Tsontakis-Bradley, Jennifer Allaire, and Leslie Weston. Cornell University.

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, Degree	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl) acetamide
acifluorfen	Blazer, Status Blazer Ultra	5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid
alachlor	Intrro, MicroTech, Partner; many	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl) acetamide
alloxydim	Clout	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	O,O-bis(1-methylethyl)S-[2-[(phenylsulfonyl)amino]ethyl]phosphorodithioate
bentazon	Basagran, Lescogran	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, Glean,Lesco TFCr	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl] benzenesulfonamide
clethodim	Prism, Select, Envoy	(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, Lontrel	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	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 Extra, Genep, Genep Plus	S-ethyl dipropyl carbamothioate
ethalfluralin	Sonalan, Curbit, Edge	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoro-methyl)benzenamine
ethametsulfuron	Muster	2-[[[[[4-ethoxy-6-(methylamino)-1,3,5-triazin-2-yl]amino] carbonyl]amino]sulfonyl]benzoic acid
ethofumesate	Nortron	(±)-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	(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, SureGuard	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
fluroxypyr	Starane, Spotlight, Tomahawk, Vista	[(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid

Common Name	Trade Name	Chemical Name
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, Revolver	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	Glyphomax, Glyphos, Roundup, Touchdown; many	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(1 H,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-dimeth-oxybenzamide
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
MCPB	Cantrol, Thistrol	4-(4-chloro-2-methylphenoxy)butanoic acid

Common Name	Trade Name	Chemical Name
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, Blade, Cimarron, Escort, Manor	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, 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, 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
phenmedipham	Spin-Aid	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate

Common Name	Trade Name	Chemical Name
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, Targa	(±)-2-[4-[(6-chloro-2-quinoxalinyl)oxy]phenoxy]propanoic acid
rimsulfuron	Matrix, Tranxit	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
thiazopyr	Mandate, Visor	methyl2-(difluoromethyl)-5-(4,5-dihydro-2-thiazolyl)-4-(2-meth ylpropyl) -6-(trifluoromethyl)-3- pyridinecarboxylate

Common Name	Trade Name	Chemical Name
thifensulfuron	Harmony GT	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, Envoke, Monument	*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
Atrabute+	atrazine + butylate
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
Canopy	chlorimuron + metribuzin
Canopy XL	chlorimuron + sulfentrazone
Canopy EX	chlorimuron + tribenuron
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
Clarion	Nicosulfuron + rimsulfuron
Confront	clopyralid + triclopyr
Cool Power	dicamba + MCPA + triclopyr
Crossbow	triclopyr + 2,4-D
Curtail	clopyralid + 2,4-D
Curtail M	clopyralid + MCPA
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

Trade Name	Common Name of Individual Herbicides
Fuego	dicamba + triasulfuron
FulTime	acetochlor + atrazine
Fusion	fenoxaprop + fluazifop
Grazon P+D	picloram + 2,4-D
Guardsman Max	atrazine + dimethenamid
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
Layby Pro	linuron + diuron
Liberty ATZ	atrazine + glufosinate
Lightning	imazapyr + imazethapyr
Lumax	atrazine + mesotrione + s-metolachlor
Marksman	atrazine + dicamba
Millennium Ultra	clopyralid + dicamba + 2,4-D
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

Trade Name	Common Name of Individual Herbicides
Spirit	primisulfuron + prosulfuron
Squadron	imazaquin + pendimethalin
Stampede	MCPA + propanil
Steadfast	nicosulfuron + rimsulfuron
Steadfast ATZ	atrazine + nicosulfuron + rimsulfuron
Steel	imazaquin + imazethapyr + pendimethalin
Stellar	flumiclorac + lactofen
Sterling Plus	atrazine + dicamba
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
Trimec 992	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
Velpar Alfamax	hexazione + diuron
Vengeance	dicamba + MCPA
Weedmaster	dicamba + 2,4-D
Westar	Hexazinone + sulfometuron
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
BAY MKH 6561	propoxycarbazone/Attribute, Olympus, Bayer
BK-800	Uniroyal
CGA-184927	clodinofop-propargyl/Discover, Syngenta
CGA-277476	oxasulfuron/Dynam, Syngenta
KIH-485	Kumiai
V-3153	flufenapyr, Valent
F4113	carfentrazone + glyphosate, FMC

PLANT GROWTH REGULATORS

Common Name	Trade Name
AVG	Retain
6-benzyl adenine	BAP-10
chlorflurecol	Maintain
chlormequat chloride	Cycocel
clofencet	Detasselor
copper ethylenediamine	Inferno
diphenylamine	
diminozide	B-nine
ethephon	Florel
forchlorfenuron	
GA 4 7/G BA	Promalin, Rite Size
GABA	Auxigro
MBTA	Ecolyst
mepiquat chloride	Mepex, Mepex Gin Out, Pix
paclobutrazol	Bonzi, Clipper, Trimmet
prohexadione	Apogee
sodium nitrophenolate	Atonik
trinexapac	Palisade, Primo
uniconazole	Prunit, Sumagic

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

AUTHORS INDEX

MAIN SUBJECT INDEX
(Herbicides, Weeds, Crops, Non-crops, and Subjects)

2

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z