WEED CONTROL WITH CHLOROACETAMIDE HERBICIDES IN CORN. C. Whaley, B. W. Trader, H. P. Wilson, and T. E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

Three of the most commonly used pesticides in 1997 were chloroacetamide herbicides, accounting for over 107 million lb ai applied in the United States. Chloroacetamide use has remained steady over the past ten years and constitutes an integral part of corn (*Zea mays* L.) weed management programs. Field studies were conducted 1996 through 1999 at the Eastern Shore Agricultural Research and Extension Center in Painter, VA to evaluate chloroacetamide weed management programs in no-tillage corn. Treatments included various chloroacetamide-atrazine prepackage mixes as well as acetochlor, alachlor, or metolachlor preemergence (PRE) with glyphosate and other tank-mix partners. Studies were arranged as a randomized complete block design with three replications. Corn injury and weed control were visually evaluated and crop yields were collected in all harvestable plots.

Corn injury from chloroacetamide and chloroacetamide tank-mixes was generally negligible to low in all years. Season-long broadleaf weed control (>80%) was attained in all years with most atrazine-chloroacetamide prepackage mixes. Control of large crabgrass (*Digitaria sanguinalis* (L.) Scop.) and fall panicum (*Panicum dichotomiflorum* Michx.) was generally lower in 1997, with only treatments of acetochlor (1.5 lb ai/A) plus sulfosate (0.66 lb ai/A) PRE, metolachlor (1.5 lb ai/A) plus glyphosate (0.66 lb ai/A) PRE, or sulfosate PRE with nicosulfuron (0.013 lb ai/A) plus rimsulfuron (0.013 lb ai/A) plus atrazine (0.85 lb ai/A) POST controlling >80% of both weed species. Weed control in 1998 and 1999 was generally good, with most atrazine-chloroacetamide prepackage mixes controlling all weeds evaluated >80%.

In 1996, chloroacetamide plus glyphosate (1.5 lb/A) PRE treatments did not increase corn yields over plots treated with glyphosate alone, while in 1997 yields were greatest in plots with addition of atrazine as a treatment. In 1998, plots with metolachlor (1.27 lb/A) plus atrazine (1.6 lb/A) or atrazine (1.62 lb/A) plus acetochlor (1.1 lb/A) resulted in greatest yields. Yields from treatments in 1999 were low with few differences.

WEED CONTROL IN GLUFOSINATE-RESISTANT CORN. B. W. Trader, C. Whaley, H. P. Wilson, and T. E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

Resistant weed populations have increased the need for alternate weed management programs including use of crops genetically engineered for tolerance to non-selective herbicides. Such programs have been adopted nationally and have increased in popularity since initially released. Engineered tolerance to glyphosate and glufosinate has allowed farmers to use these broad-spectrum herbicides with little or no injury to corn (*Zea mays* L.). The lack of residual activity from glufosinate and glyphosate, however, make it necessary to evaluate application timing and herbicide combinations to maximize weed control and crop yield.

Field experiments were conducted in 1996 through 1999, at the Eastern Shore Agricultural Research and Extension Center near Painter, VA to evaluate weed control and crop tolerance of postemergence (POST) glufosinate and combinations of glufosinate plus preemergence (PRE) and POST herbicides on glufosinate-resistant corn. Conventional tillage studies were designed as randomized complete blocks with three replications. Crop tolerance studies included glufosinate at 0.2, 0.54, 1.08, and 2.16 lb ai/A POST. All other studies included glufosinate (0.27 and 0.36 lb/A) applied early (EPOST) and/or mid-post (MPOST). Other treatment combinations included glufosinate plus atrazine (1.0 and 1.5 lb ai/A) POST or glufosinate preceded by atrazine or s-metolachlor PRE. Untreated checks and industry standards were included for comparisons. Corn injury was rated 7, 14, and 28 days after treatment (DAT) and weed control was rated 14, 28, and 56 DAT for all studies. Yields were collected for all harvestable plots.

Crop injury at 7 DAT was < 8% for all treatments except tolerance studies where injury was < 17% over all glufosinate rates. All treatments of glufosinate plus atrazine controlled broadleaf weeds > 90%. Annual grass control with glufosinate plus atrazine treatments ranged 70 to 99% and the application of metolachlor PRE raised annual grass control to > 91%. Glufosinate alone, glufosinate plus cultivation, and glufosinate plus metolachlor generally provided lower control. Increased rates of glufosinate in tolerance studies did not reduce yield. Corn treated with atrazine plus metolachlor PRE and glufosinate plus atrazine POST were generally the highest yielding of respective studies. Corn yields of treatments with glufosinate, glufosinate plus cultivation, or glufosinate plus metolachlor were generally lower than treatments containing atrazine. Herbicide treatment plus cultivation did not improve yield over herbicide alone.

SUPPRESSING QUACKGRASS COVER CROPS FOR HERBICIDE-RESISTANT SILAGE CORN. N. Y. Gift, R. R. Hahn, and J. Mt. Pleasant, Dept. of Crop and Soil Science, Cornell Univ., Ithaca, NY.

ABSTRACT

Quackgrass (*Elytrigia repens* (L.) Nevski) is an invasive weed – not normally considered to be a desirable cover crop. However, its high nutritional value makes this weed more tolerable in alfalfa (*Medicago sativa* L.) than in corn (*Zea mays* L.). Growers typically attempt to eradicate quackgrass from corn fields, but manage this weed less aggressively in alfalfa, where it contributes to hay quality and yield. The objective of this study was to evaluate herbicides for use in herbicide-resistant corn which could: 1) suppress quackgrass to minimize its effect on corn silage yield, 2) leave adequate quackgrass residue to control erosion (act as a good cover crop), and 3) leave quackgrass as a grass companion crop for alfalfa. In 1999, at each of two locations, objectives two and three were met by most treatments, and objective one was met for at least one treatment at each location. Here we report the results of objective one for the 2000 season.

This study was performed at three sites, all with heavy existing quackgrass infestations, two of the sites being in the same field in Dryden, N.Y. In Dryden, corn hybrids 'DK493GR' (glufosinate-resistant) and 'DK493RR' (glyphosate-resistant) were planted on June 10, 2000 in a split plot arrangement, with corn hybrid as the main plot, and herbicide as the subplot. Late post emergence treatments were applied on July 19, 2000 to both hybrids . In the 1999 experiment, plots weres plit with half planted to corn and half planted to alfalfa in spring 2000. Treatments included an untreated check (both hybrids), glufosinate (0.37 and 0.44 lb ai/A) (GR only), glyphosate (1.0 lb ai/A) (RR only), primisulfuron (0.57 oz ai/A) (RR only), and nicosulfuron (0.50 oz ai/A) (both hybrids). In Valatie, N.Y., 'DK493SR' was also included, as well as the additional treatments sethoxydim (0.19 and 0.28 lb ai/A) (SR only). Untreated check and nicosulfuron treatments were also included with SR corn. Corn in Valatie was planted on May 17, 2000, and herbicides were applied on July 23, 2000.

Response variables included quackgrass ratings, corn ratings (including yellowing and leaf rolling, due to drought conditions), corn silage yields, and ground cover measurements. Glyphosate treatments resulted in the highest yields at all three sites (9.42 and 10.59 tons/A in Dryden; 19.6 tons/A in Valatie). Many treatments at Valatie were statistically equivalent in yield to glyphosate, including glufosinate at 0.37 lb/A and primisulfuron at (19.3 tons/A), nicosulfuron (16.8 tons/A), and glufosinate at 0.44 lb/A (16.9 tons/A). In Dryden, at the new site, all herbicide-treated plots yielded as well, statistically, as the glyphosate-treated corn. However, in the Dryden experiment repeated on last year's plots, only nicosulfuron plots yielded as well, statistically (8.8 tons/A) as glyphosate plots. This suggests a cumulative effect of consecutive years of nicosulfuron treatments. Weedy check treatments had the lowest yields at Dryden (7.1 and 4.2 tons/A) and in Valatie (12.2 tons/A). In-season quackgrass control ratings for both locations indicate that yields were highly correlated with the degree of quackgrass suppression.

IMAZETHAPYR PLUS IMAZAPYR IN IMIDAZOLINONE-RESISTANT CORN. R. J. Richardson, G. R. Armel, H. P. Wilson, and T. E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

The use of herbicide-resistant crop hybrids continues to increase in the U. S. due to several factors including additional herbicide options, crop rotation concerns, and resistant weed populations. Imidazolinone-resistant (IR) corn (*Zea mays* L.) allows growers the opportunity to use a greater variety of acetolactate synthase (ALS) inhibitors in corn without crop injury. Field studies were conducted in 1996, 1997, 1999, and 2000 at the Eastern Shore Agricultural Research and Extension Center in Painter, VA to evaluate weed and crop response to imazethapyr plus imazapyr and imazethapyr plus imazapyr with various herbicide combinations. Imazethapyr plus imazapyr (0.056 lb ai/A) was applied postemergence (POST) alone or tank-mixed with urea ammonium nitrate (1.0 % v/v) or herbicide combinations. An untreated check, atrazine plus metolachlor and other industry standards were included for comparisons.

Crop injury for all imazethapyr plus imazapyr treatments in all years was < 15 % by 35 days after treatment (DAT). Imazethapyr plus imazapyr generally did not provide commercially acceptable control of common ragweed (*Ambrosia artemsiifolia* L.) or grass weed species 56 DAT. The addition of atrazine to imazethapyr plus imazapyr increased grass and broadleaf weed control. Imazethapyr plus imazapyr with atrazine (0.75 and 1.0 lb ai/A), and imazethapyr plus imazapyr with dicamba (0.19 lb ai/A) controlled all broadleaf weeds > 80 %. Weed control with imazethapyr plus imazapyr treatments was generally similar when applied to 2-to 3-inch or 4-to 6-inch tall weeds, or when tank-mixed with non-ionic surfactant (0.25 % v/v) or methylated sunflower oil (1.5 % v/v). The addition of urea ammonium nitrate (1.0 % v/v) to imazethapyr plus imazapyr generally increased weed control and crop yield. Crop yields were significantly increased in 1997 and 2000 with the addition of atrazine or dicamba to imazethapyr plus imazapyr treatments. No yield differences between treatments existed in 1996 or 1999 most likely due to weather conditions.

INTERACTIONS OF SETHOXYDIM WITH POSTEMERGENCE BROADLEAF HERBICIDES IN SETHOXYDIM-RESISTANT CORN (*Zea mays*). M. A. Isaacs, Univ. of Delaware, Georgetown, DE; H. P. Wilson, Virginia Tech Univ., Painter, VA; and J. E. Toler, Clemson Univ., Clemson, SC.

ABSTRACT

Field studies were conducted in 1995 and 1996 to investigate postemergence (POST) tank mixtures of sethoxydim with various acetolactate synthase (ALS) and non ALS-inhibitor herbicides for weed control in sethoxydim-resistant (SR) corn. Sethoxydim at 213 g/ha was applied alone and in combination with bentazon (1120 g/ha), bentazon plus atrazine (1166 g/ha), dicamba (280 g/ha), atrazine (1120 g/ha), dicamba plus atrazine (896 g/ha), bromoxynil (140 g/ha), halosulfuron-methyl (35 g/ha) plus 2,4-D (140 g/ha), CGA 152005 plus primisulfuron at 35 g/ha plus 2,4-D (140 g/ha), rimsulfuron plus thifensulfuron-methyl (RT) at 18 g/ha plus 2,4-D (140 g/ha), RT (18 g/ha) plus 280 g/ha 2,4-D, and flumetsulam plus clopyralid plus 2,4-D at 235 g/ha. All herbicide treatments included DASH HC® spray adjuvant at 1% v/v except one sethoxydim plus bentazon plus atrazine treatment which included 30% urea ammonium nitrate (UAN) at 2% v/v. Also, sethoxydim tank-mixed with flumetsulam plus clopyralid plus 2,4-D and nicosulfuron plus bromoxynil were applied with only a nonionic surfactant at 0.25% v/v. An additional treatment included nicosulfuron (35 g/ha) plus bromoxynil (140 g/ha). Treatments were applied with a tractor-mounted compressed-air sprayer in 234 L/ha of water at 207 kPa through flat fan nozzles when corn was in the two-collar stage.

Sethoxydim alone controlled giant foxtail ³ 92% and was equal in control to nicosulfuron plus bromoxynil. However, giant foxtail control from sethoxydim tank-mixed with bentazon plus atrazine with urea ammonium nitrate (UAN), or with ALS-inhibiting herbicides plus 2,4-D except halosulfuron-methyl was 24% lower when averaged over treatments. Most herbicide combinations controlled common ragweed and common lambsquarters 90 days after treatment (DAT), except when bentazon and bromoxynil were included. Averaged across all sethoxydim tank mixtures and nicosulfuron plus bromoxynil, corn yields were increased 168% compared to yields from plots treated with sethoxydim alone. Sethoxydim mixed with atrazine provided a corn yield of 5790 kg/ha. Yield of corn treated with sethoxydim or sethoxydim mixed with combinations of sulfonylurea herbicides plus 2,4-D were low, with the exception of halosulfuron-methyl. According to these studies, understanding tank mixtures with sethoxydim and selected POST broadleaf corn herbicides is crucial for effective weed management.

EFFECT OF JOHNSONGRASS (*Sorghum halepense*) CONTROL METHOD ON THE INCIDENCE AND SEVERITY OF VIRUS DISEASES IN GLYPHOSATE-RESISTANT CORN (*Zea mays*). S. R. King, Virginia Tech Univ., Blacksburg, VA; R. Chandran, West Virginia Univ., Morgantown, WV; and E. S. Hagood, Virginia Tech Univ., Blacksburg, VA.

ABSTRACT

Field experiments were conducted in 2000 in Virginia and West Virginia to evaluate the incidence and severity of maize chlorotic dwarf virus (MCDV) and maize dwarf mosaic virus (MDMV) in response to postemergence johnsongrass control in two corn hybrids. Previous research has documented increased disease severity in virus susceptible hybrids as a result of increased transmission from dying johnsongrass to the corn crop. Recent observations have indicated a lack of virus tolerance in transgenic corn hybrids commercially available in Virginia. A transgenic glyphosate-tolerant hybrid and a non-transgenic hybrid, similar in growth characteristics and maturity, were subjected to postemergence treatments of nicosulfuron, while the glyphosate-tolerant hybrid was also treated with glyphosate for johnsongrass control. Treatments included: 1) broadcast POST nicosulfuron or glyphosate, 2) directed POST nicosulfuron or glyphosate, 3) broadcast POST nicosulfuron or glyphosate to weed free plots, 4) weed free control and, 5) weedy control. Experiments were conducted in a split-plot, randomized complete block design with corn hybrid as the main plot and herbicide treatment as the subplot. In each experiment, dependent variables included johnsongrass control and the incidence and severity of virus diseases evaluated throughout the season, as well as corn yield evaluated at maturity. Both nicosulfuron and glyphosate, broadcast or directed, provided essentially complete johnsongrass control, although initial johnsongrass control was greater with glyphosate treatments. The glyphosate-tolerant hybrid was observed to develop significantly higher levels of virus incidence three weeks after treatment than the non-transgenic hybrid, and virus incidence and severity increased throughout the duration of the growing season. Virus diseases were not visually detected in the non-transgenic hybrid at any time during the growing season. With the glyphosate-tolerant hybrid, significant increases in disease incidence were observed in response to any herbicidal treatments applied to johnsongrass containing plots relative to the same herbicidal treatments applied to weed free plots. No significant difference in virus disease incidence and severity was observed in respect to varying herbicide treatment or method of application in the glyphosate-tolerant hybrid. Yield data indicated that 40 to 60 percent yield loss occurred in corn plants with virus infection relative to plants without infection.

RESPONSE OF IMIDAZOLINONE-RESISTANT CORN TO CGA-362622. A. S. Graves, R. J. Richardson, H. P. Wilson, and T. E. Hines, Virginia Tech Univ. Painter, VA.

ABSTRACT

Imidazolinone–resistant (IR) corn (*Zea mays* L.) allows growers the option of applying acetolactate synthase (ALS) inhibitor herbicides that would otherwise cause excessive crop response. Field and greenhouse studies were conducted in 2000 at the Eastern Shore Agricultural Research and Extension Center near Painter, VA to evaluate weed and crop response to postemergence (POST) applications of the experimental ALS-inhibitor CGA-362622. In a repeated field study of three replicates, CGA-362622 was applied at 0.0, 0.0034, 0.0067, 0.01, and 0.0134 lb ai/A preceded by s-metolachlor (0.96 lb ai/A) preemergence (PRE). As comparison treatments, ZA-1296 (0.14 lb ai/A) plus s-metolachlor (0.96 lb/A) PRE followed by CGA-362622 (0.0067 lb/A) POST and CGA-362622 (0.0067 lb/A) plus nicosulfuron (0.016 lb ai/A) POST were included in the study. Treatments were applied to 15 to 20 inch tall corn. Crop injury was rated at 7, 14, and 28 days after treatment (DAT) and weed control was rated at 14, 28, and 56 DAT. Corn was harvested to permit grain yield determinations. Greenhouse treatments in a repeated four replicate test were CGA-362622 at 0.0, 0.0034, 0.0067, 0.001, 0.0134, 0.0168, 0.0340, and 0.34 lb/A. Applications were made to 6 to 8 inch tall corn. Crop response was rated 7, 14, and 21 DAT and corn heights and dry weights were determined 21 DAT.

Corn injury in the field from all treatments was low (< 10 %) at 7 DAT and decreased to < 6 % at 28 DAT. Control of common lambsquarters (*Chenopodium album* L.), morningglory species (*Ipomoea spp.*), common ragweed (*Ambrosia artemisiifolia* L.), and carpetweed (*Mollugo verticillata* L.) at 56 DAT was > 93 % for all CGA-362622 treatments. Annual grass control was > 90 % for all treatments with s-metolachlor PRE while CGA-362622 + nicosulfuron averaged 82 % annual grass control over the two studies. Greenhouse corn injury at 7 DAT was also low (< 11 %) for all treatments. Injury at 21 DAT was < 7 % for all treatments. Heights were generally similar among treatments.

injury and weed control effectiveness were collected at roughly 2, 4, and 6 weeks after application. Estimates of corn silage yields were made at the end of the growing season by harvesting 1/1000th of an acre of corn, weighing, and determining dry matter content of the corn. The sweet corn yields were determined by harvesting ears from two rows 16.4 feet in length and measuring total number of ears, number of marketable ears, total ear weight and marketable ear weight.

ENVIRONMENTAL CONDITIONS

May, June, and July were cooler and wetter than normal. Rainfall during the month of August was a bit behind the average, but there is sufficient moisture for adequate pollination and grain fill. Early season corn growth was delayed and the plants exhibited more overall chill-stress chlorosis than we usually expect to see (this is particularly evident in the ZA-AR corn chlorophyll measurements (Table 1). There was sufficient moisture following preemergence spray to activate and move the chemical into the soil where germinating weeds would be affected. Although generally quite cool, there was enough heat to bring plants to maturity.

RESULTS

CROP TOLERANCE. Field and sweet corn tolerance to ZA1296 was excellent. In the ZA-AR study, crop injury was less than 5% in the worst case. In the sweet corn, injury was slight. Only Permit applied post caused any crop injury and that was on the order of 25% (data not shown). In that case, the corn exhibited some chlorosis in the inner whorl.

Table 1. Early V-2 Growth Stage – Preemergence Injury Assessments

Study	Treatment	Injury	Stunting	SPAD
ZA-AR	Check	0.4	0	29.8
	Standard	10.4	0	28.9
	ZA – 3 oz pre	0.4	0	29.6
	ZA – 3 oz post	**	**	***
	ZA – tank mix	0.4	0	29.1
LSD (0.05)	***	8.0	**	NS
ZA-Sweet corn	Check	0	0	40.5
	Standard	0	0.5	38.8
	ZA – 3 oz pre	0	2	39.3
	ZA – 3 oz post	**	**	***
LSD (0.05)	***	8.0	**	NS

CONTROL OF PROBLEM WEEDS WITH ZA1296 IN FIELD AND SWEET CORN PRODUCTION IN MAINE. J. Jemison and A. Nejako, Univ. of Maine Cooperative Extension, Orono. ME.

INTRODUCTION

Mesotrione (ZA1296) is a new low-rate herbicide awaiting registration for use in field corn in the Northeast. This product may be applied pre or postemergence and will likely have a recommended application rate of 3 ounces of product/acre. It controls many broadleaf weeds and has some effect on annual grasses (especially crabgrass) as well. One exciting feature of this product is it offers growers a pigment inhibitor mode of action to prevent weed resistance to herbicides. It has low toxicity on mammals, birds, fish, and honeybees. Product safety, low soil mobility, and low application rate have put this product on the EPA short track for registration.

During the summer of 2000, we evaluated mesotrione in three studies; one study (ZA-CE) had a dense population of nutsedge (*Cyperus esculentus* L.), and the other study (ZA-AR) had a significant population quackgrass (*Agropyron repens* L.). We also evaluated ZA1296 in sweet corn production. In this report, we will focus on the work from the ZA-AR study and the sweet corn study. Other common weeds in both studies included common lambsquarters (*Chenopodium album* L.), red rooted pigweed (*Amaranthus retroflexus* L.) and the annual grasses barnyard grass (*Echinochloa crus-galli* L.) and witchgrass (*Panicum capillare* L.). Quackgrass and nutsedge are two of the most common weed problems corn producers face in central Maine, and we were particularly interested in seeing how ZA1296 would perform on these problem weeds. For the purpose of this report, I will focus on the treatments common to both the studies:

- Treatment 1 - Weedy check;
- Treatment 2 - Herbicide standard (Atrazine (2.2 lbs/ac) and Dual II - Magnum 1.5 pt/ac);
- Treatment 3 - 3 oz ZA1296 product/ac applied preemergence;
- Treatment 4 - 3 oz ZA1296/ac postemergence;
- Treatment 5 - ZA1296 in tank mix with acetochlor.

PROJECT GOALS

- Evaluate crop tolerance at recommended rates of mesotrione and tank mixes
- Evaluate ZA1296 (mesotrione) alone and in tank mixtures control of problem weeds in conventional tilled medium textured soils;

METHODS

Corn (Agway 144) was planted on 18 May 2000 at a seeding rate of 31,000 seeds/ac. Final populations was slightly over 28,000 plants/ac. The soil used in this study was a silt loam with a pH of 6.0 and an organic matter content of 5.2%. Sweet corn (Ecstasy – 68 day SE corn) was planted at 27,000 seeds to the acre in a fine sandy loam soil with a pH of 6.0 and an organic matter content of 4.9%. All herbicides were applied with a backpack sprayer on small plots (10.66 feet wide and 24 feet long). Application delivery rate was 20 gallons/acre with pressure set at 30 lb/in^2. Ratings for

ZA1296: PREEMERGENCE AND POSTEMERGENCE PERFORMANCE IN WEED CONTROL PROGRAMS. B. A. Lackey and K. H. Brownell, ZENECA Ag Products, Richmond, CA.

ABSTRACT

ZA1296 (2-[4-methylsulfonyl-2-nitrobenzoyl]-1,3-cyclohexanedione, proposed name mesotrione), is a new active ingredient for broadleaf weed control in corn.

Mesotrione 4SC (4 lbai/gal) can be applied both preemergence and postemergence. Postemergence applications of mesotrione will control velvetleaf (*Abutilon theophrasti* Medicus), common cocklebur (*Xanthium strumarium* L.), pigweeds and waterhemps (*Amaranthus* sp.), common lambsquarters (*Chenopodium album* L.), common ragweed (*Ambrosia artemisiifolia* L.), jimsonweed (*Datura stramonium* L.), nightshade (*Solanum* sp.), common sunflower (*Helianthus annuus* L.), smartweed (*Polygonum* sp.), and several other common broadleaf weeds. The typical use rate postemergence is 0.094 lbai/A of mesotrione with crop oil concentrate and UAN fertilizer. For larger or more difficult-to-control broadleaf weeds, the addition of 0.25 lb atrazine is recommended.

Broad spectrum grass and broadleaf weed control systems include (a) mesotrione applied postemergence following preemergence applications of an acetanilide herbicide or atrazine premix, or (b) by a postemergence tankmix of mesotrione with a postemergence grass herbicide. Applied preemergence with an acetanilide, mesotrione provides control of all of the important weeds, including velvetleaf, pigweeds, waterhemps, common lambsquarters, common ragweed, kochia, common sunflower, jimsonweed, nightshade, smartweed, plus other grasses and broadleaves. Mesotrione performs well in conventional, minimum and no-tillage programs.

Corn has excellent tolerance to both preemergence and postemergence applications of mesotrione. Mesotrione should not be applied postemergence to corn treated with terbufos, nor should mesotrione be tankmixed with foliar organophosphate insecticides. There are no interactions with other soil insecticides or pyrethroid insecticides.

Table 2. V-3 Growth Stage – Two Weeks After Post Treatment Applications – Injury Assessments

Study	Treatment	Injury	Stunting	SPAD
ZA-AR	Check	0.0	0	29.8
	Standard	0.0	0	28.9
	ZA – 3 oz pre	0.0	0	29.6
	ZA – 3 oz post	00	0	***
	ZA – tank mix	0.0	0	29.1
LSD (0.05)	***	NS	NS	NS
		Injury	Plant Height - cm	SPAD
ZA-Sweet corn	Check	0.0	20.8	46.7
	Standard	0.0	16.4	43.4
	ZA – 3 oz pre	0.0	17.4	42.9
	ZA – 3 oz post	0.0	17.6	42.3
LSD (0.05)	***	NS	NS	NS

WEED EVALUATIONS. Weed control with ZA1296 on small seeded broadleaf weeds was good to excellent on lambsquarters, red rooted pigweed, and yellow mustard. Annual and perennial grass control was less than favorable indicating the need to tank mix an annual grass herbicide to obtain optimum control. In Table 3, we present data for weed control at canopy closure. In Tables 4 and 5, we present information on weed biomass and yield.

Table 3. Weed Control at Canopy Closure

Study	Treatment	CHEAL	SINAR	Annual Grass	AGRRE	All
		********* % Weed Control ***********				
ZA-AR	Check	32.3	83.3	90	65	18.7
	Standard	100	100	100	90.3	90.3
	ZA – 3 oz pre	98.8	99.0	91.8	71.3	67.5
	ZA – 3 oz post	99.6	100	98.8	67.2	63.7
	ZA – tank mix	95.5	100	100	78.0	77.8
LSD (0.05)	***		8.5	4.1	12.5	12.3
		CHEAL	AMARE	Annual Grass	AGRRE	All
ZA-Sweet corn	Check	40.0	36.0	60.0	99.0	32.0
	Standard	99.0	100	100	98.0	98.0
	ZA – 3 oz pre	99.0	100	70.5	99.0	69.0
	ZA – 3 oz post	98.0	98.0	64.0	99.0	64.0
LSD (0.05)	***	8.5	9.4	9.0	NS	12

Table 4. Weed Biomass

Study	Treatment	Broadleaf Weeds	Annual Grass	Perennial Grass
Study	Treatment	***********	g/m2	**************
ZA-AR	Check	128.7	1.10	29.7
	Standard	0.0	0.00	10.6
	ZA – 3 oz pre	2.3	4.6	22.8
	ZA – 3 oz post	77.25	10.8	36.0
	ZA – tank mix	0.85	8.5	13.3
LSD (0.05)	***	89.5	NS	NS
ZA-Sweet corn	Check	117.1	37.0	1.2
	Standard	0.0	0.0	6.7
	ZA – 3 oz pre	17.2	50.95	0.45
	ZA – 3 oz post	0.8	93.1	15.7
LSD (0.05)	***	36.6	33.7	NS

These data from both studies show that control with ZA1296 on annual broadleaf weeds is excellent applied pre or postemergence. Although the annual grass population was light in the ZA-AR study, there were significantly higher annual grass levels in the ZA-3 oz/ac pre treatment than the standard or post treatments. In the sweet corn study, annual grasses (primarily witchgrass and barnyard grass) were more abundant and control was significantly poorer with ZA1296 alone (pre or postemergence) than with the standard. The material does burn annual grass and a splotchy chlorosis is common. But, the plants do eventually recover. We found a similar response in the ZA-CE study with nutsedge control. The control was hit or miss. Sometimes the top of the plant died, and other times the herbicide did not seem to affect plant health at all. Quackgrass control is also somewhat weak. The atrazine in the ZA-AR standard treatment significantly improved quackgrass control over ZA1296 alone. As with annual grass, the ZA1296 slowed quackgrass growth. If the plant were growing from a single rhizome, ZA1296 was occasionally lethal; but if the plant was growing from a mass of rhizomes, it quickly recovered from the herbicide application.

Table 5. Crop Yield as Influenced by Herbicide Treatments

Study	Treatment	Field Weight	Dry Matter Yield	Yield at 30% Dry Matter
		********* tons/ac **********		
ZA-AR	Check	17.4	4.34	14.4
	Standard	21.2	4.93	16.4
	ZA – 3 oz pre	23.3	5.44	18.1
	ZA – 3 oz post	21.7	5.12	17.1
	ZA – tank mix	24.3	5.69	19.0
LSD (0.05)	***	NS	0.84	2.8
		Marketable Ears	Total Ear Weight	Marketable Ear Weight
			*** tons/acre ***	
ZA-Sweet corn	Check	15,125	5.17	2.59
	Standard	20,875	6.86	3.43
	ZA – 3 oz pre	21,750	6.98	3.49
	ZA – 3 oz post	19,875	6.15	3.07
LSD (0.05)	***	4,428	1.16	0.58

Yields were reduced this year compared to past years due to the cool damp weather through much of the growing season. Yields in the field corn study from the ZA1296 applied pre or postemergence treatments were equal to or higher than the commercial standard. Even with the sensitive SE sweet corn variety, yields were not reduced by the new herbicide. Given the cool and wet environmental conditions of this spring, one might have expected to see some injury from this herbicide. The environmental safety combined with apparently low crop phytotoxicity, this product may become a good replacement for some of the other herbicides registered for use in the past that are no longer available.

EVALUATION OF ZA-1296 FOR PREEMERGENCE AND POSTEMERGENCE WEED CONTROL IN FIELD CORN. F. J. Himmelstein and R.J. Durgy, Univ. of Connecticut, Storrs, CT.

ABSTRACT

ZA-1296 is a new experimental triketone herbicide being developed for preemergence (PRE) and postemergence (POST) weed control in field corn (*Zea mays* L.). Two Connecticut field studies were conducted in 2000 to evaluate the efficacy of ZA-1296 applied PRE and POST alone and in combination with other herbicides. PRE treatments included a premix of acetochlor (Topnotch) + ZA-1296 at 1.8 + 0.163 lb ai/A, and 2.0 + 0.181 lb ai/A, ZA-1296 at 0.163 and 0.181 lb ai/A, acetochlor at 1.8 and 2.0 lb ai/A, s- metolachlor (Dual II Magnum) at 1.27 lb ai/A alone and in combination with ZA-1296 at 0.163 lb ai/A, s-metolachlor + atrazine (Bicep II Magnum) at 2.89 lb/ai A, and pendimethalin (Prowl) + atrazine at 1.5 + 1.0 lb ai/A. PRE followed by POST treatments included acetochlor at 1.8 lb ai/A followed by either ZA-1296 at 0.094 lb ai/A or ZA-1296 + atrazine at 0.094 + 0.25 lb ai/A, acetochlor + atrazine (Fultime) at 3.0 lb ai/A followed by ZA-1296 at 0.094 lb ai/A, s-metolachlor at 1.27 lb ai/A followed by prosulfuron + primisulfuron (Exceed) at 0.036 lb ai/A, and dimethenamid (Frontier) at 1.4 lb ai/A followed by dicamba + atrazine (Marksman) at 1.4 lb ai/A. Total POST treatments included ZA-1296 at 0.094 lb ai/A alone and in combination with atrazine at 0.25 lb ai/A. Corn was planted on May 31 at Storrs, and on July 11 at Enfield. PRE treatments were applied two days after planting. POST treatments were applied in Storrs when the corn had 6-to-7 leaves, 9-to-12 inches in height, and in Enfield when the corn had 3-to-4 leaves, 5-to-10 inches in height. Weed heights for POST treatments ranged between 1-to-6 inches at Storrs, and 0.25-to-1.5 inches at Enfield. Herbicides were applied with a CO_2 backpack sprayer delivering 20 gpa at 32 psi. Weed species included common lambsquarters [*Chenopodium album* L.], redroot pigweed (*Amaranthus retroflexus* L.), and large crabgrass [*Digitaria sanguinalis* (L.) Scop.] at both locations, and velvetleaf [*Abutilon theophrasti* Medik] at the Enfield site.

All herbicide treatments provided excellent control of both redroot pigweed and large crabgrass at both locations. Herbicide treatments gave excellent control of common lambsquarters at both locations with the exception of the s-metolachlor treatment at the Storrs site that resulted in poor lambsquarters control. Herbicide treatments gave excellent velvetleaf control at the Enfield site with the exception of the s-metolachlor and acetochlor treatments. Corn grain yield at the Storrs site was significantly greater for all herbicide treatments compared to the untreated check with the exception of dimethenamid followed by dicamba + atrazine. Dicamba + atrazine applied POST at the 1.4 lb ai/A rate resulted in significant suppression of corn growth. Due to a late planting at the Enfield site, corn did not mature by the time of harvest so silage yields were taken. There were no significant yield differences among treatments at the Enfield site with the exception of the s-metolachlor treatment followed by prosulfuron + primisulfuron. Silage yields were significant lower for this treatment compared to the ZA-1296 premix treatments with acetochlor, ZA-1296 applied alone PRE at 0.181 lb ai/A and POST at 0.094 lb ai/A. These studies indicate that ZA-1296 can provide effective weed control in field corn when applied as either as a PRE or POST treatment alone or in combination with other herbicides.

HERBICIDE TOLERANT CORN: WEED MANAGEMENT OPTIONS

P. C. Bhowmik[1]

ABSTRACT

Transgenic crops are becoming popular. Herbicide tolerance traits in crops are being introduced by genetic manipulations. Monsanto, Dekalb, Pioneer, and others have developed glyphosate tolerant corn by incorporating EPSP synthase resistant gene. Experiments with glyphosate tolerant (RR) corn were conducted from 1997, 1998 and 1999, while glufosinate tolerant (GR) and sethoxydim tolerant (SR) corn trials were conducted in 1998.

In 1997, RR corn trial was conducted on an old alfalfa field infested with quackgrass [*Elytrigia repens* (L.) Beauv.], large crabgrass [*Digitaria sanguinalis* (L.) Scop.], yellow foxtail [*Setaria lutescens* (Weigel) Hubb.], and common lambsquarters (*Chenopodium album* L.). All other trials were conducted in areas infested with large crabgrass, yellow foxtail, common lambsquarters, and redroot pigweed (*Amaranthus retroflexus* L.). PRE treatments were applied on May 22, 1997, on May 29, 1998 and May 13, 1999. POST treatments were applied on June 20 (6 to 7 L corn), 1997, on June 29 (6 to 7 L) and July 10 (7 to 8 L corn), 1998, and on May 27 (3 L), June 3 (4 L) and June 9 (6 L corn), 1999. Treatments were applied using a CO_2-backpack sprayer that delivered 20 gpa at 22 psi. Crop tolerance was determined by foliar injury, plant height and final grain and silage yields. Weed control was rated on a scale of 0 to 100% (where 0 = no control and 100 = complete control) 1, 2, 3, 7, 8 weeks after treatment (WAT).

In all trials from 1997 to 2000, RR corn (DK 493) was completely tolerant to POST treatments of glyphosate applied either alone or in combination with other PRE treatments. Control of all above weed species was excellent with all treatments. The treatment options included PRE treatment followed by a POST application of glyphosate (0.75 lb/A), a single application of glyphosate, or sequential POST applications (EP and LP) of glyphosate (0.75 + 0.75 lb/A). PRE treatments included alachlor + atrazine, metolachlor + atrazine, FOE 5043, or FOE 5043 + atrazine. Sequential applications of glyphosate at 0.56 or 0.75 lb/A did not increase weed control or corn grain yield over a single application of glyphosate at the same rate.

In 1998, GR corn (DK 493) was completely tolerant to glufosinate at 0.26 lb/A and to sequential applications of glufosinate (0.26 + 0.26 lb/A) at EP and LP, and these treatments controlled all weed species effectively. The same treatments when combined with ammonium sulfate also resulted in excellent control of all weed species with no corn injury. SR corn (DK 493) was completely tolerant to EP application of sethoxydim (0.25 lb/A). These treatments controlled all weed species effectively. Both grain and silage yields from all POST treatments to GR and SR corn were equal or better than the yield obtained from the cultivated check.

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WEED MANAGEMENT SYSTEMS IN GLYPHOSATE-RESISTANT SOYBEAN. G.R. Armel, R.J. Richardson, H.P. Wilson, and T.E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

Glyphosate-resistant soybeans (*Glycine max* (L.) Merr.) account for about 40 to 50% of the soybean acreage on the Eastern Shore of Virginia. Preemergence (PRE) herbicides or tank mixes of other soybean herbicides with glyphosate postemergence (POST) may enhance control of tough annual weeds such as morningglory spp. (*Ipomoea* spp.) and spurred anoda (*Anoda cristata* L. Schlecht.) over glyphosate alone. Field studies were conducted in 1999 and 2000 at the Eastern Shore Agricultural Research and Extension Center near Painter, VA to evaluate soybean and weed responses to various weed management programs containing glyphosate.

In 1999, glyphosate (0.75 lb ai/A) combinations with fomesafen (0.19 and 0.38 lb ai/A), acifluorfen (0.25 and 0.38 lb ai/A), 2,4-DB (0.031 lb ai/A), imazethapyr (0.063 lb ai/A) increased soybean injury in comparison to glyphosate alone. However, plants recovered rapidly and there were no significant differences in soybean yields between treatments. Glyphosate combinations with fomesafen or acifluorfen controlled morningglory spp. 91 to 97% 2 WAT, while glyphosate controlled morningglory spp. 54%. By 4 WAT all treatments controlled morningglory spp. 82 to 87%. Glyphosate combinations did not enhance control of common ragweed (*Ambrosia artemisiifolia* L.), smooth pigweed (*Amaranthus hybridus* L.), or common lambsquarters (*Chenopodium album* L.) over glyphosate alone. This study was repeated in 2000 with similar soybean and weed responses.

In 2000, PRE pendimethalin (0.93 lb ai/A), alachlor (2.0 lb ai/A), or cloransulam (0.016 or 0.031 lb ai/A) was followed by glyphosate (1.0 lb/A) or glyphosate plus imazethapyr (0.75 plus 0.063 lb/A, respectively). Preemergence herbicides did not increase control of foxtail spp. (*Setaria* spp.), common ragweed, or jimsonweed (*Datura stramonium* L.) in comparison to glyphosate alone. However, preemergence pendimethalin or cloransulam followed by glyphosate and the postemergence combination of glyphosate plus imazethapyr improved control of morningglory spp. over that obtained by glyphosate alone.

IMPACT OF HERBICIDES ON SOYBEAN LEAF AREA. B. F. Johnson, H. P. Wilson, D. L. Holshouser, W. A. Bailey, and T. E. Hines, Virginia Tech. Univ., Painter, VA.

ABSTRACT

Herbicides are an integral component of full-season and double-crop soybean (*Glycine max* [L.] Merr.) production systems. Herbicide selection is based on the ability of the product to control important weeds without causing significant injury to the crop. Although the margin of crop safety varies widely among soybean products on the market, it has generally been accepted that these products will not impact soybean yield potential when used according to label and during favorable environmental conditions. A soybean crop that develops adequate leaf area can easily compensate for herbicide injury, however some soybean production systems may not allow the leaf area needed to compensate for this injury. Minor soybean injury due to herbicides in these systems may be causing larger yield reductions than realized.

Leaf area index (LAI) is the ratio of unit leaf area of the crop to unit land area. A LAI of 3 means that there are 3 square feet of leaves distributed above one square foot of land. In order to approach maximum yield, soybeans need a minimum LAI of approximately 3.5 to 4.0. If a soybean crop has a LAI of 4.5 or greater, which is typical of non-stressed full-season soybeans, it is easy to understand why a minimal loss in leaf area due to herbicide injury does not affect yield. However, many double-crop systems do not achieve the minimal soybean leaf area of 3.5. Therefore, any decline in leaf area may result in a direct yield loss.

Field experiments were conducted in 1999 and 2000 to investigate the critical LAI levels needed to tolerate herbicide-induced crop injury and maintain soybean yield. Three Roundup Ready® soybean cultivars representing maturity groups III, IV, and V were planted at dates representing the full-season and double-crop soybean production systems used by Mid-Atlantic growers. Within each cultivar and planting date, fifteen herbicide treatments representing different modes of action, in addition to a control receiving only metolachlor (PRE), were applied to cause multiple levels of crop injury. Percent visual injury and height of soybeans were measured throughout the growing season. LAI was determined three times throughout the growing season using the LAI-2000 plant canopy analyzer from LI-COR.

In the 1999 full-season and double-crop studies, soybean yield loss occurred from some herbicides. A relationship was apparent between percent visual herbicide injury or LAI reduction and soybean yield loss. Acifluorfen (0.38 lb a.i./A) plus 2,4-DB (0.031 lb a. i./A) reduced LAI below 3.5 and soybean yield was reduced. Reduction in soybean yields due to herbicide treatments was greater in the double-crop study compared to the full-season study.

A SURVEY OF TRIAZINE-RESISTANT COMMON LAMBSQUARTERS ON PENNSYLVANIA FARMS. M. A. Bravo, W. S. Curran, Penn State Univ., University Park, PA.

ABSTRACT

Common lambsquarters *(Chenopodium album* L.*)* is a major weed problem in Pennsylvania (PA) cropping systems. Triazine-resistant common lambsquarters was discovered in the early 1970s and is today considered to be prevalent on many PA farms. A survey sent to county agents and crop consultants provided a pool of farms known to have common lambsquarters present in their fields. Nineteen counties were selected for a survey. Soil samples were collected from three fields on each of three to four farms from each county. Field histories of herbicide use, crop rotation, and tillage practices were documented for each field. Soil samples from each field were divided into three trays, placed in the greenhouse and provided a 12 hr photoperiod and ample moisture to allow weed seed germination. Trays were thinned of all seedlings other than *Chenopodium*, *Ambrosia*, and *Amaranthus* (pigweed) species. Following emergence, seedling weeds in each tray were counted and sprayed with either 1 or 5 lb ai/A atrazine when they had one or more true leaves and were at least 1 inch tall. An untreated check was included. Ten to 12 days after application, plants were counted again and classified as either alive (resistant) or dead (susceptible). A plant of each species from each field that survived the 5 lb/A rate was allowed to flower for species identification. The experiment was repeated.

Most *Chenopodium* plants grown to maturity were identified as *Chenopodium album*. Samples from 58 farms contained viable nondormant common lambsquarters seed. On average, common lambsquarters were 81% resistant to both rates across all samples. Of the 58 farms, common lambsquarters from 4 farms were 9% or less triazine-resistant, while common lambsquarters from 34 farms were greater than 90% triazine-resistant. The remaining farms contained a mixed population of susceptible and resistant common lambsquarters. Samples from 52 farms contained viable nondormant pigweed seed. On average, pigweed was 32% resistant to both rates across all samples. Of the 52 farms, pigweeds from 23 farms were 1% or less triazine-resistant, while pigweeds from 3 farms were 100% triazine-resistant. The remaining farms contained a mixed population of susceptible and resistant pigweed. Common lambsquarters and pigweed were found together in fields from 52 farms. Surprisingly, many fields that contained triazine-resistant common lambsquarters contained triazine-susceptible pigweed. A few fields had the same level of resistance or susceptibility in both species.

Mexicantea *(Chenopodium ambrosioides* L.), spreading orach (*Atriplex patula* L.*)*, halberdleaf orach *(Atriplex patula* L. *var. hastata* (L) Gray.), spiny amaranth (*Amaranthus spinosus* L.) and common ragweed (*Ambrosia artemisiifolia* L.) were found in a few samples and all were 100% triazine-susceptible. Pigweed species grown to maturity were identified as redroot pigweed (*Amaranthus retroflexus* L.), smooth pigweed (*Amaranthus hybridus L.*) and Powell amaranth (*Amaranthus powellii* S. Wats.). Several pigweed plants exhibited vegetative and floral characteristics that varied from classical descriptions of these three pigweed species.

PREEMERGENCE AND POSTEMERGENCE CONTROL OF TRIAZINE-RESISTANT COMMON LAMBSQUARTERS (*Chenopodium album*) IN NO-TILL CORN. H. Menbere and R. L. Ritter, Agric. Exp. Sta., Dept. Nat. Res. Sciences and Land. Arch., Univ. of MD, College Park, MD.

ABSTRACT

Triazine-resistant common lambsquarters continue to be a major threat to no-till corn farmers in the mid-Atlantic region of the U. S. In general, preemergence control is hard to achieve and necessitates the use of a postemergence herbicide. Pendimethalin (Prowl - BASF) has some preemergence activity but has been inconsistent in studies conducted in Maryland. The package-mix thifensulfuron-methyl + rimsulfuron (Basis - DuPont) shows promise when applied preemergence. Depending upon rate, corn injury may occur. Flumetsulam (Python - Dow AgroSciences) also shows promise when applied preemergence. Depending upon rate, flumetsulam may also injure corn. Isoxaflutole (Balance - Aventis) provides good preemergence control control but is not labeled in the mid-Atlantic region. Mesotrione (ZA 1296, Callisto - Syngenta) has also been tested and shows good preemergence and postemergence activity with good corn tolerance. New postemergence products showing good control include the following: diflufenzopyr + the sodium salt of dicamba (Distinct - BASF), primisulfuron-methyl + the sodium salt of dicamba (NorthStar - Syngenta), and a tank-mix of pyridate (Tough - Syngenta) + primisulfuron-methyl + prosulfuron (Exceed - Syngenta).

ALS-RESISTANT PIGWEED IN PENNSYLVANIA – IS IT FINALLY HERE? D. D. Lingenfelter and W. S. Curran, Dept. of Agronomy, Penn State Univ., University Park, PA.

ABSTRACT

A population of redroot pigweed (*Amaranthus retroflexus* L.) was identified in 1998 in Lancaster County, Pennsylvania that was no longer controlled by ALS-inhibitor herbicides. The farm in question has raised corn, soybean, wheat, and forages and several different types of animals including chickens. The pigweed problem was relatively new on the farm. Redroot pigweed seeds were collected the fall of 1998 and 1999 from the initial field and in 2000 from adjacent fields on the same farm as well as neighboring farms that had suspected resistance. Greenhouse research was conducted to determine if the populations were resistant to selected ALS-inhibitor herbicides from the, imidazolinone, sulfonylurea, and sulfonamide herbicide families.

In the greenhouse study, redroot pigweed seeds were planted in cups containing a typical greenhouse potting mix. Plants were watered and fertilized as needed. Herbicides were applied POST with a greenhouse track-sprayer that delivered 20 gpa through a flat fan spray tip when pigweed seedlings had 3 to 4 true leaves. Herbicides included imazethapyr at 0.063 and 0.125 lb ae/A; chlorimuron at 0.0078 and 0.0156 lb ai/A; thifensulfuron at 0.0039 lb ai/A; cloransulam at 0.016 lb ai/A; primisulfuron at 0.036 lb ai/A; imazamox at 0.031 lb ae/A; and atrazine at 2.0 lb ai/A. Crop oil concentrate at 1% v/v was included in all of the treatments. Visual control ratings and plant dry weights were collected.

Redroot pigweed seed collected from the original infestation varied in response the ALS-inhibitor herbicides. Chlorimuron, primisulfuron, thifensulfuron, and cloransulam provided less than 25% control across all rates. Imazethapyr and imazamox provided between 50 and 70% control and, atrazine provided 100% control. Percent dry weight reduction corresponded well with the visual control data. Pigweed species from adjacent fields and neighboring farms are currently being tested.

In summary, results thus far show that at least one population of redroot pigweed in Pennsylvania is resistant to ALS-inhibitor herbicides. What is unknown is the origin of this resistant population. It is possible that resistant pigweed seed was introduced into the area via imported animal feed, seed, and/or manure. However, consecutive years of ALS-inhibitor herbicide applications may have also caused or contributed to the problem. ALS-resistant pigweed species (and possibly other weed species) will likely become more commonplace in Pennsylvania and throughout the major crop producing regions of the U.S., if herbicide resistance management strategies are not implemented.

TRIAZINE-RESISTANT COMMON RAGWEED: FACT OR FICTION IN PENNSYLVANIA? D. T. Messersmith, W. S. Curran, D. D. Lingenfelter, and R.C. Stout, Dept. of Agron., Penn State Univ., University Park, PA.

ABSTRACT

Common ragweed (*Ambrosia artimisiifolia* L.) escapes following atrazine-based PRE programs are becoming more prevalent throughout Pennsylvania. Historically, these herbicide programs have provided season-long control of common ragweed, so previous escapes have been thought to be weather or application timing related. However more frequent escapes in fields with a history of triazine use have raised the question of triazine resistance.

In 2000, a field study was conducted at two locations in Pennsylvania where there has been a history of triazine use and common ragweed escapes in corn (*Zea mays* L.). One location was in Armstrong County in western, Pennsylvania and the other was in Wayne County in the northeast corner of the state. The study consisted of five PRE atrazine treatments ranging from 0.75 to 2.0 lb ai/A and a POST atrazine treatment at 1.5 lb/A. Also included in the study were several competitive products commonly used in corn. POST applications were made approximately 6 WAP when corn was V6 and when ragweed averaged 6 to 12 inches tall. Visual ratings were made at 2 and 6 WAP and were compared to an untreated check.

Armstrong County location experienced an early dry period that may have influenced PRE herbicide activity, while the Wayne County location had ample early season moisture. Common ragweed control varied across the two study locations. At the Wayne County location ragweed control from PRE atrazine treatments ranged from 15% (0.75 lb/A) to 64% (2.0 lb/A) 5 WAP. Control from the 1.5 lb/A POST atrazine treatment was somewhat less than the 1.5 lb/A PRE treatment indicating weed size and application timing influenced ragweed control. These preliminary results suggest that the rate of atrazine typically applied in Pennsylvania corn may be inadequate for control of some common ragweed populations. Lack of timely rainfall following PRE application may also be contributing to poor common ragweed control.

EVALUATION OF VARIOUS DRIFT RETARDANTS. M. J. VanGessel and Q. Johnson, Univ. of Delaware, Georgetown, DE.

ABSTRACT

There has been a lot of interest in the past few years for using drift control agents (or drift retardants). Much of the interest is due to applications of non-selective herbicides associated with herbicide-resistant crops in close proximity to susceptible crops. However, the effectiveness of these products to reduce drift has not been evaluated under field conditions. Research was undertaken in 1999 and 2000 at the University of Delaware's Research and Education Center to evaluate the effectiveness of various drift control agents on reducing glyphosate drift and the potential impact on glyphosate performance.

The first study was designed to evaluate effect of drift control agents on reducing spray drift. This study was a two factor factorial. The first factor was drift control agent, (BreezeEase at 4 oz/100 gal, Windbrake at 1 oz/100 gal, Border EG at 10 oz/100 gal, or no additive) and the second factor was nozzle type (flat fan or floods). Grain sorghum (*Sorghum bicolor*) was planted next to glyphosate-resistant soybeans (*Glycine max*), with a 5 foot area separating the two crops. Glyphosate, at 1 lb ai/A, plus the drift control agents were sprayed to the soybeans with an air-blast sprayer blowing perpendicular to the soybean plots (towards the sorghum) and moving with the spray boom. Applications were made 3 to 4 weeks after planting. The air-blast sprayer was adjusted to deliver 15 mph wind at the boom. Water-sensitive papers were placed adjacent to the sorghum, 4 and 18 inches above the soil, to measure drift. Sorghum was visually evaluated for percent injury from glyphosate drift.

In 1999, neither spray nozzles nor drift control agents had an impact on reducing drift as measured by water-sensitive papers or sorghum injury or sorghum yield. In 2000, drift control agents did not reduce drift and sorghum injury or sorghum yield compared to no drift agent. Flood tips increased drift in relation to flat fan, but this was due to positioning of the air stream from the air blast sprayer rather than differences in the tips. In 2000, Array was also included as a drift control agent. Ratings of treatments with Array for sorghum injury were not different than no additive, yet weed biomass present in area separating the soybean and grain sorghum was much greater with Array than other treatments, indicating less glyphosate drift. Water sensitive papers have not been analyzed yet.

The second study was designed to evaluate the impact of various drift control agents on herbicide performance. A contact and translocated herbicide were included in this study to determine if the drift control agents would impact spray coverage. The drift control agents used in the first study were mixed with acifluorfen (a contact herbicide), at 0.27 lb ai/A, or glyphosate (a translocated herbicide), at 0.5 lb ai/A. Plots were sprayed with flat fan nozzles and less than 5 mph wind. Plots were evaluated for percent weed control, crop injury, and soybean yield. For all measured parameters, Main effect of drift control agents was non-significant and there was no interaction with herbicide used.

Based on these results, BreezeEase, Windbrake, and Border EG had no impact on reducing spray drift, but did not impact herbicide performance. Array may have potential to reduce spray drift. There are more effective means of reducing spray drift than drift control agents, most notably nozzle tip selection and spray pressure.

FLUMIOXAZIN: A NEW PRE-EMERGENCE HERBICIDE FOR USE IN SOYBEANS AND PEANUTS. T. G. Bean and J. A. Pawlak, Valent USA Corporation, Walnut Creek, CA.

ABSTRACT

Flumioxazin, marketed under the trade name Valor™ Herbicide, is being developed by Valent USA Corporation as a low use rate preemergence herbicide for use in soybeans and peanuts. Valor Herbicide is also being developed for use in almonds, sugarcane, cotton, and grapes.

Flumioxazin is an N-phenylphtalimide herbicide. The mode of action is believed to be inhibition of protoporphyrinogen oxidase. Porphyrins accumulate in susceptible plants which leads to membrane lipid peroxidation upon exposure to UV light. Susceptible weeds germinating in flumioxazin treated soil become necrotic and die shortly after exposure to sunlight.

In conventional tillage soybean herbicide programs, Valor Herbicide suppresses certain annual grasses and controls problem broadleaf weeds such as common lambsquarters, pigweed species, black nightshade, tall and common waterhemp, common ragweed, and prickly sida. In no-till and reduced tillage programs, Valor Herbicide aids rapid burndown and offers residual control (4 to 6 weeks) of broadleaf weeds. There are few carryover concerns for rotational crops with Valor Herbicide.

CONTROL OF WINTER ANNUAL GRASSES IN WHEAT. R. L. Ritter, and H. Menbere, Agric. Exp. Sta., Dept. Nat. Res. Sciences and Land. Arch., Univ. of MD, College Park, MD.

ABSTRACT

The package-mix thifensulfuron-methyl + tribenuron-methyl (Harmony Extra - DuPont) has the lion's share of the postemergence small grain herbicide market in the mid-Atlantic region of the U. S. This package-mix controls most of the broadleaf weeds growers are typically faced with. With continued usage of this package-mix, we are starting to see a shift in weed problems. Winter annual grasses such as annual bluegrass (*Poa annua* L.), annual ryegrass (*Lolium multiflorum* Lam.), brome grass species (*Bromus* spp.), bulbous oatgrass (*Arrhenatherum elatius* var. *bulbosus* Willd.), and rough-stalked bluegrass (*Poa trivialis* L.) are becoming more invasive in many small grain fields. Diclofop-methyl (Hoelon - Aventis) has been tested for its activity on these grass species. It has activity on annual ryegrass, yet it will not control the other grasses. With continued usage of diclofop-methyl, diclofop-methyl resistant annual ryegrass is now prevalent throughout the region. From 1996 to 2000, a variety of preemergence and postemergence herbicides were evaluated for their biological activity on these different weedy grass species. Also, soybeans were planted behind the herbicide applications, typifying a double-crop soybean situation, in order to study carryover effects.

Products tested for postemergence activity included the following: imazamethabenz-methyl (Assert - BASF), tralkoxydim (Achieve - Syngenta), clodinafop-propargyl (Horizon-1998, Discover-1999/2000 - Syngenta) and sulfosulfuron (Maverick - Monsanto). Imazamethabenz-methyl had activity on some of the grass species, but wheat tolerance was unacceptable. Sulfosulfuron had the best activity of all the products tested, with good control of annual bluegrass, and some activity on annual ryegrass and bulbous oatgrass. Wheat tolerance was acceptable. Carryover to double-crop soybeans was observed with sulfosulfuron. The carryover effects were negated with a planting of 'STS' soybeans.

Preemergence applications of s-metolachlor (Dual II Magnum - Syngenta) and flufenacet + metribuzin (Axiom - Bayer), as well as preemergence and postemergence applications of chlorsulfuron (Glean - DuPont) and chlorsulfuron + metsulfuron-methyl (Finesse - DuPont) were examined for control of annual ryegrass. Depending upon rate, good annual ryegrass control was achieved with preemergence applications of all four herbicides. Poor ryegrass control was achieved with postemergence applications of chlorsulfuron and chlorsulfuron + metsulfuron-methyl. Carryover to double-crop soybeans was noted with chlorsulfuron and chlorsulfuron + metsulfuron-methyl. The caryover effects were negated with a planting of 'STS' soybeans.

EVALUATION OF ROUGHSTALK BLUEGRASS CONTROL IN VIRGINIA SMALL GRAINS DURING 1999 AND 2000. K. W. Bradley and E. S. Hagood, Virginia Tech Univ., Blacksburg, VA.

ABSTRACT

Roughstalk bluegrass (*Poa trivialis* L.) is a perennial grass capable of reproducing from both seed and stolons, and has recently developed into a problem weed for certain winter wheat (*Triticum aestivum* L.) and barley (*Hordeum vulgare* L.) growers in Virginia. For this reason, separate field experiments were established in areas with severe roughstalk bluegrass infestations in Virginia during 1999 and 2000 to evaluate roughstalk bluegrass control with several small grain herbicides. In both 1999 and 2000, the postemergence herbicides diclofop, clodinafop-propargyl, tralkoxydim, sulfosulfuron, chlorsulfuron, and chlorsulfuron plus metsulfuron were applied to roughstalk bluegrass that ranged from two to three inches in height. In 2000, the herbicide fluthiamide was included as a preemergence roughstalk bluegrass treatment and the effect of roughstalk bluegrass control on wheat yield was also determined. During both years, all rates of diclofop, tralkoxydim, chlorsulfuron, and chlorsulfuron plus metsulfuron provided less than 50% visible control of roughstalk bluegrass at two months after treatment (2 MAT). However, much higher levels of roughstalk bluegrass control were achieved with clodinafop-propargyl and sulfosulfuron during both years and also with fluthiamide followed by sulfosulfuron in 2000. For example, clodinafop-propargyl at 0.112 lbs per acre provided 91 and 85% control of roughstalk bluegrass at 2 MAT in 1999 and 2000, respectively. Similarly, 0.062 lbs sulfosulfuron provided 87% roughstalk bluegrass control at 2 MAT in 1999 and 78% control in 2000. Additionally, applications of fluthiamide at 0.425 lbs followed by 0.062 lbs sulfosulfuron provided 90% control of roughstalk bluegrass at 2 MAT in 2000, which was significantly higher than the control afforded by an application of sulfosulfuron alone. In 2000, there were no significant differences in the yield of wheat for any of the treatments evaluated. In 1999, however, applications of sulfosulfuron and clodinafop-propargyl resulted in significantly higher levels of visible barley injury (16 to 50%) when compared to the remainder of the treatments included in the trial. These results indicate that none of the herbicides evaluated in these experiments are capable of providing selective control of roughstalk bluegrass in barley, but that clodinafop-propargyl, sulfosulfuron, and fluthiamide followed by sulfosulfuron are all herbicide treatments that are capable of providing good to excellent roughstalk bluegrass control in wheat.

GLYPHOSATE-RESISTANT CORN SYSTEMS AND APPLICATION TIMING. T.E. Dutt, J. F. Haldeman, R. A. DeWaine, and D. J. Mayonado, Monsanto Agricultural Company, Fogelsville, PA, York, PA, Sherrill, NY, and Salisbury, MD, respectively.

ABSTRACT

Roundup Ready®[1] (glyphosate-resistant) corn (*Zea mays*) efficacy and yield trials were conducted in 1998, 1999, and 2000 under Northeast regional conditions. Roundup Ready corn weed control systems were compared to conventional preemergence (PRE), postemergence (POST), and PRE followed by POST programs. Roundup Ready corn weed control systems evaluated were Roundup Ultra®[1] early-POST tank mixture treatments, PRE followed by Roundup Ultra POST treatments and sequential POST Roundup Ultra treatments. Single early-POST, mid-POST, and late-POST Roundup Ultra only treatments were also evaluated. Field trials were conducted primarily at locations in Pennsylvania and New York with predominantly annual weed spectrums (mostly giant foxtail [*Setaria faberi* Herrm.], common lambsquarters [*Chenopodium album* L.], and velvetleaf [*Abutilon theophrasti* Medik.]).

Roundup Ready corn weed control systems and conventional PRE followed by POST programs provided the best and most consistent season-long weed control. Roundup Ready corn weed control systems generally worked better than conventional programs in 1998 (wet spring followed by a dry summer) and 1999 (very dry season). All programs generally worked well in 2000 (very wet season).

In 1998, early-mid POST (V3-V5 corn, 1-6 inch weeds) applications of Roundup Ultra provided the same yield potential as conventional PRE treatments. However, utilizing a recommended Roundup Ready corn weed control system (adding a residual PRE or POST in the program, or making a sequential Roundup application) increased yield potential by 5-15%.

In 1999, all single POST applications of Roundup Ultra out-yielded conventional PRE treatments. Utilizing a recommended Roundup Ready corn weed control system increased yield potential by 8% over a single early-POST (V3-V4 corn, 2-4 inch weeds) Roundup Ultra application; by 20% over a single mid-POST (V5-V6 corn, 4-6 inch weeds) application; and by 30% over a single late-POST (V7-V8 corn, 8-24 inch weeds) application.

In 2000, all program treatments, including early-late POST Roundup Ultra only applications, yielded within 5% of each other. Although application timing results varied across years, the data generally shows increased yield potentials by using a recommended Roundup Ready corn weed control program over a single Roundup only application.

[1]®Roundup Ready and Roundup Ultra are registered trademarks of Monsanto Company.

RYEGRASS CONTROL IN WHEAT WITH PREMERGENCE HERBICIDES. M. G. Schnappinger, Novartis Crop Protection; Centreville, MD; R. L. Ritter, H. Menbere, Agric. Exp. Sta., Dept. Nat. Res. Sci. and Land. Arch., Univ. of Maryland, College Park, MD; and C. A. S. Pearson and D. W. Kidder, Novartis Crop Protection, Inc., Canonsburg, PA.

ABSTRACT

Italian ryegrass (*Lolium multiflorum* Lam.) is a serious problem in winter wheat (*Triticum aestivum* L.). Geographical distribution of ryegrass in wheat is rapidly increasing throughout the mid-Atlantic area. Traditional methods of control using post-selective herbicides are generally ineffective due to difficulty in application timing or the development of resistance to this class of chemistry.

Five replicated small plot field trials were established near Beltsville and Centreville, MD in 1998 and 1999 to evaluate *S*-metolachlor with regard to crop safety on wheat and efficacy on ryegrass. Preemergence or very early postemergence applications of *S*-metolachlor were made at rates from 0.25-1.0 lbs ai/acre. Crop safety was very good to excellent in all cases. While slight injury was noted at the higher rates in one trial, no adverse effect on yield was observed in several trials where yields were taken. Rates of 0.38-0.5 lbs ai/acre gave acceptable to excellent ryegrass control depending on the year and location. *S*-metolachlor offers a safe and effective preemergence option for the control of ryegrass in wheat.

Table 1: Final Italian ryegrass control ratings taken just prior to harvest at five Maryland locations.

Location		Beltsville		Centreville			Average
	Treatment year	1998 Site 1	1999 Site 2	1998 Site 3	1999 Site 4	1999 Site 5	
	lbs ai/A	% Control					
Untreated		0	0	0	0	0	0
s-metolachlor	0.25	65	67	70	70	53	65
s-metolachlor	0.38	68	85	77	92	90	82
s-metolachlor	0.50	92	93	70	98	93	89
s-metolachlor	0.75	92	98	80	97	90	91
s-metolachlor	1.00	98	100				99

EFFECT OF RESIDUAL HERBICIDES AND APPLICATION TIMING ON EFFICACY OF GLYPHOSATE-RESISTANT SOYBEANS. R. R. Hahn and P. J. Stachowski, Dept. of Crop and Soil Sci., Cornell Univ., Ithaca, NY.

ABSTRACT

Field experiments were conducted to investigate the effect of application timing with glyphosate alone and to provide additional information on the contribution, if any, of residual herbicides in glyphosate-resistant soybeans [*Glycine max* (L.) Merr.]. Soybeans 'CX196RR' and 'Pioneer 91B91' were planted on June 5, 1998 near Aurora, NY and on May 27, 1999 near Mt. Morris, NY respectively. Glyphosate at I lb ai/A was applied alone and following a preemergence (PRE) application of 2.16 lb ai/A of flumetsulam/metolachlor (Broadstrike + Dual) 3, 4, 5, and 6 weeks after planting (WAP). There was also a PRE flumetsulam/metolachlor only treatment and an untreated check at each location. Herbicide applications were made in water to 10- by 25-ft plots in 22 or 25 gpa of spray solution. In addition to different weed populations and soils (Mt. Morris has a much higher yield potential than Aurora), there was also a difference in rainfall for activation of the PRE herbicides between the two locations. The PRE treatments received 1.5 and 0.25 inches of rain during the first week after application in 1998 and 1999 respectively.

In 1998 at Aurora, velvetleaf (*Abutilon theophrasti* (Medicus) and green foxtail (*Setaria viridis* (L.) Beauv.) were the dominant weeds. Velvetleaf control was 100% when flumetsulam/metolachlor was applied alone and when followed by sequential glyphosate applications. When glyphosate was applied alone, velvetleaf control ranged from 94 to 97% on the four postemergence (POST) application dates. Green foxtail control was 100% with all treatments. The four PRE flumetsulam/metolachlor treatments followed by sequential glyphosate applications averaged 36 bu/A which was not significantly greater than the 34 bu/A yield from the PRE flumetsulam/metolachlor only treatment. The glyphosate only treatments applied 3, 4, or 5 WAP averaged 37 bu/A and there were no differences among these treatments. When glyphosate application was delayed until 6 WAP, the soybean yield of 31 bu/A was less than when glyphosate was applied 3 or 4 WAP. Yield from the untreated check was 20 bu/A. In 1999 at Mt. Morris, velvetleaf and redroot pigweed (*Amaranthus retroflexus* L.) were the dominant weeds. Although there was only 0.42 inch of rain during the 3 WAP, the PRE application of flumetsulam/metolachlor controlled 65% of the redroot pigweed. When PRE applications of flumetsulam/metolachlor were followed by POST glyphosate applications, pigweed control was 99 or 100%. Pigweed control was 88, 96, 98, and 99% respectively when glyphosate was applied alone 3, 4, 5, or 6 WAP. Velvetleaf control with the PRE flumetsulam/metolachlor treatment alone was only 17% and averaged 96% when PRE applications were followed by POST glyphosate applications 3, 4, 5, or 6 WAP. Finally, when glyphosate was applied alone 3, 4, 5, or 6 WAP, velvetleaf control averaged 94%. Yields from the untreated check and the PRE only treatment were 7 and 20 bu/A respectively. Yields from the four PRE followed by POST glyphosate applications 3, 4, or 5 WAP averaged 75 bu/A while those with glyphosate alone 3, 4, or 5 WAP averaged 72 bu/A. As in 1998, it was only when glyphosate application was delayed until 6 WAP that a significant yield reduction (17 bu/A) occurred.

NEW ZENECA GLYPHOSATE HERBICIDE: BIOEFFICACY AND CROP TOLERANCE ON GLYPHOSATE-RESISTANT CROPS. B. A. Lackey, ZENECA Ag Products, Macedon, NY.

ABSTRACT

ZENECA Ag Products evaluated a new glyphosate formulation on a wide variety of weed species throughout the agricultural production areas of the United States in 2000. This new formulation was extensively tested for use postemergence on glyphosate-resistant corn and soybeans to determine crop response, yield effect, rate definition, and application timings.

Thorough research on this novel formulation has been conducted to determine important attributes of the product, such as the speed of cuticle penetration, translocation throughout the vascular system, and the percentage of glyphosate penetration into a target plant.

Efficacy trials were conducted on common ragweed (*Ambrosia artemisiifolia* L.), giant ragweed (*Ambrosia trifida* L.), common lambsquarters (*Chenopodium album* L.), common sunflower (*Helianthus annuus* L.), smartweed (*Polygonum* sp.), morningglory (*Ipomoea* sp.), yellow nutsedge (*Cyperus esculentus* L.), prickly sida (*Sida spinosa* L.), velvetleaf (*Abutilon theophrasti* Medicus), foxtail species (*Setaria* sp.), nightshade (*Solanum* sp.), dandelion (*Taraxacum officinale* Weber in Wiggers) and pigweed species (*Amaranthus* sp.). This glyphosate formulation provided excellent control (>90%) of common lambsquarters, giant ragweed, redroot pigweed, velvetleaf, and common sunflower at 0.56 lbae/A. The 0.75 lbae/A rate provided greater than 90% control of dandelion and prickly sida and improved the activity on morningglory species.

Three rates of the formulation, applied at different application timings, were evaluated to determine the response on glyphosate-resistant corn and soybeans. ZENECA's glyphosate formulation had little or no effect on corn or soybeans. Results from soybean studies showed no yellowing of soybean leaflets or yield reductions from expected popular commercial rates, regardless of application timing. Similarly, results from corn studies reveal minimal injury, comparable to that observed with other glyphosate formulations, with no effect on corn yields.

SUCCESS OF TOTAL POST WEED CONTROL IN NORTHEASTERN U.S. CORN. W. S. Curran, Penn State Univ., University Park, PA; M. J. VanGessel, Univ. of Delaware, Georgetown DE; B. A. Majek, Rutgers Univ., Bridgeton, NJ; P. C. Bhowmik, Univ. of Massachusetts, Amherst MA; E. S. Hagood, Virginia Tech Univ., Blacksburg, VA; R. R. Hahn, Cornell Univ., Ithaca, NY; F. J. Himmelstein, Univ. of Connecticut, Vernon, CT; J. M. Jemison, Univ. of Maine, Orono ME; R. L. Ritter, Univ. of Maryland, College Park, MD; H. P. Wilson, Virginia Tech, Painter, VA; T. E. Dutt, Monsanto Co., Fogelsville, PA; and D. J. Mayonado, Monsanto Co., Salisbury, MD.

ABSTRACT

An experiment was conducted at multiple locations throughout the Northeast in 2000 to evaluate the effectiveness of a total POST weed control program over a broad range of conditions. The study included 14 treatments utilizing glyphosate-resistant corn. The series of treatments examined the need for residual herbicides when a total POST program is used. Glyphosate alone or glyphosate plus a prepackage mixture of acetochlor or alachlor plus atrazine were applied to approximately V-2 and V-4 corn. Glyphosate alone was also applied to V-6 corn and also in a sequential timing at V-2 followed by V-6. A prepackage mixture of rimsulfuron, nicosulfuron, and atrazine in combination with dicamba was included for comparison. A weedy and weed-free check were also included.

Study sites included no-till as well as conventional tillage and irrigated and non-irrigated locations. County agents helped conduct trials at some locations. Weed density and height, by species were determined prior to each POST application. Visional weed control ratings and additional emergence was recorded 2 and 4 weeks after treatment. In late summer or fall, weed biomass and grain or silage yield was collected.

At the time of writing this abstract, weed biomass and corn yield data were still being processed at a number of locations. However, preliminary results showed that control varied across locations depending on weed species, severity, and rainfall. In general, PRE herbicide treatments were fairly effective at least early season with most areas receiving adequate rainfall. At some locations, late season control with PRE treatments alone declined. The effectiveness of POST control was strongly tied to weed species and severity. In Pennsylvania, good control of common lambsquarters (*Chenopodium album* L.) and other annual weeds was achieved with glyphosate alone, except at the early POST (V-2) timing, where weed emergence subsequent to the early application was a problem. In addition, certain weeds such as dandelion (*Taraxacum officinale* Weber in Wiggers) were not effectively controlled in no-till corn. In general, the mid POST application (V-4) regardless of treatment provided the best control compared with the other POST timings. Residual herbicides either improved or maintained control compared to glyphosate alone. Weed control in the late POST (V-6) timing varied depending on weed species and severity. As expected a sequential application of glyphosate was generally effective for control of most weeds.

WEED MANAGEMENT OPTIONS IN GLYPHOSATE-RESISTANT FIELD CORN. F. J. Himmelstein and R. J. Durgy, Univ. of Connecticut, Storrs, CT.

ABSTRACT

Two Connecticut field trials conducted in 2000 evaluated the timing and rate of glyphosate (Roundup Ultra) application for weed management in field corn (*Zea mays*). Doebler's 639 RYG, a 110 day glyphosate-resistant corn variety, was planted at both locations on May 31, 2000. Treatments included glyphosate alone at 0.5, 0.75, and 1.0 lb ai/A, applied at early postemergence (EP), mid postemergence (MP), and late postemergence (LP) timings. Other treatments included glyphosate + atrazine (Ready Master ATZ) at 1.5 lb ai/A EP, glyphosate + acetochlor + atrazine (Mon 69423) at 2.5 lb ai/A EP, glyphosate EP followed by glyphosate LP, both at 1.0 ai/A, acetochlor + atrazine (Harness Xtra 5.6L) at 2.1 lb ai/A PRE followed by glyphosate at 1.0 lb ai/A MP, and acetochlor (Harness) at 1.8 lb ai/A PRE followed by halosulfuron (Permit) + dicamba (Banvel) at 0.031 + 0.25 lb ai/A EP. Comparative treatments included s-metolachlor + atrazine (Bicep II Magnum) at 2.9 lb ai/A PRE, rimsulfuron + atrazine + nicosulfuron (Basis Gold) at 0.79 lb ai/A EP, and s-metolachlor (Dual II Magnum) at 1.27 lb ai/A PRE followed by prosulfuron + primisulfuron (Exceed) + dicamba at 0.036 + 0.125 lb ai/A EP. EP treatments were applied in Lebanon when the corn had 4-to-5 leaves, 7-to-8 inches in height, and in Storrs when the corn had 4 leaves, 5-to-7 inches in height . MP treatments were applied in Lebanon when the corn had 7-to-8 leaves, 13-to-21 inches in height, and in Storrs when the corn had 6-to-7 leaves, 10-to-13 inches in height. LP treatments were applied in Lebanon when the corn had 8-to-9 leaves, 30-to-36 inches in height, and in Storrs when the corn had 6-to-8 leaves, 14-to-28 inches in height. Herbicides were applied with a CO_2 backpack sprayer delivering 20 gpa at 32 psi. Weed species included common lambsquarters (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*), and large crabgrass (*Digitaria sanguinalis*) at both locations, and velvetleaf (*Abutilon theophrasti*), giant foxtail (*Setaria faberi*), and burcucumber (*Sicyos angulatus*) in Lebanon.

Herbicide treatments resulted in excellent control of all weed species at the Storrs site by the time of harvest, although common lambsquarters control was weaker when glyphosate was applied alone LP. At the Lebanon site, herbicide treatments controlled all weed species with the exception of burcucumber. Glyphosate applied alone provided greater control of burcucumber when applied either MP or LP compared to EP. Glyphosate EP + LP gave greater burcucumber control than glyphosate applied alone EP, or in combination with residual materials applied EP. At the Storrs site, both the overall corn silage and grain yields were reduced by the extended period of weed competition when glyphosate treatments applied alone were delayed. Average silage yields were 27.7, 25.6, and 22.2 T/A, with the EP, MP, and LP treatments of glyphosate, respectively. Average grain yields were 153, 143, and 128 bu/A, with the EP, MP, and LP treatments of glyphosate, respectively. The level of burcucumber control determined corn yields at the Lebanon site with the glyphosate EP + LP treatment resulting in the greatest corn grain yields at that location. When glyphosate is applied alone in field corn, applications should be made EP in order to avoid potential yield loss from the extended period of weed competition with a second application to be made when needed to control certain late germinating problem weeds in order to maximize crop yield.

Conyza canadensis INSENSITIVITY TO GLYPHOSATE. M. J. VanGessel, Univ. of Delaware, Georgetown, DE and J. L. Glasgow, Sygenta, Richmond, CA.

ABSTRACT

Lack of weed control from a given herbicide can result from a number of reasons, including environmental conditions at time of application as well changes in the weed populations. In 1999, a number of growers and dealers reported poor control of *Conyza canadensis* (horseweed) with glyphosate applications for burn-down in no-till full-season (NTFS) soybean. Much of the poor control was attributed to the extremely dry spring the region experienced that year. However, similar reports were made in 2000, when growing conditions were ideal for achieving maximum level of control from herbicide applications. Initial tests were conducted to determine the susceptibility of horseweed in these fields to glyphosate and the best approach to controlling horseweed plants not effectively controlled with burndown glyphosate applications.

A field in Kent County DE, was treated with 1.5 qts/A of glyphosate (Roundup Ultra) for burndown control in NTFS soybean and many horseweed plants were not controlled. However, other plants in the same field were completely dead. Lack of control was not due to application or environment. A study was established at this site. The study was a two factor factorial arranged as a randomized complete block with three replications. The first factor was POST herbicide treatments consisting of Roundup Ultra at 0.75, 1.0, 1.5, and 2.0 lbs ai/A, Roundup Ultra at 0.75 lb ai/A plus cloransulam (0.016 lb ai/A) or chlorimuron (0.008 lb ai/A), cloransulam at 0.016 lb ai/A, chlorimuron at 0.008 or 0.012 lb ai/A, and bentazon at 1.0 lb ai/A. Treatments were applied to horseweed exhibiting some chlorosis from Roundup Ultra application and apparently at the same height as the initial burndown treatment and then 10 days later. Horseweed plants at this later application timing had begun to re-grow and were 3 to 4 inches taller than the initial application. A comparison treatment of cloransulam at 0.019 applied at first timing was also included.

Control of horseweed was not influenced by time of POST application. Control 4 WAP was highest with cloransulam applied alone and tankmixed with Roundup Ultra, chlorimuron tankmixed with Roundup Ultra, and Roundup Ultra alone at 2 lbs ai/A (averaging 73% control).

Individual horseweed plants surviving after 1.5 qt/A Roundup Ultra applied burndown plus 1.5 qt/A applied POST were transplanted into pots and brought back to the University of Delaware's Research and Education Center (REC). Horseweed plants from the REC were collected from areas with no history of glyphosate application and transplanted into pots. Plants were treated with Roundup Ultra at 1, 2 , 3, 4, and >10 lbs ai/A. Four weeks after treatment, plants collected from Kent County DE, treated with Roundup at 4 lbs ai/A had a control rating of 59% and produced some seed, while plants from the REC were dead with 3.0 lbs ai/A.

More work is needed to determine if *C. canadensis* in Delaware and surrounding states is resistant to glyphosate and what management strategy will be most successful for its control.

EVALUATION OF POTENTIAL ALLELOPATHIC EFFECTS OF FINE FESCUE (*Festuca rubra*) ACCESSIONS ON TURF WEEDS. C. Bertin, L. A. Weston, F. S. Rossi, Dept. of Hort., Cornell Univ., Ithaca NY.

ABSTRACT

A two year study was conducted in Ithaca, NY to evaluate hard red and chewing fescues (*Festuca longifolia* Thuill, *Festuca rubra* L.ssp *rubra*, *Festuca rubra* L ssp *commutata* Gaud.) which were observed to inhibit germination and establishment of common annual and perennial weeds in turf. Eighty fescue accessions were evaluated in the field under low to moderate mowing heights for their weed suppressive abilities and suitability for turfgrass. Over two growing seasons, five fescue accessions consistently provided excellent suppression of common turf weeds when established at similar planting densities while other accessions provided moderate to little weed suppression. Laboratory studies were conducted to evaluate potential allelopathic interference of selected fine fescues using agar and sand establishment assays. When suppressive fine fescues were established for 14 days before introduction of weed seeds, curly cress growth was strongly reduced with certain accessions apparently by producing toxic root exudates. Using a capillary mat system to produce large quantities of root biomass, root exudates were collected from fescue accessions of interest. The production of root exudates varied with accession; certain accessions corresponding to those most suppressive in field conditions also produced exudates exhibiting strong inhibition of seed germination. HPLC, TLC and MS techniques are currently being utilized to determine the chemical nature of the bioherbicides in active root exudates.

BIOLOGICAL CONTROL OF PURPLE LOOSESTRIFE (*Lythrum salicaria*) IN CONNECTICUT WETLANDS. D. R. Ellis, Dept. of Plant Sci., Univ. of Connecticut, Storrs, CT.

ABSTRACT

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

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

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

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

VARIATION IN REPONSE OF SUNFLOWER CULTIVARS TO *Pseudomonas syringae* pv. *tagetis*. J. C. Cook and J. C. Neal, Dept. of Hort. Sci., North Carolina State Univ., Raleigh, NC.

ABSTRACT

Pseudomonas syringae pv. *tagetis* (PST) is being evaluated as a potential biological control agent for weeds in the Asteraceae. Before such a broad host range pathogen is widely used for weed biocontrol it is imperative that the potential for off-target movement be documented. Sunflower (*Helianthus annuus*) is a documented host of PST and many cultivars are available. This research was conducted to identify highly susceptible cultivars for use as an indicator species in PST off-target movement investigations.

Two greenhouse studies were conducted to evaluate the relative susceptibility of eleven cultivars of sunflower (*Helianthus annuus*) to *Pseudomonas syringae* pv. *tagetis* (PST). The concentration of PST inoculum in both tests was 10^8 colony forming units (cfu's) per ml, and was applied with a hand held, air-pressurized sprayer at 1247 L/ha. PST was applied alone or with 0.2% or 0.4% (v/v) Silwet-L77, an organosilicate adjuvant. These treatments were compared to plants treated with Silwet at 0.4% (without PST) and to untreated plants. Plants, grown from seed, were approximately 3-4 weeks old. The eleven cultivars tested were: Golden Glory, Orange Sun, Sunbright, Full Sun, Superior Sunset, Goldburst, Sunbeam, Red Treasures, Floristan, Watermelon Shades (mixed), and Sonja.

All cultivars were susceptible to foliar burn from 0.4% Silwet, but significant variation was noted among cultivars. Sonja, Floristan, and Red Treasure were the most sensitive to 0.4% Silwet; Orange Sun, Superior Sunset and Sunbeam were the least sensitive. In the absence of Silwet, no sunflower cultivar expressed disease symptoms; whereas, all cultivars were susceptible to PST when applied with Silwet. Sunbeam, Superior Sunset, and Watermelon Shades (mixed), when sprayed with 0.4% Silwet (without PST), had normal regrowth after three weeks. When these cultivars were treated with PST + 0.4% Silwet, disease expression increased over the three week period. Applications of 0.4% Silwet resulted in greater foliar damage from surfactant injury and increased disease expression as compared to that of 0.2% Silwet.

Silwet at 0.4% appeared to mask the expression of disease symptoms, preventing separation of varietal differences. In order to separate cultivar susceptibility to PST from tissue sensitivity to Silwet, experiments are being conducted in a misting chamber in the absence of Silwet.

PREDISPERSAL WEED SEED PREDATION IN SOYBEAN FIELDS. R.E. Nurse and C.J. Swanton, Dept. of Plant Agric., Univ. of Guelph, Guelph ON, Canada. Current address of first author: Cornell University, Ithaca, NY.

ABSTRACT

Field experiments were conducted from 1998 to 1999 to determine the influence of soil tillage and soybean row width on levels of predispersal weed seed predation in *Amaranthus retroflexus* and *Chenopodium album*. Wide and narrow row soybeans were planted into conventional and conservation tillage systems. Additional control plots were also established where soybeans were not planted. We hypothesized that reduced tillage (disturbance) in combination with narrow row soybeans (planting pattern) would alter the microclimatic conditions within the crop canopy to favor enhanced levels of predispersal seed predation. This study confirmed that predispersal weed seed predation was occurring in soybeans, and lepidopteran micro-moths were found to be responsible for the predation of <1 to 17% and 2 to 4% of seeds in *Amaranthus retroflexus* and *Chenopodium album* respectively. Individual plants of both species had predation levels ranging from 0 to 80%. An interaction between soil tillage and row width was found for *Amaranthus retroflexus*, but not for *Chenopodium album*. The data showed that the highest level of predation occurred in the no-till wide row soybeans. Weeds with the crop canopy received less photosynthetic photon flux (PPF), produced less aboveground biomass, smaller terminal inflorescences and fewer seeds than those outside of the canopy. Levels of PPF averaged over the entire growing season were found to indirectly influence seed predation levels by possibly altering the morphology of the weeds. Weed morphological characteristics such as plant height, terminal inflorescence weight, and total seeds were directly correlated to increased levels of predation in both weed species. Weed location within the field, however, had no direct correlation with levels of seed predation. Understanding the mechanisms influencing the potential for predispersal predation on weed population dynamics is an important component of an effective integrated weed management strategy.

INFLUENCE OF BASAL BARK APPLICATION OF TRICLOPYR AND IMAZAPYR ON *Ailanthus* RESPROUTING. J. M. Johnson, A. E. Gover, and L. J. Kuhns, Penn State Univ., University Park, PA.

ABSTRACT

As part of an ongoing research project funded by the Pennsylvania Department of Transportation, a trial was initiated to determine if the addition of imazapyr to a triclopyr basal bark treatment would improve suppression of suckering of Ailanthus (*Ailanthus altissima* [Mill.] Swingle). Treatments included an untreated check; 0.6 lb/gal triclopyr; and 0.06 lb/gal imazapyr with either 0.6 or 0.04 lb/gal triclopyr. Dormant season applications of 0.6 lb/gal triclopyr or greater have been shown to cause a girdling effect on treated stems resulting in control of the treated stem without translocation of the material to the roots. A rate of 0.6 lb/gal triclopyr alone and in combination with imazapyr was used to evaluate how much the triclopyr restricts movement of imazapyr within the plant. The reduced rate of 0.04 lb/gal triclopyr was used in combination with imazapyr to determine whether the triclopyr would provide partial control but still allow for the translocation of the imazapyr to the root system. All treatments were diluted in a commercial basal oil. Treatments were applied on June 3, 1999. Ailanthus was at full canopy, with active leaf initiation still occurring. The treatments were applied to completely cover the lower 12 inches of each stem. Application equipment included backpack sprayers equipped with a Spraying Systems #5500 Adjustable ConeJet nozzle with a Y-2 tip.

The study area was located on the westbound shoulder of SR 22 near Newport, PA. Treatments were applied to plots averaging 40 by 50 ft in size. There were three replications arranged in a randomized complete block design. A subplot 20 by 20 ft in size was located within each plot. Each Ailanthus stem within the subplots was measured for caliper at a height of six inches above the soil surface prior to treatment. Stem diameters within the subplots ranged from 0.5 to 11 inches. On September 20, 1999 (16 weeks after treatment, WAT) and October 10, 2000 (70 WAT) ratings of percent canopy reduction of the treated stems plus the number, height, and caliper of all resprouts were taken within each subplot. Resprout counts 70 WAT distinguished between one-and two-year old resprouts. These values were used to determine resprout basal area, total resprout height, and resprout mortality (Tables 1a and 1b). Percent resprout mortality represented those sprouts counted 16 WAT that were not present at 70 WAT as second year sprouts.

All treatments provided effective control of the treated stems, as well as suppression of suckering. The untreated check was not included in the statistical analysis because a zero value was assigned for canopy reduction and essentially no resprouting occurred due to the intact canopy within these plots. There were no statistical differences at either rating period for any of the measurements recorded. Analysis of covariance using original basal area as the covariate revealed no effect on any dependent variable. Canopy reduction for the treated stems was 95% or greater for all three treatments. Resprouts occurred in all treated plots, but the number of resprouts averaged 7 or fewer per sub-plot by 70 WAT. Resprout mortality between 16 and 70 WAT was 77 percent or greater for all treatments.

Compared to previous dormant-season basal applications in the same area, the degree of resprouting was extremely low. The low rate of resprouting may be due to changes in physiological activity and translocation due to the late timing of the application. This effect has been observed in operational applications, but has not yet been compared in research trials.

TABLE 1a. Canopy reduction provided by various basal bark treatments applied to Ailanthus June 3, 1999. The original stem number was counted June 3, 1999, and resprout number was counted September 20, 1999 (16 WAT), and October 10, 2000 (70 WAT) The 70 WAT resprout count distinguished first year and second year resprouts. Percent resprout mortality represents the loss of sprouts from 16 WAT that were not present 70 WAT. Each value is the mean of three replications.

Herbicide	Application Rate	% Canopy Reduction		Original Stem Number	Resprout Numbers		% Resprout Mortality
		16 WAT	70 WAT	(no. of stems)	16 WAT	70 WAT	70 WAT
Untreated Check[a]	- -	1	1	36	0	1	0
triclopyr basal oil	0.6 lb/gal 85% v/v	100	99	46	33	7	77
triclopyr imazapyr basal oil	0.6 lb/gal 0.06 lb/gal 82% v/v	100	100	36	38	7	90
triclopyr imazapyr basal oil	0.04 lb/gal 0.06 lb/gal 96% v/v	95	95	33	8	2	96
Fisher's Protected LSD (p=0.05)		n.s.	n.s.	---	n.s.	n.s	n.s.

[a]The untreated check was not included in the statistical analysis.

TABLE 1b. Summary of treatment effects on Ailanthus resprout basal area and cumulative height. Each value is the mean of three replications.

Herbicide	Application Rate	Original Basal Area (in.^{2})	Resprout Basal Area (in.^{2})		Total Resprout Height (in.)	
	(% v/v)		16 WAT	70 WAT	16 WAT	70 WAT
Untreated Check[a]	- -	137	0.0	0.2	1	31
triclopyr basal oil	0.6 lb/gal 85% v/v	123	1.0	1.2	196	161
triclopyr imazapyr basal oil	0.6 lb/gal 0.06 lb/gal 82% v/v	209	1.8	0.9	185	118
triclopyr imazapyr basal oil	0.04 lb/gal 0.06 lb/gal 96% v/v	145	0.2	0.1	47	35
Fisher's Protected LSD (p=0.05)		---	n.s.	n.s.	n.s.	n.s.

[a]The untreated check was not included in the statistical analysis.

COMPARING SEQUENCES TO CONVERT CANADA THISTLE-INFESTED CROWNVETCH TO A COOL-SEASON GRASS MIXTURE. A. E. Gover, J. M. Johnson, and L. J. Kuhns, Penn State Univ., University Park, PA.

ABSTRACT

As part of an ongoing research project funded by the Pennsylvania Department of Transportation, a study was initiated to compare three operational sequences to convert stands of crownvetch (*Coronilla varia* L.) infested with Canada thistle (*Cirsium arvense* (L.) Scop.) to a perennial, cool-season grass mixture. The operations in each sequence were a primary herbicide treatment to provide the initial control of the thistle/crownvetch stand, a secondary herbicide treatment to control remnant undesirable vegetation, and seeding of a 55/35/10 percent, by weight, mixture of hard fescue (*Festuca brevipila* Tracey), creeping red fescue (*Festuca rubra* ssp. *rubra* L.), and annual ryegrass (*Lolium multiflorum* Lam.), respectively, at 112 kg/ha. The sequences compared were SEQ1 - concurrent primary treatment and seeding in spring, secondary treatment late summer; SEQ2 - primary treatment spring, concurrent secondary treatment and seeding late summer; and SEQ3 - primary treatment late summer, seeding late summer, and secondary treatment the following spring. The study site was a 12 year-old stand of thistle-infested crownvetch and flatpea (*Lathyris sylvestris* L.) on a north-facing earthen berm, approximately 45 percent slope, at the interchange of SR 78 and SR 412, in Hellertown, PA Individual plots were 9 by 15 m, arranged in a randomized complete block with three replications. The herbicide treatment used for all primary applications as well as the secondary application for SEQ2 was glyphosate plus clopyralid at 3.4 plus 0.21 kg ae/ha. The secondary treatment for SEQ1 and SEQ3 was dicamba plus clopyralid at 1.1 plus 0.21 kg ae/ha. All herbicide treatments included an organosilicone-based surfactant at 0.1 percent v/v.

Herbicide applications were made using a lever-actuated, piston pump backpack sprayer, equipped with a single spray tip. Spray tip selection varied with target conditions and applicator preference, and included Spraying Systems OC-04 off-center flat fan, 4004 flat fan, or #5500 ConeJet with X-6 tip. Pre-weighed lots of seed were distributed by hand for all seedings. SEQ1 received primary treatment and was seeded April 30, 1998. Canada thistle was up to 20 cm tall, and crownvetch was elongated up to 25 cm. When he secondary treatment was applied August 31, 1998, average cover from total vegetation and fine fescue was 91 and 45 percent, respectively. SEQ2 received primary treatment May 28, secondary treatment August 31, and was seeded September 13, 1998. At primary treatment, the Canada thistle and crownvetch canopy was 75 to 90 cm tall. Average vegetative cover at the secondary treatment was 25 percent. The primary treatment was applied to SEQ3 August 31, 1998. Average vegetative cover was 95 percent, 78 percent from crownvetch. Spring growth of Canada thistle had senesced, and late season resprouts provided 2 percent cover. Seeding and secondary treatment were done September 13, 1998, and June 10, 1999, respectively.

Fine fescue cover for SEQ1, SEQ2, and SEQ3 on June 10, 1999 was 68, 40 , and 20 percent, respectively, and Canada thistle cover was 12, 2, and 6 percent, respectively. The difference in fine fescue establishment between SEQ2 and SEQ3, which were seeded the same day, appeared to be due to the respective amounts of vegetative residue. The amount of residue in SEQ2 acted more as mulch, while

recently-treated, full-canopy residue in SEQ3 appeared to be inhibitory. All plots were treated with triclopyr plus a pre-mix of 2,4-D, 2,4-DP, and dicamba at 0.84 plus 0.56, 0.56, and 0.14 kg/ha, respectively, on May 11, 2000. Fine fescue cover for all three treatments ranged from 94 to 96 percent on August 7, 2000, and Canada thistle was detected in only one plot. Establishment differences 13 months after trial initiation were temporary, and all three rehabilitation sequences effectively replaced Canada thistle infested crownvetch with a fine fescue mixture.

GERMINATION OF IMMATURE SEEDS OF AN INVASIVE EXOTIC TREE, *Paulownia tomentosa*. S. H. Kay, North Carolina State Univ., Raleigh and G. Horng, National Taiwan Univ.

ABSTRACT

The exotic tree, *Paulownia tomentosa* (princess tree or empress tree), originally was introduced as an ornamental because of its beautiful flowers and for wood production for use in specialty carving. It has escaped from cultivation and now is common along roadsides, in abandoned fields, and in other disturbed areas, particularly in the piedmont and mountain regions of the southeastern Appalachians, where it grows readily on poor soils, including rocky crags and outcroppings. It is considered to be moderately to highly invasive and has become a serious pest in the Great Smoky Mountain National Park, where it is colonizing areas that have been subjected to fire as a forest management tool. Large *Paulownia* trees can produce up to 20 million tiny, wind-dispersed seeds per year. It is known that the seeds do not exhibit dormancy and that light is required for germination. However, there is no information to indicate whether or not seed pods attached to branches that are cut or broken from the trees prior to the time of normal dehiscence and seed release can be a vector for dispersal of this species. The objective of our study was to determine the influence of maturity on the viability and germination of *Paulownia tomentosa* seeds. Seeds were field collected at approximately 2-wk intervals from early July through mid-September, removed from the pods, and allowed to dry at room temperature in the laboratory for 72 hr. Five replicates of fifty seeds each were placed into petri plates on moist seed germination paper and transferred into a germinator at 26 C with continuous light. First germination occurred approximately three wk afterward. Germinated seeds were removed when cotyledons opened. We found that percent germination was directly proportional to the maturity of the seeds. Mature seeds remaining in pods from the previous year germinated more readily than immature seeds from the current growing season. However, even a 1% germination rate of immature seeds could pose a significant invasion threat, if broken branches are moved from the vicinity of the parent tree.

THE NON-NATIVE VASCULAR FLORA OF STATUE OF LIBERTY NATIONAL MONUMENT, NEW YORK CITY, NEW YORK

R. Stalter and N. Tang[1]

ABSTRACT

The vascular flora of Statue of Liberty National Monument, a 4.86 hectare island in New York Harbor, consists of 97 species within 82 genera and 39 families. Sixty three species, 65% of the flora, are non-native; these taxa are a major component of the flora. The largest families in the flora are the Asteraceae (18 species) and Poaceae (16 species); these families contain the largest number of non-native species.

INTRODUCTION

The Statue of Liberty National Monument is located on Bedloe's Island, an island in the upper Bay of New York Harbor[1]. Bedloe Island is named after its first owner, Isaac Bedloe, who acquired the island as a grant from the governor of New York prior to 1670. The island's ownership passed through several families before it was purchased by New York City to be used as a Quarantine Station. During the 1790's, the Federal Government expressed an interest in the site as a port, and in 1800 the title to the island was transferred from the State to the Federal Government. By 1808, construction began on an 11-point star fort, which was completed in 1811. The fort was named Fort Wood, in 1814, in honor of Colonel Eleazer D. Wood, an officer killed in the war of 1812. Until the Civil War began in 1861, the fort was garrisoned with infantry and artillery; in 1861 it became a recruiting station and ordnance depot. At the end of the Civil War, 1865 to 1877, the fort was garrisoned by a small number of soldiers. In 1877 the fort was selected as the site for the new Statue, " Liberty Enlightening the World"[1].

With the exception of the 1886 photograph showing what is probably Ailanthus, there are no photos of sufficient quality and clarity to identify the vegetation at the island. There are references to " Horse Chestnut" in old reports, but no vegetation lists exist for the island. Today, vegetation at the site consists of a well maintained lawn, hedges of Taxus cuspidata and Euonymous atropurpurea and arborescent plantings of Acer plantanoides, Platanus acerifolia, Prunus serrulata and Tilia cordata.

The closest coastal site to Statue Liberty National Monument with a complete floristic inventory is Ellis Island, New York, a site 1 km from the Statue of Liberty. The vascular flora of Ellis Island consists of 247 species with 164 genera and 69 families. One hundred forty nine species, 60.32% of the flora, are not native to nearby New York and Northern New Jersey[8].

Another nearby site, Liberty State Park, New Jersey, comprising 445 hectares, was studied by Anderson[2] from October 1987 to September 1988. A total of 331 species of vascular plants were identified in Anderson's study. Nine additional plants were added to the list, a total of 340 species, during collecting trips in 1989-1990. One hundred eighty five species, 56% of the flora, are native to the United States. Of Liberty Park's 146 non-native species, most are of European origin.

A third coastal site, with a complete floristic inventory is Sandy Hook, New Jersey, a site approximately 20 km from Ellis Island. Stalter and Lamont[7] identified 482 species of vascular plants at Sandy Hook including189 species of extra-regional origin.

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A somewhat similar coastal site, Orient Beach State Park, N.Y. has a non-native flora of 121 --species (43.7%)[4]; most non-native plants occur within the eastern portion of Orient Beach State Park, where human impact is considerable. An urban inland site, the Wave Hill National Area, Bronx New York, has a high (48%) percentage of non-native plants[9]. Wave Hill, like Ellis Island, Liberty State Park, Sandy Hook, Fire Island National Seashore and Orient Beach State Park (east end) are sites of human visitation and disturbance. Human disturbance and periodic maintenance disturb soil and provides excellent habitat for annual native and non-native plants which are common at the above-mentioned sites and at Ellis Island[8].

The objective of this study is to identify the alien vascular flora at Statue of Liberty National Monument and compare the non-native and native vascular plants at this site. Secondary objectives are to compare the native and non-native plants at Liberty Island with those found at four coastal sites: Ellis Island, N.Y., Sandy Hook, New Jersey, Liberty Island State Park, N.J., and Orient Beach State Park, N.Y..

METHODS

Six collecting trips were made to the study area during the growing season from September 9, 1999 to August 15, 2000. Objectives for each trip included collecting voucher specimens and accumulating information on abundance and apparent habitat preference for each species. More than 250 specimens form the basis for this study. Taxonomically problematic specimens were sent to various experts for annotation. Gleason and Cronquist[3] was consulted to determine the native status of each taxon.

Indication of species rarity across all of New York State is based upon the New York Natural Heritage Program (indicated in the checklist as NYNHP) list of rare plant species[10].

The species occurrences at five localities were cross-classified by status as a native or non-native species (Table 2). These frequencies were placed into two-way contingency tables and the factors tested for independence by likelihood ratio statistics[6].

Nomenclature follows Gleason and Cronquist[3]. Ornamental shrubs and trees were classified according to Rehder[5].

RESULTS AND DISCUSSION

The vascular flora of Statue of Liberty National Monument consists of 97 species within 82 genera and 39 families (Table 1). The major families of the total flora are the Poaceae (16 species) and Asteraceae (18 species); 34% of the species comprising the total flora are contained in these families. Sixty three species, or 65% of the flora, are not native to New York State. Seventeen families represented in this survey are comprised exclusively of non-native species. Families with large numbers of non-native plants are the Poaceae (11 species) and Asteraceae (10 species).

Information in the Cultural Landscape Report[1] lists several woody species that have been planted by the National Park Services; these are: Oriental Cherry Prunus serrulata, Norway Maple Acer platanoides, London Plane Tree Tilia cordata, and Japanese Black Pine Pinus nigra. Horse Chestnut Aesculus hippocastanum, oaks Quercus spp. and maples Acer spp. were present at the island when it was used as a military post.

Notable planted shrubs include a hedge of Japanese yew (Taxus cuspidata) and burning bush (Euonymous atropurpurea). Additional planted shrubs in the 1960's were Amur privet (Ligustrum amurense), Cockspur Hawthorne (Crataegus crus-galli), English Ivy (Hedera helix), and Periwinkle (Vinca sp.). Ligustrum amurense and Crataegus hedges were removed in the mid

1980's. As this paper goes to press, L. amurense is represented by a few naturally reproducing individuals near the sea wall. Two additional exotics, Tilia cordata and Gleditisia triacanthos are also reproducing at this site.

Table 2 provides the frequencies of native versus non-native plant taxa for five coastal sites, including Liberty Island National Monument. There is significant heterogeneity among the five sites in percentage of non-native versus native taxa (G = 90.1 df, P< 0.0001.) The 65.0% non-native taxa at Liberty Island is not significantly different from the 60.37 % non-native taxa at Ellis Island (two-tailed Fisher's Exact Test, P=0.46). The percentage of the non-native taxa at Ellis Island, Liberty State Park and Sandy Hook, New Jersey are 60.4, 44, and 44% respectively, while the average percentage of non-native taxa at the four coastal sites, exclusive of Liberty Island National Monument, averages 46.7% (Table 2).

In summary, the species of extra-regional origin of Liberty Island National Monument are a major component of the flora. Most species, native and non-native, occur principally in disturbed soil near the maintenance building, lawns, the drain surrounding the base of the statue and along the edge of the sea wall.

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Table 1. A statistical summary of the vascular flora of Liberty Island, New York.

	Ferns	Gymnosperms	Dicots	Monocots	Total
Families	1	1	32	5	39
Genera	1	1	66	14	82
Species	1	1	75	20	97
Native Species	1	0	26	7	34
Introduced Species	0	1	49	13	63

Table 2. Frequencies of native versus non native plants at Statue of Liberty National Monument (SLMN), NY, Liberty State Park (LSP), NJ (Anderson 1989), Ellis Island (EI), NY (Stalter and Scotto 1999), Orient Beach State Park (OBSP), NY (Lamont and Stalter 1991), and Sandy Hook (SH), NJ (Stalter and Lamont 1999).

	Locality				
	Liberty Island	Liberty St. Park	Ellis I.	Orient B.	Sandy Hook
	NY	NJ	NY	NY	NJ
Native Species	34	185	98	156	269
Non-Native Species	63	146	149	121	213
% Non-Native Species	65%	44%	60.3%	43.7%	44.2%
Total Species	97	340	247	277	482

COMPETITION AND CRITICAL-PERIOD THRESHOLDS FOR VEGETATION MANAGEMENT IN YOUNG CONIFER STANDS. R. G. Wagner, Cooperative Forestry Research Unit, Univ. of Maine, Orono, ME.

ABSTRACT

Thresholds define the time when management action is required to prevent a loss in yield, but have remained relatively elusive in forest vegetation management. Hundreds of studies quantifying the effects of competing vegetation in young forest stands, however, have produced reasonably consistent patterns and magnitudes of tree responses. These consistencies reveal a set of general guidelines that can be used to assist forest managers in deciding when vegetation management treatments are needed. Among the variety of vegetation control thresholds that have been defined, competition and critical-period thresholds can be interpreted from existing forest vegetation research.

The competition threshold is defined as the vegetation density at which growth loss begins to occur. Research indicates that competition thresholds vary with the attribute of stand growth being considered. Tree survival responds differently than stem volume growth. Height growth responds differently than diameter or basal area growth. Competition thresholds vary, therefore, depending on whether the stand management objective is to maximize survival, height increment, basal area growth, or biomass. Many of these interactions also appear to vary depending on whether woody or herbaceous plants are the principal competitors.

The critical-period threshold defines the time period when vegetation control must occur to prevent yield loss. Results from one critical-period study indicated that capturing the potential for conifer growth required control of herbaceous vegetation for the first several years after planting. The critical-period was as short as a couple of years for intolerant conifer species, and at least four or more years for tolerant species. Good vegetation management before and shortly after planting is imperative. A single year of vegetation control within the first 2 years after planting produced the same volume growth response as 2 years of vegetation control applied later.

SEASONAL TOLERANCE OF RED SPRUCE AND BALSAM FIR TO GLYPHOSATE, TRICLOPYR, AND IMAZAPYR HERBICIDES. R. G. Wagner, Cooperative Forestry Research Unit, Univ. of Maine, Orono, ME.

ABSTRACT

Inconsistent results with herbicide applications in Maine forests, including reports of greater conifer injury and less effective vegetation control from release treatments, prompted installation of this 1998 study. The objectives were to 1) document the seasonal pattern of injury to young red spruce and balsam fir following typical applications of glyphosate (Accord®, Vision®), imazapyr (Arsenal Applicators Concentrate®), and triclopyr (Garlon 4®); and 2) examine the relationship between degree of conifer injury produced by these herbicides during the growing season and a variety of phenological indicators.

A randomized complete block, split-plot, design with 3 replications (blocks) was installed on a regenerating clearcut site, which contains high densities of red spruce and balsam fir, near Medway, ME. A total of 150 treatment plots (7 timings x 7 herbicide treatments x 3 blocks plus 3 untreated subplots) were established, treated, and measured during 1998. The treatments were applied June 1, June 22, July 13, August 3, August 24, September 21, and October 6 of 1998 to capture seasonal patterns of herbicide tolerance for each tree species. Ten healthy trees of each species were tagged in each plot before treatment, making a total sample of 1500 spruce and 1500 fir. First-year injury to spruce and fir, quantified as a damage index based on foliage injury to the leader, 1st-order lateral branches, and 2nd- and 3rd-order lateral branches, was recorded at the end of October 1998. The phenological stages of the fir and spruce (measured as bark color, number of bud primordia, leader extension, and cuticular transpiration) were assessed each time treatments were applied.

Accord/Entry II and Vision (old Roundup) glyphosate products produced no difference in the degree of fir or spruce injury. Glyphosate injury decreased with time of season for both species until early August. Any applications before August produced unacceptably high levels of foliage injury to both conifer species. Spruce injury declined substantially by the end of July, while fir injury occurred through mid-August -- suggesting a slightly longer "window" (1 to 2 weeks) of glyphosate application for spruce than fir. Entry II surfactant significantly increased Accord (glyphosate) injury in both fir and spruce.

Triclopyr (Garlon 4) injury also decreased with time of season until early August, producing levels of injury that were the same as glyphosate (Accord) without the Entry II surfactant. Red spruce also was less susceptible to injury by triclopyr than balsam fir.

Imazapyr (Arsenal) produced no visible foliar injury to either spruce or fir. However, by dissecting buds at the end of the growing season we found substantial differences in the number of needle primordia on treated relative to untreated trees when imazapyr was applied before early August. The pattern of bud primordia injury was similar to the pattern of foliage injury produced by both glyphosate and triclopyr. The 4 oz / A rate of imazapyr caused more injury than the 2 oz / A rate. No difference in degree of bud injury by imazapyr was found between spruce and fir. Measurement of height increment in the first and second seasons (1999 and 2000) after treatment indicate that Arsenal injury reduces future height growth in both spruce and fir.

Bark color and number of needle primordia were the phenological indicators most closely correlated with herbicide injury.

HERBICIDE USAGE IN REGENERATING FORESTS AND THE AVAILABILITY OF FLORAL RESOURCES FOR BENEFICIAL POLLINATOR AND PARASITOID INSECTS. K. Georgitis, and S. A. Woods, Dept. of Biol. Sci., Univ. of Maine, Orono, ME.

ABSTRACT

Beneficial pollinating insects depend on nectar and pollen to complete their life cycles and adults of beneficial parasitic insects depend on nectar to sustain themselves while searching for herbivorous pests. Clearcut harvesting of forest stands provides opportunities for early-succession plants which are generally rich in floral resources for many years after harvest. The availability of these floral resources may increase the presence of pollinators and parasitic insects in clearcut stands as well as adjacent mature forests where these resources are less available. Applications of herbicides might reduce the availability of the floral resources by killing flowering plants or might increase their availability by removing hardwood competitors and setting back succession and crown closure. We conducted extensive vegetation sampling in 14 recent and older clearcut stands, half of which had been treated with herbicides and half of which had not. Three untreated stands with mature trees and three tree plantations were also sampled as reference points for differences among the clearcut stands. Four line transect samples (40 m in length) were conducted to estimate the density of flowers at successive two week intervals throughout the summer of 2000 to document the availability of floral resources in each of the treated stands. Data are currently being analyzed and results will be presented.

EVALUATION OF PREEMERGENCE AND POSTEMERGENCE LIVERWORT AND MOSS CONTROL. J.C. Fausey*, Valent U.S.A. Corporation, Lansing, MI and A.F Senesac, Cornell Coop. Ext., Riverhead, NY.

ABSTRACT

Due to the recent increase of liverwort (*Marchantia spp.*) and moss infestations in container-grown ornamentals throughout the Northeast and Midwest United States, producers need acceptable recommendations for control. Producers of container-grown perennials do not routinely apply broadcast herbicide applications, but they do use fungicides and other pesticides regularly. Some of these non-herbicidal compounds reportedly display activity on liverwort and moss. Experiments were conducted at the Long Island Horticultural Research and Extension Center in Riverhead, NY and at Sawyer Nursery in Hudsonville, MI to evaluate twenty-one different active ingredients for efficacy of liverwort and moss. The objective of these trials was to evaluate the performance of herbicidal and non-herbicidal compounds for preemergence and postemergence liverwort and moss control. Several compounds displayed promising short-term postemergence control of both liverwort and moss. However, in many of these treatments, re-infestations were observed within 3 weeks of exposing treated soil media to liverwort and moss. Overall, only flumioxazin, oxadiazon, and oxyfluorfen provided acceptable residual liverwort and moss control. Liverwort and moss have tremendous reproductive capabilities, thus early detection and implementation of control practices, which may require the use of a residual herbicide, is critical to preventing widespread infestations in container-grown ornamentals.

LIVERWORT MANAGEMENT IN CONTAINER NURSERIES. A. F. Senesac, Cornell Coop. Extn. of Suffolk County, Riverhead, NY.

ABSTRACT

Liverwort (*Marchantia polymorpha*) is a serious weed in ornamental perennial nurseries, propagation greenhouses and other commercial growing enterprises. It is a weed that thrives in moist conditions and suffers if the media surface dries out for any extended period. It can spread by spores as well as by water-carried clonal bodies called gemmae. Often managers of these operations do not use herbicides on a regular basis, so cultural practices which can manage this weed are important to identify.

Greenhouse studies were conducted in 1999-2000 at the Long Island Horticultural Research and Extension Center to examine the role that altering media surface pH can play in managing this weed. Liverwort infestations were established by pouring 100 ml of slurry on the surface of Scotts Metro-Mix with ScottsCoir™ in 8" containers. The slurry was prepared by maceration of liverwort plants (1:5 plants:water). The pots were kept in a greenhouse under 12 hours artificial halogen light and irrigated by misting every hour for 12 hours per day. The treatments consisted of several methods of altering the pH of the surface of the growing media. Each treatment was applied at one of three times: either 'post' (treatments applied to five week old liverwort), 'simultaneous' (treatments and liverwort applied to containers at the same time) or 'pre', (treatments applied 5 weeks prior to liverwort infestation).The treatments included: pulverized lime and pelletized lime top dressings each at 10 and 20 ml per pot, and hydrated lime solution at 1 and 2 lbs/100 gal water (100 ml solution per pot), elemental sulfur top dressing at 10 and 20 ml per pot, aluminum sulfate solution at 1 and 2 lb/5 gal water (100 ml solution per pot), and elemental sulfur solution at 1 and 2 lb/50 gal water (100 ml solution per pot).Liverwort percent cover was observed on 1/5/00, 1/12/00, and 1/31/00. Media pH at the top and bottom of the pot was measured on 1/24/00 using a handheld pH meter with the electrode being inserted horizontally into the topmost layer of media then into the bottom layer of media via the side drainage hole of the pot. Liverwort plugs were harvested on 2/16/00 and oven dried. Media samples were also collected on 2/16/00 from the top and bottom of the pot and pH was measured from these samples with a conventional benchtop pH meter.

The results indicate that top dressing elemental sulfur was the only treatment which resulted in a significantly decreased liverwort percent cover at any of the three application timings. This treatment also caused a much greater decrease in pH of the media than any of the other acidity enhancing treatments. None of the lime treatments significantly changed media pH or controlled liverwort. The results indicate that there are opportunities for manipulating cultural practices such as altering media components and pH which can have a powerful effect on liverwort growth and establishment. Research is continuing to determine how this effect can be practically incorporated into nursery practices.

IR-4 ORNAMENTAL WEED CONTROL RESEARCH DURING 2000. J. R. Frank, IR-4 Project, Rutgers, The State University of New Jersey, North Brunswick, NJ.

ABSTRACT

During 2000 over 640 IR-4 Ornamental Research Trials on pesticides and biopesticides were conducted in 23 states at 36 locations by 55 researchers. In the Northeast Region, eight researchers in five states actively conducted weed control research for floral, forestry, nursery, and turf production, and maintenance. Research was also conducted to develop pesticides for the commercial landscape.

Herbicides researched during 2000 included: Clethodim (Envoy), Clopyralid (Stinger), Diclobenil (Casaron), Diquat Dibromide (Reward L.S.), Dithiopyr (Dimension), Flumioxazin (Valor), Imazapic (Plateau), Isoxaben (Gallery), S-Metolachlor (Pennant Magnum), Napropamide (Devrinol), Oryzalin (Surflan), Oxadiazon + Pendimethalin (Kansel Plus), Oxyfluorfen (Goal T/O), Oxyfluorfen + Oryzalin (Rout 3G), Oxyfluorfen + Oxadiazon (Regal 0-0 Herbicide), Oxyfluorfen + Pendimethalin (Ornamental Herbicide II), Pendimethalin (Corral, Pendulum), Prodiamine (Barricade), Thiazopyr (Visor).

Research was also conducted during 2000 with the following plant growth regulators: 6-Benzyl Adenine (BAP-10), Paclobutrazol (Bonzi), and Uniconazole P (Sumagic).

Biopesticide projects for weed control in nursery and turf crops included: Research with two strains of the pathogenic bacteria *Xanthomonas campestris* for control of annual biotypes of bluegrass (*Poa annua*) in turf. Research was also conducted on broadleaf weeds in grassland, riparian and turfgrass areas with the pathogenic fungus *Sclerotinia sclerotiorum*.

IR-4 ornamental research for the green industry has led to over 8,800 national label registrations since 1977. These registrations have included 1,653 herbicides and 119 plant growth regulators.

EVALUATIONS OF FLUMIOXAZIN FOR WEED CONTROL IN CONTAINER-GROWN WOODY ORNAMENTALS. T. L. Mervosh and J. F. Ahrens, Connecticut Agric. Exp. Stn., Windsor, CT.

ABSTRACT

Flumioxazin (V-53482) is a new herbicide with potential use in ornamental crops. We evaluated plant tolerances and herbicidal efficacy of flumioxazin in containers in 2000. Newly potted plants in 1-gallon containers included rhododendron (*Rhododendron catawbiense* 'Roseum Elegans'), azalea (*Rhododendron* 'Delaware Valley White'), spirea (*Spiraea nipponica* 'Snowmound'), potentilla (*Potentilla fruticosa* 'Gold Finger'), and two junipers (*Juniperus horizontalis* 'Bar Harbor' and *J. squamata* 'Blue Star'). Plants were arranged in a randomized complete block design with four replicates. Each plot contained three pots of each plant.

Treatments consisted of an untreated check, Ornamental Herbicide II (OH-II) granules [oxyfluorfen (2 lb/A ai) + pendimethalin (1 lb/A ai)], flumioxazin 0.17G granules (0.17, 0.34, and 0.68 lb/A ai), flumioxazin 0.17G (0.34 and 0.68 lb/A ai) plus pendimethalin 2G (2 lb/A ai), and sprays of flumioxazin 50WDG (0.17 and 0.34 lb/A ai). Treatments were applied on July 13, 2000. After morning dew had dried, granular treatments were applied with a calibrated auger-fed drop spreader. Overhead sprinkler irrigation was run for 30 min. Then spray treatments were applied with a CO_2-pressurized bottle sprayer using a two-nozzle boom with 8003VS tips at 24 psi pressure and 30 gal/A spray volume. Fifteen minutes later, the plots were irrigated for 30 min by overhead sprinklers. On July 20, seeds of large crabgrass (*Digitaria sanguinalis*) were uniformly spread over three containers per plot.

Visual estimates of plant injury (0-10, with 0 = no injury, 10 = dead) were taken 1 week and 7 weeks after treatment (WAT). No treatment caused any visible injury to the two juniper varieties. The OH-II treatment did not injure any plants. Also, pendimethalin granules did not appear to contribute to plant injury. At 1 WAT, foliage of rhododendron, azalea, spirea and potentilla were injured (ratings of 2.5 to 4.25) by the two sprayed treatments of flumioxazin. Injury was in the form of contact burn and veinal necrosis. Slight spotting (0.75 to 1.25) was observed on azalea foliage treated with flumioxazin granules at 0.68 lb/A. At 7 WAT, injury ratings for rhododendron and azalea treated with flumioxazin sprays ranged from 2.25 to 3.5. Injury to spirea (1.25 to 2.5) and potentilla (1.0, for the 0.34 lb/A rate) was also observed. The following injury ratings were recorded for plants treated with flumioxazin granules at 0.68 lb/A: azalea (1.75), rhododendron (0.75), and spirea (0.75).

Weeds were counted and removed from pots on September 6 (8 WAT) and October 17 (14 WAT). At equivalent rates of active ingredient, flumioxazin sprays performed better than flumioxazin granules in preventing weeds. At 8 WAT, large crabgrass numbers were reduced 73% in plots treated with flumioxazin granules at 0.17 lb/A and 81% in plots treated with OH-II, whereas all other flumioxazin treatments reduced crabgrass numbers at least 93%. Treatments that included pendimethalin 2G provided greater than 99% crabgrass control. Total weeds, which included horseweed (*Conyza canadensis*) and northern willowherb (*Epilobium ciliatum*), were reduced at least 94% by all treatments except flumioxazin granules at 0.17 lb/A (56%) and OH-II (73%). At 14 WAT, weeds included horseweed, willowherb, bittercress (*Cardamine hirsuta*), yellow woodsorrel (*Oxalis stricta*), prostrate spurge (*Euphorbia humistrata*) and

birdseye pearlwort (*Sagina procumbens*). Total weed reductions were 82 to 95% for all treatments except flumioxazin granules at 0.17 lb/A (30%) and OH-II (70%).

Herbicide treatments were applied again on October 17, 2000. Plant tolerances and weed control will be monitored into the spring of 2001.

SELECTIVITY OF FLUMIOXAZIN IN FIELD-GROWN HOLLY, YEW AND FRASER FIR. J. F. Ahrens and T. L. Mervosh, Connecticut Agric. Exp. Stn., Windsor, CT.

ABSTRACT

Replicated experiments were conducted during 2000 in Connecticut and Vermont in which flumioxazin (V-53482) in granular (0.17 G) or sprayable (50WDG) form was applied over established holly (*Ilex* x *meserveae* 'Blue Girl'/'Blue Boy') and Japanese yew (*Taxus cuspidata*), and established and newly planted fraser fir (*Abies fraseri*). Granules were applied with a calibrated auger-feed spreader or by diluting with sand and spreading by hand. The WDG was applied in a volume of 30 gal/A, using a calibrated CO_2-backpack sprayer and hand-held boom with Spraying Systems 8003-VS nozzles. Flumioxazin rates were 0.17, 0.34 and 0.68 lb ai/A, applied either before bud break or during active foliar growth. At several intervals after treatment, starting within 2 weeks, weed control and plant injury ratings were made on a scale of 0 to 10, with 0 equal to no control or injury and 10 equal to complete control or all plants dead.

Emerged weeds in the dormant holly, treated on April 20 in Connecticut, included mugwort (*Artemisia vulgaris* L.), common chickweed (*Stellaria media* (L.) Vill.), annual bluegrass (*Poa annua* L.) and knawel (*Scleranthus annuus* L.). Flumioxazin WDG at 0.17 or 0.34 lb/A suppressed mugwort, gave excellent (>90%) control of the other weeds, but severely injured holly (ratings of 4.3 to 5). However, the holly largely recovered by July. Granular flumioxazin, applied after weeding on May 30 to actively growing holly, gave good control of mugwort at 0.68 lb/A with slight to moderate temporary spotting of holly leaves (rating of 2.3).

After tillage in May, flumioxazin sprays at 0.34 lb/A and granules at up to 0.68 lb/A on actively growing yews in Connecticut gave excellent control of large crabgrass (*Digitaria sanguinalis* (L.) Scop.) and common ragweed (*Ambrosia artemisiifolia* L.) with no injury. At 0.17 lb/A, control of crabgrass diminished in the third month after treatment. Emerged crabgrass was not controlled by flumioxazin.

Flumioxazin sprays applied in May at 0.17 to 0.68 lb/A did not injure dormant fraser fir, but injured any firs with green bud tips (ratings of 0.5 to 0.8). Applied in June at 0.17 and 0.34 lb/A, flumioxazin sprays severely injured the new growth (ratings of 4 to 6.8). Flumioxazin granules applied in Connecticut at 0.34 lb/A under high humidity also caused moderate burning of 1- to 3-inch long fraser fir foliage, similar to frost damage (rating of 3.0). Flumioxazin gave good control of the perennial sweet vernalgrass (*Anthoxanthum odoratum* L.) but only suppressed other mixed perennial grasses in the Vermont experiment.

Flumioxazin has potential for preemergence and/or postemergence control of several important weeds in ornamentals and Christmas trees. However, timing studies will be necessary for each ornamental species to determine plant tolerance to granular and spray formulations at various growth stages.

GROWTH STAGE INFLUENCES FRASER FIR (*Abies fraseri*) TOLERANCE TO AZAFENIDIN.

R. E. Wooten and J. C. Neal, Dept. of Hort., N. C. State Univ. Raleigh, NC.

ABSTRACT

Goal 2E (oxyfluorfen) is labeled for broadleaf and grass weed control in Fraser fir (*Abies fraseri*) seedbeds, transplant beds and field plantings. However, if applied within several weeks after bud-break, injury to the new growth may occur. Milestone 65DF (azafenidin) is a preemergence and postemergence herbicide with a similar mode of action that is being evaluated for potential use in Christmas trees. This study was conducted to compare the susceptibility of Fraser fir trees at several stages of growth to Goal and Milestone.

The treatments were Milestone at 0.25, 0.5 and 1.0 lb ai/A and Goal at 0.5 lb ai/A. The Goal treatment included 0.25% nonionic surfactant. Herbicides were applied as directed applications to contact the lower 24 inches of Fraser fir trees at three timings: pre-budbreak, 2" extension of the new growth and maturity of the new growth. The corresponding application dates were 4/14/99, 5/26/99 and 7/15/99. The treatments were applied using a CO_2 pressurized backpack sprayer with two 8003 flat fan nozzles at 30 gallons per acre delivery rate. The trees were planted on 5-foot centers with 5 feet between rows and 7 trees in each plot. Percent injury to the "contacted foliage" was visually evaluated at approximately 2-week intervals throughout the season. Non-treated foliage was monitored on each rating date.

There was no injury from any treatment applied at pre-budbreak or maturity. At 2" extension, Milestone at all three rates severely damaged the contacted foliage (71% to 76% injury). Goal caused minor damage (25%) at 2" extension, but no injury on the other treatment dates. No injury was observed on non-treated foliage or buds from any treatment. These results suggest that seasonal patterns of Fraser fir susceptibility to Milestone and Goal are similar, but when tender new growth is present Milestone will cause significantly more injury than Goal.

Table 1. Milestone and Goal injury to Fraser fir (*Abies fraseri*), applied when trees had 2 inches of new growth. Note: no injury was observed from any treatment when herbicides were applied pre-budbreak or after new growth had matured.

Herbicide	Rate (lb ai/A)	June 17	July 15	August 4	Oct. 7
Milestone	0.25	71	70	64	72
	0.5	78	79	74	84
	1	76	81	76	86
Goal	0.5	25	16	11	9
LSD (0.05)		8	7	7	3

USE OF DICHLOBENIL IN CONTAINER GROWN ORNAMENTALS. A. F. Senesac,
Cornell Coop. Extn. of Suffolk County, Riverhead, NY.

ABSTRACT

Commercial growers of containerized woody ornamentals often have to manage weeds that are brought outdoors from the propagation beds with plant material. A few weed species, such as *Oxalis stricta, Oxalis corniculata* and *Cardamine hirsuta*, are well adapted to both greenhouse and outdoor infestations. When perennial weeds such as *Oxalis* spp. are brought outdoors, there is currently no effective and safe postemergence herbicides. Dichlobenil, a field-applied herbicide that has been a reliable perennial weed management tool for nurserymen, is not currently labeled for container use in the United States. However, a sprayable formulation is being developed and may have a place in this type of nursery production.

The objective of this study was to evaluate two dichlobenil formulations (4% granule and 1.4 lbs./gal. microencapsulated concentrate) for safety to recently transplanted ornamentals and efficacy on selected perennial weeds. In mid-July 1999, rooted cuttings of *Juniper horizontalis* 'Bar Harbor', *Juniper conferta* 'Pacific Blue' and *Itea virginica* were transplanted to either 1 or 2 gallon containers filled with 60:40 compost: pine bark media. Also *Physostegia virginica*, *Equisetum arvense* and *Oxalis stricta* were grown in containers to serve as model plants for efficacy evaluation. Two months later, half of the plants were treated with either formulation of dichlobenil applied at 6.0 lbs/a. Two months after that, on November 13, 1999, the remainder of the plants were similarly treated. Immediately following both treatments the plants were irrigated with 1.0" of water. The entire test was overwintered in an unheated hoop house covered with white polyethelene sheeting. The following spring plant growth was measured and the plants visually evaluated for injury.

The results of shoot number counts of *Equisetum arvense* and *Physostegia virginica* in May, 2000 indicate that both application timings and formulations were equally effective in nearly complete control of these species. No useful data were collected from the *Oxalis stricta* plots. The height of the deciduous shrub, *Itea virginica* was significantly reduced by all dichlobenil treatments. The growth of *Juniper conferta* 'Pacific Blue' grown in 1 gallon containers was reduced by both formulation. No growth reduction was measured in the other treatments of this species or *Juniper horizontalis* 'Bar Harbor'. These results appear to indicate a level of safety from dichlobenil for some container –grown woody ornamentals, as well as efficacy on certain perennial weeds.

EARLY-POSTEMERGENCE BURN DOWN OF CONTAINER WEEDS WITH FLUMIOXAZIN. C. A. Judge and J. C. Neal, Dept. of Hort. Sci., North Carolina State University, Raleigh, NC.

ABSTRACT

The container nursery industry relies upon broad-spectrum preemergence herbicides for weed control. However, preemergence herbicides provide only 60 to 90 days of residual weed control after which time weeds begin to emerge. Pots must be hand weeded before herbicides are reapplied. In many situations it is not possible to completely remove all emerged weeds or to apply the preemergence herbicides before new weeds have germinated. Anecdotal evidence suggests that a granular formulation of flumioxazin, currently being evaluated for preemergence broadleaf weed control in nursery crops, may provide early postemergence control of common nursery weeds.

Two container studies, one outdoor and one in the greenhouse, were conducted to compare flumioxazin 0.17 G at 0.25 lbs ai/A to container industry standard preemergence herbicides, oxyfluorfen + pendimethalin [Scott's Ornamental Herbicide II 3 G (OH 2)] at 3.0 lbs ai/A and isoxaben + trifluralin (Snapshot TG 2.5 G) at 5.0 lbs ai/A. Flumioxazin and oxyfluorfen are both protoporphyrinogen oxidase inhibitors (PPO's) that can burn crop foliage if granules are trapped on the leaf surface. Snapshot TG is a non-burning herbicide and is used in the nursery industry in situations where burning of the crop foliage needs to be avoided.

In the greenhouse experiment, the weed species evaluated were hairy bittercress (*Cardamine hirsuta* L.), common groundsel (*Senecio vulgaris* L.) and spotted spurge (*Euphorbia maculata* L.). In the outdoor experiment, only hairy bittercress was evaluated. Herbicides were applied to weeds at three different growth stages; preemergence, cotyledon to one-leaf, and two to four-leaf. Percent weed control was visually evaluated at two and four weeks after final application.

Flumioxazin, OH 2 and Snapshot TG applied preemergence each controlled all three weeds. At the cotyledon to one-leaf timing, flumioxazin and OH 2 each controlled hairy bittercress, spotted spurge and common groundsel; whereas, Snapshot TG controlled hairy bittercress and spotted spurge and not common groundsel. At the two to four leaf stage, flumioxazin and OH 2 provided better control of all three weeds than Snapshot TG. Outdoors, OH 2 was slightly superior to flumioxazin whereas in the greenhouse flumioxazin was slightly superior to OH 2. These data suggest that applications of flumioxazin and OH 2 at the cotyledon to one-leaf growth stage can provide postemergence control and residual preemergence control of these three weed species. Later applications may result in variable control.

WEED CONTROL IN CONTAINERIZED ORNAMENTALS WITH FLUMIOXAZIN. J. N. Barney, M. A. Czarnota and L. A. Weston, Dept. of Hort., Cornell Univ., Ithaca, NY.

ABSTRACT

The search for a preemergent herbicide that provides long periods of weed control as well as safety to a large spectrum of plant material is of key importance for weed control research in ornamental crops. The herbicide flumioxazin is being evaluated as a preemergent herbicide in several crops, including herbaceous and woody ornamentals. Flumioxazin belongs to the chemical family *N*-phenylphthalimides, and inhibits the germination of selected broadleaf and grass weeds.

Studies were conducted in the summer of 2000 to determine the efficacy of flumioxazin on two weeds, crabgrass (*Digitaria sanguinalis* (L.) Scop.) and tall morningglory (*Ipomoea pupurea* (L.) Roth)). Safety to three selected ornamentals; dianthus (*Dianthus alpinus*), varigated liriope (*Liriope muscari* 'Variegata'), and spirea (*Spirea x bumalda* 'Anthony Waterer') was also evaluated.

All ornamentals were received as liners, potted in one gallon containers, and allowed to establish for 4 weeks. Prior to herbicide application, each container was overseeded with a mixture of weed seed containing crabgrass and tall morningglory. Two formulations of flumioxazin, granular and liquid, were tested. The granular formulation was applied alone at three rates (0.19, 0.38, and 0.57 kg ai/ha), and in combination with pendimethalin (2.24 kg ai/kg) at two rates (0.38 and 0.57 kg ai/ha). The liquid formulation was applied at 0.57 kg ai/ha. A sequential application of all treatments was made 8 weeks after initial treatments. Injury and control ratings were taken at 1, 2, 4, and 8 weeks after the initial treatments, and at 2 and 4 weeks after the sequential application.

No significant injury was observed in liriope due to any of the treatments. The liquid formulation of flumioxazin caused significant injury to dianthus at 1, 2, and 4 weeks after the initial treatment, and to spirea at all but the 8 WAT rating. Control ratings of all treatments of tall morningglory exceeded 77% at 2, 4, and 8 weeks after initial treatment, and 2 weeks after the sequential application. At 4 weeks after sequential application, control ratings of tall morningglory fell below 71% in all treatments except the flumioxazin / pendimethalin applications. Crabgrass control at 2 and 4 weeks after initial treatment, and 2 weeks after sequential application, exceeded 80% in all treatments. At 8 weeks after the initial treatments, crabgrass control ratings with flumioxazin at 0.19 and 0.38 kg ai/ha did not exceed 66%, but all other treatments exceeded 87%. Only the liquid application (0.19 kg ai/ha) and the higher rates (0.57 kg ai/ha) of the granular alone and in combination with pendimethalin provided adequate crabgrass control (approximately 80%) at 4 weeks after sequential application.

It appeared that the liquid application of flumioxazin and the higher rate of granular flumioxazin in combination with pendimethalin provided excellent long term control of crabgrass and tall morningglory. Although the liquid formulation of flumioxazin provided excellent control of weed species evaluated, injury to the dianthus and spirea cultivars studied was variable but significant at 4 weeks after sequential application (0 - 20%).

COMPARATIVE INNOVATIVE WEED CONTROL METHODS IN CONTAINER CULTURE. H. Mathers, Dept. of Hort. and Crop Sci., Ohio State University, Columbus, OH.

ABSTRACT

Weed growth in container-grown nursery stock is a particularly serious problem, because the nutrients, air and water available are limited to the volume of the container. Nursery growers estimate they spend $500 to $2000 per acre for manual removal of weeds, depending upon the weed species being removed. Reduction of this expense with improved weed control methodologies would have a significant impact on the industry. This study compares herbicide treated bark nuggets found extremely effective for weed control in a 1998 study with various new methods of container weed control and investigates the effects of high salt levels in containers when two conventional preemergent herbicides are used. This study has three objectives: 1) determine the efficacy and duration of weed control of twenty four different control methods, two mulches, one plastic sleeve, one plastic lid, one weed control disc, two sizes of bark coated with various preemergents, one new herbicide chemistry and two conventional chemical controls; 2) assess the phytotoxicity of different methods; and, 3) determine phytotoxicity of three fertilizer concentrations in combination with the various treatments. Evaluations of efficacy and phytotoxicity have been conducted in two ways. Dry weight data and a visual rating of weed control 0 (no control) to 10 (complete control) and 7 (commercially acceptable) was collected for efficacy. Dry weights and a visual rating score of 1 (no injury) to 10 (complete kill) was used for phytotoxicity. The data indicates significant treatment, species and fertilizer effects in efficacy and phytotoxicity and significant treatment by species phytotoxicity effects. Sixteen of 24 treatments gave a rating of seven or higher for efficacy. The bark nugget treatments gave excellent control, representing five of the top six treatments. Flumioxazin was the most efficacious treatment. The bark nuggets need to be treated to work and a synergistic effect appears present. Wulpack and PennMulch applied at one-quarter inch gave an unacceptable level of weed control; however, applied at one-half inch weed control was good. Wulpack applied at one-quarter inch and pre-treated with Surflan, applied at one-half the label rate, gave similar control as Wulpack applied at one-half inch.

THE TOLERANCE OF CHRISTMAS TREES TO PRE- AND POST BUDBREAK APPLICATIONS OF AZAFENIDIN. L. J. Kuhns and T. L. Harpster, Dept. of Hort., Penn State Univ., University Park, PA .

ABSTRACT

The studies were conducted in Pennsylvania at The Penn State University Horticulture Research Farm (HRF) in Rock Springs, and Carino's Nursery (CAR) in Indiana during 1999 and 2000, and at Heritage Acres Evergreens (HER) in Bloomsburg in 2000. All three sites contained Douglas fir (*Pseudotsuga menzesii* (Mirb) Franco) and Fraser fir (*Abies fraseri* (Pursh) Poir). Two of the sites contained Colorado spruce (*Picea pungens* Engelm.), and eastern white pine (*Pinus strobus* L.). One site had Canaan fir (*Abies balsamea phanerolepis* Fern.), white fir (*Abies concolor* (Gord. & Glend.), and Scotch pine (*Pinus sylvestris* L.). Trees at the HRF were planted in spring, 1996. Trees at the CAR and HER were planted in spring of 1999. Most trees at CAR and HER were 12 to 24 inches tall at the time of the first application. The trees at the HRF were 3 to 5 feet tall. There were five trees per plot, and each treatment was replicated three times at each site for each species. Applications at CAR and HER were made over-the-top with a CO_2 test plot sprayer at 30 psi through an 8004E nozzle with an output equivalent to approximately 22 gpa. At the HRF an OC04 nozzle was used to apply a directed spray that hit at least the lower 12 inches of foliage. The system had an output equivalent to approximately 45 gpa. A list of treatments is presented in Table 3. Trees were evaluated for quality at the HRF in July of 1999 and August of 2000; CAR in September of 1999 and July of 2000; and HER in July of 2000.

The following weeds were present in the test areas: CAR – Rubus sp., quackgrass (*Elytrigia repens* (L.) Nevski), common ragweed (*Ambrosia artemisiifolia* L), red sorrel (*Rumex acetosella* L.), white clover (*Trifolium repens* L.), goldenrod (*Solidago* sp.), hemp dogbane (*Apocynum cannabinum* L.), black medic (*Medicago lupulina* L.), common yarrow (*Achillea millefolium* L.), Canada thistle (*Cirsium arvense* (L.) Scop.), common chickweed (*Stellaria media* (L.) Vill.); and HER - wild carrot (*Daucus carota* L.), goldenrod, giant foxtail (*Setaria faberi* Herrm.), quackgrass, common ragweed, and Canada thistle. When applied postemergence, azafenidin killed annual grasses contacted, but provided poor weed control overall (data not shown). Combinations of sulfometuron and azafenidin, even at 4 oz/A, provided excellent weed control (Table 1). Azafenidin alone provided acceptable weed control at rates of 8 oz/A and above. At 4 and 6 oz/A the control provided varied with the site. CAR had severe weed pressure and control was poor. The HRF has light weed pressure and the control was very good. At HER, both weed pressure and control were intermediate. Azafenidin provided excellent control of most annual weeds in the plots, but weak control of perennial weeds such as Canada thistle, hemp dogbane, Rubus, and goldenrod.

Azafenidin did not injure any of the plants treated in 1999 (data not shown). This was an extremely dry year, and it is possible that not much chemical reached the root systems of treated plants.

In 2000, there was adequate moisture throughout the state, and plants at the HRF and CAR received their second applications of azafenidin. Balsam fir and Colorado spruce were only injured by the 24 oz/A rate (Tables 2 and 3). Scotch pine and white pine at CAR were only injured by the 16 and 24 oz/A rates. White pine at the HRF were not injured. White fir was injured by the 8 oz/A rate and above. Douglas fir was

slightly injured by the 16 oz/A rate, but severely injured by the 24 oz/A rate. Fraser fir was only slightly injured by the 24 oz/A rate. Injury symptoms included stunted growth, drooping of new growth, chlorosis or development of a dull, gray color and smaller needles; and in severe cases, death of tips or the entire plant. When injury did occur in any of the species tested, it was extremely erratic. A perfectly normal tree could be located right next to a severely injured tree.

Post-budbreak applications of azafenidin severely injured Douglas fir and Fraser fir (Table 3). Symptoms included yellow stunted leaders, scorched or spotted needles, and death of the entire plant. All treatments including sulfometuron caused significant injury to both Douglas fir and Fraser fir.

At 6 to 8 oz/A azafenidin provided good weed control without injuring any of the Christmas tree species tested except white fir when applied pre-budbreak. Post-budbreak applications should not be made.

Table 1. Weed control ratings for preemergence applications of azafenidin made alone, or in combination with sulfometuron, to Christmas tree species at the Penn State Horticulture Research Farm (Rock Springs, PA) and Carino's Nursery (Indiana, PA.) in 1999 and 2000, and at Heritage Acres Evergreens (Bloomsburg, PA.) in 2000. Control was evaluated 14 to 18 weeks after treatment. Weed control was rated on a scale of 1-10, with 1 = no control and 10 = total control.[1]

Treatment	Rate (oz./A)	Carino's Nursery 2000	Horticulture Farm 1999	Horticulture Farm 2000	Heritage Acres 2000
Control		1.5 f	3.4 d	1.0 b	1.0 g
Azafenidin	4	3.3 e	8.1 c		6.5 de
Azafenidin	6	4.3 d	8.6 bc		7.3 cd
Azafenidin	8	6.7 c	8.6 bc		7.8 c
Azafenidin	12	8.3 b	9.0 ab		
Azafenidin	16	8.8 a	9.1 ab	9.0 a	8.0 bc
Azafenidin	24	9.0 a	9.7 a	9.0 a	
Azafenidin + Sulfometuron	4 1.5			9.0 a	9.8 a
Azafenidin + Sulfometuron	6 1.5			9.0 a	9.7 a
Azafenidin + Sulfometuron	8 1.5			9.0 a	9.8 a
Azafenidin + Sulfometuron	12 3			10.0 a	10.0 a
Sulfometuron	1.5			10.0 a	9.2 ab

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

Table 2. Plant quality ratings for Christmas tree species receiving over-the-top applications of azafenidin at Carino's Nursery (Indiana, PA) in April, 1999 and 2000. Plant quality was rated on July 21, 2000, 15 weeks after the 2000 treatment, on a scale of 1-10 with 1 = dead and 10 = highest quality. Treatments were applied pre-budbreak, which was also preemergence with respect to the weeds.[1]

Treatment + Rate (oz./A)	Balsam Fir	Fraser Fir	Doug. Fir	White Fir	Scotch Pine	White Pine	Colo. Spruce
Control	9.6 a	9.4 ab	8.4 a	9.2 a	9.7 a	9.9 a	9.8 a
Azafenidin (4)	9.6 a	9.5 a	8.6 a	8.7 ab	10.0 a	9.2 ab	9.9 a
Azafenidin (6)	9.8 a	9.6 a	8.4 a	7.1 abc	9.1 a	9.7 a	9.9 a
Azafenidin (8)	9.8 a	9.8 a	7.8 a	6.4 c	9.6 a	9.7 a	9.1 a
Azafenidin (12)	9.6 a	9.3 ab	7.8 a	6.9 bc	7.9 ab	9.2 ab	9.6 a
Azafenidin (16)	9.1 a	9.8 a	6.8 a	4.2 d	6.4 bc	7.7 c	9.5 a
Azafenidin (24)	8.1 b	8.7 b	4.8 b	3.6 d	5.0 c	8.9 b	6.3 b

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

Table 3. Plant quality ratings for Christmas tree species receiving over-the-top applications of azafenidin alone or in combination with sulfometuron at the Penn State Horticulture Research Farm (HRF), Carino's Nursery (CAR) and Heritage Acres Evergreens (HER). Plant quality was rated on a scale of 1to 10 with 1 = dead and 10 = highest quality. Treatments were applied pre- or post-budbreak, which was also pre- or postemergence with respect to the weeds.[1]

	Rate		Douglas Fir		Fraser Fir			White Pine	Colo. Spruce
Treatment	(oz./A)	Timing	HRF	HER	CAR	HRF	HER	HRF	HRF
Control			9.9 a	9.4 a	9.4 a	9.9 a	8.1 a	9.3 a	9.9 a
Azafenidin	4	Pre		9.3 a	9.5 a		7.9 a		
Azafenidin	6	Pre		9.1 ab	9.6 a		8.1 a		
Azafenidin	8	Pre		8.5 ab	9.8 a		8.3 a		
Azafenidin	16	Pre	9.3 ab	7.2 cd	9.8 a	10.0 a	6.9 ab	8.8 a	9.7 a
Azafenidin	24	Pre	7.9 c			9.6 a		8.6 a	9.2 a
Azafenidin + Sulfometuron	4 1.5	Pre	9.3 ab	7.1 cde	8.7 ab	9.2 b	4.2 de	8.7 a	9.6 a
Azafenidin + Sulfometuron	6 1.5	Pre	9.2 ab	6.5 de	8.7 ab	9.8 ab	4.9 cde	9.0 a	9.8 a
Azafenidin + Sulfometuron	8 1.5	Pre	9.5 ab	6.1 de	8.7 ab	7.7 c	5.6 bcd	8.4 a	8.1 b
Azafenidin + Sulfometuron	12 3	Pre	7.4 c	6.0 e	6.4 c	7.9 c	4.5 cde	8.4 a	5.8 c
Sulfometuron	1.5	Pre	8.9 b	8.1 bc	7.8 b	9.2 b	5.9 bc	8.1 a	7.3 b
Azafenidin	4	Post		4.0 f	6.4 c		4.2 de		
Azafenidin	6	Post		3.4 fg	6.4 c		3.6 ef		
Azafenidin	8	Post		2.8 g	6.4 c		4.5 cde		
Azafenidin + Surfactant (.025%)	6	Post		2.9 fg	5.6 c		2.6 f		

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

TREE AND SHRUB SPECIES AS POTENTIAL WEEDS IN HERBACEOUS PERENNIAL PRODUCTION

Annamarie Pennucci[1]

ABSTRACT

Numerous native and introduced tree and shrub species were troublesome long-term weeds in containerized herbaceous perennial production in 1999 and 2000. Most of these appeared as wind-blown propagules from trees surrounding the four nurseries inventoried. Nearly half of the tree weeds (t/w) encountered were germlings from the previous seasons seed crop; the remainder arose from seed deposited in spring and summer of the current crop year.

T/W occurred in various herbaceous perennials without regard to host genus or species and developed in liners, flats, and pots of various diameters with vastly different amounts of soil available. T/W germinated in pots fully invested with crop, with no soil visible and in pots where little or no light interception was possible. Tree species occurring as weeds included those previously identified as nursery crop weeds and several novel species unrecognized as potential weeds in nursery crop production (Table 1). Maple (*Acer rubrum, A. platanoides*) seedlings were widely wind-deposited and in two cases arose from bales of contaminated soilless mix that had been stored out-of-doors during 1998 and 1999. Blending 10% soil into soilless mixes increased the likelihood of introducing t/w; whether blended on-site or introduced from wooded construction sites; pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*) were imported from nearby urban developments. Birch (*Betula nigra*), elm (*Ulmus americana*), oak (*Quercus rubra*) and poplar (*Populus deltoides*) were wind-deposited from trees located on the property border while no point of origin could be determined for larch (*Larix laricina*), spruce (*Picea glauca*), mulberry (*Morus alba*), or willow (*Salix alba tristis*).

Increased industry pressures and customer expectations have forced these nurseries to offer new and unusual tree and shrub species; often without knowledge of or regard for their mobility or potential weediness. Several of these introduced species occurred as wide-spread weeds in adjacent containerized and field-grown herbaceous perennials (Table 2).

Shrub species occurring as weeds appeared to have originated within each of these the nurseries as seeds of crops propagated and finished on-site. Other sources for shrub/weeds (sh/w) included demonstration gardens, property boundaries, introduced soils, and rarely, samples left for identification.

Hand weeding proved difficult and inefficient as personnel could not easily distinguish same sized t/w from crops. Cutting t/w with shears resulted in renewed weed growth and excessive branching. Sh\w were more easily removed when young but rapid growth rates inhibited the crop plant. Competition for light, water and available nutrients, vectored pathologies or entomologies, alleleopathy, and physical crowding are possible explanations for crop stress and crop loss.

Preemergent herbicides delayed the onset of t/w and sh/w growth; but herbicides did not provide season-long control. Earliest t/w germination followed autumn applied pendimethalin or trifluralin or spring applied dacthal or pendimethalin treatments. Spring applied trifluralin or oxidiazone provided only 7-10 weeks control, prodimaine provided 12-18 weeks of control. Weed control intervals were 32-50% less than expected; excess moisture accompanied by cool and fluctuating temperatures appears to have satisfied t/w and sh/w seed stratification requirements.

Cool moist spring conditions followed by an unusually cool and rainy summer in 2000 provided ideal conditions for germination and growth of both tree and shrub weeds. Because conditions in 2000 were optimal; it will require several additional seasons to determine if these species can act as true weeds.

[1] Northeast Turf and Ornamental Research, Raymond, N.H. 03077

Table 1: Identification of tree and shrub weeds in four herbaceous perennial nurseries.

Tree species with apparent weed tendencies		Shrub species with apparent weed tendencies	
Genus, species	Common name	Genus, species	Common name
Abies sps.	Spruce	Amelanchier alnifolia	Serviceberry
Acer negundo	Box elder	Aronia arbutifolia	Red Chokeberry
Acer rubrum	Red or swamp maple	Berberis sps.	Barberry - many
Acer platanoides	Norway maple	Buddleia davidii	Butterfly bush
Acer saccharinum	Silver maple	Callicarpa dichotoma	Purple Beautyberry
Acer saccharum	Sugar maple	Caragana arborescens	Siberian peashrub
Aesculus hippocastanum	Horsechestnut	Chaenomeles japonica	Japanese quince
Alnus sps.	Black alder	Clethra alnifolia	Summersweet
Amelanchier canadensis	Shadbush	Cornus alba argenteo	Red twig dogwood
Betula lenta, nigra	Black, river birch	Cotinus coggygria	Smokebush
Betula papyrifera	Paper birch	Cotoneaster sps	Cotoneaster sps.
Cercidiphyllum japonicum	Katsura	Cytisus x praecox	Broom
Cornus mas	Cornelian cherry	Elaeagnus sps.	Autumn olive
Crataegus sps	Hawthorne	Euonymus sps	Euonymus sps
Fagus grandifolia	American beech	Hamamelis x intermedia	Witchhazel
Fraxinus americana	White ash	Ilex verticillata	Winterberry
Fraxinus pennsylvanica	Green ash	Kalmia latifolia	Mountain laurel
Larix laricina	Larch	Kerria japonica	Kerria
Malus sps	Crabapple	Kolkwitzia amabilis	Beautybush
Morus alba	White mulberry	Ligustrum sps.	Privet
Picea glauca	White spruce	Loncera sps.	Honeysuckle
Pinus strobus	White pine	Physocarpus opulifolius	Dwarf ninebark
Pinus sylvestris	Scotch pine	Pieris japonica	Andromeda
Populus deltoides	Poplar	Potentilla sps	Potentilla
Prunus sargentii, sps.	Flowering cherry	Prunus besseyi	Western sandcherry
Prunus serotina	Black cherry	Prunus maritima	Beach plum
Prunus virginiana	Chokeberry	Pyracantha angustifolia	Firethorn
Pyrus calleryana	Flowering pear	Rhamnas frangula	Fernleaf buckthorn
Quercus rubra	Red oak	Rhus aromatica	Fragrant sumac
Salix alba tristis	Golden weeping willow	Salix discolor	Pussy willow
Sorbus americana	Mountain ash	Sambucus candensis	American elder
Tsuga canadensis	Eastern hemlock	Spiraea sps.	Spirea sps.
Ulmus americana	American Elm	Viburnam sps.	Viburnam sps.
Zelkova serrata	Zelkova	Weigela florida	Weigela cultivars

Table 2: Identification of new tree and shrub weeds in four herbaceous perennial nurseries.

Tree species with apparent weed tendencies		Shrub species with apparent weed tendencies	
Genus, species	Common name	Genus, species	Common name
Acer palmatum atropurp	Japanese cutleaf maple	Amelanchier canadensis	Glenform
Acer ginnala	Amur maple	A. x grandiflora	Apple, autumn, Cole
Acer tartaricum	Tatarian maple	A. laevis	Allegheny
Carpinus japonica	Japanese hornbeam	Aronia melanocarpa	Black chokeberry
Crataegus cvs.	cockspur, c cloud etc	Berberis sps	Many cultivars
Fagus sylvatica	European beech	Buddleia alternifolia	Fountain butterfly bush
Magnolia loebneri, cvs	Messel, Merrill	Callicarpa japonica	Japanese beautyberry
Malus floribunda	Japanese fl crabapple	Cephalanthus occidentalis	Buttonbush
Morus alba pendula	Weeping mulberry	Chaenomeles speciosa	Cameo, Texas Scarlet cvs
Prunus cerasifera	Thundercloud plum	Clethra alnifolia rosea	Pink summersweet
Prunus cistena	Purpleleaf sandcherry	Cornus alba	Bud's yellow, Siberica
Pyrus calleryanna	Cultivars	Cornus racemosa, sericea	Gray, redosier, cultivars
Quercus palustris	Pin oak	Cotoneaster dammeri	Lowfast cotoneaster
Salix matsudana	Corkscrew willow	Cotoneaster divaricata	Spreading cotoneaster
Sorbus alnifolia	Korean mountain ash	Forsythia suspensa	Weeping forsythia
Sorbus aucuparia	Royal european ash	Hamamelis sps	many cultivars
Styrax sps	Snowbell	Ilex verticillata, sps.	Sparkleberry
Tilia americana	Linden	Loncera sps.	Honeyrose, Claveyi,
		Potentilla sps.	Goldfinger. Princess
		Salix chaenomeloides	Japanese pussy willow
		Sambucus canadensis	Adams, aurea, nigra
		Sorbaria sorbifolia	Ural falsespirea
		Spirea sps.	A Waterer, L Princess
		Viburnam cassinoides	Witherod, others
		V lentago opulus,trilobum	many cultivars

ADDITIONS TO THE LIST OF HERBACEOUS PERENNIALS WITH WEED AND WEED-LIKE POTENTIALS

Annamarie Pennucci[1]

ABSTRACT

Nursery crops with the potential to act as moderate to severe, and thus potentially invasive, weeds include those plants recognized as annuals, biennials, herbaceous perennials, shrubs and tree species. Those species with rapid seed, stolon or rhizome distribution without annual loss of the mother plant, accompanied by within-year repetitive regeneration, pose the greatest risk to surrounding nursery crop production areas, landscapes and habitats. Several seemingly desirable herbaceous perennials exhibit rapid dissemination in both intra- and inter-nursery environments. Previous listings of such herbaceous perennials included newly released plant materials with extensive mobilities; such crops/weeds (c/w) demonstrated a wide range in host specificity and enormous lateral spread.

Many additional herbaceous perennial crops were observed as weeds in four New Hampshire nurseries in 2000 (Table 1). The cool wet spring followed by a summer with more than adequate rainfall provided optimum conditions for floral development, seed maturity and release, dissemination and germination. Many of these crop/weeds are old garden favorites while most have no reported history of unexpected movement or encroachment.

Several of these weeds pose year-long challenges to production efforts attempting to maintain weed-free and properly identified stock. Many of the c/w were encountered in widely differing "host" species and demonstrated no preference for any one or more genera. Most of the c/w identified here grew in liners, flats and pots of various diameters with vastly different amounts of soil available.

Early season herbicides applied during April and May 2000 restricted c/w germination for 12 to 20 weeks. None of the herbicides used in any of these nurseries provided season long control. The earliest weed development was seen in pots treated with pendimethalin or trifluralin in autumn 1999 or treated with dacthal or pendimethalin in spring 2000. Spring applied trifluralin provided 10-12 weeks of c/w control while prodiamine applied in mid-May provided 23 weeks of c/w control. Exceptions included *Linaria*, *Lunaria*, *Malva*, *Oenothera*, *Oxalis* and *Viola* sps where prodiamine control ranged from 15 to 18 weeks. Weed control intervals were 20-35% less than expected; frequent rainfall and fluctuating temperatures may account for the short duration. Season long handweeding proved unreasonable as personnel were unable to recognize or distinguish between crop or weed.

Many of these c/w are valuable because of their voluminous seed production; however their rapid cross-nursery spread appeared to be exacerbated by frequent rainfall, high winds and cool temperatures. Such conditions increased the likelihood of their season-long germination and establishment as weeds.

The supra-optimal weather conditions, however, limit the usefulness of data predicated upon observations made in only one season. Observations made over several subsequent seasons will be essential in determining the long-term threat these c/w actually pose in production, landscape or natural situations.

[1] Northeast Turf and Ornamental Research, Raymond, N.H. 03077

Table 1: Identification, morphological characteristics and season of dispersal of crop plants exhibiting rapid dissemination and cross-nursery spread. The first 14 are ranked by distance as a measure of relative importance.

Crop plants with apparent weed tendencies

Identification: Genus, species	Common name	Morphology of dispersal	Season of dispersal	Range
Oxalis crassipes rosea	Strawberry oxalis	seeds, rhizomes	all season	4 A
Trifolium purpurascens	Black 4-leaf clover	seeds, stolons	all season	4 A
Linaria purpurea	Toadflax	seeds	all season	4 A
Coronilla varia	Crownvetch	seeds, vetchlings	all season	4 A
Isatis tinctoria	Dyer's woad	seeds	all season	4 A
Viola sps.	Violets	seeds	autumn, winter, spring	4 A
Oenothera missouriensis	Evening primrose	seeds	summer, autumn	4 A
Liatris sps.	Gayfeather	seeds	all season	4 A
Saponaria officinalis	Bouncing bet	seeds, rhizomes	all season	4 A
Malva alcea, fastigiata	Hollyhock malva	seeds	all season	4 A
Tradescantia andersoniana	Virginia spiderwort	seeds, rhizomes	all season	4 A
Hyssopus officinalis	Hyssop	seeds	autumn, winter	4 A
Gaillardia sps	Blanket flower	seeds	all season	4 A
Agastache sps	Anise hyssop	seeds	summer, autumn	4 A
Achillea - sps / hybrids	Yarrow	seed, stolon, plantlet	summer, autumn	1 A
Aegopodium variegata	Bishop's weed	rhizomes	all season	4 A
Alopecurus prat. aureus	Golden foxtail grass	seeds	summer, autumn, spring	4 A
Amsonia tabernaemontana	Blue stars	seeds	autumn, winter, spring	100 ft^2
Anaphalis triplinervis	Pearly everlasting	seeds	summer, autumn	100 ft^2
Anchusa azurea	Alkanet, bugloss	seeds	summer, autumn, winter	50 ft^2
Antennaria doica	Pussytoes	seeds, rhizomes	summer, autumn, winter	500 ft^2
Anthemis sps.	Marguerite	seeds	summer, autumn	500 ft^2
Aquilegia - hybrids	Columbine	seeds	all season	100 ft^2
Artemisia lactiflora	Ghost plant	seeds	summer, autumn	50 ft^2
Aruncus sps	Goat's beard	seeds	summer, autumn	50 ft^2
Asclepias tuberosa, incarnata	Butterfly weed	seeds	summer, autumn, winter	1 A
Calaminta sps.	Cat mint	seeds, stolons	all season	50 ft^2
Calmagrostis acutifolia	Feather reed grass	seeds	autumn, winter	100 ft^2
Campanula punctata	Checkered bellflower	seeds	summer, autumn, winter	50 ft^2
Catanache coerulea	Cupids dart	seeds	summer, autumn, spring	100 ft^2
Centaurea montana	Mountain bluet	seeds	spring, summer	1 A

Chasmanthium latifolium	Northern sea oats	seeds	autumn, winter	500 ft^2
Coreopsis auriculata nana	Dw. eared coreopsis	seeds	autumn, winter	50 ft^2
Dicentra sps	Bleeding heart	seeds	spring, summer. autumn	100 ft^2
Digitalis sps	Foxglove	seeds, plantlet	summer, autumn	500 ft^2
Dianthus sps	Pinks	seeds	all season	100 ft^2
Echinacea purpurea	Prairie coneflower	seeds	summer, autumn, winter	500 ft^2
Eragrostis spectabilis	Sand love grass	seeds	all season	1 A
Erigeron speciosus	Fleabane	seeds	all season	100 ft^2
Euphorbia seguieriana, sps	Spurge	seeds	autumn, winter	500 ft^2
Eupatorium maculatum	Joe Pye weed	seeds	autumn, winter	1 A
Geranium sps	Perennial geranium	seeds, rhizomes	summer, autumn	100 ft^2
Galium odoratum	Sweet Woodruff	seeds, rhizomes	summer, autumn	500 ft^2
Gaura lindheimeri	Whirling butterflies	seeds	summer, autumn	50 ft^2
Gypsophila sps	Baby's breath	seeds	summer, autumn	100 ft^2
Festuca ovina glauca	Blue fescue	seeds	summer, autumn, winter	100 ft^2
Helenium autumnale	Helen's flower	seeds	autumn, winter	500 ft^2
Helianthus multiflorus	Per sunflower	seeds	autumn	500 ft^2
Heliopsis helianthoides	Hardy zinnia	seeds	summer	500 ft^2
Hesperis matronalis	Dame's rocket	seeds	summer, autumn	4 A
Houttuynia cordata	Chameleon	seeds, rhizomes	all season	100 ft^2
Holcus mollis variegata	Var. velvet grass	seeds, rhizomes	all season	100 ft^2
Inula ensifolia	Inula, horseheal	seeds	all season	4 A
Lathyrus latifolius	Perennial sweet pea	seeds	autumn, winter, spring	4 A
Linum perenne	Perennial blue flax	seeds	spring, summer, autumn	4 A
Liriope spicata	Creeping lily-turf	rhizomes	summer, autumn	100 ft^2
Lobelia cardinalis	Cardinal flower	seeds	autumn	500 ft^2
Lobelia syphilitica	Blue Cardinal flower	seeds	autumn	1 A
Lunaria biennis	Silver dollar	seeds	summer, autumn, winter	1 A
Lychnis chalcedonica	Maltese cross	seeds	summer, autumn	50 ft^2
Lychnis coronaria oculata	Rose champion	seeds	summer, autumn	100 ft^2
Lychnis viscaria	Catchfly	seeds	summer, autumn, winter	4 A
Lysimachia punctata	Yellow loosestrife	seeds, rhizomes	all season	1 A
Malva sylvestris	Mallow	seeds	summer, autumn	4 A
Mazus reptans, M. alba	Creeping mazus	seeds, stolons	summer	100 ft^2
Mentha sps.	Mints	rhizomes, stolons	all season	1 A
Myosotis palustris	Forget-me-not	seeds	all season	1 A
Panicum virgatum	Switch grass	seeds	autumn, winter	1 A
Patrinia triloba	Patrinia	seeds	autumn	1 A

Pennisetum alopecuroides	Dw fountain grass	seeds	autumn	500 ft^2
Physalis alkekengi	Chinese lantern	seeds, rhizones	all season	1 A
Platycodon grandiflorus	Balloon flower	seeds	summer, autumn, winter	1 A
Podophyllum peltatum	Mayapple	rhizomes	all season	1 A
Polemonium caeruleum	Jacob's ladder	seeds	summer, autumn	1 A
Potentilla sps.	Cinqueflower	seeds, rooted stems	summer, autumn	4 A
Pyrethrum coccineus	Painted Daisy	seeds	summer, autumn, winter	500 ft^2
Ratibida pinnata	Gray coneflower	seeds	autumn, winter	500 ft^2
Rudbeckia sps.	Black-eyed Susan	seeds	summer, autumn, spring	4 A
Scabiosa sps.	Pincushion flower	seeds	spring, summer, autumn	500 ft^2
Scutellaria alpina	Skullcap	rhizomes	autumn	100 ft^2
Sidalcea malviflora	Checkermallow	seeds	summer, autumn	500 ft^2
Silene dioica	Campion	seeds	all season	4 A
Sorghastrum nutans	Indian grass	seeds	all season	4 A
Spartina pectinata	Saltwater cordgrass	seeds, rhizomes	all season	4 A
Stipa tenuissima	Feather grass	seeds	autumn	1 A
Thalictrum sps	Meadow rue	seeds	autumn, winter	1 A
Veronicastrum virginicum	Culver's root	seeds	autumn, winter	50 ft^2

EFFECT OF PREEMERGENCE HERBICIDE APPLICATION TIMING FOR WEED CONTROL IN APPLE. R. S. Chandran, West Virginia Univ., Morgantown, WV; and H. W. Hogmire, Tree Fruit Res. and Educ. Cntr., West Virginia Univ, Kearneysville, WV.

ABSTRACT

Field experiments at Kearneysville, West Virginia, in 1999-2000, evaluated the effect of PRE herbicides applied in winter (December 02, 1999), or early spring (February 24, 2000), or late spring (May 31, 2000) on apple weed control during the growing season of 2000. Azafenidin applied at 0.375 or 0.75 lb a.i./A was compared with recommended rates of diuron, norflurazon, simazine, and terbacil applied either alone or as tank mixtures, for residual weed control. All treatments included 1 lb/A of glyphosate to completely control the existing vegetation. The weed species in the orchard included daisy fleabane (*Erigeron annuus*), goldenrod (*Solidago* spp.), dandelion (*Taraxacum officinale*), brambles (*Rubus* spp.), and poison ivy (*Toxicodendron radicans*). Weed control was monitored throughout the growing season. Winter application of all herbicide treatments resulted in <40% overall weed control in subsequent spring (May 2000). Early spring application of azafenidin at 0.75 lb/A resulted in >80% weed control in May and July, similar to that provided by a tank-mixture of diuron + simazine or norflurazon + simazine, at 2 lb/A of the constituents. Weed control from azafenidin at 0.375 lb/A, and diuron, norflurazon and terbacil applied alone at 3 lb/A in early spring was <70% in May. However, the same chemicals and rates applied in late spring resulted in >80% weed control in July. Weed control from early spring-applied azafenidin at 0.75 lb/A was >80% till the end of the growing season (October). Late spring applications of azafenidin at 0.375 lb/A, and diruon, norflurazon and terbacil alone at 3 lb/A gave >80% weed control till October. All the PRE herbicide treatments failed to control brambles and poison ivy.

CLETHODIM NEW CROP USES. T. G. Bean, A. Kurtz, and K. Perry, Valent USA Corporation, Walnut Creek, CA.

ABSTRACT

Valent USA Corporation anticipates federal registration, permitting the use of clethodim (Select® Herbicide) in several new crops, beginning in early 2001. Crops include potato(including sweet potatoes and yams), sunflower and canola as well as the minor crops cucumber, pepper (bell and non-bell),root vegetables, leafy petiole and cucurbit crop groups as well as strawberry, cranberry and clover. Registration in these minor crops was made possible with the assistance of the IR-4 Project. Select controls a broad spectrum of annual and perennial grasses when applied postemergence to the listed crops as well as to currently labeled crops. Research conducted or sponsored by Valent USA Corporation confirmed excellent tolerance of these crops to Select applications. Select application rates in the new crops will be similar to those used in currently labeled crops. Pre-harvest intervals for the new crops will be as follows [interval in ( )]: canola (60 days); potato (30 days); sunflower (70 days); cucumber (14 days); pepper (20 days). Select is formulated as an emulsifiable concentrate containing 2 pounds of active ingredient per gallon.

ASSESSING THE TARGET SPECIES RANGE FOR RIMSULFURON IN CRANBERRIES IN SOUTHEASTERN MASSACHUSETTS. L. Romaneo, and H. A. Sandler, Ocean Spray Cranberries, Inc, Lakeville-Middleboro, MA; and D. Regan, Univ. of Massachusetts Cranberry Experiment Station, East Wareham, MA

ABSTRACT

Herbicides that fall into the class of sulfonylureas have been the subject of recent weed research, particularly in corn, potato, and tomato. The sulfonylureas, particularly rimsulfuron, have also shown good promise with regards to phytotoxicity tests for cranberry. However, the range of target species typically found on commercial cranberry farms has not been well studied. Seeds for nine different plant species were germinated in the greenhouse during the summer of 2000. The species included in the study were: barnyard grass (*Echinolchloa crus-galli*), reed canarygrass (*Phalaris arundinaceae*), switchgrass (*Panicum virgitatum*), yellow foxtail (*Setaria lutescens*), lurid carex (*Carex lurida*), nut sedge (*Cyperus dentatus*), woolgrass (*Scirpus cyperinus*), narrow leaved goldenrod (*Euthamia tenuifolia*), and poison ivy (*Toxidendron radicans*). Rimsulfuron was applied postemergence to the seedlings in the 4-6 leaf stage. Five rates of herbicide were used: 0, 9, 18, 27, and 35 g a.i./A. Rimsulfuron had no deleterious effect on any of the plants species tested except for reed canarygrass. The herbicide caused serious necrosis or death of reed canarygrass at all tested rates. Reed canarygrass is a minor weed problem that could also be controlled by other available herbicides. These results do not strongly support the continued investigation of rimsulfuron for use in cranberry farm systems.

ENVIRONMENTAL FACTORS AND TIMING AFFECT EFFICACY OF AZAFENIDIN, RIMSULFURON AND PENDIMETHALIN ON WEEDS IN WILD BLUEBERRIES. D.E. Yarborough and T.M. Hess, Univ. of Maine, Orono, ME.

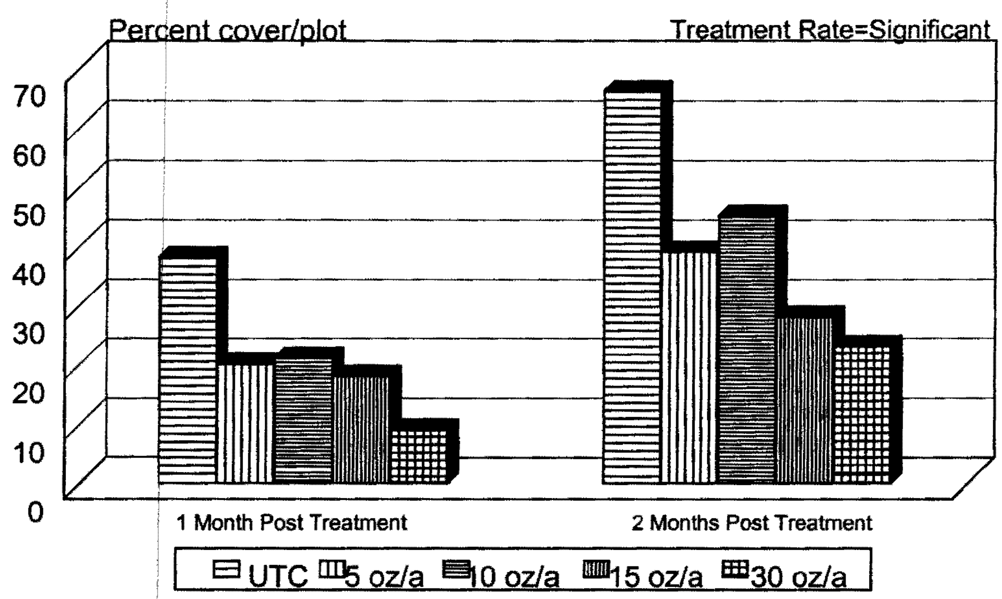
ABSTRACT

Hexazinone has been the principle herbicide used in wild blueberry (*Vaccinium angustifolium*) fields since 1982, and its use has contributed to increasing yields over three fold. Hexazinone is easily detected, highly leachable, and has been found in groundwater throughout the state. In addition, annual grass populations have been increasing with the use of hexazinone. Alternative herbicides were evaluated for rotation in order to lessen the industry's reliance on this one herbicide. Initial trials conducted in 1998 with azafenidin, rimsulfuron, and pendimethalin indicated good weed suppression of weeds at one and two months after application (see Proc. NEWSS V53:2-3 and V53:90-91).

All trials were randomized, complete block design with weed cover rated at 1, 3 and 13 months post-treatment and were all conducted at Blueberry Hill Farm Research Station in Jonesboro, Maine. A fall vs spring comparison trial was treated 10-26-98 or 05-17-99 with 0, 10, or 15 oz/a azafenidin with hexazinone at 1.33 lb/a applied to the left half of each plot. In 2000, azafenidin was applied at 0, 5, 10, 15 or 30 oz/a on May 4th or 17th. Rimsulfuron in a fall vs spring trial was applied on 10-26-98 or 5-12-99 at 0, 0.5, 1 or 2 oz/a. A third rimsulfuron trial was treated on 5-4-2000 or 5-16-2000, just before emergence, with 0, 1, 2 or 4 oz/a. Pendimethalin was applied to plots on 10-26-98 at 1.4, 2.8, 5.6 and 11.2 pt/a and on 5-27-99 at 0, 2.4, 4.8, 9.6 or 19.2 pints/a. In 2000, pendimethalin was applied on 5-4 or 5-17, just before emergence, with 0, 4.8, 9.6 or 14.4 pints/a.

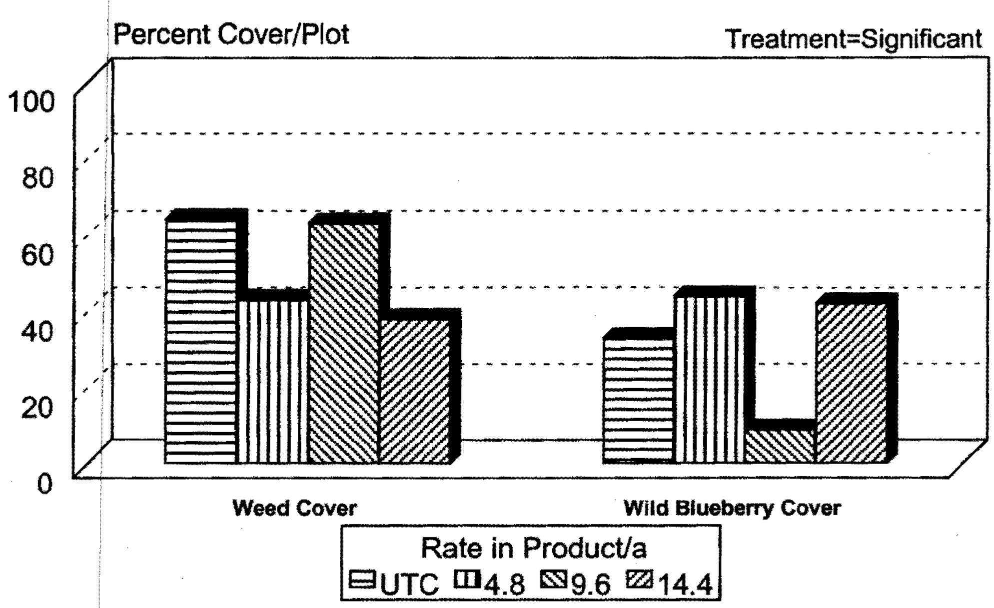
Initial trials conducted in 1998 indicated good weed control from azafenidin, rimsulfuron and pendimethalin as reported previously. Dry weather conditions in 1999 prevented movement of the herbicides applied in 1999, so none of the treatments had any significant weed suppression. All fall applications were also ineffective. In 2000 the precipitation was low, but was closer to the average, especially during April, May and June. Azafenidin and pendimethalin significantly reduced weeds but rimsulfuron did not (Figures 1 and 2). Weed cover at the 9.6 pt/a pendimethalin rate increased because of lack of blueberry cover in those plots (Figure 2). Future trials will investigate earlier applications with different soil types and weed populations to develop a better under-standing of how these herbicides will fit into the wild blueberry weed management program.

Figure 1. Effect of Azafenidin on Weed Cover



All rates are in product/acre

Figure 2. Effect of Pendimethalin on Wild Blueberry and Weed Cover



Pendimethalin applied 5-4 or 5-17-2000

IMPACT OF PLANTING DATE AND HERBICIDE APPLICATION TIMING ON WEED MANAGEMENT IN SNAP BEAN.

S. Sankula and M. J. VanGessel, Univ. of Delaware, Georgetown, DE.

ABSTRACT

Snap bean (*Phaseolus vulgaris* L.) is commonly planted over a range of dates from mid April to early August. Altering planting date may alter emergence, vigor, growth pattern, and resource allocation of the weeds thereby necessitating the need for changing the timing of weed management based on the crop planting date. A field study was conducted in 2000 at the University of Delaware's Research and Education Center to evaluate the optimum herbicide application timing for weed control in snap bean planted at various dates. Experimental design was a split plot with planting dates as main plots and herbicide application timings as sub-plots. Processing snap bean variety, 'Hystyle' was planted on either 19 May, 26 June, or 19 July at 350,000 plants/ha in rows that are 76 cm apart. Herbicide applications, comprising a mixture of bentazon (0.85 kg ai/ha) plus fomesafen (0.28 kg ai/ha) plus sethoxydim (0.27 kg ai/ha), with a non-ionic surfactant (0.25% v/v), were made at 10, 20, 30, or 40 days after planting (DAP). A weedy check and weed-free check plots were included for comparison.

Predominant weed species in the study were common lambsquarters (*Chenopodium album* L.), common ragweed (*Ambrosia artemisiifolia* L.), fall panicum (*Panicum dichotomiflorum* Michx.), and yellow nutsedge (*Cyperus esculentus* L.). Crop injury and visual weed control evaluations were made 7 days after herbicide application (DAT), 21 DAT, and pre-harvest. At harvest, snap bean plants from 2.33/m^2 area were hand-harvested, beans separated, and 100 beans graded into groups 1 and 2, 3 and 4, or 5 based on diameter of the beans. Commercially preferred snap bean grades are 3 and 4.

Weed control generally improved when snap bean planting date was delayed until July. Common lambsquarter control was reduced by 30 to 43% when herbicides were applied 30 or 40 days after planting at all planting dates. Poor control of common lambsquarter with later herbicide applications (30 DAP or later) at all planting dates may be attributed to its size. Similar response was noted with fall panicum in June planting only. Fall panicum control was 90 percent or higher with later applications in May and July. Regardless of planting date, nutsedge control was lowest when herbicide applications were made 10 DAP. Snap bean yield from June planting was lowest compared to rest of the plantings. More beans were in grades 1 and 2 (smallest size) with June planting than other plantings which might have contributed to this lower yield.

Timing of weed management in snap bean depends on the planting date. Weeds need to be controlled within 20 to 30 days of planting when snap bean is planted in May or June. However, herbicide application timing may be delayed beyond 30 DAP when the crop is planted in July.

EVALUATION OF METHYL BROMIDE ALTERNATIVES FOR YELLOW NUTSEDGE CONTROL IN PLASTICULTURE TOMATO. W. A. Bailey, H. P. Wilson, and T. E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

Tomato (*Lycopersicon esculentum* Mill.) production is significant in southern and mid-Atlantic regions of the U.S. Virginia ranks third in fresh market staked tomato production with approximately 4500 acres grown on the Eastern Shore at an estimated gross value of $54,000,000. The expected cancellation of methyl bromide registration is encouraging growers to search for alternative means of weed control for tomato grown under plastic. Nutsedge species (*Cyperus* spp.) are a major problem in tomato production primarily due to the highly competitive nature of these weeds and their frequent penetration of plastic bed covers. Herbicides known to suppress the growth of nutsedge species include metolachlor (chloroacetamide), pebulate (thiocarbamate), and the sulfonylureas rimsulfuron and halosulfuron.

Field experiments were conducted in 2000 to evaluate the tolerance of tomato to *s*-metolachlor, pebulate, rimsulfuron, and halosulfuron. Study design was a randomized complete block with three replications. Where herbicides were applied under plastic, applications were made to uncovered beds and mechanically incorporated immediately after application. Approximately one month later, beds were covered with white plastic and a standard commercial tomato variety was transplanted 12-in apart into the beds. Treatments included *s*-metolachlor (1 lb ai/A), pebulate (4.5 lb ai/A), rimsulfuron (0.016 or 0.023 lb ai/A), halosulfuron (0.032 or 0.063 lb ai/A), *s*-metolachlor plus rimsulfuron (0.016 lb/A) or halosulfuron (0.032 lb/A), pebulate plus rimsulfuron (0.016 lb/A) or halosulfuron (0.032 lb/A), or nontreated. Tomato injury and yellow nutsedge control were visually estimated at 1, 2, 4, and 6 wk after transplanting. In a separate field experiment, rimsulfuron (0.016 or 0.023 lb/A), halosulfuron (0.032 or 0.063 lb/A), rimsulfuron plus halosulfuron (0.016 plus 0.032 lb/A or 0.023 plus 0.063 lb/A), and metolachlor (0.96 lb ai/A) were applied as post-directed treatments between beds of 12-in tall tomato. Tomato injury was estimated 1, 2, 4, and 6 wk after treatment.

Tomato injury was no more than 5% from herbicides applied between beds. Tomato injury from herbicides applied under plastic was generally highest from treatments containing halosulfuron, although injury was no more than 11%. All treatments under plastic that contained *s*-metolachlor or halosulfuron controlled yellow nutsedge at least 85%. In general, herbicides applied under plastic had little effect on tomato yield.

RESPONSE OF ROTATIONAL VEGETABLES TO TRIAZOLOPYRIMIDINE HERBICIDES.

B. A. Scott and M. J. VanGessel, Univ. of Delaware, Georgetown, DE; D. W. Monks, North Carolina State Univ., Raleigh, NC; and B. D. Olson, Dow AgroSciences, Geneva, NY.

ABSTRACT

The mid-Atlantic region has seen an increase in the usage of the triazolopyrimidine family herbicides in recent years. Furthermore, other herbicides in this family are being developed. This research was conducted to test potential carryover of three triazolopyrimidine family herbicides at ten to twelve month plant-back intervals on eight vegetable crops.

The study was a randomized complete block design with four replications conducted in DE and NC. Preplant incorporated treatments consisted of dicosulam at 0.016, 0.024, or 0.048 (2x) lb ai/A , flumetsulam at 0.062 or 0.125 (2x) lb ai/A, and cloransulam at 0.032 or 0.039 lb ai/A, applied in June of 1999. Cloransulam was applied POST at 0.016 lb ai/A at 14 days after planting (DAP) and sequentially at 14 and 28 DAP. An untreated check was included as a control. The study area was field cultivated prior to vegetable planting and the first crop was planted in early March; the last crop was planted in early June. Vegetable rotation included white potato ('Superior'), cabbage ('Bravo'), sweet corn ('Bonus'), peppers ('Jupiter'), cucumbers ('Dasher II' or 'Sumter'), watermelons ('Sangria'), snap beans ('Hystyle'), and sweet potato ('Beauregard'). Weed control in 2000 was maintained by hand weeding.

The efficacy of the herbicides used was recorded by weed control ratings in 1999. Soybean injury and yield were also documented. Data collected for the rotational crops included crop injury ratings, based on stunting and delayed maturity, plant heights and widths, and yield data.

The most pronounced effects were observed in the cabbage crop where injury at 6 weeks after transplanting (WAT) was recorded with the high rate of flumetsulam. At DE, >25% injury was observed with all rates of diclosulam and flumetsulam. Injury from these treatments resulted in reduced cabbage yields. Diclosulam injured snap beans at 6 weeks after planting (WAP), yet no yield reduction was observed. Less than 15% injury was observed with all other crops and treatments at N.C. site. In DE, sweet corn injury was observed and yield loss occurred with the high rate of diclosulam. Delayed maturity was apparent in the yields for watermelon harvest for each rate of diclosulam, flumetsulam, and POST applications of cloransulam. The dicosulam, flumetsulam, or cloransulam produced no significant yield differences in cucumber, pepper, white potato, or sweet potato crops, however, there was a trend for increased white potato injury and yield loss with increasing rates of diclosulam.

EFFICACY OF S-METOLACHLOR PLUS ATRAZINE PREMIXES AS A COMPONENT OF WEED MANAGEMENT PROGRAMS IN GLYPHOSATE-RESISTANT CORN. D. B. Vitolo, C. Pearson, M. G. Schnappinger, R. Schmenk, and B. Manley, Novartis Crop Protection, Hudson, NY.

ABSTRACT

Replicated field trials were conducted across the U.S. in 1999 and 2000 to evaluate the effect of pre- and postemergence herbicide programs on weed control and corn grain yield. Grain yield data were obtained from five sites in 1999. Bicep II MAGNUM ® brand herbicide applied preemergence at ½x, ¾x and 1x normal use rates (based on soil type) were compared to three timings of a total postemergence herbicide program using Roundup Ultra brand herbicide (glyphosate), and to Bicep II MAGNUM brand herbicide followed by glyphosate. Glyphosate + ammonium sulfate (AMS) at 840 g ai/ha + 1.9 kg ai/ha was applied at three postemergence timings with average weed heights of 2 to 4, 6 to 8, and 10 to 14 inches, corresponding to early postemergence (EPO), mid-postemergence (MPO), and late postemergence (LPO) applications, respectively. A treatment program of glyphosate + AMS applied EPO + LPO was included for comparison. All permutations of soil applied herbicide rates and postemergence timings were evaluated. Control of eighteen common weed species was evaluated, including multiple sites with giant foxtail (*Setaria faberi* Herrm.), common lambsquarters (*Chenopodium album* L.), velvetleaf (*Abutilon theophrasti* Medik.), *Amaranthus* spp., and *Ipomoea* spp.

Glyphosate-resistant corn exhibited excellent tolerance to all treatments and no significant crop injury was observed at any of the locations. Grain yield loss was correlated with delaying postemergence applications in the absence of a preemergence herbicide application. Overall weed control and corn grain yield were consistently optimized with herbicide programs that utilized two applications rather than one, regardless of the herbicide applied. Glyphosate alone EPO did not provide adequate weed control and resulted in lower corn yields than two-pass programs including Bicep II MAGNUM brand herbicide at ¾x or 1x rate followed by glyphosate EPO or the glyphosate applied EPO + LPO treatment. Glyphosate alone applied MPO or LPO provided good to excellent overall weed control, but produced lower average grain yields than glyphosate EPO + LPO or any of the treatments of Bicep II Magnum brand herbicide followed by glyphosate, either MPO or LPO.

Given the challenge that herbicide applicators have in covering their acres, and the unpredictability of each season (weather, wet fields, and proper timing), a preemergence herbicide application followed by a postemergence herbicide, provides corn growers with the most consistent weed control program and assurance of maximum yields.

RELATIVE INTENSITY OF INTRA- AND INTER-SPECIFIC COMPETITION ON VELVETLEAF AND SOYBEAN REPRODUCTION. A. DiTommaso, Dept. of Crop and Soil Sciences, Cornell Univ., Ithaca, NY; and A. K. Watson, Dept. of Plant Sci., McGill Univ., Ste-Anne-de-Bellevue, QC, Canada.

ABSTRACT

Field experiments were conducted over 3 years to evaluate the relative intensity of intra-specific and inter-specific competition on reproduction of velvetleaf (*Abutilon theophrasti* Medic.) and soybean (*Glycine max* (L.) Merr. 'Maple Arrow') grown in monoculture and 1:1 mixtures at varied population densities. Seed yield and fruit production per plant decreased significantly with increasing monoculture and mixture density in both species. However, the number of seeds produced per fruit as well as seed unit weight remained relatively constant over most of the density range. At the low to intermediate densities used (i.e., 10 to 80 plants/m^2), reproductive output per plant was generally greater for soybean competing with con-species than with velvetleaf. At higher densities, soybean reproduction was greater for plants grown in 1:1 mixture than in pure stand. In monoculture, soybean reproductive output per unit area typically peaked at the 40-plants/m^2 density. In mixture, highest yields were recorded at the highest densities used (320 or 480 plants/m^2). Intra-specific competition (as measured using the relative monoculture response, R_m) had a more deleterious effect on velvetleaf reproduction than soybean, especially at lower monoculture densities. In contrast with findings for soybean, at the low to intermediate densities, velvetleaf reproductive output per plant was greater in mixture than in pure stand. The opposite trend was observed at higher densities. Reproductive output per unit area in velvetleaf typically peaked at the lowest densities (i.e., 10, 20, 40 plants/m^2) and then declined steadily irrespective of form of competition. At the lower mixture densities, inter-specific competition (as measured by the relative mixture response, R_x) was a more important limiting factor to soybean reproductive output than it was to velvetleaf reproduction. These results demonstrate that soybean and velvetleaf do not respond to intra-and inter-specific competition in a similar way and that this response is greatly influenced by density level.

EASTERN GAMAGRASS ESTABLISHMENT WITH HERBICIDES.

C. B. Coffman, USDA, ARS, SASL, Beltsville, MD; and L. R. Vough, NRSL, Univ. of Maryland, College Park, MD.

ABSTRACT

Eastern gamagrass [*Tripsacum dactyloides* (L). L.] is a native perennial, warm-season bunch grass having desirable production and nutritional properities. This forage grass can be grown across a wide range of soil conditions and provides more feed production than cool-season grasses and legumes during hot, dry summers. However, eastern gamagrass tends to establish slowly and thus is susceptible to severe competition from annual weeds. Although eastern gamagrass has demonstrated tolerance to several corn herbicides, there are presently no herbicides labeled for use with this forage. This investigation was established to develop preliminary information concerning the tolerance of eastern gamagrass to selected herbicides prior to submission of requests to IR-4 for establishment of research projects pursuant to obtaining national label registrations.

Eastern gamagrass seed was sown in 30-inch rows on 10 June, 1999, into standing rye using a no-till corn planter. The seeding rate was 10 lb/A and seed were sown 1.5 inches deep. Fertilizer was applied according to soil test recommendations. The rye was flail mowed prior to the application of herbicide treatments, which were applied five days after seeding (DAS). Preemergence (PRE) treatments were replicated three times and included the following herbicides and rates: s-metolachlor/atrazine (Bicep II Magnum, 2.5 qt/A), flumetsulam (Python, 1.3 oz/A), dimethenamid plus atrazine (Frontier plus AAtrex Nine-O, 1.7 pt/A plus 1.1 lb/A), alachlor plus atrazine (Micro-Tech plus AAtrex Nine-O, 3 qt/A plus 1.8 lb/A), and acetachlor plus atrazine (Harness plus AAtrex Nine-O, 1.75 pt/A plus 1.1 lb/A). Plots were 14 by 40 feet. The research area was not irrigated and rainfall totals were approximately one inch by 14 DAS.

Visual estimates of weed cover and crop stand were made in late August, 1999, nearly 30 days after gamagrass seed germination. Weed cover ranged from 30 to 60 percent and crop stand ranged from 40 to 60 percent. Gamagrass in plots treated with flumetsulam were slightly shorter than plants in the other treatments, and also had the lowest estimated stand. A postemergence application of 2,4-D plus dicamba (0.25 pt/A plus 0.50 pt/A) was made across all treatments including the controls in May of 2000 to manage perennial broadleaf weeds. All plots were mowed to six inches on 7 July, 2000, with plant material removed from the field. Crop and weed biomass were obtained following 4 weeks of regrowth. Lowest crop yields and highest weed yields were in the untreated controls. Gamagrass yields from PRE herbicide treated plots ranged from 611 g/m^2 to 958 g/m^2 for dimethenamid plus atrazine and alachlor plus atrazine treatments, respectively.

EVALUATION OF ALTERNATIVE CONTROL METHODS FOR ANNUAL RYEGRASS (*Lolium multiflorum*) IN TYPICAL VIRGINIA CROP ROTATIONS.
S. R. King and E. S. Hagood, Virginia Tech Univ., Blacksburg, VA.

ABSTRACT

In Virginia, annual ryegrass has become one of the most troublesome and difficult to control weeds in small grains, as well as in corn and soybeans grown in rotation with small grains. Annual ryegrass control has declined due to the development of resistance to diclofop, which has been the only treatment available for control of this species in wheat and barley. Lack of control in small grains has allowed annual ryegrass to proliferate and become problematic in other cropping systems. Annual ryegrass has proven to be extremely difficult to control in no-till corn establishment, where high triazine herbicide rates or sequential applications of nonselective herbicides are frequently required for acceptable control. The use of cyanazine has proven effective for annual ryegrass control in no-till corn establishment, and loss of registration of this compound severely limits control options in this crop. Extensive use of glyphosate-resistant soybean varieties has also been theorized to contribute to the proliferation of annual ryegrass, due to the lack of use of residual herbicides which can afford some control of this species in early fall. Experiments were initiated in 2000 in Virginia to: 1) evaluate herbicide programs using transgenic corn hybrids for control of annual ryegrass in no-till establishment, 2) evaluate the effects of varying residual herbicide programs for soybeans on annual ryegrass populations in rotational small grains, and 3) evaluate alternatives to diclofop for the control of annual ryegrass in small grains. No-till corn experiments were conducted in a split-plot, randomized complete block design with corn hybrid as the main plot and herbicide treatment as the subplot. Transgenic corn hybrids included glyphosate-, sethoxydim-, imidazolinone-, and glufosinate-resistant lines. Herbicide treatments in soybeans were arranged in a randomized complete block design and included preemergence metolachlor, acetochlor, sulfentrazone plus chlorimuron ethyl, pendimethalin, flufenacet plus metribuzin, and imazethapyr. Experiments in small grains were arranged in a randomized complete block design and included the compounds azafenidin, flufenacet plus metribuzin, and chlorsulfuron plus metsulfuron methyl. Glyphosate provided significantly higher levels of annual ryegrass control in no-till corn establishment than any of the other postemergence treatments, and provided excellent control with sequential applications or when combined with atrazine. The addition of rimsulfuron plus thifensulfuron methyl also provided increased ryegrass control. Significant effects of residual soybean herbicides on annual ryegrass populations were also observed, as were effects of application of azafenadin and flufenacet plus metribuzin on annual ryegrass control in barley.

COMPARISON OF PELARGONIC ACID AND AMMONIUM PELARGONATE FOR NON-SELECTIVE WEED CONTROL. M. J. VanGessel, B. A. Scott, and Q. R. Johnson, Univ. of Delaware, Georgetown, DE; C. E. Beste, Univ. of Maryland, Salisbury, MD; and R. A. Smiley, Consulting Chemist, Wilmington, DE.

ABSTRACT

Pelargonic acid is insoluble in water, but it is emulsified with surfactants and sold as Scythe to provide non-selective commercial weed control. The ammonium salt of pelargonic acid has high water solubility and has potential as an herbicide. These products were compared in greenhouse and field studies for herbicidal efficacy. Greenhouse studies were conducted in 1999 at the University of Delaware's Research and Education Center. Large crabgrass (*Digitaria sanguinalis*), giant foxtail (*Setaria faberi*), ivyleaf morningglory (*Ipomoea hederacea*), jimsonweed (*Datura stramonium*), and velvetleaf (*Abutilon theophrasti*) were seeded in flats and treated 2 weeks after planting. Treatments were ammonium pelargonate (AP) or Scythe applied at 5.3, 7.9, 10.5, or 15.8 lbs ae/A applied in 50 gpa. A non-ionic surfactant was added to all treatments at 0.25% v/v. An untreated check was included for comparison. At two weeks after treatment (WAT), weed control was similar among treatments for large crabgrass and ivyleaf morningglory with <15% and 49% control, respectively. Ammonium pelargonate provided better giant foxtail control than Scythe, but neither level of control was acceptable. A rate of 10.5 lb ae/A or greater of either Scythe or AP provided the highest level of jimsonweed control (77%). Rate of 7.9 lb ae/A or greater of either Scythe or AP were needed for the highest level of velvetleaf control (58%).

Field studies were conducted at the University of Delaware's Research and Education Center and University of Maryland's Lower Eastern Shore Research and Education Center in 2000. Studies were a three factor factorial. These factors were Scythe, 6.6 or 13.3 % w/w or AP, 5.9 or 11.7% w/w applied at spray volumes of 25, 50 or 100 gpa. Ammonium pelargonate is 33% w/w of pelargonic acid (2.6 lb ae/gal) and Scythe is 57% w/w of pelargonic acid (4.2 lb ae/gal). The actual application rates of pelargonic acid were as follows: Scythe, 6.6% applied at 25, 50 and 100 gpa was 13.7, 27.7, and 55.4 lb ae/A, respectively; and the 13.3% w/w concentration applied at 25, 50 and 100 gpa was 27.7, 55.4 and 110.9 lb ai/A, respectively. Ammonium pelargonate, 5.9% w/w concentration applied at 25, 50 and 100 gpa was 12.2, 24.4 and 48.9 lb ae/A, respectively; and the 11.8% w/w concentration applied at 25, 50 and 100 gpa was 24.4, 48.9 and 97.8 lb ae/A, respectively. A non-ionic surfactant was added to all treatments at 0.25% v/v. An untreated check was included for comparison. Treatments were applied when average weed height was 3 and 7 inches in Delaware and Maryland, respectively.

At both locations, when rated 2 WAT Scythe at 6.6% applied in 25 gal/A was not as effective as the other Scythe treatments. Ammonium pelargonate required 11.8% w/w at 50 gpa to provide >80% broadleaf weed control. Scythe, 6.6% w/w at 25 gpa had >90% common lambsquarters (*Chenopodium album*) control but AP required 50 gpa of the 5.9% w/w for the same control. Foliar coverage of weeds and adequate concentrations are critical factors for AP and Scythe efficacy.

UTILIZING THE 'POT IN POT' TECHNIQUE FOR WEED DISPLAY GARDENS. A. F. Senesac, Cornell Coop. Extn. of Suffolk County, Riverhead, NY.

ABSTRACT

Since 1998, three weed identification display gardens have been established on Long Island successfully employing the 'Pot in Pot' method for in-ground establishment of individual weed species. At each location: Bayard Cutting Arboretum, Suffolk County Community College and the Long Island Horticultural Research and Extension Center, the area was prepared by removing existing vegetation and leveling the soil surface. The holes (45 to 80) for the containers were dug in an established grid. The area was overlaid with black polypropylene landscape fabric and appropriately sized holes were cut to accommodate 3-gallon containers. Two containers were placed snugly in each hole. The upper container was filled with media (compost : pine bark) and a weed was planted in each. A drip irrigation grid was established with a single emitter for each pot and the entire grid is irrigated daily. Two inches of crushed stone mulch were laid between all pots. Permanent labeling was established at each container identifying each weed species with basic biology and habitat information.

Each container is regularly maintained free of other weeds. Residual herbicides are applied over the mulch between the containers to prevent weed seeds from establishing. Aggressive rhizomotous perennial weeds are prevented from growing out their containers by the placement of Biobarriar® (landscape fabric impregnated with trifluralin) between the two nestled pots. The 'pot in pot' method allows for easy replacement and replenishment of dead weeds.

The weed displays are visited regularly by landscapers, homeowners and students and are a useful educational tool for commercial grower meetings and master gardener classes.

THE MISSION AND GOALS OF THE SLATER CENTER FOR ENVIRONMENTAL BIOTECHNOLOGY. T. E. Vrabel, Slater Center for Environmental Biotechnology, Narragansett, RI.

ABSTRACT

The Slater Centers of Excellence initiative was created to foster the creation of high technology commercialization clusters in the state of Rhode Island. The Slater Center for Environmental Biotechnology actively promotes the development and commercialization of innovative environmental biotechnologies through technology transfer, business services, strategic partnerships and collaborations. Environmental biotechnology encompasses all areas of biotechnology not included in human medicine and includes industry niches that are Rhode Island strengths such as turfgrass science, aquaculture, and environmental pollution mitigation.

The Center sponsors a commercial innovation program that invests in research and development, or commercialization activities with a high probability of success through an equity convertible competitive award loan program. The Center also assists start-up ventures in turning promising ideas developed in Rhode Island from scientific concepts into marketable technologies. Success in this proof of principle development stage will help attract more significant partnerships and additional funding to these companies. Coupled with the award program are mentoring programs in business plan development, venture capital acquisition, management team creation, and business network development.

Affiliation of the Center with the University of Rhode Island is focused on business incubator space creation and academic program development. The Center Director is working closely with the Environmental Biotechnology Initiative (a consortium of over fifty faculty involved in environmental life sciences) to update academic programs, encourage commercialization of discoveries, and initiate employment and training opportunities for undergraduate students with participating companies. Technologies that are currently being funded by the Center include: development of male sterility linkages with herbicide resistance traits in turfgrass, insertion of improved muscle development genetics into fish for aquaculture, microbially based organic pollutant filtration systems, plantibody transgenic manipulation of plants for insertion of companion pet vaccines, and development of novel livestock insecticide application systems to reduce resistance potential.

THE EFFECT OF GLUTAMINE SYNTHETASE INHIBITORS ON GLUFOSINATE TOLERANT AND SUSCEPTIBLE CORN AND SOYBEAN. I. Y. Lee, National Inst. of Agric. Sci. and Technol., Republic of Korea; B. O. Bachmann, Chem. Dept., The John Hopkins Institute, Baltimore, MD; J.P. Mullen, Entek, Elkridge, MD; and J. Lydon, USDA/ARS/Weed Sci. Lab., Beltsville, MD.

ABSTRACT

This study was conducted to determine if glufosinate-tolerant soybean and corn are tolerant to other structurally-related glutamine synthetase inhibitors. Growth chamber-grown ten day-old soybean plants and seven day-old corn plants were treated with 3 ml per plant of a 0.1% Tween 20 solution containing D,L-glufosinate, L-methionine sulfoximine (MSO), or tabtoxinine-β-lactam (TβL) at rates of 0 to 4 kg ha^{-1}. Plants were then grown under greenhouse conditions and shoots were harvested 14 days after treatment for dry weight determinations. Glufosinate at 0.063 to 0.5 kg ha^{-1} had no effect on shoot dry wt. of glufosinate-tolerant soybean plants, however glufosinate-sensitive soybean plants were killed at rates as low as 0.63 kg ha^{-1}. Glufosinate-tolerant soybean plants were tolerant to MSO at rates up to 0.5 kg ha^{-1}, however, shoot dry wt. of glufosinate-susceptible plants was significantly reduced at rates of 0.125 kg ha^{-1} and plants were killed at of 0.25 and 0.5 kg ha^{-1}. TβL at 1 kg ha^{-1} had no effect on shoot dry wt. of glufosinate-tolerant soybean plants, however, this rate killed glufosinate-sensitive soybean plants. Glufosinate at 0.25 to 2.0 kg ha^{-1} had no effect on shoot dry wt. of glufosinate-tolerant corn plants, however, the 2.0 kg ha^{-1} rate killed glufosinate-sensitive corn plants, and rates as low as 0.25 kg ha^{-1} caused a 44% reduction in shoot dry wt. MSO at 1 kg ha^{-1} killed glufosinate-sensitive corn plants and rates as low as 0.125 kg ha^{-1} caused dramatic reductions in shoot growth. Shoot growth of glufosinate-tolerant corn plants was also effected by the MSO treatments but to a much less degree. The results of this study indicate that plants genetically modified with the *bar* or *pat* genes which encode for an acetyltransferase that detoxifies glufosinate also display tolerance to other glutamine synthetase inhibitors.

INVASIVENESS BY DEFINITION: THE CONCEPT OF BIOLOGICAL INVASIONS WITH SPECIFIC REFERENCE TO WEEDS. S. H. Kay, North Carolina State Univ., Raleigh.

ABSTRACT

Biological invasions by definition are the movement of species from one area into others where they do not already exist. These invasions have occurred naturally since the origin of life on Planet Earth. The impacts of biological invasions vary in extent from essentially un-noticeable to those which alter ecosystem function and result in severe loss of species richness and diversity. Naturally occurring movements of species generally do not cause major ecological disruptions and extirpations of large numbers of species in the invaded habitats. In historical times, numerous biological invasions have occurred, and most of these have occurred either directly or indirectly as the result of human activities. In the past century, biological invasions have occurred at a pace several orders of magnitude more rapid than natural invasions. This has been the direct result of the increased mobility of human society and the tendency for humans to take with them everything that is familiar, including species used for food and fiber, as well as the inevitable uninvited guests - the pests. Many of these invasions have resulted in major impacts on the invaded ecosystems. Among the most serious and costly pests that have been introduced either intentionally or inadvertently are the pest plants or weeds. Weed introductions impact both agricultural and non-agricultural systems both directly and indirectly. Indirect impacts of weed invasions may occur as the result of elimination of one or more native plants which are important resources for other species (e.g., loss of a food source for birds). With recent worldwide attention focused on the impacts of nonindigenous species, the term "invasion" has been misused frequently and has become synonymous with the term "pest". This paper reviews the concept of invasiveness in general, with emphasis on use of terminology and its application to weedy vegetation.

THE TOLERANCE OF CRABAPPLE, HONEYLOCUST, AND RED MAPLE TO DIRECTED SPRAY APPLICATIONS OF FLUROXYPYR. L. J. Kuhns and T. L. Harpster, Dept. of Hort., Penn State Univ., University Park, PA.

ABSTRACT

The study was conducted at Log Barn Nursery in Bloomsburg, PA. On June 8, 2000, treatments presented in Table 1 were applied to Norway maple (*Acer platanoides* L. 'Crimson King'), Thornless Common Honeylocust (*Gleditsia triacanthos* L. var. *inermis* Willd. 'Skyline'), and Flowering Crabapple (*Malus* Mill. 'Spring Snow'). Trees were approximately 1 to 1.5 inches in diameter six inches above the soil line. All trees had white tree guards that were removed just before application. Applications were made with a CO_2 test plot sprayer at 30 psi through an OC02 nozzle. Treatments were applied in 18-inch wide strips to both sides of the tree rows. Approximately 6 to 10 inches of the lower part of each trunk was covered with the spray solution. The system had an output equivalent to 36 gallons per acre. Tree guards were replaced 30-45 minutes after the treatments were applied. The temperature was 65 - 70°F, wind was 3 mph and there was no rain predicted. There were five trees per plot, and each treatment was replicated three times for each species. The following weeds were present in the test area: white clover (*Trifolium repens* L.), common dandelion (*Taraxacum officinale* Weber in Wiggers), goldenrod (*Solidago* spp), Virginia pepperweed (*Lepidium virginicum* L.), black medic (*Medicago lupulina* L.), prickly lettuce (*Lactuca serriola* L.), shepherds-purse (Capsella bursa-pastoris (L.) Medicus), annual fleabane (*Erigeron annuus* (L.) Pers.), birdsfoot trefoil (*Lotus corniculatus* L.), marestail (*Hippuris vulgaris* L.), Canada thistle (*Cirsium arvense* (L.) Scop.), black mustard (*Brassica nigra* (L.) W.J.D.Koch), common yellow woodsorrel (*Oxalis stricta* L.), yellow rocket (*Barbarea vulgaris* R. Br) and hairy vetch (*Vicia villosa* Roth). Plant quality and weed control were evaluated on July 26, 2000.

None of the treatments injured any of the plants (data not shown). Weed control provided by the clopyralid alone was superior to the control provided by any of the treatments containing fluroxypyr (Table 1). The combination of fluroxypyr and fluazifop-p-butyl would be expected to provide better control than clopyralid alone, but there were almost no grasses in the test area to be controlled by the fluazifop. The predominant weeds that survived the clopyralid treatment were annual grasses, common yellow woodsorrel, annual fleabane, and yellow rocket. The predominant weeds in the plots treated with fluroxypyr were dandelion, marestail, some Canada thistle and annual fleabane.

Table 1. Effect of directed spray applications of fluroxypyr applied alone, or in combination with fluazifop-p-butyl; or clopyralid on weed control in Norway maple, honeylocust, and crabapple plantings. All treatments included the non-ionic surfactant (LI 700[1]) at 0.5% v/v. Weed control was rated on a scale of 1-10, with 1 = no control and 10 = total control.

Treatment	Rate (lbs/A)	Weed Control[2]
Control		1.2 d
Fluroxypyr	0.0825	3.2 c
Fluroxypyr	0.168	4.4 bc
Fluroxypyr +	0.168	5.6 ab
Fluazifop-p-butyl	0.14	
Clopyralid	0.375	7.0 a

[1]Surfactant, penetrant and acidifier made by Loveland, Greeley, CO.

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

THE TOLERANCE OF COLORADO SPRUCE, DOUGLAS FIR, AND FRASER FIR TO OVER-THE-TOP APPLICATIONS OF FLUROXYPYR. L. J. Kuhns and T. L. Harpster, Dept. of Hort., Penn State Univ., University Park, PA.

ABSTRACT

The study was conducted at Kuhns Tree Farm in Boalsburg, PA. On June 15, 2000, the treatments presented in Table 1 were applied over-the-top of Douglas Fir (*Pseudotsuga menzesii* (Mirb) Franco), Fraser Fir (*Abies fraseri* (Pursh) Poir), and Colorado Spruce (*Picea pungens* Engelm.). The Fraser fir and Colorado spruce had been planted in early-April, 2000 and were 10 to 14 inches tall. The Douglas fir had been planted in April, 1999 and were 18 to 24 inches tall. All plants had several inches of succulent new growth at the time of application. Applications were made with a CO_2 test plot sprayer at 30 psi through an 8004E nozzle. The system had an output equivalent to approximately 26 gallons per acre. The temperature was 72°F and the wind was 3-4 mile per hour. Heavy rain showers occurred four hours after the application. There were five trees per plot, and each treatment was replicated three times for each species.

Determining crop tolerance to fluroxypyr was the primary objective of the study, so weed control data was not collected. On June 22, one week after treatment (WAT), the treated trees were checked for signs of injury, but data was not collected. The Colorado spruce showed no signs of injury from any of the treatments. The new growth of the Douglas fir was slightly injured (slight weeping) and the Fraser fir were severely injured by the fluroxypyr treatments.

On August 10, 2000, 8 WAT, the quality of all plants was evaluated. The quality of all plants in the untreated control, and plots treated with clopyralid, was excellent, with no signs of injury (Table 1). The quality of all Colorado spruce receiving treatments containing fluroxypyr was excellent. Douglas fir were injured by the treatments containing fluroxypyr, with the higher rate causing the most injury. Symptoms included loss of apical dominance, tip burn and clustered stunted growth. The Fraser fir were severely injured by all treatments including fluroxypyr. Many to most of the tips were killed. Plants treated with the higher rate were almost killed by the treatments.

The wide range of tolerance to fluroxypyr by the three Christmas tree species included in this test indicate that further testing is needed on these, and other Christmas tree species before this product can be routinely recommended for use on Christmas trees.

Table 1. Plant quality ratings for Christmas tree species receiving over-the-top applications of fluroxypyr applied alone, or in combination with fluazifop-p-butyl; or clopyralid alone, at Kuhns Tree Farm (Boalsburg, PA). All treatments included the non-ionic surfactant (LI 700[1]) at 0.5% v/v. At the time of application all plants had several inches of succulent new growth. Plant quality was rated on a scale of 1-10 with 1 = dead and 10 = highest quality. [2]

Treatment	Rate (lbs/A)	Colorado Spruce	Douglas Fir	Fraser Fir
Control		9.9 a	9.6 a	9.8 a
Fluroxypyr	0.0825	9.9 a	8.1 b	4.7 b
Fluroxypyr	0.165	9.9 a	6.3 c	2.8 c
Fluroxypyr Fluazifop-p-butyl	0.165 0.5	9.8 a	6.6 c	3.0 c
Clopyralid	0.14	10.0 a	9.7 a	9.8 a

[1]Surfactant, penetrant and acidifier made by Loveland, Greeley, CO.

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

THE CONTROL OF GROUND IVY (*Glechoma hederacea*) IN TURFGRASS WITH QUINCLORAC. M. A. Czarnota, J. N. Barney and L. A. Weston, Dept. of Hort., Cornell Univ., Ithaca, NY.

ABSTRACT

From flavoring beer to cure-all teas, ground ivy (*Glechoma hederacea* L.) has had a long and whimsical history. Unfortunately, this aggressive dicot can be very difficult to control in turfgrass. Herbicides in the phenoxy, benzoic acid, and pyridinecarboxylic families can provide adequate weed control of ground ivy, and have been the mainstay of controlling this weed. Quinclorac, a new turf herbicide, primarily marketed for crabgrass control, also provides control of certain dicots. Although not labeled to control ground ivy, preliminary studies have shown that quinclorac applied at labeled rates (<1.68 kg ai/ha) controlled ground ivy.

In the spring of 2000, field studies were performed in mixed stands of Kentucky bluegrass (*Poa pratensis* L.) / tall fescue (*Festuca arundinaceaa* Schreb.) that were infested with ground ivy (> 25% cover). Quinclorac was applied at two rates (0.56 and 0.84 kg ai/ha) at three different stages of flowering (early flower, later flower, and after flower). The first application (early flower) was applied April 26, 2000, and subsequent applications were applied every two weeks. Turf injury ratings were taken at 6 and 8 weeks after treatment (WAT). Ground ivy control ratings were taken at 6, 8, and 12 WAT.

Injury symptoms did not appear until 5 weeks after the first treatment. At 6 and 8 WAT, no quinclorac treatment provided less than 70% control. At 12 WAT, the lower rate of quinclorac applied at early and late flower provided no better than 56% control. The lower rate of quinclorac applied after flower, and all of the 0.84 kg ai/ha applications provided greater than 85% control of ground ivy. Regrowth was apparent with both rates of quinclorac applied at early and late flower.

BROADLEAF WEED CONTROL IN 2000. T. L. Watschke and J. A. Borger, Dept. of Agron., Penn State University, University Park, PA.

ABSTRACT

This study was conducted on a mature stand of perennial ryegrass (*Lolium perenne* L.) at the Landscape Management Research Center, Penn State University, University Park, Pa. The objective of the study was to determine the efficacy of broadleaf herbicides for the control of dandelion (*Taraxacum officinale*), common plantain (*Plantago major*), and white clover (*Trifolium repens*). This study was a randomized complete block design with three replications. All of the treatments were applied on May 11, 2000 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 6504 nozzles at 40 psi. Control of dandelions was rated four times (6/11, 6/23, 7/7, 7/28) throughout the study. Three treatments XRM3972 (clopyralid) at 0.375 lbs ai/A combined with XRM 5316 (fluroxypyr) at 0.06 lbs ai/A, XRM3972 at 0.375 lbs ai/A combined with XRM 5316 at 0.25 lbs ai/A, and XRM3972 at 0.375 lbs ai/A provided control above 90 percent on all rating dates. Two treatments XRM3972 at 0.25 lbs ai/A combined with XRM 5316 at 0.06 lbs ai/A, XRM3972 at 0.375 lbs ai/A combined with XRM 5316 at 0.12 lbs ai/A controlled dandelions above the 90 percent level on the first rating date but fell below 90 percent control by the final rating date. All other treated turfgrass provided some control of dandelions on the first rating date but by the final rating date provided unacceptable control. Control of broadleaf plantain was rated four times (6/11, 6/23, 7/7, 7/28) throughout the study. Seven treatments XRM3972 at 0.375 lbs ai/A combined with XRM 5316 at 0.12 lbs ai/A, XRM3972 at 0.25 lbs ai/A combined with XRM 5316 at 0.25 lbs ai/A, XRM3972 at 0.25 lbs ai/A, EF1154 (fluroxypyr, clopyralid, MCPA) at 3.2 pt/A, Confront (triclopyr, clopyralid) at 2 pt/A, Lontrel (clopyralid) at 0.67 pt/A, and UHS302 at 4 pt/A provided control above 90 percent on the first rating date and above 80 percent control at the final rating date. Four treatments XRM3972 at 0.187 lbs ai/A combined with XRM 5316 at 0.25 lbs ai/A, Confront at 1 pt/A, UHS 302 at 3.2 pt/A and 3.6 pt/A provided control above 80 percent through the study. Turf treated with XRM3972 at 0.375 lbs ai/A combined with XRM 5316 at 0.25 lbs ai/A controlled broadleaf plantain at 77.8 percent at the first rating and 86.1 percent by the final rating date. All other treated turfgrass provided some control of broadleaf plantain on the first rating date but by the final rating date provided unacceptable control. Only turf treated with XRM 5316 at 0.06 and 0.12 lbs ai/A failed to control white clover.

ANNUAL BLUEGRASS CONTROL AND SEEDHEAD SUPPRESSION WITH ETHOFUMESATE. S. E. Hart and D.W. Lycan, New Jersey Agricultural Experiment Station, Cook College, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Field experiments were conducted in 2000 at the Rutgers University Experimental Horticultural Farm II in New Brunswick, NJ and the Riverton Golf Country Club in Riverton, NJ to evaluate spring and summer applications of ethofumesate for control of annual bluegrass and seedhead supression in golf course fairways. At Horticultural Farm II the creeping bentgrass (*Agrostis palustris* 'Southshore') fairway was infested with approximately 40-50% annual bluegrass while the fairway at Riverton was an unknown variety of perennial ryegrass (*Lolium perenne)* infested with approximately 50-60% annual bluegrass. Ethofumesate applications were initiated on March 30 and April 2 at Riverton and Horticultural Farm II, respectively, and applied 8 times at approximately 3-4 week intervals throughout the spring and summer. The ethofumesate treatments consisted of two applications at 0.75 lb ai/A followed by six applications at 0.5, 0.38 or 0 lb/A, or 8 applications applied at 0.5 or 0.38 lb/A. One application of 0.5 lb/A paclobutrazol, applied in early May, was also evaluated for control of annual bluegrass. In the seedhead suppression experiment, single and sequential applications of ethofumesate were applied at 1.5, 1.0 or 0.75 lb/A, while single and sequential applications of ethephon were applied at 0.75 lb/A. A single application of mefluidide at 0.12 lb/A was included as a standard comparison. All ethofumesate applications were applied with 4.8 kg/h of urea, using a CO_2 backpack sprayer delivering 80 GPA.

In the seed head suppression study, a single application of ethofumesate provided 69-75% seed head suppression 7 WAT. Increasing the rate of ethofumesate did not significantly increase seed head suppression. However, applying a sequential application of ethofumesate increased seedhead suppression by 10-20%. Single and sequential applications of ethephon provided 76 and 86% seed head suppression, respectively. Mefluidide provided 96% seed head suppression at 4 WAT but seed head suppression fell to 73% at 7 WAT.

In the annual bluegrass control study at Riverton, annual bluegrass populations in check plots declined 25% by June, stabilized in the summer, and increased back to spring levels in late September. Two applications of ethofumeste at 0.75, 0.5, and 0.38 lb/A provided 45-55, 42, and 16% reductions in annual bluegrass populations by June. Summer applications of ethofumesate did not further reduce annual bluegrass populations. A single application of paclobutrazol reduced annual bluegrass populations by 52% by June. By late September annual bluegrass populations increased in all treatments, but the extent of this increase was less in the ethofumesate treatments than in the untreated check and the pacobutrazol treatment.

At Horticultural Farm II, annual bluegrass populations in the check plots remained stable throughout the spring and summer. Two applications of ethofumeste at 0.75, 0.5, and 0.38 lb/A provided 18-22, 18, and 9% reductions in annual bluegrass populations by June. Summer applications of ethofumesate did not further reduce annual bluegrass populations. Turf quality of bentgrass in the ethofumesate treatments remained equal to the untreated check, regardless of ethofumesate rate or number of applications. A single application of paclobutrazol reduced annual bluegrass populations

25% by June. In late September annual bluegrass populations increased in all treatments and equaled levels observed in early spring.

MONITORING ANNUAL BLUEGRASS EMERGENCE AND ITS CONTROL WITH PREEMERGENCE HERBICIDES. J.E. Kaminski, Grad. Res. Asst. and P.H. Dernoeden, Prof., Dept. of Natural Resource Sciences & LA, Univ. of Maryland, College Park, MD 20742

ABSTRACT

There have been no studies conducted in Maryland to monitor the seasonal emergence patterns of annual bluegrass (*Poa annua* L. ssp. *annua*). Proper timing of preemergence herbicides, based on known emergence patterns, would improve herbicide efficacy. Hence, the objectives of this study were to monitor seasonal annual bluegrass emergence patterns and to assess preemergence herbicides for efficacy in controlling *P. annua*. All studies were conducted at the University of Maryland Golf Club in College Park. Soil was a silt loam with a pH of 4.7 and 5.0 % OM. The common bermudagrass (*Cynodon dactylon* L.) turf site was a rough mowed to a height of 2.5 inches. *Poa annua* emergence was monitored for two years. On 8 Sept 1998 and 1999, four circular spots about a square foot in area (124 to 154 sq in) were killed with a non-selective herbicide (glyphosate). Annual bluegrass seedlings were counted and removed weekly from inside each spot from 8 Oct 1998 to 14 May 1999 and from 27 Sept 1999 to 23 May 2000. Herbicides were evaluated in 1999 only and were applied on the dates footnoted in Table 1. A few *P. annua* seedlings were observed in the test site when the study was initiated. The site was irrigated within 48 hr of each herbicide application. Sprayable herbicides were applied in 50 gpa using a CO_2 pressurized (35psi) sprayer equipped with a flat-fan nozzle. Granulars were applied with a shaker bottle. Plots were 5 x 5 ft and were arranged in a randomized complete block with 4 replications. Percent of plot area covered with *P. annua* was assessed visually on a 0 to 100% scale where 0 = no *P. annua* and 100 = entire plot area covered with *P. annua*.

During the first and second week of Oct 1998, an average of about 150 and 100 seedlings sq ft^{-1} wk^{-1} emerged, respectively. By mid-Oct, however, germination declined to less than an average of 40 seedlings sq ft^{-1} wk^{-1}. *Poa annua* seedlings continued to emerge in moderate numbers (average = 17 seedlings sq ft^{-1} wk^{-1}) throughout Nov and Dec, 1998. Seedling emergence was observed in small numbers (average = 3 seedlings sq ft^{-1} wk^{-1}) throughout winter and into early May 1999. Over 12 inches of rain fell in early Sept 1999, following a prolonged drought. The heavy rain stimulated early emergence of *P. annua* and a few seedlings were observed in the study area when spots were killed on 8 Sept 1999. An average of almost 350 annual bluegrass seedlings sq ft^{-1} emerged between 8 Sept and 27 Sept. A large number of seedlings (i.e., > 130 seedlings sq ft^{-1}) germinated the week prior to 5 Oct 1999. Seedling counts were generally lower (average = 36 seedlings sq ft^{-1} wk^{-1}) from 11 Oct to 3 Nov. *Poa annua* seedlings continued to emerge in moderate numbers (average = 9 seedlings sq ft^{-1} wk^{-1}) throughout Nov and Dec. A few seedlings emerged between mid-March and early May 2000, coinciding with unusually warm temperatures. Data collected in both years showed that the major emergence period of *P. annua* was between early Sept and mid-Nov. Low to moderate populations of seedlings, however, emerged between Dec and May of each year. Herbicide treatments with *P. annua* levels within or close to the acceptable threshold (i.e., <5% *Poa* cover) on 1 May 2000 were Ronstar (2.0 and 4.0 lb ai/A), Team Pro (3.0 lb ai/A), and Pendulum (1.5 + 1.5 lb ai/A). Dimension did not reduce *P. annua* cover significantly when compared to the untreated control. All other treatments reduced annual bluegrass cover, but the level of control was generally poor.

Table 1. Percent of plot area covered by *Poa annua* in a bermudagrass rough treated with herbicides in College Park, MD.

Material	Rate lb ai/A	Percent *Poa annua* cover, 2000		
		23 Mar	14 April	1 May
			%	
Ronstar 2G	1.0+1.0[x]	23 b[y]	29 bc	28 cde
Ronstar 2G	2.0	2 e	2 f	4 f
Ronstar 2G	4.0	1 e	0 f	1 f
Dimension 1EC	0.5	20 bc	35 b	55 ab
Barracade 65DG	0.325	14 cd	24 bcd	47 bc
LescoSan 4L	7.5+7.5	11 d	13 def	20 def
Pendulum 3.3EC	1.5 +1.5	2 e	4 ef	6 ef
Pendulum 3.3EC	2.0	9 de	19 cde	42 bcd
Pendulum 3.3EC	3.0	5 de	11 def	20 def
Team Pro 0.86G	1.5 + 1.5	8 de	14 def	19 def
Team Pro 0.86G	3.0	1 e	1 f	2 f
Untreated	-	56 a	65 a	73 a

[x] Treatments initially were applied 8 Sept and sequential treatments were applied 21 Oct 1999.

[y] Means in a column followed by the same letter are not significantly different at P=0.05 according to the least significant difference t-test.

CREEPING BENTGRASS SAFETY AND SMOOTH CRABGRASS CONTROL WITH QUINCLORAC. P. H. Dernoeden, Prof., J. M. Krouse, Res. Assoc., and J. E. Kaminski, Grad. Res. Asst., Dept. of Natural Resource Sciences & LA, Univ. of Maryland, College Park, MD 20742.

ABSTRACT

Quinclorac was registered for use on creeping bentgrass (*Agrostis palustris* Huds.) for postemergence smooth crabgrass (*Digitaria ischaemum* [Schreb.] Schreb. ex. Muhl) control in 1999. Unpublished research conducted at the Univ. of Maryland in 1999 showed that quinclorac applied at the label use rate (i.e., 0.75 lb ai/A) elicited an objectionable chlorosis in creeping bentgrass and did not consistently control crabgrass in a single application. The objectives of this study were to assess several sequential versus single rate applications of quinclorac in three timings for creeping bentgrass tolerance and efficacy in controlling smooth crabgrass.

Treatments were applied to a mature stand of 'Penncross' creeping bentgrass mowed to a height of 0.5 inches. There was no crabgrass in the bentgrass site, so the treatments were simultaneously applied to a mature perennial ryegrass (*Lolium perenne* L.) stand with a history of severe crabgrass pressure. The perennial ryegrass was mowed to a height of 1.5 inches twice weekly. Soil at both sites was a Sassafras sandy loam with a pH of 6.1 - 6.3 and 1.1 - 1.3% OM. No fertilizer was applied to either site during the study, but each site received 2.0 lb N/1000 sq ft the previous autumn.

Quinclorac was tank-mixed with methylated seed oil (1.0% v/v) and applied in 50 gpa using a CO_2 pressurized (35 psi) sprayer equipped with an 8004E flat fan nozzle. There was excellent soil moisture on each application date, and the site was irrigated or received significant rain (>0.20 inches) within 48 hrs of each treatment. There were three application timings as follows: early postemergence (EPO) treatments were initiated on 1 June when crabgrass was in the 1 to 4 leaf stage; mid-postemergence (MPO) treatments were initiated 30 June when crabgrass was in the 5 leaf to 3 tiller stage; and late postemergence treatments were initiated 27 July when crabgrass had 4 to 22 tillers. Crabgrasws cover was rated visually on a linear o to 100% scale, and turf color was rated visually on a 0 to 10 scale. Plots were 5 x 5 ft and were arranged in a randomized complete block with four replications. Data were subjected to the analysis of variance and significantly different means were separated by the LSD t-test at $P = 0.05$.

Quinclorac was applied in a single (0.75 lb/A) application or sequentially (0.50 + 0.50, 0.75 + 0.75, and 0.375 + 0.375 + 0.375 lb ai/A) in EPO, MPO and LPO timings. The 0.75 + 0.75 (applied on a 4 wk interval) and 0.375 + 0.375 + 0.375 lb/A (applied on a 2 wk interval) provided good to excellent postemergence control of crabgrass in all three timings. Poor control was provided by 0.75 and 0.50 + 0.50 lb/A quinclorac treatments, regardless of timing. Most treatments elicited an unacceptable chlorosis in the bentgrass for about 4 wk. The best combination of control and safety (i.e., fewest weeks of unacceptable yellowing) was provided by 0.375 + 0.375 + 0.375 lb/A quinclorac treatment applied EPO, which discolored bentgrass unacceptably for only 2 wk. Except for 0.75 lb/A treatment, color data showed that the EPO and MPO quinclorac timings reduced turf color significantly for the10 wk period following application, after which time data collection ceased. Quinclorac also predisposed turf to scalping. Hence, quinclorac should be used with caution on creeping bentgrass fairway turf.

PREEMERGENCE CRABGRASS CONTROL IN 2000. T. L. Watschke and J. A. Borger, Dept. of Agron., Penn State University, University Park, PA.

ABSTRACT

This study was conducted on a mature stand of "Midnight" Kentucky bluegrass (*Poa pratensis*) at the Landscape Management Research Center, Penn State University, University Park, Pa. The objective of the study was to evaluate the efficacy of herbicides for the preemergence control of smooth crabgrass (*Digitaria ischaemum*). This study was a randomized complete block design with three replications. All of the treatments were applied on April 19, 2000 using a three foot CO_2 powered boom sprayer calibrated to deliver 80 gpa using two, flat fan, 6504 nozzles at 40 psi. Some treatments were re-applied eight weeks later on June 16, 2000. Granular treatments were applied with a shaker jar. After application the entire test site received approximately 0.5 inch of water. On April 19, 2000 0.5 lb N/M was applied from urea and 0.5 lb N/M from a 24-4-12 SCU fertilizer to treatments that did not contain any nitrogen fertilizer as a carrier. Crabgrass germination was first noted in the test site on May 5, 2000. The following herbicides provided preemergence crabgrass control near or above the 85% level considered to be commercially acceptable: Pendulum (pendimethalin) 2G at 2 lbs ai/A, all rates of Barricade (prodiamine) 4FL and 65WDG, Betasan (bensulide) at 9.2 oz/M and 5.5 oz/M followed by 3.65 oz/M eight weeks later, Ronstar (oxadiazon) 2G (fine) at 2 lbs ai/A, Dimension (dithiopyr) 1EC at 0.25 lbs ai/A, Dimension 40WP at 0.25 lbs ai/A, Dimension 2.65MEC (PE1XF00020) at 0.25 lbs ai/A, Dimension 2.65MEC (PE1XF00045) at 0.18 and 0.25 lbs ai/A, Dimension (AND442) 0.035G at 0.18 lbs ai/A.

CRABGRASS CONTROL IN COOL-SEASON TURFGRASSES: PRE- AND POST-EMERGENCE STRATEGIES

P. C. Bhowmik and M. Elston[1]

ABSTRACT

Field experiments were conducted on established stands of Kentucky bluegrass (*Poa pratensis* L.) or perennial ryegrass (*Lolium perenne* L.) to evaluate PRE or POST activity of several herbicides in large crabgrass [*Digitaria sanguinalis* (L.) Scop.] control. Treatments were applied to 3.5 by 10 ft. plots with a CO_2-backpack sprayer at a pressure of 22 psi in 50 gpa. PRE treatments were applied either in October (Fall PRE) or in April (Spring PRE). POST treatments were applied to 4- to 6-leaf (June) and 1- to 3-tiller (July) crabgrass in 1996 and to 2- to 3-leaf (June) crabgrass in 1998. Weed control was estimated on a scale of 0 to 100% (where 0 = no weed control and 100 = complete control) 4, 7, 9, 35, 40, and 47 weeks after treatment (WAT).

In all five trials (1994 to 1997), all treatments applied Fall PRE controlled large crabgrass in the following year (35 to 47 WAT) with no turfgrass injury. Dithiopyr (0.5 and 0.75 lb/A), prodiamine (0.5 and 0.75 lb/A), pendimethalin (0.4 lb/A) and oxadiazon (0.4 lb/A) provided excellent crabgrass control throughout the next growing season. Pendimethalin (3.0 lb/A), oxadiazon (3.0 lb/A) and bensulide (6.0 or 8.0 lb/A), applied Fall PRE did not provide acceptable control of crabgrass in the following year. However, Spring PRE treatments of pendimethalin (3.0 lb/A), oxadiazon (3.0 lb/A), dithiopyr (0.38 lb/A) and prodiamine (0.5 lb/A) resulted in excellent crabgrass control throughout the growing season. The granular formulation (0.164 G) of dithiopyr performed better than the EC formulation regardless of the PRE timing of application (Fall or Spring).

In 1996, POST treatments of a premix combination of fenoxaprop and pendimethalin (3.09 EC) at 1.55 or 2.06 lb/A, applied to 4- to 6-leaf crabgrass, controlled crabgrass over 90% 7 WAT, while the lowest rate (1.03 lb/A) controlled only 37% of crabgrass. These same treatments when applied to 1- to 3-tiller crabgrass resulted in slightly lower crabgrass control compared the 4- to 6-leaf stage. The tank mix combination of dithiopyr and fenoxaprop at 0.25 and 0.12 lb/A resulted in 95% crabgrass control 9 WAT. None of these treatments showed any objectionable injury to Kentucky bluegrass.

In 1998, quinclorac at 0.75 lb/A applied to 3- to 5-leaf crabgrass resulted in excellent crabgrass control 8 WAT. The combinations of quinclorac and pendimethalin (0.75 + 1.5 lb/A) and quinclorac and dimension (0.75 + 0.5 lb/A) provided excellent crabgrass control 8 WAT. In the same trail, fenoxaprop extra (0.116 lb/A) or dithiopyr (0.5 lb/A) controlled crabgrass over 90% 4 WAT, however, the control declined and was not acceptable 8 WAT.

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POSTEMERGENCE CRABGRASS CONTROL IN 2000. T. L. Watschke and J. A. Borger, Dept. of Agron., Penn State University, University Park, PA.

ABSTRACT

Three studies were conducted on a mature stand of perennial ryegrass (*Lolium perenne* L.) at the Landscape Management Research Center, Penn State University, University Park, Pa. The objective of the studies was to evaluate the efficacy of postemergence herbicides for the postemergence control of smooth crabgrass (*Digitaria ischaemum*). All studies were a randomized complete block design with three replications. For the pre/post study, all of the treatments were applied on June 14, 2000, for the post study, all of the treatments were applied on July 2, 2000, and for the multiple timing study, treatments were applied on June 14, June 29, July 2, July 12, July 17, and Aug 1, 2000 using a three foot CO_2 powered boom sprayer calibrated to deliver 40 gpa using two, flat fan, 6504 nozzles at 40 psi. Granular treatments were applied with a shaker jar. Evaluations of the pre/post study revealed that only Acclaim Extra (fenoxaprop-p-ethyl) at 0.12 lbs ai/A combined with pendimethalin at 1.5 lbs ai/A provided acceptable post emergence control of smooth crabgrass. The 40WP formulation of Dimension (dithiopyr) at 0.5 lbs ai/A and the 0.38 lb ai/A rate of XF00020 (dithiopyr) 2.65MEC approached commercial acceptance by providing 80% control. It appears that these two formulations of Dimension have potential to be satisfactory control products, at least at the highest rates for each. It is likely that a rate of 0.5 lbs ai/A of either XF00020 or XF00045 would provide acceptable control. For the post study, the addition of MacroSorb Foliar to the 0.5 lb ai/A rate of Drive (quinclorac) 75DF improved control from 68 to 78%. Drive 75DF alone at 0.75 lb ai/A provided 82% control which was close to being acceptable. There is little doubt that supplementing the 0.75 lb ai/A rate of Drive 75DF with MacroSorb Foliar would have easily increased control above the acceptable level. Acclaim Extra 0.57EW provided excellent control at 20 and 28 oz/A as did Ricestar (fenoxaprop-p-ethyl). Puma (fenoxaprop-p-ethyl) also provided excellent control at 11.4 and 16 oz/A. The addition of MacroSorb Foliar to a low rate of Acclaim Extra (10 and 15 oz/A) allowed for control that approached acceptability (83%). For the multiple timing study, only Drive 75DF applied once at 0.75 lbs ai/A failed to provide acceptable post emergence control of smooth crabgrass. Multiple applications (even using rates lower than 0.75 lbs ai/A) improved control of smooth crabgrass substantially. It appears, that by using multiple applications, the historical weakness in control using Drive at some growth stages, can be overcome.

USE OF QUINCLORAC FOR CRABGRASS CONTROL IN NEWLY SEEDED KENTUCKY BLUEGRASS AND CREEPING BENTGRASS. D. W. Lycan, S. E. Hart, and J. A. Murphy, New Jersey Agricultural Experiment Station, Cook College, Rutgers Univ., New Brunswick, NJ.

ABSTRACT

Field experiments were conducted in 2000 at the Rutgers Plant Science Research Center in Adelphia, NJ and at the Turfgrass Research Facility at Horticultural Farm II in North Brunswick, NJ to evaluate quinclorac for control of large crabgrass (*Digitaria sanguinalis* (L.) Scop.) in newly seeded Kentucky bluegrass (*Poa pratensis* L.'Baron') and creeping bentgrass (*Agrostis palustris* Huds. 'L-93'), respectively. Soil type at Adelphia and North Brunswick was a Holmdel sandy-loam (OM=2%) and a Nixon loam (OM=3%), respectively. Kentucky bluegrass (KBG) was seeded on May 3 and creeping bentgrass was seeded on June 30. Herbicide treatments on KBG plots consisted of PRE applications of siduron at 3 and 6 lbs ai/A; PRE applications of quinclorac at 0.75 and 1.5 lbs ai/A; single early postemergence (EPOST) applications of quinclorac at 0.38, 0.57, 0.75, and 1.5 lbs/A; and sequential postemergence applications of quinclorac at 0.38, 0.57, and 0.75 lbs/A. Single EPOST applications were made on June 5 when large crabgrass was at the 1 to 2 leaf stage. The second application of the sequential treatments was made on July 11 when crabgrass plants had 2 to 3 leaves of regrowth. Herbicide treatments on creeping bentgrass plots consisted of PRE applications of siduron at 3, 4.5, and 6 lbs/A; PRE applications of quinclorac at 0.38, 0.57, 0.75 and 1.5 lbs/A; and single EPOST applications of quinclorac at 0.38, 0.57, 0.75, and 1.5 lbs/A. EPOST applications were made on July 31 when crabgrass was at the 1 to 3 leaf stage. All postemergence applications of quinclorac in both studies included methylated seed oil (1% vol/vol) in the spray solution.

PRE-applied quinclorac at 1.5 and 0.75 lbs/A reduced ground coverage of KBG by 76 and 39%, respectively, at 30 DAT. By 90 DAT, KBG had recovered from the lower rate of quinclorac; however, substantial thinning from the higher rate was still evident. Siduron at 6 lbs/A demonstrated only slight reductions in KBG coverage at 30 DAT. Single EPOST applications of quinclorac at 1.5 lbs/A reduced ground coverage of KBG by 13% at 30 DAT. Turfgrass thinning had not fully recovered from this higher rate by 60 DAT. All PRE applications of quinclorac and siduron provided at least 91% control of large crabgrass at 90 DAT. Single EPOST applications of quinclorac gave greater than 95% control of crabgrass at 30 DAT. Sequential postemergence applications of quinclorac at 0.38 and 0.57 lbs/A improved late summer crabgrass control as compared to single EPOST applications of these rates.

PRE applications of quinclorac at 1.5, 0.75, and 0.38 lbs/A reduced ground coverage of creeping bentgrass by 92, 60, and 24%, respectively, at 30 DAT. Siduron did not reduce bentgrass coverage at 30 DAT. Single EPOST applications of quinclorac at 0.38 to 0.75 lbs/A resulted in 7 to 23% bentgrass chlorosis at 10 DAT. By 30 DAT, no chlorotic symptoms were visible. Control of large crabgrass from PRE-applied quinclorac at 0.38 lbs/A and siduron at 3 lbs/A fell below 80% by 60 DAT. All single EPOST applications of quinclorac provided at least 95% control of crabgrass at 30 DAT.

These studies suggest that PRE-applied quinclorac has the potential to reduce ground coverage of newly emerging stands of Kentucky bluegrass and creeping

bentgrass. In addition, Kentucky bluegrass injury from postemergence applications of quinclorac may be lessened without sacrificing large crabgrass control by applying sequential, lower rate applications instead of a single, higher rate application.

INFLUENCE OF CREEPING BENTGRASS VARIETY ON ANNUAL BLUEGRASS CONTROL PROGRAMS. G. M. Henry, S. E. Hart, and J. A. Murphy, New Jersey Agricultural Experiment Station, Cook College, Rutgers Univ., New Brunswick NJ.

ABSTRACT

Field Experiments were conducted in 2000 at the Rutgers University Experimental Horticultural Farm II located in New Brunswick NJ to evaluate annual bluegrass control programs in 'Penn G-2', 'L-93', and 'Penncross' creeping bentgrass varieties established the previous fall and maintained at a fairway mowing height of 0.34 in. Annual bluegrass control programs consisted of 0.75, 0.5, or 0.38 lb a.i./A of ethofumesate applied on April 2 and May 2, or one application of 0.5 lb/A paclobutrazol applied on May 2. Ethofumesate treatments were reinitiated on September 19 with a sequential application on October 23. Paclobutrazol was also applied on October 23. An additional treatment of 1.5 lb/A of ethofumesate was applied in the fall. All ethofumesate applications were applied with 4.3 lb/A of urea using a CO_2 backpack sprayer delivering 80 GPA.

Annual bluegrass populations in the early spring were at an infestation level of approximately 40-45% across all three bentgrass varieties. Populations in the untreated check plots remained stable at this level throughout the summer and into the fall. On June 22, ethofumesate applied at 0.75 lb/A reduced annual bluegrass populations by 51, 39 and 30% in 'L-93', 'Penn G-2', and 'Penncross', respectively. As the rate of ethofumesate decreased, so did the extent of annual bluegrass population reduction. This was most evident in 'Penncross'. Paclobutrazol reduced annual bluegrass populations by 30 and 27% in 'L-93' and 'Penn G-2', but only by 13% in 'Penncross'. Annual bluegrass populations increased in all treatments across each variety as the season progressed into September.

Herbicide treatments had no effect on turf quality. However, the turf quality of 'Penncross' was lower compared with 'L-93' and 'Penn G-2', especially during the summer months. This can most likely be attributed to the higher incidence of dollar spot disease in 'Penncross'.

The results from the spring treatments suggest that annual bluegrass may be more readily controlled in newer creeping bentgrass varieties such as 'Penn G-2' and 'L-93' compared with 'Penncross'. However, fall treatments have not been fully evaluated.

EFFECTS OF DAZOMET SOIL FUMIGANT ON *Poa annua* SEED GERMINATION. B. S. Park and P. J. Landschoot, Dept. Agron., Penn State Univ., University Park, PA.

ABSTRACT

Dazomet (Basamid® Granular) is a soil fumigant that controls weeds, fungi, and nematodes in soils. Although dazomet is labeled for turfgrass, little is known about its ability to inhibit *P. annua* seed germination, particularly when it is surface-applied. This study determined the effects of different rates of surface-applied dazomet and covering treated areas with plastic sheets on *P. annua* seed germination. Treatments consisted of dazomet applied at 347, 303, 260, and 173 lbs ai/A and glyphosate (Roundup PRO®) applied at of 3 lbs ai/A. One set of these treatments was covered with clear plastic sheets and another set was not covered. Results from 1999 and 2000 demonstrated that covering dazomet-treated plots with plastic reduced *P. annua* seed germination relative to non-covered plots. There were no differences in *P. annua* counts among the different rates of dazomet when covered with plastic sheets. However, differences did occur among dazomet treatments in 2000 for non-covered plots, with lower rates yielding higher seedling counts. *Poa annua* counts were greater for glyphosate treatments than dazomet treatments and there was no difference in counts between covered and non-covered glyphosate treatments.

GROWTH REGULATION IN BENTGRASS AS INFLUENCED BY TRINEXAPAC-ETHYL AND A BIOSTIMULANT.

J. E. Kaminski, Grad. Res. Asst., and P. H. Dernoeden, Prof., Dept. of Natural Resource Sciences & LA, Univ.of Maryland, College Park, MD 20742.

ABSTRACT

Golf course superintendents routinely apply trinexapac-ethyl (TE) to putting greens to suppress clippings and improve green speed. The biostimulant Astron® (Floratine Products Group, Inc., Collierville, TN) is used on greens to improve turf vigor in the summer. Trinexapac-ethyl inhibits growth by suppressing gibberellic acid (GA) synthesis in plants. Astron contains some micronutrients and an unspecified amount and source of GA, which may influence the growth regulation effects of TE. The objectives of this study were to assess any potential positive or negative TE and Astron interactions. Astron and TE were applied to 'Providence' creeping bentgrass (*Agrostis palustris* Huds.) grown on a USGA specified green mix and mowed to a height of 0.20 in. Treatments were applied on the dates footnoted in Table 1. All treatments were applied with a CO_2 pressurized sprayer (35 psi) calibrated to deliver 50 gpa. Plots were generally mowed one to two days after treatment and then again after clipping weights were obtained. Clipping weights were measured by making two passes through each plot with a walkbehind greensmower equipped with a basket. The collected clippings were dried at 50 - 60°C for at least 3 d and reweighed. Turf quality was visually assessed weekly. Plots were 5 x 10 ft and were arranged in a randomized complete block with four replications. Data were subjected to the analysis of variance and significantly different means were separated by LSD t-test $P = 0.05$.

Astron and TE were applied either alone or tank-mixed together on a 14-d interval. A fourth treatment involved TE applied weekly and tank-mixed with Astron on a 14-d interval. Seven days following the first application (21 June), plots treated with TE alone were suppressed more (47%) than plots treated with TE + Astron (29 - 31%). Except on 30 June, Astron reduced the effectiveness of TE in the TE + Astron 14-d treatment between 21 June and 11 Aug. On 6 July, clipping weights were slightly increased in plots treated with TE + Astron (14-d), and these clipping weights were equivalent to those collected from the untreated control. Plots treated with TE alone or TE + Astron on 14-d interval incurred post inhibition growth stimulation by 11 and 25 Aug, respectively. Plots treated with TE weekly + Astron on a 14-d interval exhibited a similar level of growth inhibition when compared to plots treated with TE alone on about half of the rating dates between 21 June and 4 Aug. On 13 and 20 July, however, plots treated with TE weekly + Astron on a 14-d interval exhibited significantly less growth suppression versus plots treated with TE alone and applied on a 14-d interval. Between 21 June and 4 August, the average reduction of clippings as a percent of the control was 43%, 23% and 45% for plots treated with TE alone, TE + Astron on the 14-d interval, and TE weekly + Astron on a 14-d interval; respectively. Hence, there was no dramatic improvement in growth suppression accorded by applying TE weekly and Astron on a 14-d interval, when compared to TE alone on a 14-d interval. Evidently, the GA and possibly the nutrients in Astron reduced the effectiveness of TE applied on a 14-d interval, but (on average) not when TE was applied weekly. Astron alone only improved quality, when compared to untreated plots, on 11 and 18 August. Except during the 11 to 18 July period, however, there was no significant enhancement in quality provided by Astron used in conjunction with TE.

Table 1. Clipping weight as a percent of the untreated control as influenced by trinexapac-ethyl (TE) and Astron, 2000.

	Rate	Spray Interval	Clipping weight (gr plot^{-1})									
Treatment	oz product/1000ft^2	(days)	21 Jun	30 Jun	6 Jul	13 Jul	20 Jul	28 Jul	4 Aug	11 Aug	21 Aug	25 Aug
[x]TE	0.10	14	-47c[z]	-36bc	-36c	-39c	-64e	-53c	-23b	16a	16a	16a
[x]Astron	0.75	14	-2a	2a	23a	7a	9a	1a	-6a	-1bc	-4c	-5c
[x]TE+Astron	0.10 + 0.75	14	-29b	-20b	4b	-23b	-19c	-39b	-35c	-1bc	9ab	14a
[y]TE+Astron	0.10 + 0.75	7 + 14	-31b	-45c	-46c	-16b	-45d	-52d	-50d	-16c	6abc	10ab
Untreated	--	--	0a	0a	0b	0a	0b	0a	0a	0b	0bc	0bc

[x]Treatments were applied 14 and 30 June, and 13 July 2000.
[y]Trinexapac-ethyl was applied weekly on 14, 21, and 30 June, and 6, 13 and 20 July; whereas Astron was applied 14 and 21 June and 6 and 20 July 2000.
[z]Means in a column followed by the same letter are not significantly different at P = 0.05 according to the least significant difference t-test.

RAPIDITY OF GLYPHOSATE RAINFASTNESS ON COOL-SEASON TURFGRASSES. R. B. Taylorson, Adjunct Prof., Dept. Plant Sciences, Univ. of Rhode Island, Kingston, RI 02881.

ABSTRACT

Experiments were conducted in 1999 and 2000 on glyphosate rainfastness in mixed Kentucky bluegrass (Poa pratensis) and fine fescue (Festuca spp.) turfs. In 1999, three formulations of glyphosate were evaluated in a non-replicated strip trial. Glyphosate applications were followed by a period of time for uptake, then given a measured amount (0.1 in.) of simulated rainfall by sprinkler irrigation. Timing of herbicide application was staggered such that all timed treatments terminated when irrigation was begun. The glyphosate formulations were original Roundup, Roundup Pro and Roundup Pro Dry. The liquid formulations were applied at 2% v/v and the dry at 1.3%, all in 48 gpa. Simulated rainfall was applied at 15, 30, 60 and 90 minutes after glyphosate application. A no-rainfall control was covered during irrigation. Percent turfgrass kill 3 weeks after treatment was 95-100% for all timings, but kill was faster when simulated rainfall was applied at 30 or more minutes after herbicide treatment. Differences between formulations were minor.

On July 13, 2000, Roundup Pro Dry at 1.6 and 4.0 oz. ai/gal. was applied in 94 gpa to a fine fescue turf. The plots received 0.1 and 0.2 inches of simulated rainfall at 15, 30 and 60 minutes after herbicide application. No rain controls of the two application rates were also included. The plots were 5 ft. wide by 10 ft. long, replicated four times, and arranged in two separate blocks, one for each rainfall amount. Within each block were the rate and rainfall timing treatments. Separating the blocks were the two no-rainfall controls and buffer strips. As before, applications were staggered so as to terminate simultaneously. Ratings of turf kill were taken over a 56-day period after treatment and used as a measure of rainfastness. Seven days after treatment (DAT), glyphosate at 1.6 oz. and at all rainfall timings displayed less turf damage than the 4.0 oz. rate, although not always statistically significant. Similarly, turf damage increased as timing of rainfall introduction increased from 15 to 60 minutes. At 10, 14 and 21 DAT, all treatments of the 4.0 oz. rate and the rainfall timings of 30 and 60 minutes were statistically similar, with percent kill ratings 90% or better. At 42 DAT however, the 1.6 oz. rate with 0.1 inch irrigation 15 minutes after application was rated only 68% turf kill, significantly less than all other treatments. The marked reduction was due to regrowth. This treatment showed further reduction to 36% turf kill by 56 DAT. Other 1.6 oz. treatments were also showing varying degrees of recovery which were not all significant. Percent turf kill from the 4.0 oz. treatments with rainfall timings of 15, 30 and 60 minutes after application were still in the 90's.

These studies show that glyphosate (Roundup Pro Dry) became rainfast within 30 minutes at the 4.0 oz. rate, but the rainfast period was more variable at the 1.6 oz. rate. These studies suggest glyphosate rainfastness is a function of application rate, the timing and amount of rainfall and the specific plant species.

IR-4 MINOR CROP HERBICIDE REGISTRATION UPDATE. M. Arsenovic, F. P. Salzman, M. P. Braverman, D. L. Kunkel, and J. J. Baron, IR-4 Project, Rutgers, The State University of New Jersey, North Brunscwick, NJ.

ABSTRACT

The IR-4 project is a publicly funded effort to support the registration of pest control products on minor use crops. The year 2000 has been an active year for the IR-4 Project as many petitions have been submitted to the EPA.

To date the petitions submitted to EPA include: carfentrazone on caneberry; clomazone on mint; clopyralid on flax and perennial strawberries, endothal on hop; ethephon on coffee; dicamba plus diflufenzopyr on sweet corn and pasture/rangeland grasses; dimethenamid on root and tuber vegetables (includes sugar beet, potato, sweet potato, and dry bulb onion); fomesafen on dry bean; halosufuron on melon subgroup (including cantaloupe, citron melon, muskmelon and watermelon); pendimethalin on fruiting vegetables (includes tomato and peppers [bell and non-bell]), paraquat on tanier and taro, prometryn on rhubarb; sethoxydim on avocado, basil, fresh herbs, lingonberry, turnip green, tropical fruit; and sulfentrazone on sunflower.

In addition, this year to date, notices of filing have been published in the Federal Register for: clethodim on root vegetables (includes garden beet, carrot, horseradish, radish, and turnip), leaf petiole crops (celery and rhubarb), cucurbit vegetables (includes cantaloupe, watermelon, and summer and winter squash), caneberry, strawberry, and clover for seed; imazamox on legume vegetables (includes guar, snap bean; lima bean, dry bean, succulent pea, and dry pea); paraquat on endive; prometryn on cilantro; and sethoxydim on pistachio and safflower.

A final rule allowing for the registration has beenpublished in the Federal Register for glyphosate in numerous commodities applied pre-emergence, post-emergence directed, hooded in row middles and for halosulfuron on cucumber/squash subgroup (includes Chayote [fruit], Chinese waxgourd, cucumber, gherkin, edible gourd, Momordica spp., pumpkin, summer and winter squash). Through the definition of medicinal crops as non food crops, a label was obtained for glyphosate in several medicinal crops. The status of these and other projects will be updated.

EVALUATION OF SAND STOCKPILES AS SIGNIFICANT SOURCES OF THE SEEDBANK OF CRANBERRY WEEDS.

H. A. Sandler and J. Mason, Univ. of Massachusetts Cranberry Experiment Station, East Wareham, MA; and L. Romaneo, Ocean Spray Cranberries, Inc., Lakeville-Middleboro, MA.

ABSTRACT

Control of weed infestations in new and established cranberry plantings pose significant economic input for the grower. Sand, destined for horticultural or pest management use, is typically stored as piles in the vicinity to the production area. These piles may be utilized annually or left undisturbed for several seasons. Growers have observed that emerging weed populations on recently sanded areas can be associated with different sand sources. These stockpiles may be a significant source allowing (re)introduction of populations of weed seed into the production system.

Sand piles, located on commercial bogs in Southeastern Massachusetts, New Jersey, Wisconsin, and Washington, were sampled quarterly (spring, summer, fall, and winter). Samples were taken from the exterior and one from the interior (~ 3 feet from the exterior) of the pile. The sand was placed into small trays in the greenhouse to allow germination of the seeds present. Seedlings were identified, quantified, and removed from the tray. Species diversity and abundance were determined.

During the first year of the study, over 40 different species of weeds have been identified thus far. Site-to-site differences are apparent; not all stockpiles have significant weed germination while others consistently do. In piles that are heavily infested, samples from the exterior of the pile tend to have more weed seeds that germinate than samples taken from the interior of the pile. Data from the first year will be presented. This study will be continued through the year 2001.

HERBICIDE TREATMENT INFLUENCE ON BERRY COLOR, SIZE, AND YIELD IN CRANBERRIES. O. Ayeni and B. A. Majek, Rutgers University, Bridgeton, NJ.

ABSTRACT

In addition to weed control efficacy, herbicides also affect crop performance qualitatively and quantitatively. Some of these effects may impact crop marketability where consumer preferences are strong for certain qualities. As part of ongoing research to identify more herbicide options for cranberry growers in New Jersey, several herbicides were evaluated in a cranberry bog at the Rutgers Blueberry/Cranberry Research Center, Chatsworth, New Jersey, in 1999 and 2000 to determine their influence on berry color, size and yield. In a randomized complete block design with four replications, herbicide treatments were applied with a CO_2 backpack sprayer (220 l/ha, 145 kPa) to 1.5 by 3m plots of previously established cranberries. In 1999, the first herbicide applications were made in early spring (04/29/99) to dormant cranberry plants (Early Spring Dormancy or ESD applications), and the second applications in late spring (06/09/99) to actively growing plants (Late Spring Active Growth or LSAG applications). Berries were harvested in September 1999 (3 to 5 months after treatment) and September 2000 (15 to 17 months after treatment) and evaluated for color, size, and yield. Berry color was visually rated on a scale of 0 to 100% where 0% means completely green berries and 100% means completely red or crimson berries. The berry size was based on 100-berry weight and berry yield was based on the weight of berries scooped with a manual cranberry harvester from a 42 by 150 cm area at the center of the plot.

At 3 to 5 months after treatment (MAT), 17 of 23 herbicide treatments resulted in berries with more red color (49 to 65% red) than the untreated (= 42% red). Late spring applications promoted red berry color more than ESD applications. At 15 to 17 MAT, only 2 of 23 herbicide treatments, 0.14 kg/ha clethodim and 4.5 kg/ha asulam applied LSAG, resulted in berries with more red color (87 to 88 % red) than the untreated (78% red). At 3 to 5 MAT, ESD application of 4.5 kg/ha simazine, resulted in larger berries (1.15 g/berry) than the untreated (1.05g/berry). The smallest berries (0.86 g/berry) were recorded in 4.5 kg/ha asulam applied LSAG. At 15 to 17 MAT, no herbicide treatment resulted in larger berry size than the untreated (1.27 g/berry) but smaller berry sizes (1.15 to 1.22) than in the untreated were observed in 12 of 23 herbicide treatments. Nine herbicide treatments, four applied ESD and five LSAG, resulted in berry yields (1727 to 2114 g/m^2) that were comparable to the yield from the untreated (2040 g/m^2) at 3 to 5 MAT. Berry yields (723 to 1705 g/m^2) from 14 herbicide treatments were lower than the yield from the untreated. At 15 to 17 MAT, berry yields (2318 to 2673 g/m^2) from nine herbicide treatments, five applied ESD and four LSAG, were higher than the yield from the untreated plot (1895 g/m^2). The yields (1581 to 2264 g/m^2) from 14 herbicide treatments were comparable to the yield from the untreated. The average data for 1999 and 2000 showed that LSAG applications of asulam, clopyralid, triasulfuron, and clethodim (0.14 kg/ha) reduced berry yield while other herbicide treatments had no effect on yield (see Tables 1 to 7).

This study showed that herbicides have both short- and long-term influences on cranberry performance, which might be considered along with weed control efficacy results when making recommendation to growers.

Table 1. Herbicide treatment influence on berry color in cranberries in 1999 (3-5 months after treatment).

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	Berry Color (%Red)[2]
1	Clopyralid	0.3	Stinger 3SL	LSAG	65 a
2	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	64 ab
3	Quinclorac	0.6	Impact 75WG + NIS	LSAG	63 ab
4	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	63 ab
5	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	60 abc
6	Quinclorac	0.6	Impact 75WG	ESD	59 abcd
7	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	58 bcd
8	Napropamide	9.0	Devrinol 50DF (WG)	ESD	58 bcd
9	Tribenuron	0.02	Express 75WG + NIS	LSAG	55 cde
10	Asulam	2.2	Asulox 3.34SL	ESD	53 de
11	Dichlobenil	3.4	Casoron 4G (GR)	ESD	53 de
12	Dichlobenil	1.7	Casoron MC	ESD	51 ef
13	Dichlobenil	3.4	Casoron MC	ESD	51 ef
14	Asulam	4.5	Asulox 3.34SL	LSAG	50 ef
15	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	50 ef
16	Tribenuron	0.01	Express 75WG + NIS	LSAG	50 ef
17	Norflurazon	4.5	Solicam DF (80WG)	ESD	49 efg
18	Asulam	4.5	Asulox 3.34SL	ESD	46 fgh
19	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	46 fgh
20	Pronamide	3.4	Kerb 50-W (WP)	ESD	43 gh
21	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	43 gh
22	Untreated	----	----	----	42 h
23	Simazine	4.5	Princep 4L (SC)	ESD	42 h
24	Asulam	2.2	Asulox 3.34SL	LSAG	41 h

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 2. Herbicide treatment influence on berry color in cranberries in 2000 (15- 17 months after treatment).

Position (Descend-ing order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	Berry Color (%Red)[2]
1	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	88 a
2	Asulam	4.5	Asulox 3.34SL	LSAG	87 ab
3	Norflurazon	4.5	Solicam DF (80WG)	ESD	83 abc
4	Dichlobenil	1.7	Casoron MC	ESD	81 abc
5	Dichlobenil	3.4	Casoron MC	ESD	81 abc
6	Triflusulfuron	0.07	Upbeet 50DF +NIS	LSAG	81 abc
7	Asulam	2.2	Asulox 3.34SL	LSAG	80 abc
8	Napropamide	9.0	Devrinol 50DF (WG)	ESD	80 abc
9	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	80 abc
10	Pronamide	3.4	Kerb 50-W (WP)	ESD	80 abc
11	Quinclorac	0.6	Impact 75WG + NIS	LSAG	80 abc
12	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	80 abc
13	Asulam	2.2	Asulox 3.34SL	ESD	79 bcd
14	Asulam	4.5	Asulox 3.34SL	ESD	79 bcd
15	Dichlobenil	3.4	Casoron 4G (GR)	ESD	79 bcd
16	Quinclorac	0.6	Impact 75WG	ESD	79 bcd
17	Untreated	----	----	----	78 cd
18	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	78 cd
19	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	78 cd
20	Clopyralid	0.3	Stinger 3SL	LSAG	78 cd
21	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	78 cd
22	Tribenuron	0.02	Express 75WG + NIS	LSAG	78 cd
23	Simazine	4.5	Princep 4L (SC)	ESD	76 cd
24	Tribenuron	0.01	Express 75WG + NIS	LSAG	71 d

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 3. Herbicide treatment influence on berry size in cranberries in 1999 (3-5 months after treatment).

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	100-berry wt. (g)[2]
1	Simazine	4.5	Princep 4L (SC)	ESD	115 a
2	Dichlobenil	1.7	Casoron MC	ESD	111 ab
3	Pronamide	3.4	Kerb 50-W (WP)	ESD	110 ab
4	Dichlobenil	3.4	Casoron MC	ESD	109 abc
5	Dichlobenil	3.4	Casoron 4G (GR)	ESD	108 bcd
6	Clopyralid	0.3	Stinger 3SL	LSAG	106 bcde
7	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	106 bcde
8	Untreated	----	----	----	105 bcde
9	Asulam	4.5	Asulox 3.34SL	ESD	105 bcde
10	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	105 bcde
11	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	103 cdef
12	Quinclorac	0.6	Impact 75WG	ESD	103 cdef
13	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	103 cdef
14	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	102 def
15	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	101 efg
16	Tribenuron	0.01	Express 75WG + NIS	LSAG	101efg
17	Norflurazon	4.5	Solicam DF (80WG)	ESD	100 efg
18	Quinclorac	0.6	Impact 75WG + NIS	LSAG	100 efg
19	Asulam	2.2	Asulox 3.34SL	LSAG	98 fgh
20	Nicosulfuron	0.07	Accent 75WG	LSAG	98 fgh
21	Asulam	2.2	Asulox 3.34SL	ESD	97 fgh
22	Napropamide	9.0	Devrinol 50DF (WG)	ESD	95 gh
23	Tribenuron	0.02	Express 75WG + NIS	ESD	93 h
24	Asulam	4.5	Asulox 3.34SL	LSAG	86 i

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 4. Herbicide treatment influence on berry size in cranberries in 2000 (15-17 months after treatment).

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	100-berry wt. (g)[2]
1	Quinclorac	0.6	Impact 75WG	ESD	131 a
2	Asulam	4.5	Asulam 3.34SL	ESD	129 ab
3	Tribenuron	0.02	Express 75WG	LSAG	128 abc
4	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	128 abc
5	Untreated	----	----	----	127 abc
6	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	127 abc
7	Dichlobenil	3.4	Casoron 4G (GR)	ESD	127 abc
8	Pronamide	3.4	Kerb 50-W (WP)	ESD	127 abc
9	Dichlobenil	3.4	Casoron MC	ESD	126 bcd
10	Asulam	2.2	Asulox 3.34SL	ESD	125 bcde
11	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	125 bcde
12	Simazine	4.5	Princep 4L (SC)	ESD	124 cde
13	Asulam	4.5	Asulox 3.34SL	LSAG	122 def
14	Clopyralid	0.3	Stinger 3SL	LSAG	122 def
15	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	122 def
16	Tribenuron	0.01	Express 75WG + NIS	LSAG	122 def
17	Asulam	2.2	Asulox 3.34SL	LSAG	121 efg
18	Dichlobenil	1.7	Casoron MC	ESD	121 efg
19	Norflurazon	4.5	Solicam DF (80WG)	ESD	119 fgh
20	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	117 gh
21	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	116 h
22	Napropamide	9.0	Devrinol 50DF (WG)	ESD	116 h
23	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	116 h
24	Quinclorac	0.6	Impact 75WG + NIS	LSAG	115 h

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 5. Herbicide treatment influence on berry yield in cranberries in 1999 (3-5 months after treatment).

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	Berry yield (g/m^2)[2]
1	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	2114 a
2	Untreated	----	----	----	2040 ab
3	Quinclorac	0.6	Impact 75WG + NIS	LSAG	1991 abc
4	Simazine	4.5	Princep 4L (SC)	ESD	1918 abcd
5	Dichlobenil	1.7	Casoron MC	ESD	1846 abcde
6	Quinclorac	0.6	Impact 75WG	ESD	1832 abcde
7	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	1777 bcdef
8	Dichlobenil	3.4	Casoron 4G (GR)	ESD	1745 bcdefg
9	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	1741 bcdefg
10	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	1727 bcdefg
11	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	1705 cdefg
12	Norflurazon	4.5	Solicam DF (80WG)	ESD	1700 cdefg
13	Clopyralid	0.3	Stinger 3SL	LSAG	1677 cdefg
14	Asulam	2.2	Asulox 3.34SL	ESD	1673 cdefg
15	Napropamide	9.0	Devrinol 50DF (WG)	ESD	1659 defg
16	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	1564 efgh
17	Pronamide	3.4	Kerb 50-W (WP)	ESD	1495 fghi
18	Asulam	2.2	Asulox 3.34SL	LSAG	1436 ghi
19	Asulam	4.5	Asulox 3.34SL	ESD	1314 hi
20	Dichlobenil	3.4	Casoron MC	ESD	1282 hi
21	Tribenuron	0.02	Express 75WG + NIS	LSAG	1205 ij
22	Triasulfuron	0.03	Matrix 25G + NIS	LSAG	886 jk
23	Tribenuron	0.01	Express 75WG + NIS	LSAG	859 k
24	Asulam	4.5	Asulox 3.34SL	LSAG	723 k

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 6. Herbicide treatment influence on berry yield in cranberries in 2000 (15-17 months after treatment)

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	Berry yield (g/m^2)[2]
1	Tribenuron	0.01	Express 75WG + NIS	LSAG	2673 a
2	Tribenuron	0.02	Express 75WG + NIS	LSAG	2523 ab
3	Dichlobenil	3.4	Casoron MC	ESD	2468 abc
4	Asulam	4.5	Asulox 3.34SL	ESD	2455 abc
5	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	2386 abc
6	Napropamide	9.0	Devrinol 50DF (WG)	ESD	2386 abc
7	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	2373 abc
8	Pronamide	3.4	Kerb 50-W (WP)	ESD	2318 abcd
9	Simazine	4.5	Princep 4L (SL)	ESD	2318 abcd
10	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	2264 bcde
11	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	2222 bcde
12	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	2168 bcdef
13	Norflurazon	4.5	Solicam DF (80WG)	ESD	2168 bcdef
14	Dichlobenil	1.7	Casoron MC	ESD	2100 cdefg
15	Quinclorac	0.6	Impact 75WG + NIS	LSAG	1991 defg
16	Quinclorac	0.6	Impact 75WG	ESD	1977 defgh
17	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	1964 defgh
18	Untreated	----	----	----	1895 efghi
19	Dichlobenil	3.4	Casoron 4G (GR)	ESD	1841 fghi
20	Asulam	2.2	Asulox 3.34SL	ESD	1786 ghi
21	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	1773 ghi
22	Asulam	4.5	Asulox 3.34SL	LSAG	1759 ghi
23	Asulam	2.2	Asulox 3.34SL	LSAG	1609 hi
24	Clopyralid	0.3	Stinger 3SL	LSAG	1581 i

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

Table 7. Herbicide treatment influence on berry yield in cranberries (Average for 1999 and 2000 harvests)

Position (Descending order)	Herbicide	Rate (kg/ha)	Formulation	Timing[1]	Berry yield (g/m^2)[2]
1	Nicosulfuron	0.07	Accent 75WG + NIS	LSAG	2243 a
2	Simazine	4.5	Princep 4L (SL)	ESD	2118 ab
3	Napropamide	9.0	Devrinol 50DF (WG)	ESD	2023 abc
4	Pronamide	3.4	Kerb 50-W (WP)	ESD	2022 abc
5	Rimsulfuron	0.03	Matrix 25G + NIS	LSAG	1996 abc
6	Quinclorac	0.6	Impact 75WG + NIS	LSAG	1991 abc
7	Chlorimuron	0.02	Classic 25WG + NIS	LSAG	1975 abc
8	Dichlobenil	1.7	Casoron MC	ESD	1973 abc
9	Untreated	----	----	----	1968 abc
10	Clethodim	0.4	Select 2EC + Oil Conc	LSAG	1937 abcd
11	Norflurazon	4.5	Solicam DF (80WG)	ESD	1934 abcd
12	Quinclorac	0.6	Impact 75WG	ESD	1905 bcd
13	Tribenuron	0.02	Express 75WG + NIS	LSAG	1903 bcd
14	Asulam	4.5	Asulox 3.34SL	ESD	1900 bcd
15	Dichlobenil	3.4	Casoron MC	ESD	1875 bcde
16	Triflusulfuron	0.07	Upbeet 50DF + NIS	LSAG	1853 bcde
17	Dichlobenil	3.4	Casoron 4G (GR)	ESD	1793 bcdef
18	Tribenuron	0.01	Express 75 WG + NIS	LSAG	1766 cdef
19	Asulam	2.2	Asulox 3.34SL	ESD	1729 cdef
20	Clopyralid	0.3	Stinger 3SL	LSAG	1629 def
21	Triasulfuron	0.06	Amber 75WG + NIS	LSAG	1554 efg
22	Asulam	2.2	Asulox 3.34SL	LSAG	1523 fg
23	Clethodim	0.14	Select 2EC + Oil Conc	LSAG	1475 fg
24	Asulam	4.5	Asulox 3.34SL	LSAG	1241 g

[1]ESD denotes early spring application at dormancy, LSAG means late spring application during active growth.
[2]Within column, figures followed by similar letters are not significantly different (DMRT, $P \leq 0.05$).

NEW HERBICIDES FOR BEANS: TRIAL AND ERROR. R. Bellinder and A. Miller, Dept. of Hort., Cornell University, Ithaca, NY.

ABSTRACT

Several new and old herbicides were evaluated for potential use in snap and dry beans in ten trials (6 snap beans, 4 dry beans) conducted on-farm and at the H.C. Thompson Vegetable Research Farm in Freeville, NY in 2000. Preemergence herbicides were: fomesafen (0.25, 0.32 lb ai/A), flumioxazin (0.032, 0.044 lb ai), isoxaben (0.125, 0.25 lb ai), pyrithiobac (0.02 lb ai), halosulfuron (0.032 lb ai), prometryn (1.0 lb ai), bispyribac (0.016 lb ai), oxasulfuron (0.06 lb ai), imazamox (0.032, 0.064 lb ai–dry beans only) and azafenidin (0.03, 0.05, 0.07 lb ai). Postemergence herbicides were: flufenpyr (0.01, 0.02 lb ai) and pyrithiobac (0.02, 0.03, 0.04 lb ai). Stand losses at the Freeville site occurred with flumioxazin (10%, snap beans only), isoxaben (20-30%), and azafenidin (50-80%). Across all trials, preemergence appplications of flumioxazin, pyrithiobac, oxasulfuron, and azafenidin consistently caused greater than 15% stunting, than the other herbicides. However, rainfall in June had a significant impact on crop tolerance, particularly in snap bean trials conducted at the Freeville site. These beans were planted on 6/8 and 5 days later recieved 1.7 in of rain one day before crop emergence. Dry beans were planted on 6/15 and again, 5 days later recieved 0.8 in of rain. Temperatures were similar throughout the 2wk period. The difference in degree of injury was 73 vs 30% (flumioxazin), 30 vs 22% (pyrithiobac), 33 vs 10% (oxasulfuron), and 63 vs 25% (azafenidin) for snap and dry beans, respectively. Broadleaf weed control (Amare, Abuth, Cheal, Ambel, Polco, Polpe) varied with site and weather conditions, but tended to be inadequate or marginal with all of the preemergence herbicides except flumioxazin and fomesafen (0.32 lb). Yields of both beans were reduced, largely due to lack of weed control, with prometryn, bispyribac and pyrithiobac. Injury combined with lack of weed control contributed to yield reductions with isoxaben, azafenidin, and oxasulfuron (0.044 lb, snap beans only). Postemergence applications of flufenpyr and pyrithiobac were compared to bentazon (0.5 lb ai) + fomesafen (0.16 lb ai). A low rate of s-metolachlor was applied to control grass weeds. Pyrithiobac caused significant but transitory chlorosis 6 DAT. Both 6 and 31 DAT, the degree of stunting observed with both of the new postemergence herbicides was equivalent (13-20 and 8-15%, respectively). Broadleaf weed control was less than adequate with both herbicides, regardless of rate, yet despite this, yields were reduced only in one on-farm dry bean trial.

EVALUATING FOMESAFEN CONTROL OF COMMON RAGWEED IN BEANS WHEN CONSIDERING CARRYOVER POTENTIAL. B. Rauch, R. Bellinder, and A. Miller, Dept. of Hort., Cornell Univ., Ithaca, NY.

ABSTRACT

In order to reduce the fomesafen sweet corn crop rotation restriction from 18 to10 months in New York, a series of studies were designed to demonstrate the efficacy and lack of carryover potential with multiple applications of low rates (0.04, 0,08, 0.16, and 0.32 lb ai). Control of common ragweed (*Ambrosia artemisiifolia*) was evaluated in one greenhouse and two field trials. Soil persistence studies were begun in 1999 and repeated in 2000. Treatments, in the soil persistence trials, were applied at times representing the 1-3 trifoliate and prebloom stages of snap and dry beans when planted in early June. In the 1999 efficacy trial, treatments were applied 2 and 6 wk after ragweed emergence. In 2000, the first application was made 2 wk after emergence and the second was made on an "as needed basis". In the greenhouse trial, all rates were evaluated preemergence and at the cotyledon to 2, 2 to 4, and 4 to 6 leaf stages. The 1999 season was extremely hot and dry whereas the 2000 season was the opposite. Ragweed control was generally better in 1999. Treatments in 1999 having greater than 90% control, in late August, were 0.08 + 0.08, 0.16 (EPOST), 0.16 + 0.16, and 0.32 (EPOST) lb ai. In 2000, in addition to the last 2 treatments listed above, 0.16 + 0.08, and 0.08 + 0.16 lb ai provided 90% or better control. In the dose-response trial, greater than 90% control of ragweed, at all growth stages, was achieved with rates of 0.08 lb ai or higher. Soil persistence trials had fomesafen applied to a ragweed canopy (1999) and to bare soil (2000). In 1999, Soil was sampled 2, 3, 5, 9, and 13 months after the last application. Wild mustard (*Brassica kaber*) was used in a bioassay with soil from each field plot. Emergence, visual injury ratings and dry weight data were collected. Visual injury decreased 75% and 65% by spring 2000 for single and double applications, respectively. Double application treatments were variable. Future research is planned to determine the response of wild mustard and sweet corn, to known concentrations of fomesafen. Effects of soil organic matter content on bioavailability will also be evaluated.

WEED MANAGEMENT IN SNAP BEAN WITH FOMESAFEN. W. A. Bailey, H. P. Wilson, and T. E. Hines, Virginia Tech Univ., Painter, VA.

ABSTRACT

Snap bean (*Phaseolus vulgaris* L.) production is significant in eastern regions of the U. S. Virginia ranks seventh in fresh market snap bean production with 4500 acres harvested in 1999 at a value of $2,565,000. Snap bean yields are often significantly reduced by weed interference. The lack of residual herbicides for broadleaf weed control in snap bean increases the need for cultivation and/or postemergence (POST) herbicide applications. Bentazon is a non-residual POST herbicide registered for use in snap bean for control of several broadleaf weeds including common lambsquarters (*Chenopodium album* L.) and velvetleaf (*Abutilon theophrasti* Medic.), but is ineffective on pigweed species (*Amaranthus* spp.). Fomesafen is a diphenylether herbicide registered for POST use in soybean and is currently used in snap bean under a Section 18 Emergency Use Permit. Fomesafen provides residual control of several broadleaf species including common ragweed (*Ambrosia artemisiifolia* L.), certain nightshade species, and pigweed species.

Field experiments were conducted in 1995 to 2000 to evaluate weed control and snap bean response to POST applications of fomesafen. Study design in each year was a randomized complete block with three replications. Metolachlor (0.75 lb ai/A) was applied preemergence (PRE) to all plots. Treatments included fomesafen POST at 0.063, 0.125, 0.19, 0.25, 0.31, and 0.38 lb ai/A, bentazon POST at 0.25 and 0.5 lb ai/A, combinations of fomesafen plus bentazon at 0.19 plus 0.25 or 0.25 plus 0.5 lb/A, respectively, and metolachlor PRE alone. All POST applications were made to 1 to 2 trifoliolate snap bean 2 to 3 wk after planting. Snap bean injury and weed control were visually estimated approximately 1 and 2 to 3 wk after POST application, respectively.

Snap bean injury generally increased with increasing rates of fomesafen from 9% with 0.063 lb/A to 23% with 0.38 lb/A, and increased to 29 to 32% with combinations of fomesafen plus bentazon. Control of morningglory species (*Ipomoea* spp.) also generally increased with increasing rates of fomesafen, ranging from 77% (0.063 lb/A) to 97% (0.38 lb/A). Morningglory and common lambsquarters control from fomesafen at 0.31 or 0.38 lb/A was comparable to control from fomesafen plus bentazon combinations or bentazon alone. Smooth pigweed and common ragweed control from all rates of fomesafen were comparable to combinations of fomesafen plus bentazon and significantly better than bentazon alone. Jimsonweed (*Datura stramonium* L.) control was at least 98% with all POST herbicides. Snap bean yields from POST herbicide treatments generally ranged from 5600 to 8100 lb/A and were significantly higher than yields from metolachlor alone.

NAPHTHALIC ANHYDRIDE INHIBITS HYPOCOTYL ELONGATION IN CUCURBIT SEEDLINGS. A. O. Ayeni and B. A. Majek, Rutgers Univ., Bridgeton, NJ.

ABSTRACT

Cucurbit growers in the Mid-Atlantic region lose a substantial percentage of transplanted seedlings annually to wind whipping in the early spring due to high susceptibility of seedlings to lodging. Naphthalic anhydride (NA, commercially available as Advantage) which was previously evaluated as a herbicide safener and found to be ineffective, was tested at the Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey, to determine its influence as a growth regulator on hypocotyl length in cucurbit seedlings. The seeds of cantaloupe (cv. Delicious 51), cucumber (cv. Straight 8), summer squash (Zucchini, cv. Black Beauty), and watermelon (cv. Crimson Sweet) were dipped inside 0, 0.5, 1.0, 2.0, and 4.0% NA solutions for one minute and air-dried before planting. For each NA concentration, 96 seedlings were raised in two 48-cell flats set up in a completely randomized design and observed for 21 to 28 days under greenhouse conditions set at 28 to 32C and 16-hr light.

Seedling emergence was excellent in all the cucurbits but the order of the rate of emergence was 0.5%>0%=1%>2%>4% NA-treated seed. Measurements from ground level at 21 (for summer squash and cucumber) or 28 (for cantaloupe and watermelon) days after planting showed that dipping the cucurbit seed inside 0.5% NA solution did not inhibit hypocotyl length, but inhibition occurred at higher NA concentrations (Table 1). Cucumber and watermelon were equally sensitive to NA treatment and hypocotyl inhibition ranged from an average 30% at 1% NA treatment to an average 79% at 4% NA treatment. Cantaloupe showed moderate sensitivity of 14 to 37% hypocotyl inhibitions with 1 to 4% NA treatments. Summer squash hypocotyl length was least sensitive to NA treatment showing a 3 to 14% inhibition when seeds were dipped inside 1 to 4% NA solutions. For practical purposes a 1 to 2% NA solution was found to be adequate for hypocotyl inhibition to minimize the damaging effects of wind whipping in the cucurbits investigated.

Compared to the untreated control or the 0.5% NA treatment, seedling removal from cells for field transplanting was easier at 21 (for summer squash and cucumber) or 28 (for cantaloupe and watermelon) days after planting when seeds were dipped inside 1 to 4% NA solutions at planting. This suggested that seed dip in $\geq$ 1% NA solution enhanced root development and facilitated growth medium binding. Further studies are planned to confirm this hypothesis.

Table 1. Hypocotyl length in cucurbit seedlings (average of 96 plants) as influenced by seed treatment with naphthalic anhydride (Advantage).

Cucurbit plant	Naphthalic anhydride solution (%)				
	0.0	0.5	1.0	2.0	4.0
	---------- hypocotyl length (cm)[1] ----------				
Cantaloupe[3]	7.6 a	7.9 a	6.5 b	6.2 b	4.8 c
Cucumber[2]	14.7 a	15.2 a	10.3 b	5.4 c	4.2 c
Summer squash[2]	3.5 a	3.5 a	3.4 a	3.0 b	3.1 b
Watermelon[3]	10.8 a	11.1 a	6.7 b	4.3 c	3.5 c

[1]Within row, figures followed by a similar letter are not significantly different (Fisher's $LSD_{0.05}$)
[2]Measurements taken 21 days after planting
[3]Measurements taken 28 days after planting

INFLUENCE OF SEED TREATMENT WITH NAPHTHALIC ANHYDRIDE ON YIELD IN CUCURBITS. A. O. Ayeni and B. A. Majek, Rutgers Univ., Bridgeton, NJ.

ABSTRACT

Previous investigations showed that naphthalic anhydride (NA), developed for the market as a herbicide safener, inhibits hypocotyl elongation in cucurbit seedlings and therefore may be used by growers to minimize damage to transplanted seedlings caused by wind whipping in the early spring. Four separate studies were carried out in the field at the Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey, to determine the influence of seed treatment with NA on the performance of cantaloupe (cv. Delicious 51), cucumber (cv. Straight 8), summer squash (Zucchini, cv. Black Beauty), and watermelon (cv. Crimson Sweet). Cucurbit seedlings were raised in 48-cell flats in the greenhouse (28 to 32C, 16-hr light) from seeds that were dipped in 0, 0.5, 1, 2, and 4% NA solutions for one minute and air-dried before planting. Transplanting was done between the last week of May and first week of June 2000. Cucumber and summer squash seedlings were transplanted into black plastic mulch in the field 21 days after planting (DAP) while cantaloupe and watermelon seedlings were transplanted 28 DAP. The studies were laid out in four randomized complete blocks. The results presented were based on ten rounds of fruit harvest for cucumber and summer squash, three rounds for cantaloupe and two for watermelon. Cucumber and summer squash were harvested every 48 to 72 hours over four and three weeks, respectively. Cantaloupe harvesting was done over two weeks and watermelon over three weeks.

No stand losses were recorded for the cucurbits due to the absence of strong winds at and after transplanting. The results showed that seed treatment with 0.5% NA solution reduced fruit yield and number in cantaloupe, cucumber, and summer squash. However, the fruit yield and number were comparable to the untreated control when seed was treated with $\geq$ 1% NA solution (Tables 1 and 2). Watermelon fruit yield increased in proportion to the level of NA in the seed treatment (Table 1). Fruit number was highest in watermelon raised from 0.5% NA-treated seed (Table 2). Seed treatment with NA had no effect on the fruit size in cantaloupe, cucumber and summer squash, but the fruit size increased in the watermelon raised from $\geq$1% NA-treated seed (Table 3).

This study demonstrated the potential influence on cucurbit performance of seed treatment with NA solution at different concentrations. Naphthalic anhydride at $\geq$ 1% apparently promoted root development but inhibited hypocotyl length in cucurbits. These growth-regulating effects seemed to promote fast establishment in watermelon at transplanting and the exploitation of soil resources better than the untreated plant. This advantage did not seem pronounced in the other cucurbits, but other studies showed the inhibitory effects of NA on hypocotyl elongation which has the capacity to reduce wind whipping damage in early spring plantings in the Mid-Atlantic region.

Table 1. Naphthalic anhydride seed treatment influence on fruit yield in cucurbits

Seed treatment (% NA solution)[1]	Cucurbit plant			
	Cantaloupe	Cucumber	Summer squash	Watermelon
	Fruit yield per plot (kg)[2]			
0	44 ab	61 ab	17 b	130 d
0.5	38 c	53 d	15 c	137 c
1	42 bc	56 cd	16 bc	147 b
2	44 ab	60 bc	19 a	150 b
4	46 a	64 a	17 b	168 a

[1]Seed was dipped inside naphthalic anhydride (NA) solution for one minute and air-dried before planting in the nursery and later transplanted into black plastic mulch in the field.
[2]Within column, figures followed by similar letters are not significantly different (Fisher's $LSD_{0.05}$)

Table 2. Naphthalic anhydride seed treatment influence on fruit number in cucurbits

Seed treatment (% NA solution)[1]	Cucurbit plant			
	Cantaloupe	Cucumber	Summer squash	Watermelon
	Fruit number per plot[2]			
0	54 ab	210 c	61 ab	16 b
0.5	47 c	188 d	56 c	18 a
1	52 bc	201 c	60 bc	17 ab
2	55 ab	218 b	64 a	16 b
4	57 a	232 a	61 ab	17 ab

[1]Seed was dipped inside naphthalic anhydride (NA) solution for one minute and air-dried before planting in the nursery and later transplanted into black plastic mulch in the field.
[2]Within column, figures followed by similar letters are not significantly different (Fisher's $LSD_{0.05}$)

Table 3. Naphthalic anhydride seed treatment influence on weight per fruit in cucurbits

Seed treatment (% NA solution)[1]	Cucurbit plant			
	Cantaloupe	Cucumber	Summer squash	Watermelon
	------------------------------Weight per fruit (g) ------------------------------			
0	800	291	273	8100
0.5	800	284	267	7600
1	797	279	268	8600
2	796	274	297	9400
4	799	277	282	9900
LSD (0.05)	ns[2]	ns	ns	330.0

[1]Seed was dipped inside naphthalic anhydride (NA) solution for one minute and air-dried before planting in the nursery and later transplanted into black plastic mulch in the field.
[2]ns denotes no significant difference.

GRAPE CULTIVAR RESPONSE TO OFF-TARGET APPLICATIONS OF 2,4-D AND ANALOGOUS HERBICIDES. A. F. Senesac, Cornell Coop. Extn. of Suffolk County, Riverhead, NY.

ABSTRACT

It has been well documented that grapes (*Vitis vinifera* L.) are extraordinarily sensitive to injury from 2,4-D and other growth hormone regulating herbicides. This sensitivity can have serious ramifications in growing areas like eastern Long Island where sod and sweet corn are often grown in near proximity to vineyards. In 1999, casual observations in the research vineyard at the Long Island Horticultural Research and Extension Center suggested that some of the rootstocks that are commercially available may even be more sensitive to injury than the fruiting scion cultivars.

Studies were conducted in the greenhouse to determine the relative sensitivities several rootstocks and scions to simulated drift and vapor exposure of six commonly used growth regulating herbicides. The rootstocks evaluated were: *101-14* (RipariaXRupestris), *3309* (RipariaXRupestris) and *Riparia Gloire*. The scions were:, *Cabernet sauvignon* (UCD clones 6 and 7), *Cabernet franc* UCD clone 1, *Chardonnay* UCD clone 5, *Merlot* UCD clone 1, *Petite verdot* UCD clone 2, and *Malbec* UCD clone 4. The dormant stem tissue was pruned in November, 1999. After cold storage in moistened perlite at 40°F, the stems were cut to 3 nodes which were planted in 4" pots and placed under high pressure sodium vapor artificial lighting for 12 hours daily. Treatments were applied several weeks later when 2 to 4 leaves had expanded. The treatments consisted of over-the-top applications six herbicides diluted to the equivalent of 0.25, 0.025, or 0.01 of the labeled use rate for weed control in turf. The herbicides evaluated were: Trimec Classic (2,4-D/MCPP/dicamba), 2,4-D, clopyralid, dicamba, Chaser (triclopyr/2,4-D) and halosulfuron. In a separate study, plants were enclosed in a plastic dome for 15 minutes in the presence of an open beaker containing 250 ml solutions of 1, 10 or 100 PPM concentrations of each herbicide. Following the exposure, the plants were grown for several weeks during which plant injury ratings were periodically recorded. Shoot dry weights were recorded at the end of each study.

Although there was severe injury at the highest rate tested, at the lower rates, results indicate the herbicides can be ranked as follows from most to least injurious: Chaser, 2,4-D, Trimec, dicamba, clopyralid and halosulfuron. Rootstock 3300-09 was the most sensitive whereas, the scions *Petite verdot, Chardonnay* and *Cabernet franc* were the three most tolerant. Although some foliar injury was observed after exposure to the vapors, little or no effect was observed when dry weights were measured. The results indicate that while at higher rates, all cultivars showed severe symptoms, at very lowest rates of exposure, there are detectable differences in tolerance to these herbicides among several rootstocks and cultivars.

WEED CONTROL IN APPLES AND GRAPES WITH AZAFENIDIN. J. F. Derr, Virginia Tech, Virginia Beach, VA.

ABSTRACT

There currently are a limited number of herbicides available for use in orchards and vineyards. Experiments were conducted in newly-planted and established apples (*Malus domestica* Borkh) and grapes (*Vitis vinifera* L.) to determine efficacy of azafenidin applied preemergence. A postemergence herbicide was added to azafenidin treatments to control existing vegetation.

In apples, azafenidin was applied in spring to newly-planted 'Ramey York' and 'Fuji' and bearing 'Red Delicious' apple trees at rates ranging from 0.25 to 1.5 lb ai/A. Single and repeat applications were investigated. No crop injury was observed. Azafenidin was applied to newly-planted 'Cabernet Sauvignon' grapes at 0.25 to 1.5 lb/A in May. Treatments were reapplied in July. At 18 days after the first application, stunting of grapes was observed at 0.75 and 1.5 lb/A, but the crop outgrew the injury. When evaluated in September, no crop injury was observed in grapes treated twice with azafenidin at 0.75 lb/A or lower rates. Approximately 10% reduction in vigor was observed with 2 applications of azafenidin at 1.5 lb/A. Azafenidin was applied at 0.25 to 0.5 lb/A in April to a one year old planting of 'Vidal' grapes. No crop injury was observed in this study.

When evaluated six weeks after application, azafenidin at 0.25 lb/A provided excellent control of velvetleaf (*Abutilon theophrasti* Medicus), prickly sida (*Sida spinosa* L.), and common ragweed (*Ambrosia artemisiifolia* L.). Rates of 0.5 lb/A or higher were required to achieve good (>80%) control of a mixture of pitted (*Ipomoea lacunosa* L.) and ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.]. Yellow nutsedge (*Cyperus esculentus* L.) was suppressed 35 and 68% at 0.75 and 1.5 lb/A, respectively. Azafenidin did not control poison ivy [*Toxicodendron radicans* (L.) Ktze], horsenettle (*Solanum carolinense* L.), or bermudagrass [*Cynodon dactylon* (L.) Pers.]. At 3 weeks after treatment, azafenidin at 0.75 and 1.5 lb/A applied with 2,4-D suppressed tall fescue (*Festuca arundinacea* Schreb.) by 43%. When azafenidin was applied with glyphosate, excellent control of tall fescue was seen. At one month after treatment, all rates of azafenidin providing 89% or higher control of large crabgrass [*Digitaria sanguinalis* (L.) Scop.], although control appeared to decrease in one study by 6 WAT. At 13 weeks after treatment, azafenidin at 0.25 and 0.5 lb/A provided approximately 50% control of giant foxtail (*Setaria faberi* Herrm.), with greater control observed at higher rates. At 10 weeks following the second azafenidin application, excellent control of large crabgrass, eclipta (*Eclipta prostrata* L.), and cutleaf evening primrose (*Oenothera laciniata* Hill) was observed. Six weeks later, however, approximately 10% ground cover by cutleaf evening primrose was observed at azafenidin rates of 0.25 and 0.375 lb/A. Azafenidin at 1.5 lb/A gave complete control of this weed.

CLOMAZONE AND METOLACHLOR FOR PUMPKIN AND SQUASH WEED CONTROL. C. E. Beste, Univ. of MD-College Park, Salisbury, MD.

ABSTRACT

Pumpkins and squash are a variable vine crop group with great commercial value to mid-Atlantic growers. Historically, the herbicides chloramben and dinoseb have been replaced by clomazone for these crops. Clomazone is formulated as an emulsifiable concentrate (EC) or micro-encapsulated (ME) product. Metolachlor/*S*-metolachlor is also a herbicide candidate for pumpkins and squash.

The Connecticut field pumpkin or true pumpkin is classified as *Cucurbita pepo* L.; whereas, the jumbo pumpkin, such as 'Big Max' and 'Atlantic Giant' are classified as *Cucurbita maxima* (Duchesne ex Lam.). Seeded 'Howden' pumpkins (*Cucurbita pepo*) early growth was slightly reduced by preemergence (pre) metolachlor, 1.20 lb ai/A and *S*-metolachlor, 0.76 lb ai/A; however, yields were unaffected. Metolachlor and *S*-metolachlor, 2.40 and 1.52 lb ai/A, respectively, reduced pumpkin yields. Pumpkin 'Big Max' (*C. maxima*) was not tolerant to metolachlor or *S*-metolachlor. Both *C. pepo* and *C. maxima* pumpkins were tolerant to clomazone, pre or preplant incorporated (ppi). Pumpkin growth and yield response were the same for metolachlor and *S* -metolachlor at biologically equivalent rates for weed control. Growth reduction and foliar necrosis with clomazone, 0.50 lb ai/A were greater for 'Howden' pumpkin than 'Big Max'. Clomazone-EC, 0.50 lb ai/A was slightly more injurious to *C. pepo* and *C. maxima* than the ME formulation; however, pre application was less injurious than ppi for both formulations. 'Howden' and 'Big Max' injury by EC or ME formulations of clomazone applied ppi or pre was transient and did not affect yields. Clomazone, 0.25 lb ai/A, was non-injurious to 'Howden and 'Big Max' pumpkin. Fruit chlorosis of 'Big Max' or 'Howden' pumpkin was not observed with clomazone.

Clomazone-ME, pre or ppi, 0.50 lb ai/A had less growth reduction and foliar chlorosis than Clomazone-EC to 'Elite' zucchini squash (*C. pepo*). Clomazone, 0.25 lb ai/A effected 20% reduced growth of 'Elite' zucchini squash for both formulations applied pre or ppi. Clomazone-EC and ME, pre or ppi, 0.50 or 0.25 lb ai/A, effected 15 to 90% chlorosis and 30 to 80% growth reduction of 'Blondie' zucchini squash with the least injury for clomazone-ME, 0.25 lb ai/A, pre. 'Blondie' zucchini squash was slightly more susceptible to clomazone growth reduction and chlorosis than 'Elite'; however, both formulations and application methods caused similar injury at 0.25 and 0.50 lb ai/A. Early and total yield of 'Elite' and 'Blondie' zucchini squash were unaffected by clomazone rate, formulation, or application method. However, with green zucchini squash 'Elite' clomazone-EC, 0.50 lb ai/A, ppi caused significantly greater chlorotic fruit than clomazone-ME, 0.50 lb ai/A, ppi or EC, 0.50 lb ai/A, pre. Clomazone-EC, 0.50 lb ai/A, pre with 'Elite' zuchinni squash had chlorotic fruits non-significantly different from the control and untreated plants. Clomazone-ME, 0.50, pre, did not have chlorotic fruits of 'Elite' zucchini squash nor did any of the 0.25 lb ai/A clomazone rates. 'Blondie' yellow zucchini did not manifest visually detectable fruit chlorosis from clomazone.

Clomazone-EC, 0.13, 0.19 and 0.38 lb ai/A, pre was tolerated by *C. pepo* squash, Crookneck group, 'Superpik' summer squash and the Fordhook group, 'Autumn queen' acorn squash and by *C. moschata*, Cushaw group, 'Waltham' butternut squash. However, *C. pepo*, Marrow group, 'Elite' and 'Blondie' zucchini squash, had commercially acceptable tolerance to clomazone-EC only at 0.13 and 0.19 lb ai/A.

CONTROL OF YELLOW NUTSEDGE IN CUCURBITS WITH HALOSULFURON.
W. J. Sciarappa, Rutgers Cooperative Extension, Rutgers University, New Brunswick, NJ.

ABSTRACT

Vegetable producers in the Northeast continue to have difficulty controlling yellow nutsedge (*Cyperus esculentus* L.) due to limited herbicide options, historic infestations, confined acreage and lack of rotational flexibility. Screening studies in various vegetables by Dr. Majek revealed considerable efficacy of MON 12000 (halosulfuron-methyl) against this weed, both with pre and postemergence applications. The manufacturer of this agrichemical is currently considering label expansion into some vegetable groups.

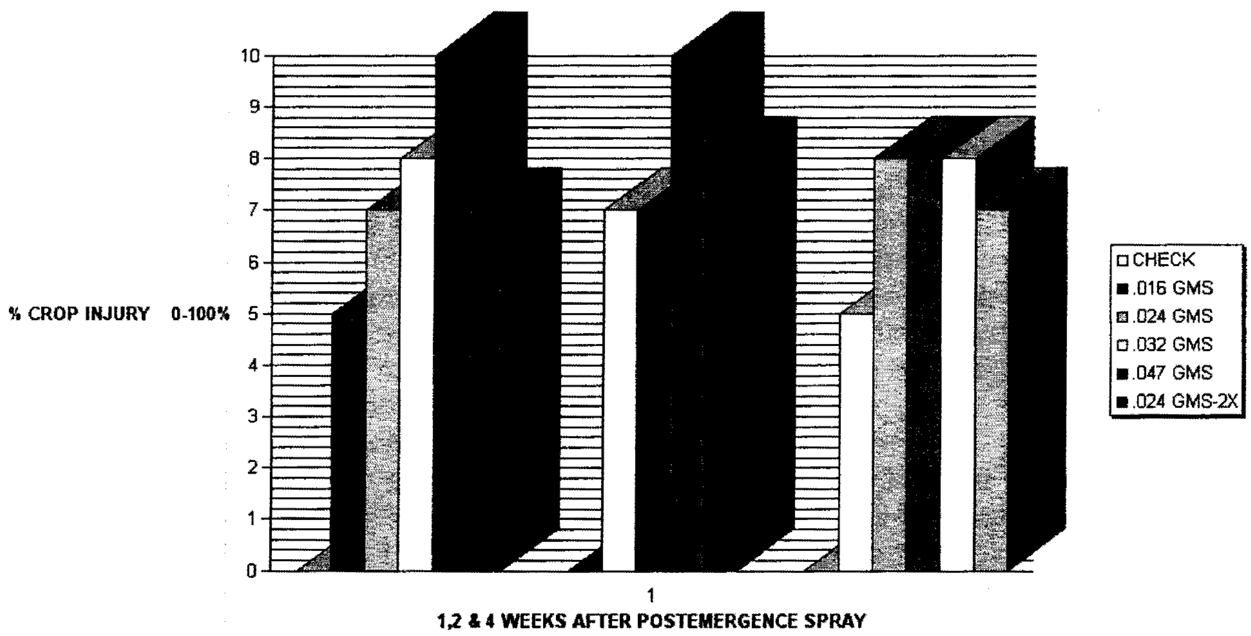
Greenhouse started cucurbits were transplanted into bare ground on May 31, 2000. Fertilizer (10-10-10) was side-dressed at planting. Plot size was 6 x 12' with 30" crop spacing. Three replications were used. The stage of growth at application ranged from 4 to 8 true leaves. Applications were made on June 6 with a CO_2 backpack sprayer and a 4 nozzle boom with T-jets 8004. Spray parameters were 35 PSI and 40 GPA. Weed size ranged from 6 to 10 inches. A similar non-crop study was conducted in an adjacent field. Indigenous populations of yellow nutsedge were extremely dense (70+ plants per square meter).

Treatments included label rates recommended for postemergence applications in field corn as well as sub-label rates to gain better selectivity in these sensitive cucurbit crops. These rates were 0.016, 0.024, 0.032, 0.047 and 0.024 + 0.024 pounds active ingredient per acre. All treatments, including the check, contained non-ionic surfactant at 0.0375%.

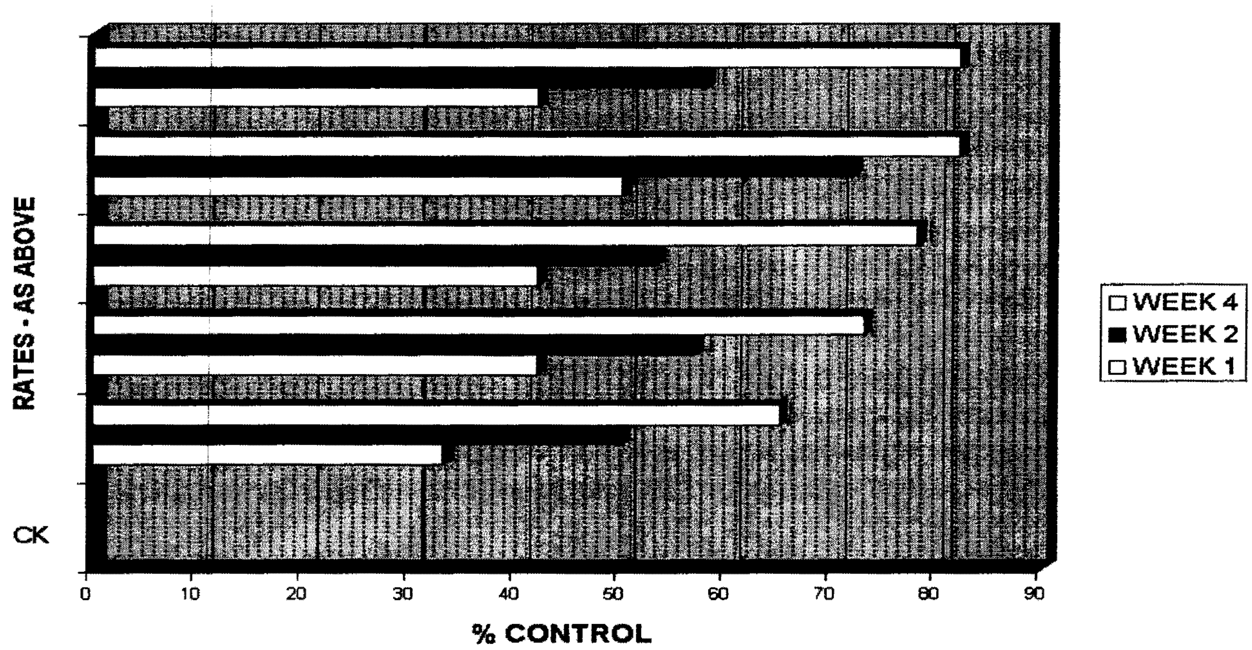
Control of yellow nutsedge increased sequentially at the first 3 evaluation times of 1, 2 and 4 weeks after application, regardless of rate. These initial weed control evaluations reflect more of the cessation of growth and color change rather than mortality. These control symptoms were expressed relatively slowly. First the growth of the weed slowed, tip burn appeared and then a general chlorosis extended over most of the leaf. The yellowed dead plants remained for the duration of the season and few developed seedheads at any rate applied. The untreated sedges proliferated throughout the season. The 0.024 lbs ai/a rate was comparable to the 0.047 lbs ai/a rate, suggesting a flatter rather than steep efficacy slope with postemergence applications.

The 0.024 lbs ai/a rate was also found to be the most promising for crop safety. In this particular season and the sandy loam soil, both cucumber (*Cucumis sativus* L.) and cantaloupe (*Cucumis melo* L.) were found to be fairly tolerant with only some minor chlorosis. Chlorosis, leaf necrosis and stunting increased considerably with zucchini (*Cucurbita pepo* L.) and sugar pumpkin (*Cucurbita pepo* L.), also at this sub-label rate. Affected most of all were watermelons where little commercial potential is seen. Please see the following page for some selected details of efficacy and phytotoxicity.

CROP SAFETY - HALOSULFURON IN CANTALOUPE



EFFICACY OF HALOSULFURON AGAINST YELLOW NUTSEDGE



ENHANCED DEGRADATION OF SELECTED SOIL ACTING HERBICIDES IN LONG-TERM EXPERIMENTS IN PEAR ORCHARDS. H. Eelen, Univ. Gent; J. Rouchaud, Catholic Univ. of Louvain; R. Bulcke, Univ. Gent; and T. Dekkers, Royal Res. Station of Gorsem, Belgium.

ABSTRACT

The dissipation of four herbicides mainly acting through the soil has been studied with chemical and biological methods in two field experiments in pear (*Pyrus domestica* Medik.) orchards originally designed to study the effects on the (weed) flora from long-term repeated application of the same herbicide(s) on the same strips. In Experiment GS at Gorsem (Province Limburg), on a loam soil, applications of chlortoluron, diuron and isoxaben, respectively, have been made each year on the same strip since 1987 whereas in Experiment ME at Melle (Province East-Flanders), on a sandy loam soil, pronamide has been applied each spring on the same strip since 1985.

In Experiment GS, using chemical methods, all three herbicides were shown to be degraded significantly faster on strips treated repeatedly when compared to strips treated for the first time. In 1996, following application of isoxaben (500 g/ha) for the 10th consecutive year, a soil half-life of 41 days was recorded indicating a significantly faster degradation than on a strip treated for the first time (half-life: 101 days). Following their 12th consecutive application in spring of 1998, both urea herbicides were shown to undergo enhanced degradation. However, as shown by their respective half-life times corresponding with repeatedly and first time treated strips respectively, the enhanced degradation phenomenon was moderate for diuron (3000 g/ha) (37 vs. 81 days) but extremely important for chlortoluron (4000 g/ha) (11 vs. 64 days). These findings are particularly important for "integrated fruit production" systems where chlortoluron serves as a replacement for diuron. In Experiment ME, enhanced degradation of pronamide (1250 g/ha) was observed in 1998 on strips treated for the 14th time; on these strips, soil half-life time was 10 days only compared to 31 days on strips never treated previously.

Greenhouse bioassays proved to be valuable tools, complementary to chemical methods, for the study of enhanced degradation; they may be used either prior to or parallel with chemical studies, or in follow-up studies. With greenhouse bioassays, the phenomenon of enhanced degradation of chlortoluron, isoxaben and pronamide could be confirmed either in soil sampled at regular intervals after application in the field and/or in soil collected prior to field application and subjected to incorporation of the respective herbicide and incubation in the laboratory. Choice of test species and response variable appeared to be critical and depending on the herbicide and its residue level. White mustard (*Sinapis alba* L.) was highly satisfactory in studies with isoxaben and chlortoluron whereas winter wheat (*Triticum aestivum* L.) and annual bluegrass (*Poa annua* L.) were suitable to monitor pronamide dissipation. Although with all test plants and herbicides studied, aboveground biomass was a good response variable, root dry matter might also be considered as response variable in studies with herbicides, such as isoxaben and pronamide, exerting drastic effects on root growth.

PARADISE INVADED: EXOTIC PLANTS IN FLORIDA. A. M. Fox, Agronomy Dept, Univ. of Florida, Gainesville, FL.

ABSTRACT

Along with Hawaii, Florida has the dubious distinction of being one of the two states in the U.S. most invaded by a wide variety of plants, animals, and microbes. With temperate to subtropical climatic zones, many importation sites, and a large population with a taste for exotic pets and plants, it is inevitable that Florida is overgrown and crawling with non-native species.

Florida has had many programs to control invasive species, most enduring being the century-old campaign against the floating water hyacinths [*Eichhornia crassipes* (Mart.) Solms-Laub]. A severe nuisance that once covered over 120,000 acres, water hyacinths have been reduced to levels of less than 2,000 acres by combined research, operational refinements, and aggressively sustained, maintenance-control policies. This control program exemplifies close cooperation between federal and state agencies, and its annual $3 million budget is top priority of all state aquatic weed control projects. Major ecological impacts in natural areas are also caused by melaleuca [*Melaleuca quinquenervia* (Cav.) Blake], cogon grass [*Imperata cylindrica* (L.) Raeuschel], and old-world climbing fern [*Lygodium microphyllum* (Cav.) R. Brown].

Principal federal agencies contributing to invasive plant management in Florida are the U.S. Army Corps of Engineers (i.e., maintenance of navigation) and the U.S. Department of Agriculture (i.e., development of biological control programs.) Agricultural pests are the responsibility of the Florida Department of Agriculture and Consumer Services, which spent over $45 million on invasive species in 1999/2000 mostly to eradicate crop pests such as the Mediterranean fruit fly and citrus canker. The Florida Department of Environmental Protection through its Bureau of Invasive Plant Management spent over $19 million in 1999/2000, most of which was dedicated to aquatic weed control. After years of reduced and non-recurring budgets, a dedicated funding source was identified in 1999, largely in response to public outcry to widespread infestations of the submersed plant hydrilla [*Hydrilla verticillata.* (L.f.) Royle]. A program for upland invasive plants in natural areas received $1 million in 1998/99. The Bureau of Invasive Plant Management established 11 working groups covering the state to prioritize suitable control projects for this funding. The effectiveness of this tactic resulted in $4 million being available in 2000/01. Five Water Management Districts spent over $10 million in 1999/2000 to control aquatic and upland invasive plants, and the Florida Department of Transportation spent a further $13 million on terrestrial invasive weeds.

Supporting the research and education associated with these invasive plant control programs are universities and professional organizations such as the Florida Aquatic Plant Management Society and the Florida Exotic Pest Plant Council (FL EPPC). The latter group biennially publishes a precautionary list of about 65 plants that are currently considered to be disrupting native plant communities, only 25 of which are species prohibited by statute. This list is controversial because it includes several popular ornamental plants, but discussions between FL EPPC and the Florida Nurserymen and Growers Association resulted in some plants being withdrawn from the

market. To help bring resolution over the remaining controversial species, the University of Florida developed an assessment of non-native plants in Florida's natural areas. Progress in managing invasive plants in Florida is encouraging but there is plenty left to do.

FEDERAL LEGISLATIVE AND ADMINISTRATIVE INVASIVE SPECIES ACTIVITY - IMPLICATIONS FOR WEED SCIENCE. R. R. Hedberg, National and Regional Weed Science Societies, Washington, DC.

ABSTRACT

Invasive species (IS) are now a major national issue after years of effort by scientists and others to raise public awareness. There is both legislative and executive branch activity to address the problem. This issue represents a significant opportunity for weed science and many weed scientists are actively involved.

On February 3, 1999 President Clinton signed Executive Order 13112 to initiate a coordinated national response to the problem of invasive species. The order established a National Invasive Species Council (NISC). The council is made up of the President's Cabinet from the Departments of State, Treasury, Defense, Interior, Agriculture, Transportation and Commerce and the Administrator of the Environmental Protection Agency. The order also called for an Invasive Species Advisory Committee (ISAC) representing a broad spectrum of scientific, commercial and conservation interests.

The initial major function of NISC has been to work in consultation with ISAC to prepare a National Management Plan (NMP) for all Invasive Species. A draft of this plan was released for an official 45-day public comment period on October 2, 2000. Release of the final plan is expected early in 2001. This plan will include a timetable for specific actions to prevent, detect and control IS, for restoration of infested sites, for research and education, for information management and for interagency coordination and international cooperation.

Funding invasive species activity is a fundamental concern. As plans are being made for future action it has been hard to determine how much is already being spent on the problem. At the request of several congressional offices the Government Accounting Office (GAO) conducted an analysis of federal and state spending on IS in the summer of 2000. This information will be used to develop an interagency crosscutting budget for invasive species management in FY 2002.

Funding for terrestrial weed control is also the subject of the Harmful Non-Native Weed Control Act, a bipartisan senate bill that was introduced in September 2000 and will be reintroduced early in the new Congress. The bill is intended to promote formation of weed management groups and provide substantial cost sharing money to implement on the ground weed management on both private and public lands.

Other legislation anticipated in 2001 includes reauthorization of the National Aquatic Nuisance Prevention And Control Act of 1990 and the related National Invasive Species Act of 1996. These laws established the composition and responsibilities for the Aquatic Nuisance Species Task Force (ANSTF) that has focused heavily on zebra mussels, the Great Lakes and ballast water management. Reauthorization will provide an opportunity to increase emphasis on aquatic weeds and possibly develop a funding mechanism for aquatic weeds similar to the one proposed for terrestrial weeds in the Harmful Non Native Weed Control Act.

THE IMPACT OF THE INTERNET ON THE MOVEMENT OF INVASIVE PLANTS. S. H. Kay, North Carolina State Univ., Raleigh, NC.

ABSTRACT

Invasive exotic weeds pose serious threats to the natural resources of the United States. About ten percent of exotic plants introduced accidentally or intentionally into the U.S. survive outside of cultivation and become naturalized. Of these, another ten percent become invasive within a few decades following their release. The availability of the Internet to households and businesses has opened a new medium for advertising, purchase, and distribution of almost any plant anywhere in the world. This new commercial medium, commonly called "e-commerce", has gone almost entirely unregulated. The objective of this study was to examine the Internet as a source for the sale and distribution of invasive pest plants of terrestrial, wetland, and aquatic habitats. I conducted on-line searches of several web browsers available to the general public using the scientific and common names of selected invasive exotic weeds currently of concern in the United States. My searches found that many invasive exotic weeds of concern in the United States either were advertised on commercial sites or could be obtained from hobbyists. The most commonly offending sites offered aquatic and wetland plants for aquarium or ornamental pool use. Websites advertised most of the aquatic and wetland plant species designated either as Federal Noxious Weeds or as noxious weeds in one or more states. These websites were based both in the U.S. and internationally. These results indicate that stronger enforcement of existing laws and regulations and intensive educational efforts are needed to prevent the further introduction of invasive weeds through e-commerce.

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Mark VanGessel, Editor
University of Delaware,
Georgetown

Northeastern Weed Science Society

54th Annual Meeting

January 4th, 2000
Hyatt Regency, Baltimore, Maryland

Presidential Address

A. Richard Bonanno
University of Massachusetts

URL's, GMO's, HRC's, IW's, and TY's

I would like to welcome everyone to the 54th annual meeting here in Baltimore and to thank you for being present this morning for the General Session. This session allows us to focus on both the successes of our members and the concerns of our Society and of weed science. This address allows me an opportunity to assess the health of our Society, to comment on our current concerns, to help provide insight into our future, and to thank those that have helped this Society stay strong for yet another year.

You may have wondered about the title of my address. In was not chosen simply to conserve space in the Proceedings. It serves to remind us that this was the time of the classic abbreviation, Y2K, which we have apparently all survived. In addition, it reminds us that we are constantly affected by what is happening in our Nations capital, where everything is referred to by an abbreviation or an acronym.

Two years ago, Nate Hartwig chaired a committee to look at educational efforts by our Society. One of the recommendations that came from that committee was for the NEWSS to develop a web site. A year later, the Executive Committee decided, after considerable debate, that the development of a web site for the Society would be a priority. We struggled, though, on deciding who would host it, how much it would cost, what it would contain, and who would maintain it. While I was at VPI this past summer for the NEWSS Collegiate Weed Contest, I ran into a guy with a camera, Ivan Morozov, who introduced himself as a graduate student who loves to develop web sites. He informed me that he had created an unofficial site for the NEWSS (one of 8 web sites he had already developed) and was planning to put an article and pictures from the Contest onto the site. Following discussions with the Executive Committee and Scott Hagood (Ivan's major professor), we decided to refine and add to Ivan's site between July and October and to make it the official site for the NEWSS. The site became public with its announcement in the November NEWSS Newsletter. I hope that most of you have visited the site. Our goal is to use the site to help members in many ways: provide electronic copies of the Newsletter, for title and abstract submission for the Annual Meeting, and to link with sites from other societies and educational institutions. We have arranged for electronic submission of titles and abstracts over the past two years, first through Brian Olson and Dow AgroSciences and then through Mark

VanGessel and the University of Delaware; we hope to expand on that success with this permanent site. The URL for the web site is in the November NEWSS Newsletter. It will also appear in all future newsletters. We welcome any comments you might have on how to improve it.

The theme of our Annual Meeting is "Herbicide-Resistant Crops: Past, Present, and Future". The issue of GMO's (genetically modified organisms) and HRC's (herbicide resistant crops) has moved to the front of the agricultural policy debate, even to the point of overshadowing FQPA and other pesticide issues. Although both GMO's and HRC's have been a part of U.S. agriculture for a few years now, increased attention by the European and Third-World communities has moved this issue into U.S. policy debates. Articles on biotechnology, GMO's, and HRC's have found their way into the Wall Street Journal, the American Vegetable Grower, Family Circle, and even Penthouse magazine. The December 1999 issue of American Vegetable Grower magazine noted that "1999 will likely be remembered as the year the big biotech controversy began. The monarch butterfly scare and debunking, the Congressional hearings on the plant pesticide rule, distributors requiring genetically modified crops to be separated from non-GMO crops, and worldwide protests are just a few highlights." There is a heightened awareness of this technology in the United States and an expression of public concern over the safety, benefits, and potential of this technology. Some have even tried to mount national sabotage campaigns against those that conduct research with this technology. In comparing European concerns with those in the United States, there appears to be an educational difference that may ultimately influence the level of debate that we see in the U.S. Here are two examples. Hoban and Miller from the Eurobarometer made the following statement and asked consumers if it was true or false: "Ordinary tomatoes do not contain genes while genetically-modified ones do." 10% of those responding in the U.S. said this was a true statement; however in the U.K. the percentage agreeing with the statement was 22%, in Spain 26%, in France 29%, and in Germany 44%. Here is a second question: "By eating a genetically-modified fruit, a person's genes could also be changed". The percentages of consumers responding that this was a true statement are as follows: U.S. 9%, U.K 15%, France 23%, Spain 27%, and Germany 30%. It is not my goal today to praise or condemn any of the players in this debate. This is new technology and there will be a natural delay in understanding and accepting this technology by consumers, including many of us. It is possible that some of this technology will never be accepted by consumers or by regulators. Weed Science and HRC's seem to garner more attention simply because our GMO's do not replace pesticides, but appear to many to perpetuate our reliance on them. My concern though is that this debate will negatively affect research efforts in this area. I feel that it is important for biotechnology research to continue, not just in the development of products but in the evaluation of them as well. The more research that is conducted on the benefits, safety, and environmental impact of this technology, the more informed we will all be. The University of Massachusetts in its Strategic Plan for Extension comments that "biotechnology presents a dilemma to agriculture. On one side, Massachusetts agriculture must keep up with advances in agricultural technology to stay competitive with other producers around the world. But on the other side, the public has concerns about genetically engineered plants, animals, and microbes. The University of Massachusetts must maintain its role as an unbiased evaluator of new agricultural technology to advise growers and the public about this new technology." As a grower, I produce about 20 different vegetable crops. I long for the days of "Roundup Ready" red leaf, green leaf, Boston, and romaine lettuce; I grow and ship about 15,000 boxes a year of these 4 items. I also realize that my ability to sell this lettuce will be determined by my broker and by the supermarket chains that I sell to. Their determinations will be made by the public. My own feeling is that most or all of this technology will eventually be accepted despite the current concerns. I also recognize that this will take time. Both today and at the General Symposium on Wednesday, I hope to learn more about the many issues surrounding this topic.

The issue of invasive weeds was highlighted during 1999 by the signing of an Executive Order designed to promote cooperation among all of the Federal agencies working with invasive species. The outreach symposium on Wednesday evening will deal with this issue at if affects Nurserymen. As you may know, WSSA through its Director of Science Policy has been working to improve communication between the Nurserymen, Regulators, and Legislators. It is only with the cooperation of all involved, including the nursery industry that legislation can move forward to address many of the current problems with invasive species. The symposium during the Industrial, Forestry, and Conservation session on Thursday morning will address the need for partnerships among federal, regional, state, and local agencies. Many of us are on the fringe of the invasive species issue. Perhaps the reason is that we do not feel comfortable in this area, especially those of us that work with agronomic crops, fruits, and vegetables. That is a legitimate concern; however, many of the players in the Northeast working on invasive species are not trained in weed management. Many work for the forestry service, are botanists, or are involved with conservation districts. In attending some invasive weed meetings this past year, I have been amazed at how many individuals in New England alone, whom I had never met, work with invasive weeds. I now find myself involved with both a state and a regional committee. The state committee is concerned primarily with developing a definition and a list of invasive species in Massachusetts. The regional committee is involved with funding and fostering cooperation across state lines to manage weeds in common ecosystems. I feel that it is important for us to be at the table. One individual in Massachusetts, for example, has been insisting that every species not native to Massachusetts be included on the invasive species list, regardless of its level of invasiveness. There is a real opportunity for us to become more involved in this exploding area of research, education, and funding. In addition, I see an opportunity for the NEWSS to work with these individuals. We have the ability to offer a venue for rapid exchange of information; it was this reason that brought weed scientists together 53 years ago, in 1947, for the first meeting of this Society.

In closing, I would like to thank all the members of the Executive Committee for their hard work over the past year. The "all volunteer" nature of our society necessitates dedication and attention to many details by individuals who have many other responsibilities. For myself, I greatly appreciate the opportunity to serve as President of the Northeastern Weed Science Society. My hope is that we all continue to learn and contribute to this field in a way that provides a safe food supply while insuring the survivability of a group of individuals that I hold dear, the American farmers.

DEVELOPMENT TECHNIQUES AND CURRENT PLANTS FOR THE HERBICIDE-RESISTANT CROPS PROGRAM. M. Hinchee, Monsanto Company, St. Louis, MO.

ABSTRACT

Herbicide-resistant crops can offer significant benefits to the farmer and to the environment. The farmer benefits are increased yields with less chemical inputs and application costs. The environment can also benefit if the resistance is to herbicides, such as Roundup, that have excellent environmental and toxicological profiles. Roundup Ready crops may be able to reduce possible environmental risks associated with some weed management practices. In addition, Roundup Ready crops can eliminate some of the barriers that exist in adopting no-till or conservation tillage practices, and thereby promote soil conservation. Monsanto's development and commercialization of Roundup Ready crop products will be described.

DEVELOPMENT OF HERBICIDE-RESISTANT TURFGRASSES. V. Meier, The Scotts Co., Marysville, OH 43041.

ABSTRACT

First response from most people outside of the turfgrass industry when they learn about the desire to have transgenic turfgrass is that it will be a disaster for the major ag crops. Many of the major weeds in agriculture are grasses. Turfgrasses include an assortment of different grasses. Therefore, huge potential problems exist by putting herbicide resistance into turfgrasses. Let's look at the available information.

What are the turfgrass species?

Genus	
Agrostis	Bents
Poa	Bluegrasses
Festuca	Fescues
Lolium	Ryegrasses
Cynodon	Bermudagrasses
Zoysia	Zoysia
Stenotaphrum	St. Augustinegrass
Buchloe	Buffalograss
Paspalum	Bahiagrass
Eremochloa	Centipedegrass

Status of transgenic turfgrasses

In 1995 Scotts was the first institution in the USA to announce their intentions to commercially release transgenic grasses and so far has been the only institution to publicly state some of the specific plans for release of these transgenic turfgrasses.

At this time, creeping bentgrass, Kentucky bluegrass, and St. Augustinegrass have the highest priority in the Scotts program to be transformed with herbicide resistance. These three species were chosen based upon their potential for good economic returns and even more importantly, they have an extremely low level of potential risk for the transgenic plants to develop into major weeds of the major agricultural crops.

On the economic return side, creeping bentgrass is the No. 1 desired species for fine golf courses. It is highly maintained on a large number of acres by well trained professionals. Kentucky bluegrass is used on a large number of acres of highly maintained turf, generally on home lawns, commercial properties and sports fields. However, the term "large number of acres of turfgrass" is relatively very small compared to acres used for agricultural purposes.

Roundup resistance in these two species would be a tremendous aid in controlling all weeds with one spray application, especially those weeds that are the perennial coarse grasses and Poa annua for which no selective control exists presently. In addition, the Roundup weed control could be applied anytime during the growing season allowing additional flexibility in application versus very narrow recommended application times for the present herbicides, especially for the preemergent herbicides.

At this time Scotts has bentgrass plants resistant to at least 256 oz./A of Roundup Pro and Kentucky bluegrass plants resistant to at least 128 oz./A. The recommended rates of Roundup Pro for controlling turfgrasses is 32 - 64 oz./A. The expected commercial release date of the Roundup-resistant cultivar of creeping bentgrass is 2003 and the expected release date for the Roundup-resistant Kentucky bluegrass is 2004. This assumes thorough testing for turf performance and the presently required testing for regulatory agencies such as USDA APHIS.

Stewardship issues include toxicity of these turfgrasses to people and animals, associated environmental issues, and the risk of creating major weeds. The FDA has approved the use of the Roundup resistance trait in crops used for food and feed. Therefore, use of the same trait in turfgrass should not be a problem since the only exposure will be walking and playing sports on the plants. From the environmental standpoint, the environmental friendly characteristics of Roundup have been well documented. Because of its high efficacy of eliminating weeds, the use of Roundup on resistant turfgrass is anticipated to lower the total pounds of herbicides used on turf as compared with present procedures.

This leaves the issue of weed creation to be addressed. The first question that should be reviewed: Are any of the turfgrasses listed above or any of its relatives within the same genus on the Federal Noxious Weed list or on any of the state seed noxious weed lists?

Noxious Weeds

Genus	
Agrostis	NO
Poa	NO
Festuca	NO
Lolium	YES
Cynodon	YES
Zoysia	NO
Stenotaphrum	NO
Buchloe	NO
Paspalum	NO
Eremochloa	NO

For Lolium, the noxious species is darnel, which produces alkaloids causing a problem for foods and feeds. However, darnels are generally only a problem if found among the seeds of wheat, rye, etc. used for seeding these crops. Because of improved procedures for producing these crops for seeding purposes, darnel is no longer a major concern. Cynodon (bermudagrass), on the other hand, is a serious weed in corn, soybeans, and cotton in the southern regions of the USA. Any effort to commercially release herbicide-resistant bermudagrass would have to be examined in more detail.

Another aspect of noxious weeds is that some states such as Virginia, Maryland, Pennsylvania and two or three additional states in the Northeastern USA have designated some grasses as Undesirable Grass Species (UGS).

Undesirable Grass Species

Bentgrass	Orchardgrass
Bermudagrass	Tall fescue
Annual bluegrass	Redtop
Rough bluegrass	Timothy
Meadow fescue	Velvetgrass

These UGS are only a problem if found in the following turfgrasses:
Bentgrass
Kentucky bluegrass
Fine fescues
Tall fescue
Perennial ryegrass

It appears that bentgrass as a weed is largely a problem only in other turfgrass species. This seems to be a reasonable statement since bentgrass, in comparison to the major agricultural crops such as corn, soybeans, wheat, cotton, etc., is a slow growing, small plant that has difficulty in surviving in competition with these large, rapidly growing plants.

Can a "super weed" be created by the outcrossing of Roundup-resistant creeping bentgrass with other plants? First, Mother Nature has created barriers to interspecific hybridization. These barriers include failure of fertilization to take place, failure of the seed to grow if fertilization takes place, failure of the seed to germinate and grow into a plant if the seed does form, lack of the hybrid plant to grow vigorously and compete in the wild if the plant can grow at all, and this hybrid plant may be partially or completely sterile producing no seed if the plant does grow. Because of these barriers, creeping bentgrass will not hybridize with plants such as quackgrass, goosegrass, and crabgrass. Creeping bentgrass will quite likely hybridize with other species within the genus *Agrostis*, which has 37 species(1). Belanger(2) has shown that herbicide-resistant creeping bentgrass will hybridize with *A. tenuis* (Colonial bent), *A. canina* (Velvet bent), *A. gigantea* (Redtop), and *A. castellana* (Dryland bent), which reconfirms citations in the older literature. The case with Kentucky bluegrass is similar to bentgrass in that it will likely hybridize with other species within the genus *Poa*, which has 69 species(1).

The gene for Roundup resistance controls only the resistance to Roundup, not resistance to all herbicides. This gene has no effect on increasing plant vigor, germination rate, or seed yield, all of which are important characteristics of weedy plants. Since the only trait affected is Roundup resistance, Roundup-resistant plants appear to be normal plants for all characteristics except for Roundup resistance, which can only be observed if Roundup is applied to the plant. Since Roundup is the primary herbicide used in turf renovation and non-selective control of turfgrass plants, different herbicides, such as glufosinate (Finale) and diquat (Reward), could be used to control Roundup-resistant plants.

In summary, the genetic modification (in this case, herbicide resistance) of turfgrasses promises to make it easier to grow better turf with major environmental benefits.

References

1. A. S. Hitchcock, 1935, Manual of the Grasses of the United States.
2. F. Belanger, 1999, Personal Communication, Rutgers University.

54th Annual Business Meeting
of the
NORTHEASTERN WEED SCIENCE SOCIETY
Hyatt Regency, Baltimore, Maryland
January 5, 2000

1. Call to Order

The annual business meeting was called to order by President Rich Bonanno on January 5, 2000 at 4:37 p.m.

2. Approval of Minutes

A motion was brought forward by Gary Schnappinger to accept the Minutes of the 53rd Annual Business Meeting as written in Volume 54, Proceedings of the NORTHEASTERN WEED SCIENCE SOCIETY, pages 153 – 156. Dave Vitolo seconded, and without any further discussion, the minutes were approved by the membership.

3. Necrology report

Andy Senesac reported that Fred Warren and Bryant Walworth passed away. Andy asked if there were any others to report. With none Andy asked for a moment of silence for remembrance.

4. Executive Committee Reports

- All of the executive committee reports were compiled in a handout and available to the membership.
- Bob Sweet asked for comments from the members on how CAST should deal with grower issues.
- Presidents' comments: Rich Bonanno indicated the annual meeting was going well and room nights at the hotel were up to 450 (NEWSS needed a minimum of 360 room nights to receive free meeting space). Attendance at the meeting was down compared to 1999.

5. Secretary/Treasurer

Andy Senesac indicated NEWSS had only 185 paid for attendance in 1999 versus 211 in 1998. He provided the NEWSS Financial Statement for 1999 and indicated the society was in the black by $2,198.19 for the 1998-1999 year. The net worth the society was $47,823.50 as of October 31, 1999.

6. Audit Committee Report

The Audit of the books was found to be in order and signed by Arthur Bing and Joseph B. Siezcka. David Vitolo will archive the financial statement with Robin Bellinder at Cornell University.

7. Awards Presentations

Dave Vitolo presented the awards for the Outstanding Educator to Dr. Thomas Watschke, Penn State University who had a significant impact on student's perspectives in weed science. The Outstanding Researcher award was presented to Dr. Prasanta Bhowmik, University of Massachusetts. Prasanta has been active in both the NEWSS and WSSA and received the NEWSS Distinguished Member award in 1998. Prasanta thanked his students and Bob Devlin for their support.

A. 1999 Collegiate Weed Contest

Dave Vitolo provided details of the contest as written in the November 1999 NEWSS newsletter.

The 1999 Northeastern Weed Science Society Collegiate Weed Contest was held July 19 and 20 at the campus of Virginia Tech in Blacksburg, VA. Our thanks to Scott Hagood and his committee for a job well done! Participating teams came from the following universities: Cornell, Delaware, Guelph, Kentucky, Maryland, North Carolina State, Nova Scotia, Penn State, SUNY-Cobleskill, and Virginia Tech. A total of 31 graduate students and 25 undergraduate students competed. In the graduate division team awards, first place went to N.C. State (Shawn Askew, George Scott, Andrew McRea, coached by John Wilcut), second place to Virginia Tech (Rob Richardson, Peter Sforza, Andy Bailey, Greg Armel, coached by Dan Poston), with third place going to Penn State (Wade Esbenshade, Steve Josimovich, coached by Dwight Lingenfelter).

In the undergraduate team awards, first place went to Nova Scotia (Kerry Cluney, Gordon Murray, Peter Burgess, Stephen Crozier, coached by Glen Sampson), second place to SUNY-Cobleskill (Steven DuBois, Andrew Miller, coached by Doug Goodale) and third place to N.C. State (Kevin Clemmer, John Lowery, Keith Burnell, coached by John Wilcut.)

For individual Graduate students, Rob Richardson of Virginia Tech placed first, Shawn Askew of N.C. State placed second, Art Graves of Virginia Tech placed third, and George Scott and Andrew McRea, both of N.C. State, tied for fourth. For individual Undergraduate students, Keith Burnell of N.C. State placed first, Gordon Murray of Nova Scotia placed second, and Andrew Miller of SUNY-Cobleskill placed third.

B. Research Poster Judging

Ben Coffman was chair, with Ted Bean, Tom Hines and John Teasdale participating as judges. Ben stressed the ease of reading and presentation of data that will draw the reader to the major facts. Poster contest winners were announced:
1st place, *Weed control and nutrient release with composted poultry litter mulch in a peach orchard* by P.L. Preusch, Hood college, Frederick, MD and T.J. Tworkoski, UDSA-ARS, Kearneysville, WV.
2nd place, *The effect of total postemergence herbicide timings on corn yield* by D.B. Vitolo, C. Pearson, M.G. Schnappinger and R. Schmenk. Novartis Crop Protection, Hudson, NY.

3rd place, *Pollen transport from genetically modified corn* by J.M. Jemison and M. Vayda. University of Maine, Orono.

C. Photo contest

Doug Goodale, thanked the other judges: Jim Saik (Chair), Ray Frank and David Yarborough. 1st place was Bill Curran, Penn State Univ. for his *Equisetum* photo, 2nd place was Kevin Bradley, Virginia Tech., for his cornflower, and 3rd place went to Todd Mervosh, CT Experiment Station for his groundnut.

D. Graduate Student Paper Contest

Chaired by Joe Neal, with Dave Vitolo, Brad Majek, and Ron Ritter as judges. Joe thanked BASF for their financial support, and indicated the comments made by the judges were to help improve the quality of the presentations. Overall quality of the presentations and slides were good. But he hoped next year the students would reduce the number of slides that were too busy and not legible.

1st place, *Lateral development of plant growth regulator-treated 'Tifway' bermudagrass* by M.J. Fagerness* and F.H. Yelverton, NC State Univ. Raleigh.

2nd place, *Double crop corn weed control in Virginia* by S.R. King*, E.S. Hagood, D. Brann and H.P. Wilson, Virginia Tech, Blacksburg.

3rd place, *Nutrient removal by weeds in container nursery crops* by G.M. Penny* and J.C. Neal, NC State Univ. Raleigh.

8. Old Business

Rich Bonanno thanked Andy Senesac for his five years of work as Secretary/Treasurer and provided him with a plaque recognizing him for his dedication to the society.

Rich indicated there would be some changes with the position of Director of Science policy held by Rob Hedberg. The position would be removed from the shared arrangement with AESOP where the cost was $110,000 and Rob would be in his own office space. The portion paid by NEWSS is $4,000. Rich indicated that an annual saving of $15-20,000 would be realized, but this would be left to accumulate to provide for future cost increases.

9. Presentation of Gavel

Rich Bonanno then passed the gavel to Brian Olson, ending his term as president. President Brian Olson thanked Rich for his time and leadership as president and presented him with an engraved gavel plaque.

10. New Business:

A. Resolutions Committee:

Tim Dutt announced that no resolutions had been submitted.

B. Nominating Committee Report:

Gary Schnappinger (chair), Frank Himmelstein, Betty Marose, Brad Majek, and Steve Dennis nominated David J. Mayonado for Vice President. Gary asked for nominations from the floor. With none Carroll Moseley asked nominations be closed and Jeff Derr seconded. Jim Parochetti requested the election by acclamation and Carroll Moseley seconded. David J. Mayonado was elected Vice President by unanimous acclamation.

C. 2000 Nomination committee
Brian Olson appointed Doug Goodale (Chair) and Art Gover to the nomination committee. Matt Mahoney and Katherine Jennings were nominated by Ron Ritter and Rakesh Chandran was nominated by Jeff Derr. Gary Schnappinger moved the nominations be closed and by Dave Vitolo seconded. Vote was unanimous for acceptance of the nomination committee.

D. 2000 Collegiate Weed Contest
Weed Contest will take place at the University of Guelph. The date for the contest has not yet been set.

E. 2001 Annual Meeting
Meeting site in 2001 will be Cambridge Marriott Wednesday through Friday 1/3-5/2001. Rooms will cost $89/night single or double. Members will travel to the meeting on Tuesday January 2, 2001 and meet on Wednesday through Friday. In 2002 the 1st is on a Tuesday so NEWSS will not meet until the following week.

F. Other business:
Brian Olson indicated he met with students and provided them with the criteria for the student representative to the Executive Committee. He will send the information out to all students. Brian will appoint a graduate student representative by the end of January.

11. New Executive Committee

Brian Olson (President) introduced the 2001 Executive Committee: Jeff Derr, President-elect; David J. Mayonado, Vice President; David E. Yarborough, Secretary/Treasurer; A. Rich Bonanno, Past President; Robert D. Sweet, CAST Representative, Mark J. VanGessel, Editor; Jerry J. Baron, Legislative; Todd L. Mervosh, Public Relations; Betty H. Marose, Research and Education Coordinator; Carroll M. Moseley, Sustaining Membership; and William S. Curran, WSSA Representative.

12. Adjournment:

President Olson asked for a motion to adjourn the 54^{th} Annual Business Meeting of the Northeastern Weed Science Society. Jim Parochetti moved, Betty Marose seconded and the motion was unanimously approved to adjourn at 5:26 PM.

NEWSS Financial Statement for 1999

November 1, 1998-October 31, 1999

INCOME:	
1999 Sustaining Membership	$3,750.00
Individual Membership	$4,360.00
Annual Meeting Registration	$10,285.00
Proceedings	$5,470.00
Annual Meeting Awards	$300.00
Interest (all acts)	$1,476.92
Coffee Break Support	$1,300.00
Weed Contest	$8,400.00
Other Income	$50.00
'Weeds of the Northeast'	$2,500.00
Subtotal	$37,891.92
EXPENSE:	
Annual Meeting	$11,578.40
Administration	$1,321.63
Proceedings	$3,464.58
NEWSS NEWS	$2,835.80
Annual Meeting Awards	$1,233.24
Weed Contest	$7,867.15
Miscellaneous	$1,333.87
WSSA Dir. of Science Policy	$4,000.00
'Weeds of the Northeast'	$2,059.06
Subtotal	$35,693.73
Total Income/Expense (1999)	$2,198.19
Balance Forwarded Savings Certificate Account (IDS Financial Services)	$17,729.31
Balance Forward Money Market Act (Compass Treasury Cash Series)	$16,618.27
Balance Forward Checking Account (North Fork Bank)	$11,277.73
TOTAL NET WORTH	**$47,823.50**
October 31, 1999 Savings Certificate Account (IDS Financial Services)	$18,541.02
October 31, 1999 Money Market Act (Compass Treasury Cash Series)	$17,283.48
October 31, 1999 Checking Account (North Fork Bank)	$11,999.00
TOTAL NET WORTH	**$47,823.50**

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

Arthur Bing

Arthur Bing

Joseph B. Sieczka

Joseph B. Sieczka

EXECUTIVE COMMITTEE REPORTS OF THE NORTHEASTERN WEED SCIENCE SOCIETY PRESENTED AT THE 54TH ANNUAL BUSINESS MEETING HYATT REGENCY, BALTIMORE, MD JANUARY 5, 2000

PRESIDENT

A. R. BONANNO

1999 was a very busy year for the Society. Following is a brief review of what happened. The 53rd annual meeting in Cambridge was a great one. The hotel selected by Dave Vitolo was excellent and the joint meeting with the NE-ASHS proved to be beneficial to both groups. The vegetable session, for example was packed with 50 participants compared to the usual 20 or 25. The forestry session was also much improved from Washington, due to a combination of great planning and a location close to the northern forests. The two new awards, "Outstanding Researcher" and "Outstanding Educator", were well accepted and will allow us to recognize contributions by all of our members. Many thanks to both Brian Olson (1999 program chair) and Joe Neal (past president and awards chair) for excellent work.

This year also saw some changes to the operation of the NEWSS Executive Committee. We welcomed David Yarborough from Maine as the Secretary/Treasurer apprentice to Andy Senesac. I want to thank Andy for his five years of excellent service to the Society as Secretary/Treasurer. Also, the responsibility for the NEWSS newsletter was moved to the public relations chair, Todd Mervosh. If the post office at Windsor, CT can figure out how to handle bulk mail, I think that change will work fine. We were fortunate to have Bob Sweet as the CAST representative for yet another year. His advice and historical recollections are always welcomed.

Rob Hedberg began work as the new Director of Science Policy (DSP) for the weed science societies. During 1999, he was located at AESOP Enterprises in Washington, DC. Rob worked for Agway in New York and Vermont for many years and has been a Congressional Science Fellow for the weed science societies and the Tri-societies. Jerry Baron, the Legislative Chair for the NEWSS serves on the WSSA Washington Liaison Committee (WLC). The WLC directs Rob's activities in Washington. Beginning in February 2000, Rob will be relocated to another office in DC; he will be located with the DSP for the Tri-societies and the Executive Director of the Agricultural Research Institute.

The Northeastern branch of the American Society for Horticultural Science (ASHS) will meet with us again in Baltimore in 2000. As you recall, their Board voted to accept our invitation for joint meetings in 1999 and 2000. As for this past meeting, registrations will kept separate, but members of the two societies will be free to attend each other's sessions.

I attended the 1999 NEWSS Collegiate Weed Contest in Blacksburg, VA on July 20. There were over 60 participants and teams were present from beyond our borders including Ontario, Nova Scotia, and Kentucky. The contest was very well organized and well run by Scott Hagood and his staff. Winning Teams were from North Carolina State (graduate) and Nova Scotia (undergraduate). Winning individuals were from VA Tech (graduate) and Nova Scotia (undergraduate). Thanks to Carroll Moseley for all his help with fund raising. Brian Olson is responsible for site selection for the 2000 contest; it will be hosted in Guelph, Ontario, Canada.

Fred Warren passed away on July 18, 1999. Many remembered him as one of the pioneers of weed science. Our thoughts are with his family in West Lafayette, Indiana and in New York.

The 54th NEWSS Annual Meeting is being held January 3-6, 2000 at the Hyatt Regency in Baltimore Maryland. The theme is "Herbicide Resistant Crops: Past, Present, and Future". The meeting will open with the Poster and General Sessions on the Morning of January 4. Jeff Derr, our Vice President and Program Chair has done an excellent job of preparing a program which addresses our most pressing issues as weed scientists. Thanks also to our editor, Mark VanGessel for organizing electronic submission of abstracts and titles. The first will be discussed both in the General Session and the General Symposium. The topic is Herbicide Resistant Crops; speakers will deal with science, politics, and public opinion. The keynote address will be presented by Dr. Maud Hinchee of Monsanto. The second major topic is that of invasive weed species. The Industrial, Forestry, and Conservation section will hold a symposium to address the need for partnerships among federal, state, regional, and local agencies. Sometimes I feel that most of us are on the fringe of the invasive species issue and could be much more involved in this exploding area of research, education, and funding. We will also sponsor two outreach sessions. These were orchestrated by the Education Coordinator, Betty Marose. The first will be held on Wednesday evening and will address invasive species issues for the Nursery Industry. The second is all day Thursday and will provide CCA soil and water quality credits for area crop advisors.

Award recipients at the 54th meeting include: Outstanding Researcher Award to Prasanta Bhowmik, Outstanding Teaching Award to Tom Watchke, Distinguished Service Awards to Ray Frank and Stan Pruss, Award of Merit to Dick Marrese. Thanks to the Awards Chair, Dave Vitolo.

The 55th NEWSS annual meeting will be held in Cambridge, Massachusetts at the Cambridge Marriott (site of the 53rd meeting). Meeting dates will be January 2-5, 2001. The travel date will be on Tuesday and the meeting will be from Wednesday through Friday. Thanks to Brian Olson for negotiating a great contract ($89 room rate).

We are proud to introduce the NEWSS Web Site. Ivan Morozov, a graduate student at VA Tech has become our Web Master. Jeff Derr, Betty Marose, and Bill Curran are serving on this committee. We hope that the web site will fill many needs including title and abstract submission, membership information, newsletter access, officer contacts, and as a vehicle to link to other weed-related sites. The URL for the web site is www.ppws.vt.edu/newss/newss.htm

I appreciate very much the opportunity to serve the Society.

PRESIDENT-ELECT
B. D. OLSON

At the NEWSS 1999 annual meeting members filled-out a survey on meeting locations and dates for the NEWSS 2001 annual meeting. Respondents overwhelmingly chose the Cambridge Marriott as the preferred hotel for the 2001 annual meeting and Tuesday – Friday, January 2-5, 2001 as the preferred meeting dates (see survey below). Contract proposals were then solicited from the Cambridge Marriott and other appropriate hotels in the Boston area. Following are the room rates from the proposed contracts (room rates do not include parking): Cambridge Marriott - $89; Boston Sheraton - $99; Cambridge Hyatt - $110; Boston Harbor Marriott - $119; and Boston Westin -$129. The Cambridge Marriott and Boston Sheraton were the only two properties with room rates less than $100. Meeting space at the Boston Sheraton was less than adequate for the NEWSS annual meeting compared to the Cambridge Marriott. Consequently, in July, the NEWSS Executive Committee unanimously approved the contract with the Cambridge Marriott for the 2001 annual meeting on January 2-5, 2001 with $89 room rates.

Year 2001 Annual Meeting Survey Results.

1. Question: Is the Cambridge Marriott acceptable for the NEWSS annual meeting? Results: Excellent (50), OK (21), Poor (2).
2. Question: Chose two hotels: 1st choice, 2nd choice.

City	Hotel	1st Place Votes	2nd Place Votes
Cambridge, MA	Marriott, $87	39	19
Philadelphia, PA	Marriott, $105	20	10
Newport, RI	Marriott, $82	12	23
Providence, RI	Marriott, $82	12	15
Hartford, CT	Sheraton, $82	3	12
Boston, MA	Marriott, $120	2	4

3. Question : Meeting dates: January 1, 2001 is a Monday, therefore when do you want to have the annual meeting? Circle the one meeting schedule of your choice.

Travel day	Meeting dates	Total
Monday (January 1)	Tuesday - Thursday (January 2-4)	3
Tuesday (January 2)	Wednesday - Friday (January 3-5)	47
Wednesday (January 3)	Thursday - Saturday (January 4-6)	6
Monday (January 8)	Tuesday - Thursday (January 9-11)	34

In other arrangements made in 1999, The Univ. of Guelph agreed to host the 2000 NEWSS Collegiate Weed Contest. Francois Tardif at the Univ. of Guelph will coordinate the contest. Contest dates will be announced in the 1st quarter of 2000.

VICE PRESIDENT
J. DERR

Photographs were taken at the Student Contest in Blacksburg in July. Copies of the prints were sent to Scott Hagood and to Todd Mervosh. An article on the results from the contest was prepared for the NEWSS and WSSA newsletters. Negatives from the 1998 contest were sent to Dave Vitolo for the archives.

The call for papers for the January 2000 meeting went out in the August newsletter. September 8, 1999 was the deadline for submission of titles. An email message was sent to the membership in September to encourage submission of titles for the annual meeting. Section chairs were asked to call their colleagues about presenting at the meeting.

Special thanks to Mark VanGessel for setting up electronic submission of titles to a web site. Approximately 90% of the submitted titles came through the website. Submitted titles were emailed from the website to me.

The theme for the 2000 meeting will be "Herbicide-Resistant Crops – Past, Present, and Future". There are six invited speakers who will address the legislative, environmental, and social issues that have arisen with genetically-modified plants. Dr. Maud Hinchee of Monsanto will discuss the techniques used to create herbicide-resistant crops, along with discussing future plans for their herbicide-resistance crops program. Dr. James White from USDA will provide information on the government regulations affecting genetically-altered crop varieties. Dr. Val Giddings of the Biotechnology Industry Organization will provide insight on the environmental issues that have been in the news recently in regards to genetically-modified crops. Dr. Nicholas Hether of Gerber Products will discuss the social and trade issues that have arisen and discuss how his company is addressing bioengineered crops. Dr. Virgil Meier of the Scotts Company will discuss herbicide-resistant turfgrass while Mr. David Tricoli of Seminis Seeds will discuss development of herbicide-resistant vegetable cultivars.

We will have three special programs at our annual meeting. Betty Marose put together an outreach program on invasive weeds for Wednesday evening. This symposium is tailored towards those attending the Mid-Atlantic Nurserymen's Trade Show, which is occurring the same week in Baltimore. Betty has also developed an outreach program for Certified Crop Advisors, addressing soil and water quality and other current issues in pest management. Jon Johnson has developed a workshop discussing the federal, state, and local partnerships that are addressing invasive weeds. These programs are an opportunity for our members to interact with invasive plants groups, native plant societies, crop producers, and other organizations that can benefit from our expertise.

Titles submitted for the annual meeting were organized into the breakout sessions. Presenters were sent a copy of the instructions for authors, along with the keyword form by email or by fax.

There are 114 volunteered papers for the 2000 meeting, along with 6 invited speakers (Keynote plus General Symposium), equaling 120 total papers. This compares favorably with 1999 (122 total papers) and 1998 (121 total papers). The volunteered papers for 2000 can be broken down as follows: Poster – 17, Agronomy – 32, Biologically-based – 8, Industrial, Forestry and Conservation – 13, Ornamentals – 11, Turfgrass – 19, and Vegetables and Fruit – 14. There are 17 papers in the 2000 student contest, exceeding the numbers in 1999 (14) and 1998 (8). As in 1999, we will be meeting jointly with NE-ASHS. Order of talks for the Vegetable and Fruit section were coordinated with Carolyn DeMoranville to minimize overlap in topics.

A rough draft of the program was sent prior to the October board meeting to the executive committee, Carolyn, and the section chairs for proofing. Revisions were made based on comments received at the October board meeting. The final program was sent to the printer on November 12, 1999.

I worked with Ivan Morozov, graduate student at Virginia Tech, concerning the NEWSS website he established on behalf of the Society. I sent him the August newsletter, sustaining members list, the final program for the 2000 meeting, and other items to place on the website. Mr. Morozov incorporated these files into the website, along with revising the site according to recommendations from the executive committee.

Rules and the judging form was sent to students participating in the student contest, as well as their advisors. Instructions for the poster session were sent to those participating in that section. The membership was sent a reminder that the deadline for hotel reservations for the annual meeting was December 3, 1999.

SECRETARY TREASURER
A.F. SENESAC

NEWSS Financial Statement for 1999
November 1, 1998-October 31, 1999

INCOME:	
1999 Sustaining Membership	$3,750.00
Individual Membership	$4,360.00
Annual Meeting Registration	$10,285.00
Proceedings	$5,470.00
Annual Meeting Awards	$300.00
Interest (all acts)	$1,476.92
Coffee Break Support	$1,300.00
Weed Contest	$8,400.00
Other Income	$50.00
'Weeds of the Northeast'	$2,500.00
Subtotal	**$37,891.92**
EXPENSE:	
Annual Meeting	$11,578.40
Administration	$1,321.63
Proceedings	$3,464.58
NEWSS NEWS	$2,835.80
Annual Meeting Awards	$1,233.24
Weed Contest	$7,867.15
Miscellaneous	$1,333.87
WSSA Dir. of Science Policy	$4,000.00
'Weeds of the Northeast'	$2,059.06
Subtotal	**$35,693.73**
Total Income/Expense (1999)	**$2,198.19**

continued on next page

Balance Forwarded Savings Certificate Account (IDS Financial Services)........$17,729.31
Balance Forward Money Market Act (Compass Treasury Cash Series)............$16,618.27
Balance Forward Checking Account (North Fork Bank)....................................$11,277.73
TOTAL NET WORTH...$47,823.50

October 31, 1999 Savings Certificate Account (IDS Financial Services)..........$18,541.02
October 31, 1999 Money Market Act (Compass Treasury Cash Series).........$17,283.48
October 31, 1999 Checking Account (North Fork Bank)....................................$11,999.00
TOTAL NET WORTH...$47,823.50

PAST- PRESIDENT
D.B. VITOLO

1999 activities included:

The Awards Committee (Vitolo, Ritter, Vrabel, Neal, Majek) reviewed nominations for all awards and submitted candidates for approval by the EC at the October 18th meeting. Plaques were prepared for all award recipients, and the Awards Presentation Brochure was prepared and printed. The student presentation contest award committee was established (Chair J. Neal) and the judging schedule coordinated with the program chair. The Photo Contest committee was established (Chair J. Saik), and an article was submitted to the Newsletter for the November edition requesting entries. The Poster Committee reorganized, with a new Chairperson (B. Coffman). Certificates were prepared for all contest winners. Accumulated archival materials were sent to the office of R. Bellinder for storage. MOP changes were prepared and reprinted. Copies of the Constitution were printed for distribution at the annual meeting.

CAST
R.D. SWEET

CAST has had a very good year. There are now 38 member societies. The finances are stable and in the black. Its reputation for reliable scientific information on agricultural issues continues to expand. It is often asked to participate in hearings, briefings, etc. In fact sometimes it initiates briefings on its own. These are well attended. The hiring of Meyers and Associates as the Washington representative is working well.

CAST has been pro-active in support of biotech research and development. Its call for signatures to Senator Bond's letter supporting biotech, which he presented at a West Coast hearing, garnered about 400 from scientists. An issue paper is due any day and an in-depth publication is in the planning stage.

Two situations still need attention: getting lengthy publications published more quickly; gaining and retaining more individual memberships. NEWSS does reasonably well but we could do better.

The next CAST board meeting is March 23-25 in D.C.

SUSTAINING MEMBERSHIP
C. M. MOSELEY

A total of $8400 was contributed in support of the 1999 Collegiate Weed Contest held in Blacksburg, VA. Please take time to thank companies and individuals that contributed time and money to this effort.

Contributors to 1999 Collegiate Weed Contest VA TECH, Blacksburg, VA	
Monsanto	$1000
Rohm & Haas	$250
Novartis	$1250
Southern States	$750
Rhone-Poulenc	$700
DuPont	$800
BASF	$1000
AgrEvo	$700
American Cyanamid	$1200
Dow Agrosciences	$750
Total	$8400

These contributions were up $5000 over the previous year and were needed to cover various expenses associated with the contest.

Contributors to Coffee Breaks For 2000 Meeting in Baltimore	
Bayer Corporation	$200
Dow Agrosciences	$200
DuPont	$200
FMC	$200
Monsanto	$200
Novartis	$200
Rhone-Poulenc (Aventis)	$200
Total	$1400

Seven companies have donated a total of $1400 for coffee breaks at the 2000 meeting in Baltimore.

2000 Sustaining Membership Fees Received As of December 30, 1999	
American Cyanamid Co.	Marbicon Inc.
ASPLUNDH	Monsanto
Aventis	Novartis Crop Protection
Bayer Crop.	PBI Gordon
Brubaker Agronomic Consulting Service*	Pioneer Hi-Bred Intl. Inc.
Crop Mgmt. Strategies, Inc.	Rohm and Haas Co.
Dow AgroSciences	SAMCO

DuPont Co.	The Scott Co.
FMC Corp.	Uniroyal Chemical Co.
For-Shore Weed Control, Inc.	Zeneca
Gandy Co.	
Griffin Corp.	
J. C. Ehrlich Chemical	
Total	$2875

As of December 30, 1999, I have received $2,875 (23 responses) in Sustaining Membership Fees. These funds are presently running $875 (7 contributors) behind 1999 contributions. The following companies provided support for 1999, but not 2000: Brewer International; ACDS; ISK Biosciences; BASF; and Valent;. The request was mailed in mid October. One reminder has been sent, along with follow up phone calls in November and December. Contact name, addresses and phone numbers are needed for Weeds, Inc; Waldrum Specialties; Sprout-less Vegetation; Timberland and ISK Biosciences. I will follow up again with companies that I have not heard from.

Total contributions from Sustaining Members are up considerably over the previous year (due to an increase for the weed contest) – approximately $4000.

There was one request for a Sustaining Membership display (PBI/Gordon).

Stratford Kay (NC State) requested booth space for the Aquatic/Noncroplan Weed Management traveling display.

Job placement forms have been received and will be available for viewing at the annual meeting. Three position available and one position desired form was received for the 2000 meeting. I will forward these on to WSSA.

In addition, I would like to propose that we set up 2-3 levels of support from various companies for "Sustainable Memberships". The present membership level is at $125. I suggest we have 2 levels – one at $150 and the other at $250. If we have good support at this level, I will not have to solicit money for coffee breaks. If the EC agrees to this, we need to name the two levels. Level I and Level II, Level A and Level B, Platinum and Gold – these are only suggestions.

PUBLIC RELATIONS
T. L. MERVOSH

I obtained photographs taken by Jeff Derr at the 1999 NEWSS annual meeting, and prepared a report for the April NEWSS newsletter. He also submitted an article and photos from our meeting to the newsletter editors for WSSA and SWSS. As discussed by the EC at the March meeting, the Public Relations Representative will now also be responsible for printing and mailing the newsletters (beginning in August 1999). Andy Senesac provided me with the mailing list file and printing information.

I was unable to attend the Collegiate Weeds Contest held at Virginia Tech on July 20. I asked Jeff Derr to take photos at the contest, and he provided a report and photos that I included in the November NEWSS NEWS. Reports were also sent to newsletter editors for WSSA and SWSS.

The August newsletter was printed by Sir Speedy Printing of Bloomfield, CT and mailed on August 24 (bulk rate postage). The total cost for printing, folding, mailing and postage for 450 copies was $858.63. Unfortunately, delivery of the August newsletter was extremely slow, and several people did not receive their newsletter in the mail until after the title submission deadline (September 8). Due to the time-sensitive information in the August and November newsletters, I proposed (and the EC agreed) that these newsletters be sent via first-class mail from now on. The additional postage cost is necessary to insure that newsletters are received well before important deadlines.

I sent a press release announcing the 54th NEWSS Annual Meeting and the special symposia to the Baltimore Sun, Washington Post, EPA, USDA, mid-Atlantic region farm publications and other pertinent organizations.

The November newsletter contained pre-registration and placement service forms, Baltimore maps and directions to the Hyatt Regency, information on hotel reservations, parking, taxi and shuttle costs to and from the airport. I had 600 copies of the November newsletter printed at Sir Speedy, and about 520 copies were mailed (first-class postage) on November 12. Total printing and mailing costs for the newsletter amounted to $1325.42. Newsletters were also mailed to non-members giving papers at the meeting, and additional copies were sent to Jeff Derr, Betty Marose and Jon Johnson to pass on to invited speakers in the General Session and the symposia.

I will take photos of speakers and award winners at the General Session, Business Meeting, and each of the special symposia at the 54th Annual Meeting in Baltimore, and will prepare a report for the April 2000 NEWSS NEWS.

EDITOR
M.J. VANGESSEL

Call For Papers, Title Submission Form, Instruction to Authors, and Keyword Form were updated. A website under the UD Research and Education Center's Homepage was set up for electronic submission of titles. A second website was used for Keyword Form submission, and text and graphics were emailed to the editor in an MSOffice compatible program. Electronic submission worked extremely well and will be expanded in the coming year. Approximately 85% of those submitting abstracts used electronic submission.

Two publications were produced for 2000 Annual Meeting. The program guide was 52 pages and 700 were printed. Approximately 300 copies were mailed by the editor with first-class postage. The proceedings were 235 pages and 325 were printed. Ninety-seven abstracts and papers were published with an additional five abstracts and papers published as a supplement to the 53rd Volume. Herbicide indices were updated for both the program guide and proceedings.

LEGISLATIVE
J.J. BARON

Highlights of this past year's activities follow.

FOOD QUALITY PROTECTION ACT OF 1996 (FQPA):

- During 1999 we have celebrated the third adversary of the Food Quality Protection Act. In honor of the event on August 2, 1999, the Administrator of the EPA, announced "voluntary agreements" to cancel many uses of methyl parathion and azinophos methyl. In her statement she also announced that the agency " has targeted several other older, widely used pesticides for priority review within the next year and a half including atrazine". The House Agriculture Committee, Subcommittee on Department Operations, Oversight, Nutrition and Forestry is very concerned about the effects of FQPA implementation. The Committee were furious about EPA August 2 decisions. They charged that EPA had short circuited the process developed to review registrations under FQPA. This process was to include decisions based on science, public involvement, transparency in decision making and a reasonable transition strategy for growers who might lose registered uses. They charged that science was taking a back seat to politics, that EPA had squandered the good faith which had been developed to date through the TRAC process, that Registrants had been coerced into signing "voluntary agreements" which included "gag clauses" . In response to the above concerns, Legislation has been introduced in both the House and Senate to (HR 1592 and S 1464) to require adequate time to develop the scientific data needed to make decisions under FQPA. Two hundred and twenty-five members of the House and Senate have signed on as sponsor to these bills.

- EPA has published a report on its progress in carrying out the Food Quality Protection Act over the past three years. Highlights in "Implementing the Food Quality Protection Act: Progress Report" include how EPA has taken several actions to eliminate or reduce the use of pesticides on foods commonly eaten by children, and registered several new, safer pesticides that pose less risk to the public and environment, and that can be used as alternatives to older, more toxic chemicals.
- On June 16, 1999, EPA held a technical briefing on the draft risk assessment for the herbicide, bensulide. They concluded bensulide's acute and chronic dietary risk from food is well below the Agency's level of concern, the Agency has concerns for homeowners who apply Bensulide with a belly grinder, there is risk to birds from all uses, but risks are highest from golf courses and risk to aquatic organisms result from surface run-off and potential is greatest in turf

- EPA plans to publish a proposal to enhance public participation in tolerance reassessment under FQPA. In conjunction with this plan, EPA has made some changes to the web site for Reregistration Eligibility Decision (RED) documents that are designed to improve the usefulness and usability of the web site. A new box at the top of the table of REDs highlights those that are open for public comment. In addition, the table now includes links from the newly added REDs to the associated Federal Register notice of availability. The RED web site is at http://www.epa.gov/REDs/.

BIOTECHNOLOGY & FOOD SAFETY

Over the last year the use of genetically modified organism (GMO's) in production agriculture has come under close scrutiny by many sectors. Some of the notable actives include:

- The Foundation on Economic Trends files a class action law suit against Monsanto, Delta Pine and Land Company, DuPont, Pioneer Hi-Bred, Dow Chemical Company, Mycogen, Novartis, AstraZeneca, Garst Seed Company, and AgriPro Seeds for allegedly selling genetically altered crops without first ensuring they were safe for consumers and the environment. A copy of the complete document filed with the court by several law firms named in the suit is posted at the following Wall Street Journal

WWW Site: http://interactive.wsj.com/documents/monsantosuit.htm. In response to the law suit, Monsanto issued a statement noting that "allegations made by longtime opponents of biotechnology in the context of a lawsuit filed today in Washington, D.C. are absolutely baseless ... This action is another in a series of unsuccessful attempts by veteran antagonists to stop a technology with the potential to improve our environment, increase food production, and improve health ... We're confident this suit will be dismissed. ... Prior to entering the commercial market, each of Monsanto's seed products underwent years of rigorous testing to determine their safety, environmental and performance characteristics. They also have been subjected to intense scrutiny by regulatory agencies, including the U.S. Department of Agriculture, the U. S. Environmental Protection Agency, and the U.S. Food and Drug Administration. Safety testing is based on internationally accepted standards developed by the World Health Organization, the United Nations Food and Agricultural Organization, and other prestigious scientific authorities. ... Monsanto is committed to the farmer's right to have access to high quality seed choices that allow them to continue in the outstanding progress they have made in producing more food with fewer resources on less land."

- McCain Foods, one of the worlds leading processors of potatoes is refusing to accept genetically engineered potatoes for processing. Starting next year, the company will no longer buy genetically altered potatoes grown by farmers. McCain's chairman, Harrison McCain, was cited as saying the decision was made after months of pressure from consumers who fear genetic tampering could damage the environment and human health, adding, "We think genetically modified material is very good science (but) at the moment, very bad public relations. We've got too many people worried about eating the product and we're in the business of giving our customers what they want, not what we think they should have. We're going to drop that until the smoke clears away and until most people are at least reasonably satisfied that that's the right thing to do."

- An EPA scientific advisory panel is drafting new requirements to ensure that biotech crops are safe for the environment at the same time several international groups, foreign governments and other U.S. agencies are taking a closer look at the controversial plants. The EPA panel met in early December to consider requiring more test data from seed companies to ensure that genetically altered canola, squash, soybeans, corn and other crops are safe for wildlife, the soil, and water sources. Stricter testing may soon be required for wildlife such as mallard ducks, bobwhite quail, rainbow trout, channel catfish, honey bees and earthworms. The agency also needs to get more information from seed companies about how quickly a biotech plant degrades in the soil, and whether the plants can cross-pollinate with weeds and disrupt the ecosystem. The advisory panel is also scheduled to make recommendations to the EPA in February about what kinds of human health data companies should provide.

- During the week of October 4 there were several hearings related to agricultural biotechnology.

House Science Committee Hearing/October 5, 1999 - The House Science Committee were primarily critical of the science behind some of the sensationalist stories which have been widely heralded. In a nutshell the risks of increased antibiotic resistance due to the presence of antibiotic resistance selectable markers and of Monarch butterfly decimation were discussed and refuted by scientists with specific expertise in these issues.

Senate Agriculture Committee, Agricultural Biotechnology Hearings/October 6 and 7, 1999 . The mood of the testimony on the first day was positive towards agricultural biotechnology and did a good job of creating a public record of the potential inherent in this technology to solve problems in both developed and underdeveloped countries. The benefits of biotechnology were discussed in terms of pesticide use reductions, the improved human nutrition through altered vitamin, protein and nutrient profiles and the potential for GMO crops as a delivery system for vaccines which could help solve significant health problems in the developing world. There were several concerns voiced at the hearings. One raised by Senator Kerrey was that despite all the promise of the technology there appeared to be a serious disconnect between the industry and the impact of public sentiment about GMO=s. The panelists on the second day included representatives from the regulatory agencies which oversee agricultural biotechnology, (USDA, FDA, EPA), as well as representatives for producers, grain marketers, the biotechnology industry and It was pointed out that it is often impossible to reach the public with the results of sound research. There was a prevalent sentiment among the panelists that the administration should take a stronger position through the top levels of the USDA, EPA and FDA to inform the public about the safety reviews, testing and promise of biotechnology.

Senate Finance Committee, International Trade Subcommittee Hearing/October 8, 1999 - The hearing addressed several aspects of agricultural trade negotiations and biotechnology figured very prominently. David Aaron, Commerce Undersecretary for International Trade stated that the US would resist any effort to reopen the SPS (Sanitary and Phytosanitary Agreement) which requires that decisions about approving ag-biotech products be based on science. He said that reopening the SPS agreement might allow Europeans to include the "Precautionary Principle" which would require the products to be "proven safe" before allowing imports. During the hearing Senator Kerrey (D-NE) stated that a new administration effort on ag-biotech is needed because the issue has gone beyond a regulatory issue to one of politics and consumer perceptions. The concept he outlined would include involvement of several other federal health agencies (National Institute of Health, Health and Human Services and the surgeon General) in addition to the current involvement of the FDA. Such a full court press is consistent with the sentiment expressed at the Senate agriculture committee hearings which called for more Administration effort to educate and inform the general public about the promise of these crops and the scrutiny they undergo.

- Two underground organizations teamed up to destroy crops and equipment at two genetic engineering (GE) facilities in Woodland, California in September. Organic-gardening guerilla groups "Reclaim the Seeds" and "Future Farmers" joined forces to decontaminate a test plot of GE sunflowers and fifty rows of GE research corn planted at a Pioneer Hi-Bred International research facility as well as several hundred GE research melons at the Rogers NK Seed Company Research Station. "Any university or corporation proclaiming the benefits of biotechnology or found to be engaging in GE research will have their crops nonviolently decontaminated by the growing movement to protect the fabric of life," forewarned Johnny Apple seed of Reclaim the Seeds.

- To ease the dilemma over the uncertainly caused by genetically modified organisms (GMO), the American Corn Growers Association (ACGA) is proposing that farmers should look at the option of planting NON GMO crops if certain questions are not answered. This is not an issue over the health or scientific effects of GMO's. It's an issue over production agriculture's inability to answer the many questions that surround this controversial issue. "GMO's have become the albatross around the neck of farmers on issues of trade, labeling, testing, certification, segregation, market availability and agribusiness concentration. Until all these issues are answered, it is best for production agriculture to examine alternatives to planting GMO's," said Gary Goldberg, Chief Executive Officer of the ACGA.

INVASIVE PLANT UPDATE

- Working through the WSSA Washington Liaison Committee and the Noxious Weed Committee, three WSSA candidates were chosen as WSSA nominees to the Invasive Species Advisory Council. This was done in June, prior to the official Federal Register request for nominations so that we could have the candidates names in place prior to the first meeting of the Invasive Species Council which was held on July 22. The nominations were chosen based on their reputation and experience and their ability to bring different geographic, technical and public/private sector interests to the table. These nominees are Nelroy Jackson, Steve Dewey and Randall Stocker. The Federal Register announcement seeking nominees came out on September 24 and nominations closed on October 24.

- The Plant Protection Act continues to be stalled over a narrow group of issues. Rob Hedberg has worked with the legislative staff of all three sponsors of the House and Senate bills, the Animal Plant Health Inspection Service (APHIS), the American Nursery and Landscape Association and The Nature Conservancy to explore their positions, facilitate discussion, suggest compromise and urge progress. It appears that time has run out for this legislation this year and it will have to be taken up in the second session of this Congress.

NEW WEED CONTROL TECHNOLOGY:

The Brighton Conference is traditionally a time for the agricultural chemical companies to publicly announce new chemistries. A total of twelve compounds were presented in the New Herbicides section. Though it is not the core mission of this Committee's to disseminate information on new weed control technology, it is deem useful that some of these new materials may be alternatives to materials lost due to cancellations associated with FQPA. For a copy of a brief summary of the new chemistry contact Jerry Baron at jbaron@assop.rutgers.edu.

EPA has released its Fiscal year 2000 Registration Division work plan. Here they list all the new chemicals they plan on reviewing in from October 1, 1999 to September

30, 2000. EPA plans on reviewing six to seven new chemicals which are classified as herbicides and four plant growth regulators. The new herbicides scheduled for review are azafenidin, clopinafop, diclosulam, flucarbazone sodium, flumioxazin, mesotrione and possibly ethametsulfuron. In addition, EPA has scheduled 53 submissions for new use of existing herbicides. If approved these 53 submissions could account for close to 500 new use registration. For a copy of the work plan, see the following Internet address: http//www.epa.gov/opprd001/work plan/fy2-newuse.htm.

USDA ACTIVITIES

Dollars from several USDA programs including Pesticide Impact Assessment, Water Quality, and Food Safety, that were considered **USDA ACTIVITIES Dollars from several USDA programs including Pesticide Impact Assessment, Water Quality, and Food Safety, that were considered** as "Formula Funds" were moved by Congress into the 406 Integrated category. Funds for these programs will be based on competitive grants. Because of the legislative mandates, money for Fiscal Year 2000 will not likely to be distributed until the end of the fiscal year. Rob Hedberg, WSSA's Director of Science Policy attended the meeting and had the following assessment:

> "The question now is: How will USDA manage award of these funds? There is a very high risk to water quality and pest management positions in individual states. This could hurt WSSA because we have supported the USDA Pesticide Impact Assessment Program (PIAP) as a way to generate real world pesticide use information for EPA to use in their pesticide risk assessments. The PIAP program relies on the presence of local expertise. This expertise is also critical when practical risk reduction methods are needed for pesticides which EPA would otherwise cancel without use pattern changes."

USDA Office of Pest Management and Policy continues to post Crop Profiles to their web site. There are now over 180 profiles online. This group has also started the release to Transition strategies documents. The first one covers Southeast Apples and the second document is California Peaches. More of these Transition Strategy documents to follow.

MISCELLANEOUS:

- In late July the Environmental Working Group (EWG) lashed out on the atrazine in a report "Into the Mouths of Babes," In the report they claimed that atrazine is polluting tap water in almost 800 Midwestern communities, and the government has underestimated exposure to the carcinogen by 15 times for infants fed formula mixed with tap water. Novartis, the basic producer of atrazine countered "'Into the Mouths of Babes' might better be titled 'Out of the Mouths of Alarmists'," said Dave Whitacre, senior vice president of science for Novartis Crop Protection, Inc., "The fact is that levels of atrazine cited in the EWG report do not put infants, children or adults at risk. Parents have no reason to fear the safety of the drinking water in their communities. The EWG has misrepresented scientific facts to attempt to create panic among American parents." "The EWG has a history of shunning the time-honored scientific peer-review process in evaluating the accuracy of it positions," added Whitacre. "Government-established standards provide a wide margin of safety to all populations."

- Mitigating Herbicide Risks: Analysis Continues on Buffer Zones. The EPA Office of Pesticide Programs is developing a standard approach for calculating buffer zones (the distance to maintain between a pesticide application site and sensitive non-target areas). With this approach, a spray drift model called AgDRIFT is used to determine the distance necessary for spray drift deposits to fall below a certain level. For herbicides, it is the level that causes up to a 25% reduction in plant growth in laboratory tests. Typically, 10 species of crop plants covering a range of taxa are tested, and EPA uses the 25% value for the most sensitive species in its assessment. The Spray Drift Task Force, a registrant group, made a preliminary analysis of theoretical buffer sizes calculated by EPA for 28 herbicides. The herbicides represent multiple classes of chemistry and modes of action. For ground applications made with a low spray boom (2 ft. above ground), about 20% of the compounds required a buffer less than or equal to 50 feet, while 70% required buffers of greater than 150 feet, and 15% needed buffers of 450 to 1,000 feet. For aerial applications, the theoretical buffers are larger. Only one of the 28 compounds examined could get by with a buffer of less than 50 feet, while 75% of the compounds required buffers of 450 to 1,000 feet. These calculations are based on several worst-case assumptions. Discussions are ongoing between the SDTF and EPA concerning ways to better reflect more representative conditions. For more information, contact Andrew Hewitt or Dave Johnson, both of Stewart Ag, at 660-762-4240. E-mail: ahewitt@marktwain.net or davejohn@marktwain.net

WSSA
W. S. CURRAN

As WSSA Representative to the WSSA, I attended the WSSA annual meeting, February 1999 in San Diego, California. I also attended the Summer Board of Directors (BOD) meeting at the Weston Harbour Castle Hotel in Toronto, Canada. The 2000 meeting will be held in February in Toronto, Canada. Here is a summary of the years activity.

1999 WSSA Board of Directors

President:	Chandler, Mike
President Elect:	Oliver, Dick
Vice President:	Eberlein, Charlotte
Past President:	Hess, Dan
Secretary:	Schroeder, Jill
Treasurer:	Dusky, Joan
Director of Publications:	Legere, Anne
Chair: Constitution and Operating Procedures:	Skipper, Horace
Director of Education:	Holt, Jodie
Member-at-Large:	Buhler, Doug
Member-at-Large:	McFarland, Janis

Member-at-Large:	Banks, Phil
Member-at-Large:	Shaw, David

Conference Members:

Aquatic Plant Management Soc.	Fox, Alison
Expert Committee on Weeds, Canada:	Benoit, Diane
NCWSS:	Harrison, Kent
NEWSS:	Curran, Bill
SWSS:	Brecke, Barry
WSSA:	Donald Thill
Executive Secretary:	Lancaster, Joyce (AM&M)
Director of Science Policy:	Hedberg, Rob

2000 MEETING: The 2000 meeting in Toronto should be a good one. The Weston Harbour Castle Hotel is a fine facility. The hotel is located in downtown Toronto on the water (Toronto Bay on Lake Ontario) and is in close proximity to many restaurants and shopping. The venue is a large multi-story hotel with sort of an international flavor. It has an attached convention center where much of the meeting will take place. In my brief stay, I can attest to comfortable rooms and an excellent health club and swimming pool which is inclusive for hotel guests. They also boast both Tennis and racquetball, but I did not have a chance to investigate in those activities. Assuming the economy stays as is, Canada is an excellent value at the moment with an exchange rate close to 1.5:1 with the U.S. dollar. The dinner entrees at a very nice French Canadian restaurant we visited cost between $12 and 18 Canadian, which after the exchange rate, is a fairly good value.

Like last year, the 2000 meeting will begin on Sunday afternoon (Feb. 6) and conclude after the banquet on Wed. eve. (Feb. 9). Several symposia are planned including the following:

- Weed Control, Weed Management, or Weed Science....Which will it be – Robert Hedberg
- Partnerships Now...Weeds Won't Wait – Randy Westbrooks and Arthur Miller
- Herbicide Resistant Crops: Implications for Latin American Agriculture – Bernal E. Valverde
- Herbicide Adjuvants – Jerry Green
- Allelopathy: Past Achievements and Future Approach – Inderjit and Chester Foy
- Impact of Genomics and Biotechnology on Weed Science – Dale Shaner

Several pre and post conference tours are in the planning including a tour of the grape/wine region, the greenhouse industry, and perhaps some other areas of agricultural interest. In addition, a number of shopping and cultural tours are in the planning stages for the spouse program.

Management by AM&M – the current AM&M contract expires, March 2000. A number of issues have occurred over the last three years that has led the BOD to consider selecting alternative management (tardiness on projects, poor quality, high turnover of personnel, etc.). The publishing side of the business (Allen Publishing) is working well and is not being considered for replacement. AM&M has recently taken several steps to rectify the situation such as appointing Theresa Pickel, the Director of Publishing, as the WSSA management director. Joyce Lancaster is still the Executive Secretary. AM&M has offered WSSA a one year extension of our current contract (instead of the 3-year renewal) to serve as a test period.

At the same time, a presentation by another management company, AIBS/Burke Associates was made during our stay in Toronto . WSSA is seriously considering replacing AM&M. As it now stands, the BOD will solicit bids from at least one additional company and will make a decision by early November, 1999. Hopefully AM&M will improve over the next 6 months which will prove to be the easiest solution.

Director of Science Policy - Mr. Robert Hedberg, Director of Science Policy provided the group with an update of his activities. He has been on the job for only a few months and seems very much committed to the WSSA and his job. He as already made numerous contacts and is quickly placing himself in a position for real progress. Much of his time thus far has been spent of issues surrounding the invasive species act. I'm sure that Rich and Jerry will provide more detail in their report.

One issue that arose related to Rob's position came from the NCWSS. They would like a letter or memorandum of understanding that details Rob's responsibilities, goals, and how his accomplishments will be reported. It was obvious from this conversation that the NCWSS and perhaps some other regions still don't feel that his position is providing sufficient communication to their members. I think we are extremely lucky in the NEWSS by having two very politically active EC members (Rich and Jerry) that keep us informed. Most regions do not have this benefit and will rely more on Rob for this information.

Lastly, Joyce Lancaster presented me with a bill for $4000 for our portion of Rob's appointment. I have forwarded this on to Andy Senesac.

Membership Directory – The new membership directory be distributed in late August and should be on-line on the WSSA website some time in the fall.

Policy Change for Weed Science Journal - Use of Latin binomials in Weed Science. Beginning with the first issue in 2000, Weed Science will use scientific names of weeds and crops rather than common names. The primary reason for this action is to enhance the status as the primary international journal of weed science. Some controversy arose after the Editorial Board for Weed Science decided to make this change. Several members complained about this change. Some individuals thought that it would make Weed Science less readable, user friendly, and perhaps a bit elitist. Weed Technology has not taken this direction. The BOD discussed this issue and more or less decided that additional discussion may be needed on this issue. Ann Legere, Director of Publications, will discuss this matter further with Bob Zimdahl, Editor for Weed Science.

Website Editor – WSSA is interested in establishing the new position of WSSA Website Editor. This person would be assigned the task of developing guidelines for submission and posting, managing current and new information, and working closely with the Webmaster and Computer Applications Committee to ensure timely posting of information on the WSSA website. An announcement has been advertised in the WSSA Newsletter asking for volunteers interested in this position. This will be a three year term.

Director of Education Jodie Holt presented an interim report that contained some long-term goals for the Director of Education. The primary goal of her position is to "Enhance and facilitate weed science education and outreach among WSSA member and the public". Some activities she hopes accomplish this year include:

- Establish communication and linkages with chairs of WSSA committees having educational responsibilities and with reps from the regional weed science societies.
- Develop a list of educational activities currently engaged in by WSSA, regional societies, and relevant state and local organizations as a starting point for planning and discussing.
- Identify new areas of need for educational activities both within and outside of WSSA and identify the potential role of the WSSA in such activities.
- Work with the 1999 Program Committee to determine the success of local outreach activities and to identify problems and concerns. Work with the 2000 Program committee to identify potential education/outreach activities for the 2000 meeting.
- Develop a proposal for the BOD for the 2000 meeting that will address the following issues: Future role of WSSA in member and nonmember education and outreach; Organizational structure of WSSA educational activities; Responsibilities of Director of Education; Potential educational activities, personnel to lead them, and location or a 3-year period; and Financial structure of educational activities.

Finally, Jodie felt that the only way the Director of Education position could really accomplish what everyone seemed to think that it should, would be through a paid position rather than volunteer. Jodie's term as interim Director is up next February.

Conversations on Change Membership Initiative - Jill Schroeder and Doug Buhler attended a CAST Conversations on Change meeting in Minnesota last May. The meeting topic centered on the issue of scientific society membership today as we strive to remain relevant and successful in a rapidly changing and complex world. It sounded like the meeting was very useful and that additional CAST sponsored meetings in the future will continue to discuss this increasingly important topic. For more information, see www.societies.org or call CAST at 515-292-2125. The BOD discussed the possibility of having a "town meeting" during the 2000 annual meeting to discuss these issues. Dick Oliver, President Elect, will look into it. WSSA Strategic Planning Committee members will likely be more involved in these future meetings.

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Slater Center for Environmental
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Sprout-Less Vegetation Control Systems
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St. John's University
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Stine Lab, S210
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SUNY Cobleskill, College of Ag & Tech
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Arthur Bing	1972-73	David B. Vitolo	1998-99
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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 University
	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 University
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

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	Robert D. Sweet	Cornell University
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	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 University
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	
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1991	John (Jack) B. Dobson	American Cyanamid
	Robert D. Shipman	Penn State University
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1993	Steve Dennis	Zeneca Ag. Products
	James Graham	Monsanto Ag. Co.
1994	Russell Hahn	Cornell University
	Maxwell McCormick	University of Maine
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	Richard Marrese	Hoechst-NorAm
1996	Roy R. Johnson	Waldrum Specialist Inc.
	Edward R. Higgins	Ciba Crop Protection
1997	Raymond B. Taylorson	UDSA-ARS
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	Stanley F. Gorski	Ohio State University
1998	Prasanta Bhowmik	University of Massachusetts
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Outstanding Researcher Award

1999	Garry Schnappinger	Novartis Crop Protection
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Outstanding Educator Award

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2000	Thomas L. Watschke	Penn State University

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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 University
	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	Ralph E. DeGregorio	University of Connecticut
	2	Avraham Y. Teitz	Ohio State University
1987	1	Russell W. Wallace	Cornell University
	2	Daniel E. Edwards	Penn State University
	2	Frank J. Himmelstein	University of Massachusetts
1988	1	William K. Vencill	Virginia Tech University
	2	Lewis K. Walker	Virginia Tech University
	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 University
	2	Russell W. Wallace	Cornell University

1991	1	Elizabeth Maynard	Cornell University
	2	Daniel A. Kunkle	Cornell University
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	2	Ted Blomgren	Cornell University
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	2	Henry C. Wetzel	University of Maryland
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	2	Mark Issacs	University of Delaware
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	2	Sowmya Mitra	University of Massachusetts
	HM	Mark Issacs	University of Delaware
1998	1	Dan Poston	Virginia Tech University
	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 University
	3	Gina Penny	North Carolina State University

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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 University
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 University
Undergraduate Individual: Allen Eadie, University of Guelph

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

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

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

1991 - Rutgers University, New Brunswick, New Jersey

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

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

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

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

1995 - Thompson Vegetable Research Farm, Freeville, New York

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

1999 - Virginia Tech University, Blacksburg, Virginia

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

2000 - University of Guelph, Guelph, Ontario, CANADA

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

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 University, Blacksburg, and T. E. Hines and H. P. Wilson, Virginia Truck and Ornamental Res. Station, Painter

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

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

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

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

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

HM. Wild Proso Millet in New York State - R. R. Hahn, Cornell Univ., Ithaca, NY

1986 1. Discharge Rate of Metolachlor from Slow Release Tablets - S. F. Gorski, M. K. Wertz and S. Refiners, Ohio State Univ., Columbus

2. Glyphosate and Wildlife Habitat in Maine - D. Santillo, Univ. of Maine, Orono

1987 1. Mycorrhiza and Transfer of Glyphosate Between Plants - M. A. Kaps and L. J. Khuns, Penn State Univ., University Park

2. Redroot Pigweed Competition Study in No-Till Potatoes - R. W. Wallace, R. R. Bellinder, and D. T. Warholic, Cornell Univ., Ithaca, NY

1988 1. Growth Suppression of Peach Trees With Competition - W. V. Welker and D. M. Glenn, USDA-ARS, Kearneysville, WV

2. Smooth Bedstraw Control in Pastures and Hayfields - R. R. Hahn, Cornell Univ., Ithaca, NY

1989 1. Burcucumber Responses to Sulfonylurea Herbicides - H. P. Wilson and T. E. Hines, Virginia Tech University, 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 University, 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. Nines, Virginia Tech University,

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

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 University
	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 University
1993	None Awarded	
1994	Robin Bellinder	Cornell University
1995	None Awarded	
1996	E. Scott Hagood	Virginia Tech University
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 University
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 University
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 University, 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 University, 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 University, 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
2,4-D	many	(2,4-dichlorophenoxy)acetic acid
2,4-DB	Butoxone, Butyrac	4-(2,4-dichlorophenoxy)butanoic acid
acetochlor	Harness, Surpass, Topnotch	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide
acifluorfen	Blazer, Status	5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid
alachlor	Lasso, MicroTech, Partner, many	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl) acetamide
ametryn	Evik	N-ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
asulam	Asulox	methyl[(4-aminophenyl)sulfonyl]carbamate
atrazine	Aatrex, many	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine
azafenidin	Milestone, Evolus	2-[2,4-dichloro-5-(2-propynyloxy)phenyl]-5,6,7,8-tetrahydro-1,2,4-triazolo[4,3-a] pyridin-3(2H)-one
azimsulfuron	Gulliver	N-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-1-methyl-4-(2-methyl-2H-tetrazol-5-yl)-1H-pyrazole-5- sulfonamide
benefin	Balan	N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine
bensulfuron	Londax	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl] amino]sulfonyl]methyl]benzoic acid
bensulide	Bensumec, Betason, Prefar, Lescosan	O,O-bis(1-methylethyl)S-[2-[(phenylsulfonyl)amino]ethyl]phosphorodithioate
bentazon	Basagran	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide
benzfendizone		methyl 2-[2-[[4-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)pyrimidinyl)phenoxy]methyl]-5-ethylphenoxy]propanoic acid
bromacil	Hyvar	5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H, 3H)pyrimidinedione
bromoxynil	Brominal, Buctril, Moxy	3,5-dibromo-4-hydroxybenzonitrile
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
carfentrazone	Aim, Affinity	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

Common Name	Trade Name	Chemical Name
chlorsulfuron	Glean, Telar	2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]carbonyl] benzenesulfonamide
clethodim	Prism, Select	(E,E)-(±)-2-[1-[[(3-chloro-2-propenyl)oxy]imino]propyl]-5-[2 -(ethylthio)propyl]- 3-hydroxy-2-cyclohexen-1-one
clomazone	Command	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone
clopyralid	Reclaim, Stinger, Transline	3,6-dichloro-2-pyridinecarboxylic acid
cloransulam	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
cyanazine	Bladex, Cy-Pro	2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitrile
cycloate	Ro-Neet	S-ethyl cyclohexylethylcarbamothioate
cyclosulfa-muron	Ichiyonmaru, Nebiros	N-[[[2-(cyclopropylcarbonyl)phenyl]amino]sulfonyl]-N'-(4,6-dimethoxy-2- pyrimidinyl)urea
dazomet	Basamid	tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione
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	Casoron, Dyclomec, Norosac	2,6-dichlorobenzonitrile
dichlorprop	Weedone 2,4-DP	(±)-2-(2,4-dichlorophenoxy)propanoic acid
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
diethatyl	Antor	N-(chloroacetyl)-N-(2,6-diethylphenyl)glycine
difenzoquat	Avenge	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium
dimethanamid	Frontier, Outlook	(RS)2-chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide
diphenamid	Enide	N,N-dimethyl-a-phenyl benzeneacetamide
diquat	Diquat, Reward	6,7-dihydrodipyrido[1,2-a:2',1'-c]pyrazinediiumion
dithiopyr	Dimension, Stakeout	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, Genep	S-ethyl dipropyl carbamothioate
ethalfluralin	Sonalan, Curbit, Edge	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoro-methyl)benzenamine
ethamet-sulfuron	Muster	2-[[[[4-ethoxy-6-(methylamino)-1,3,5-triazin-2-yl]amino] carbonyl]amino]sulfonyl]benzoic acid
ethofumesate	Nortron, Progress	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate

Common Name	Trade Name	Chemical Name
fenoxaprop	Acclaim, Horizon, Puma, Whip	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy]propanoic acid
florasulam		N-(2,6-difluorophenyl)-8-fluoro-5-ethoxy[1,2,4]triazolo[1,5-c]pyrimidine-2-sulfonamide
fluazifop	Fusilade, Horizon, Ornamec, Tornado	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]-propanoic acid
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	Flumizin, Sumisoya, Valor	2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]-4,5,6,7-tetrahydro-1H-insoindole-1,3(2H)-dione
fluometuron	Cotoran	N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]urea
flupoxam		1-[4-chloro-3-[(2,2,3,3,3-pentafluoropropoxy)methyl]-phenyl]-5-phenyl-1H-1,2,4-triazole-3-carboxamide
flupropacil		1-methylethyl 2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)-pyrimidinyl]benzoate
fluridone	Sonar	1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone
fluroxypyr	Starane, Tomahawk, Vista	[(4-amino-3,5-dichloro-6-fluoro-2-pyridinyl)oxy]acetic acid
fomesafen	Reflex, Flexstar	5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide
fosamine	Krenite	ethyl hydrogen (aminocarbonyl)phosphonate
glufosinate	Finale, Liberty, Rely	2-amino-4-(hydroxymethylphosphinyl)butanoic acid
glyphosate	Accord, Honcho, Ranger, Rodeo, Roundup, Touchdown	N-(phosphonomethyl)glycine
halosulfuron	Manage, Permit	3-chloro-5-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-1-methyl-1H-pyrazole-4-carboxylic acid
hexazinone	Pronone, Velpar	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4 (1H,3H)-dione
imazameth-abenz	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
imazapyc	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

Common Name	Trade Name	Chemical Name
imazethapyr	Pursuit	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid
isoproturon		N,N-dimethyl-N'-[4-(1-methylethyl)phenyl]urea
isoxaben	Gallery	N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide
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
mecoprop	Mecomec, Acme Super Chickweed Killer	(±)-2-(4-chloro-2-methylphenoxy)propanoic acid
mefluidide	Embark, Vistar	N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino] phenyl]acetamide
metham	Vapam	methylcarbamodithioic acid
metolachlor	Dual, Pennant	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide
metosulam		N-(2,6-dichloro-3-methylphenyl)-5,7-dimethoxy[1,2,4] triazolo[1,5-a]pyrimidine-2- sulfonamide
metribuzin	Lexone, Sencor	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
metsulfuron	Ally, Escort	2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino] carbonyl]amino]sulfonyl]benzoic acid
molinate	Ordram	S-ethyl hexahydro-1H-azepine-1-carbothioate
MSMA	Ansar, Arsonate Liquid, Bueno, Daconate	monosodium salt of MAA
napropamide	Devrinol	N,N-diethyl-2-(1-naphthalenyloxy)propanamide
naptalam	Alanap	2-[(1-naphthalenylamino)carbonyl]benzoic acid
nicosulfuron	Accent	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino] sulfonyl]-N,N-dimethyl-3-pyridinecarboxamide
norflurazon	Evital, Solicam, Predict, Zorial	4-chloro-5-(methylamino)-2-(3-(trifluoromethyl)phenyl)-3 (2H)-pyridazinone
oryzalin	Surflan	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide
oxadiazon	Ronstar	3-[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one
oxyfluorfen	Goal	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene

Common Name	Trade Name	Chemical Name
paraquat	Boa, Cyclone, Gramoxone Extra, Gramoxone Max, Starfire	1,1'-dimethyl-4,4'-bipyridiniumion
pebulate	Tillam	S-propyl butylethylcarbamothioate
pelargonic acid	Scythe	nonanoic acid
pendimethalin	Pentagon, Pendulum, Prowl	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
phenmedipham	Spin-Aid	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate
picloram	Tordon, Grazon	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid
primisulfuron	Beacon, Rifle	2-[[[[4,6-bis(difluoromethoxy)-2-pyrimidinyl]amino] carbonyl]amino]sulfonyl]benzoic acid
prodiamine	Barricade, Factor, RegalKade	2,4 dinitro-N3,N3-dipropyl-6-(trifluoromethyl)-1,3-benzenediamine
prometon	Pramitol	6-methoxy-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
prometryn	Caparol, Cotton Pro	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
pronamide	Kerb	3,5-dichloro (N-1,1-dimethyl-2-propynyl)benzamide
propachlor	Ramrod	2-chloro-N-(1-methylethyl)-N-phenylacetamide
propanil	Propanil, Stam, Superwham	N-(3,4-dichlorophenyl)propanamide
pyrazon	Pyramin	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
pyridate	Lentagran, Tough	O-(6-chloro-3-phenyl-4-pyridazinyl) S-octyl carbonothioate
pyrithiobac	Staple	2-chloro-6-[(4,6-dimethoxy-2-pyrimidinyl)thio]benzoic acid
quinclorac	Drive, Facet, Impact	3,7-dichloro-8-quinolinecarboxylic acid
quizalofop	Assure II	(±)-2-[4-[(6-chloro-2-quinoxalinyl)oxy]phenoxy]propanoic acid
rimsulfuron	Matrix, Titus	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
s-metolachlor	Dual Magnum Pennant Magnum	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide, S-enantiomer
sodium chlorate	Defol	sodium chlorate
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

Common Name	Trade Name	Chemical Name
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-methylpropyl) -6-(trifluoromethyl)-3- pyridinecarboxylate
thifensulfuron	Cheyenne, Harmony, Pinnacle	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
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
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-MIXED HERBICIDES

Common Pre-Mix Herbicides and Common Name of the Component Chemicals

TRADE NAME	COMMON NAME OF INDIVIDUAL HERBICIDES
Accent Gold	clopyralid + flumetsulam + nicosulfuron + rimsulfuron
Access	picloram + triclopyr
Arrosolo	molinate + propanil
Atrabute+	atrazine + butylate
Axiom	flufenacet + metribuzin
Axiom AT	atrazine + flufenacet + metribuzin
Backdraft	glyphosate + imazaquin
Basis	rimsulfuron + thifensulfuron
Basis Gold	atrazine + nicosulfuron + rimsulfuron
Bayonet	metribuzin + pendimethalin
Betamix	desmedipham + phenmedipham
Bicep	atrazine + metolachlor
Bicep II	atrazine + metolachlor
Bicep II Magnum	atrazine + s-metolachlor
Bicep II Magnum TR	atrazine + flumetsulam + s-metolachlor
Bicep Lite II Magnum	atrazine + s-metolachlor
Bison	bromoxynil + MCPA
Boundary	s-metolachlor + metribuzin
Broadstrike SF + Dual	flumetsulam + metolachlor
Broadstrike + Treflan	flumetsulam + trifluralin
Bronate	bromoxynil + MCPA
Bronco	alachlor + glyphosate
Brushmaster	dicamba + 2,4-D + 2,4-DP
Buckle	triallate + trifluralin
Bullet	alachlor + atrazine
Canopy	chlorimuron + metribuzin
Canopy XL	chlorimuron + sulfentrazone
Celebrity	dicamba + nicosulfuron
Chaser	triclopyr + 2,4-D
Cheyenne	fenoxaproppethyl + MCPA + thifensulfuron + tribenuron
Command Xtra	clomazone + sulfentrazone
Commence	clomazone + trifluralin
Confront	clopyralid + triclopyr
Conquest	atrazine + cyanazine
Coolpower	dicamba + MCPA + triclopyr
Crossbow	triclopyr + 2,4-D
Curtail	clopyralid + 2,4-D
Cycle	cyanazine + metolachlor
Dakota	fenoxaprop + MCPA
Degree Xtra	acetachlor + atrazine
Detail	dimethenamid + imazaquin
Dissolve	mecoprop + 2,4-D + 2,4-DP

TRADE NAME	COMMON NAME OF INDIVIDUAL HERBICIDES
Distinct	dicamba + diflufenzopyr
Domain	FOE5043 + metribuzin
Epic	FOE5043 + isoxaflutole
Eradicane	dichlormid + EPTC
Eradicane Extra	EPTC + dichlormid + dietholate
Event	imazapyr + imazethapyr
Exceed	primisulfuron + prosulfuron
Extrazine	atrazine + cyanazine
Extrazine II	atrazine + cyanazine
Extreme	glyphosate + imazethapyr
FieldMaster	acetochlor + atrazine + glyphosate
Finesse	chlorsulfuron + metsulfuron
Forge	glyphosate + 2,4-D
Freedom	alachlor + trifluralin
Frontrow	cloransulam + flumetsulam
FulTime	acetochlor + atrazine
Fusion	fenoxaprop + fluazifop
Galaxy	acifluorfen + bentazon
Gauntlet	cloransulam + sulfentrazone
Genep Plus	dichlormid + EPTC
Guardsman	atrazine + dimethenamid
Harmony Extra	thifensulfuron + tribenuron
Harness Xtra	acetochlor + atrazine
Horizon 2000	fenoxaprop + fluazifop
Hornet	clopyralid + flumetsulam
Kansel Plus	oxadiazon + pendimethalin
Krovar	bromacil + diuron
Laddok S-12	atrazine + bentazon
Landmaster	glyphosate + 2,4-D
Lariat	alachlor + atrazine
Leadoff	atrazine + dimethenamid
Liberty ATZ	atrazine + glufosinate
Lightning	imazapyr + imazethapyr
Lorox Plus	chlorimuron + linuron
Marksman	atrazine + dicamba
Millennium	clopyralid + dicamba + 2,4-D
NorthStar	dicamba + primisulfuron + prosulfuron
OH2 (Ornamental Herbicide)	oxyfluorfen + pendimethalin
Passport	imazethapyr + trifluralin
Preclaim	fenoxaprop + pendimethalin
PrePair	napropamide + oxadiazon
Preview	chlorimuron + metribuzin
Prompt	atrazne + bentazon
Pursuit Plus	imazethapyr + pendimethalin
Ready Master ATZ	atrazine + glyphosate
Regal O-O	oxadiazon + oxyfluorfen
RegalStar	oxadiazon + prodiamine

TRADE NAME	COMMON NAME OF INDIVIDUAL HERBICIDES
Reliance STS	chlorimuron + thifensulfuron
Resolve SG	dicamba + imazethapyr
Rhino	atrazine + butylate
Rout	oryzalin + oxyfluorfen
Sahara	diuron + imazapyr
Salute	metribuzin + trifluralin
Scepter O.T.	acifluorfen + imazaquin
Scorpion III	clopyralid + flumetsulam + 2,4-D
Shotgun	atrazine + 2,4-D
Simazat	atrazine + simazine
Snapshot TG	isoxaben + trifluralin
Spirit	primisulfuron + prosulfuron
Squadron	imazaquin + pendimethalin
Stampede	MCPA + propanil
Steadfast	nicosulfuron + rimsulfuron
Steel	imazaquin + imazethapyr + pendimethalin
Stellar	flumiclorac + lactofen
Sterling Plus	atrazine + dicamba
Storm	acifluorfen + bentazon
Super Trimec	dicamba + 2,4-D + 2,4-DP
Sutan+	butylate + dichlormid
Sutazine+	atrazine + butylate + dichlormid
Synchrony STS	chlorimuron + thifensulfuron
Team	benefin + trifluralin
Telone C17	chloropicrin + dichloropropene
Tiller	fenoxaprop + MCPA + 2,4-D
Tornado	fluazifop + fomesafen
Total	bromacil + diruon + sodiumchlorate + sodiummetaborate
Triamine	mecoprop + 2,4-D + 2,4-DP
Tri-Ester	mecoprop + 2,4-D + 2,4-DP
Trimec992	dicamba + mecoprop + 2,4-D
Trimec Classic	dicamba + mecoprop + 2,4-D
Trimec Super	dicamba + dichlorprop + 2,4-D
Tri-Scept	imazaquin + trifluralin
Trupower	clopyralid + dicamba + MCPA
Turbo	metolachlor + metribuzin
Typhoon	fluazifop + fomesafen
Vengeance	dicamba + MCPA
WeedERad	CMA/MAA
Weedmaster	dicamba + 2,4-D
XL 2G	benefin + oryzalin

EXPERIMENTAL HERBICIDES

Experimental Number	Common Name (proposed)/Trade Name, Company Name
AC-900001	picolinafen, BASF
AEF-115008	iodosulfuron, Aventis
AEF-130360	foramsulfuron/Equip, Tribute, Aventis
BAS 620	tepraloxydim/Aramo, Equinox, Honest, BASF
BAS 654	diflufenzopyr, BASF
BAY FOE 5043	flufenacet, Bayer
BAY MKH 3586	amicarbazone, Bayer
BAY MKH 6561	propoxycarbazone/Attribute, Olympus, Bayer
BAY MKH 6562	flucarbazone/Everest, Bayer
BK-800	Uniroyal
CGA-152005	prosulfuron/Peak, Novartis
CGA-184927	clodinofop-propargyl/Discover, Novartis
CGA-248757	fluthiacet/Action, Novartis
CGA-277476	oxasulfuron/Expert, Novartis
CGA-362622	trifloxysulfuran, Novartis
ICIA-0604	tralkoxydim/Achieve, Zeneca
MON-13900	furilazole, Monsanto
MON-37500	sulfosulfuron/Maverick, Monsanto
RPA 201772	isoxaflutole/Balance, Rhone Poulenc
SAN-582	dimethenamid/Frontier, BASF
S-3153	flufenapyr, Valent
ZA-1296	mesotrione/Callisto, Zeneca
UPH-820	
	alloxydim/Clout
	pyraflufen/Ecopart, Nihon Nohyaku
	fluzasulfuron, Zeneca
	cinidon, BASF

COMMON AND TRADE NAMES OF PLANT GROWTH REGULATORS

Common Name	Trade Name
6-benzyl adenine	BAP-10
chlormequat chloride	Cycocel
clofencet	Detasselor
copper ethylenediamine	Inferno
ethephon	Florel
glutamic	Axigro
paclobutrazol	Bonzi, Clipper, Profile Scotts TGR
prohexadione	Apogee
trinexapac	Palisade, Primo
uniconazole	Prunit, Sumagic
1-methylcyclopropene (1-MCP)	

COMMON AND CHEMICAL NAMES OF HERBICIDE MODIFIERS

Common name	Chemical name
cyometrinil	(Z)-a[(cyanomethoxy)imino]benzeneacetonitrile
dichlormid	2,2-dichloro-N,N-di-2-propenylacetamide
dietholate	O,O-diethyl O-phenyl phosphorothioate
flurazole	phenylmethyl-chloro-4-(trifluoromethyl)-5-thiazolecarboxylate
mephenate	4-chlorophenyl methylcarbamate
naphthalic anhydride	1H,3H-naphtho[1,8-cd]-pyran-1,3-dione

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