

**New Weed Management Tools from the Purdue Extension Weed Science Team**

**2004 Weed Control Guide for Ohio and Indiana (WS16) –**

Extension Weed Scientists at Ohio State and Purdue collaborated to produce a single guide for both states. The guide contains weed control information for corn, grain sorghum, soybeans, small grains, and legume, grass and mixed forages. It also contains a special section on control of particularly problematic weeds. It is available on the web at <http://ohioline.osu.edu/b789/index.html>. Printed version is available for \$6.50 from the Ohio State Publications Distribution Office (ph. 614 292-1607).

**Purdue Weed Science Website -**

<http://www.btny.purdue.edu/weedscience/>. This site contains frequently updated weedworthy articles for agronomic crops, horticulture crops, turf and lawn, and other general items of interest. Also contains links to sites on weed identification, herbicide injury, weed science faculty, staff and students at Purdue, and weed management tools from Purdue and other Universities.

**Indiana Select-A-Herb Website -**

<http://btny.agriculture.purdue.edu/herbsel/index.cfm>. This web-based tool provides herbicide response ratings for weeds in various cropping systems. The database is an accumulation of weed control ratings from several Midwest sources and allows the user to use drop down menu's to find herbicides that provide fair to excellent control of over 200 weeds in 15 crops.

**WeedSOFT 2004 for Indiana -** <http://weedsoft.unl.edu/>.

WeedSOFT is a decision support system designed to assist growers, consultants, and extension agents in making both proactive and reactive weed management decisions. WeedSOFT provides the treatment information according to specific field conditions while factoring in economic and environmental principles. The price of the software has been reduced 75% to \$50 per copy. Bulk discounts are also available for orders of multiple copies.

**Weeds to Watch Poster** – Weed communities continually shift in response to management practices. The weeds included on this poster pose an increasing threat to agronomic fields. The poster also contains maps that provide information regarding current distribution of each species in Indiana, Illinois, Iowa, Minnesota, Wisconsin and Michigan.

### **News from Industry**

*Boundary 6.5 EC* (s-metolachlor 5.25 lb/gallon + metribuzin 1.25 lb/gallon) from Syngenta is a new formulation of Boundary designed for better handling in cool conditions. This product is loaded with the same ratio of s-metolachlor to metribuzin, but is less concentrated, so product use rates will be different for the new Boundary product. Product is labeled for use as a soil applied treatment in soybeans.

*Camix* (s-metolachlor 3.34 lb/gal + mesotrione 0.33 lb/gal) from Syngenta is a product that can be used PPI, PRE, or POST on field or seed corn up to 5 inches tall. Use rates are 2.4 qt/A which provides 1.75 pt/A of Dual II Magnum and 6.3 oz/A of Callisto. This product will be available in limited quantities in MI, MN, PA, and WI. If the product is applied POST the use of NIS is recommended, but do not use COC, MSO or nitrogen solutions because of risk of crop injury. Do not use after Counter or Lorsban insecticide.

*Gangster* is a co-pack of Valor (flumioxazin) + FirstRate (cloransulam) co-marketed by Valent and DowAgroSciences. The addition of FirstRate adds activity on ragweeds, marestail, morningglories, velvetleaf and cocklebur to the activity of Valor. Soybean use rates are 1.8 to 3.6 oz/A.

*Intrro* (alachlor 4lb/gallon) from Monsanto is a new brand name for Lasso. It will be labeled for use in soybeans and grain sorghum. Lasso will be phased out of the corn market as inventories are used up. Use rate is 1.5 qt/A.

*Prowl H<sub>2</sub>O* (pendimethalin 3.8 lb/gallon) from BASF is a new water-based formulation of Prowl. This formulation is less likely to stain and have the odor of the old EC formulation, and will have greater storage flexibility. Prowl H<sub>2</sub>O is more concentrated than Prowl EC, so product use rates will be lower. It will be labeled for corn, soybean, grain sorghum, and several other crops. Limited quantities will be available in 2004 with a full launch scheduled for 2005.

Dupont has purchased Griffin Chemical company and will be marketing several of the generic brands of products such as atrazine, linuron, simazine, and others.

### *Glyphosate formulations*

There are now over 60 formulations of glyphosate labeled for use in Roundup Ready crops in Indiana. Monsanto will introduce a product called Roundup Original Max, which is a 4.5 lb ae (acid equivalent)/gallon potassium salt that does not contain the Transorb adjuvant package. Like Roundup Weathermax, use rates of Roundup Original Max will be 22 to 32 oz/A. Syngenta will introduce two new potassium salts of glyphosate called Touchdown Total (4.17 lb ae/gallon) and Touchdown HiTech (5 lb ae/gallon) in 2004.

In Table 1, we have listed several of the major glyphosate brands available for use in Roundup Ready crops and their equivalent rates to obtain 0.38 or 0.75 lb ae/A. Although not included in this table, most of the generic glyphosates are formulated as the isopropylamine salt with 3 lb of ae/gallon, similar to the Glyphomax products shown on the first line. It is important to keep in mind that each product may have unique adjuvant requirements. Here are examples of statements from labels of a few Monsanto glyphosate products:

- Roundup Weathermax – do not add additional surfactants
- Roundup Original II – additional surfactant optional
- Roundup Original – additional surfactant recommended
- Honcho Plus – additional surfactant optional
- Honcho – additional surfactant recommended

**Table 1. Glyphosate salt and formulations of several major brands available for use on Roundup Ready soybean and corn.**

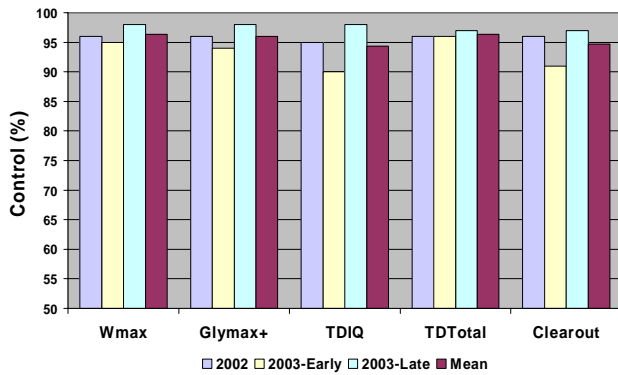
Herbicide	Concentration	0.38 lb ae/A	0.75 lb ae/A
Glyphomax, etc (isopropylamine salt)	3 lb ae/gal	16 oz	32 oz
Touchdown IQ (diammonium salt)	3 lb ae/gal	16 oz	32 oz
Touchdown Total (potassium salt)	4.17 lb ae/gal	12 oz	24 oz/A
Touchdown HiTech (potassium salt)	5 lb ae/gal	10 oz	20 oz/A
Roundup Original (isopropylamine salt)	3 lb ae/gal	16 oz	32 oz
Roundup Original II (isopropylamine salt)	3 lb ae/gal	16 oz	32 oz
Roundup Original Max (potassium salt)	4.5 lb ae/gal	11 oz	22 oz
Roundup Weathermax (potassium salt)	4.5 lb ae/gal	11 oz	22 oz

A great deal of time and effort is devoted to marketing the various glyphosate products. Many claims are made in reference to one product being superior to others. When used according to label directions we have observed very few differences in the activity of the various formulations on target weed species. Shown in the following figures are the results of two years of experiments at the Purdue University Agronomy Farm. Essentially no differences were observed between the products evaluated in these trials.

**Table 2. Dates of various operations and weed sizes in the 2002 and 2003 glyphosate formulation trials.**

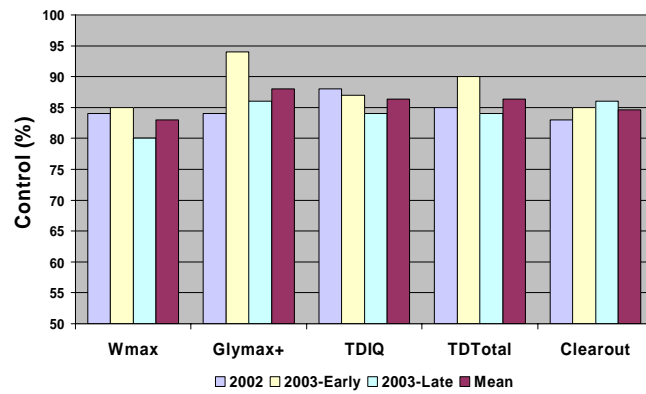
Operation	2002	2003 early	2003 late
Planting date	June 4	May 23	
Postemergence application date	June 28	June 19	
Rating date	July 11	July 22	
Soybean stage	2 trifoliolates	2 trifoliolates	3 trifoliolates
Foxtail height (inches)	4-7	4	7
Ivyleaf height (inches)	2	2	4
Velvetleaf height (inches)	3	3	6

## Giant Foxtail Control Glyphosate rate 0.75 lb ai/A



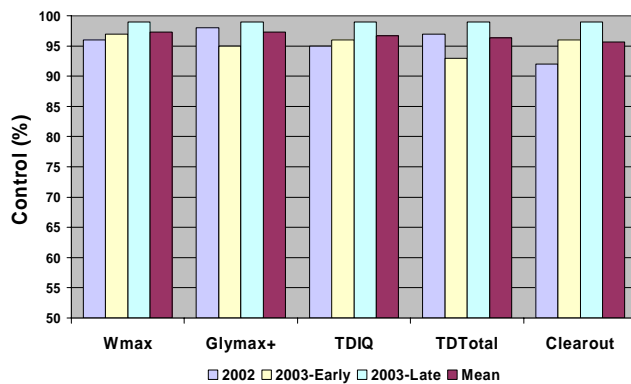
Purdue University - T.T. Bauman

## Ivyleaf Morningglory Control Glyphosate rate 0.75 lb ai/A



Purdue University - T.T. Bauman

## Velvetleaf Control Glyphosate rate 0.75 lb ai/A



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### *Metolachlor Formulations*

Similar to the situation with glyphosate, there are a number of metolachlor (Dual) formulations available in 2004. An important point to keep in mind is that the active ingredient in these products will consist of either s-metolachlor or the racemic mixture of s- and r-metolachlor. S-metolachlor is the more active isomer and so it is important to know what the product contains so the proper rate is applied.

Product name	Isomers present	Formulation (lb/gallon)	Company	Atrazine premix
Dual II	s- and r-metolachlor	7.8	Syngenta	Bicep II
Dual II Magnum	s-metolachlor	7.64	Syngenta	Bicep II Magnum
Cinch	s-metolachlor	7.64	Dupont	Cinch ATZ
Stalwart C	s- and r-metolachlor	7.8	Sipcam	Stalwart Xtra
Me-Too-lachlor	s- and r-metolachlor	7.8	Drexel	Trizmet II

### **Herbicide Injury and Weed Issues in 2003**

We received a number of corn and soybean herbicide injury reports during 2003. In most cases, the cause of the injury was related to stressful weather conditions which reduced the plant's ability to metabolize or degrade the herbicide. In some cases, because corn was planted at such a rapid rate in late April and early May before rainy weather set in, growers and custom applicators were not able to spray soil-applied herbicides before the crop emerged. As a result, many soil-applied products were put on emerged corn. This resulted in the corn plant receiving a much higher dose of herbicide than if the products were applied to the soil, and diluted before being absorbed by the corn plant.

#### *Herbicide Injury Issues*

Atrazine/chloroacetamide injury. A few cases of this type injury were observed when the products were applied to emerged corn and adjuvants, 2,4-D, simazine (Princep, others) were added to the mixture to control emerged weeds. In other cases the atrazine/chloroacetamide premix was applied in a liquid fertilizer solution to emerged corn. Symptomology observed was short, stunted corn with necrotic tissue on the leaf edges and lower leaves burned off. In addition, larger plants showed buggywhipping and twisted

whorls. Although some stand loss was observed in certain fields, in most cases the corn grew out of this injury when warm, sunny days returned. The reasons for this occurrence include the following:

1) Most labels indicate that mixtures of 2,4-D with atrazine premixes should be applied 7-14 days before planting or 3-5 days after planting, but before corn emerges. These precautions are for two reasons: First, 2,4-D is very water soluble and has a relatively short half life. Applications at corn planting can result in the product being washed down into the seed furrow if enough precipitation is received. This results in a high concentration of herbicide around the corn seed and injury. Second, 2,4-D formulations tend to be somewhat oily and can function as a crop oil concentrate and increase uptake of other herbicides.

2) The use of liquid fertilizer solutions as the carrier is discouraged on most of the labels of these products if corn has emerged. Liquid fertilizer solutions can also act as adjuvants to increase uptake of herbicides. Liquid fertilizer solutions will also cause injury symptoms on corn in addition to acting as an adjuvant.

Lumax/Callisto and Balance Pro injury. Callisto is one of the components in Lumax. We observed a few cases of bleached corn caused by these products. Injury was typically located in low or wet areas on the field and on sandy soils. Symptomology observed was short, stunted plants with chlorotic tissue on older leaves with new leaves appearing normal in color. Injury was occasionally more severe when these products were applied with higher rates of atrazine (1.5 lb ai/A or more). Injury from these herbicides is typically more noticeable than most other herbicide families. Recovery and yield potential was good if less than 30% of the plant tissue was affected (chlorotic). Reasons for this injury include the following: 1) The bleaching or chlorosis injury can also occur on emerged plants if hard rains drive the corn leaf tips into the soil. Both Balance Pro and Callisto have relatively high water solubilities and can be taken up by corn foliage after corn emergence. 2) Balance Pro injury potential is higher on sandy soils with high pH. The Balance Pro label has very specific instructions regarding appropriate use rates on various soil textures and organic matter contents. The use rate matrix reminds me of the table in the Bladex label from years past. Essentially, we should think of Balance Pro in a similar manner as Bladex and pay very close attention to the rate instructions. This issue of use rate can be particularly difficult to interpret on the sand/muck soils in northern Indiana. 3) The activity of both herbicides is increased when used

with atrazine. Although the synergistic activity of these combinations is valuable in terms of weed control, it can also cause higher incidences of crop injury.

Balance Pro and Callisto carryover to soybean. There were a number of fields in northern Indiana that showed signs of Balance Pro or Callisto carryover injury. The injury symptoms consisted of short, stunted plants with occasional bleaching and chlorosis of leaves. Injury was most prevalent on sandy, low organic matter fields that also had low pH (below 6.0). Soybean injury became noticeable during the hot dry spells of early July, and late July when soil moisture became limiting after prolonged periods of rainy weather and wet soil conditions. A few fields that contained more than one variety showed that some varieties appear to be more sensitive to these herbicides than others. In most cases the injury was cosmetic and yield was not affected.

#### *Weed Issues*

Horseweed (aka maretail) is weed common to Indiana and much of the Midwest. It can emerge in the fall or spring and is listed as one of the more difficult weeds to control and increasingly problematic according to Indiana farmers surveyed between 1996 and 2000. A characteristic of horseweed is that it is well adapted to no-till systems, typifying the response of winter annuals to the elimination of preplant tillage and subsequently infesting summer annual crops. Horseweed generally emerges in the fall (August – October), overwinters as a rosette, and produces seed the following spring or summer. However, some researchers reported that horseweed could emerge well into the spring and that spring emergence should be considered in no-till management systems.

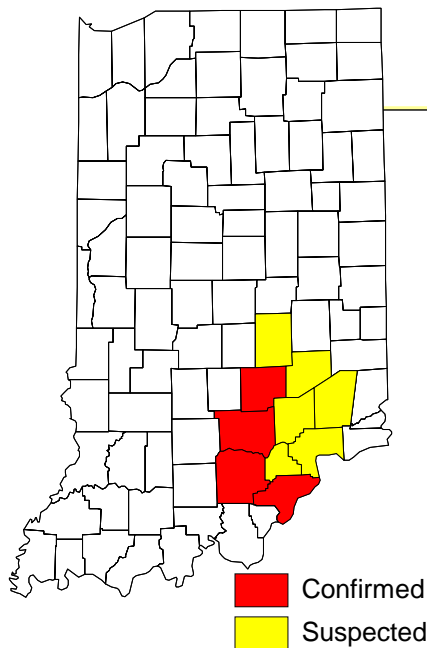
Horseweed having an 8 to 13-fold resistance compared to a susceptible population was discovered in 2000 in Delaware in continuous no-till soybean production. Since this first report, glyphosate-resistant (GR) horseweed has also been discovered in Tennessee, Kentucky, Maryland, New Jersey, Ohio, Indiana, and Arkansas in similar cropping situations. Biotypes resistant to glyphosate and cloransulam are suspected in southern Indiana and northern Ohio, respectively.

Horseweed growth patterns following glyphosate application will differ between susceptible and resistant populations.

- a. Susceptible plants will have “yellowing” in the tops or meristematic region which will eventually spread throughout the plant with the growing point dying within a few weeks.
- b. Resistant plants may be initially stunted and even display some yellowing if the glyphosate rate was high enough. The growing point will rarely die, but if it does, then the bottom of the plant may generate branches resulting in a bushy plant with multiple growing points. This can also be observed when susceptible plants are allowed to get to big (typically more than 1 ft tall prior to initial herbicide application).
- c. Often glyphosate-resistant and susceptible plants can be found beside each other and interspersed throughout a field. If horseweed growth was uniform and most of the plants were the same size at the time of application then surviving plants in the midst of dead horseweed should be considered resistant.

*Where are glyphosate-resistant horseweed populations located in Indiana?* Four sites in four southeast Indiana (Bartholomew, Clark, Jackson, and Washington counties) have confirmed populations of glyphosate-resistant horseweed. Resistance is also suspected in Jefferson, Jennings, Scott, Shelby, Decatur, and Ripley counties in southwest Indiana. No populations have been reported in southwest or northern Indiana north of Indianapolis.

### Current Estimate of the Distribution of Glyphosate-Resistant Horsweed in IN



- Confined to SE Indiana
- At least 200,000 acres affected
- As of December 19, 2003

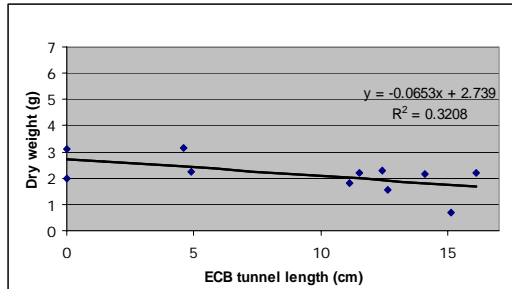
#### *Giant ragweed control and stalk boring insects*

While we do have pockets of glyphosate-resistant marestail in southeast IN, we are becoming more concerned about giant ragweed plants that do not appear to be controlled by glyphosate. In some cases, when the plant stems are split open with a knife, stalk boring insects and their tunnels are observed, particularly on plants 18 inches tall or larger. In some cases, we have split open small (less than 12 inch tall plants) and have not been able to find insect boring. By and large though, most of the escapes are large plants and in almost every instance, a stalk boring insect is present. In response to this issue, we initiated greenhouse studies to look at the influence of stalk boring insects on glyphosate efficacy in giant ragweed. We have completed a couple of runs of this experiment and wanted to share some of our findings to date.

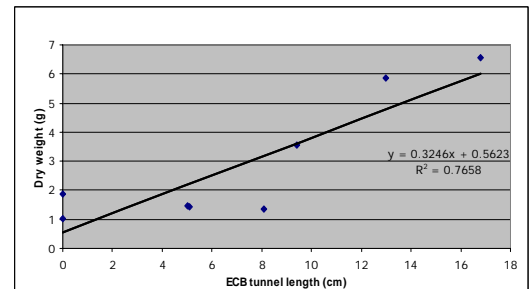
Methods. Giant ragweed seedlings (cotyledon to 2-leaf stage) were collected from the Purdue University ACRE Farm near West Lafayette and brought into the greenhouse. Individual plants were placed in plastic pots and watered as needed to bring them back to health after transplanting. European corn borer larvae were obtained from a commercial source and 2-4 larvae were placed on the plant leaves when the plants were 4 inches tall. When the plants were either 6 or 18 inches tall, Roundup Weathermax was applied at 16, 22, or 44 oz/A to these plants with a track sprayer. At 3 weeks after herbicide

treatment, plants were harvested at the soil surface and the length of tunnels measured and dry weights recorded.

Giant ragweed dry weight as a function of ECB tunnel length on 16 to 20 inch tall plants sprayed with 44 oz/A of Roundup Weathermax.



Giant ragweed dry weight as a function of ECB tunnel length on 16 to 20 inch tall plants sprayed with 16 oz/A of Roundup Weathermax



**Results.** Insect tunneling was observed in all plants infested with European corn bore larvae. Unfortunately, these insects are somewhat mobile and tunneling was also observed in non-infested plants. So, we made the decision to plot plant dry weight versus the length of tunnel on a graph. On plants treated with glyphosate when they were 6 inches tall, we observed no correlations between tunnel length and glyphosate efficacy. On plants treated with glyphosate when they were 18 inches tall, we observed a negative correlation between tunnel length and glyphosate efficacy on plants treated with 16 oz/A of Roundup Weathermax. We did not observe any relationships between tunneling and herbicide efficacy on plants treated with higher rates of Roundup Weathermax.

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Bill Johnson, Glenn Nice, and Tom Bauman Extension Weed Specialists, Purdue University Cooperative Extension Service

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Information listed here is based on research and outreach/extension programming at Purdue University and elsewhere. The use of trade names is for clarity to readers of this site, does not imply endorsement of a particular brand nor does exclusion imply non-approval. Always consult the herbicide label for the most current and update precautions and restrictions. Copies, reproductions, or transcriptions of this document or its information must bear the statement 'Produced and prepared by Purdue University Extension Weed Science' unless approval is given by the author.