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In This Issue

Insects, Mites, and Nematodes

- Winter Temperatures and Field Crop Insects
- Rootworm Insecticide Classifications and Consistency of Performance

Weeds

- 2003 Indiana Weed Management Update
- WeedSOFT 2003 – A New Weed Management Decision Aid for Indiana

Bits & Pieces

- Purdue Extension Specialists Listing 2003

Insects, Mites, and Nematodes

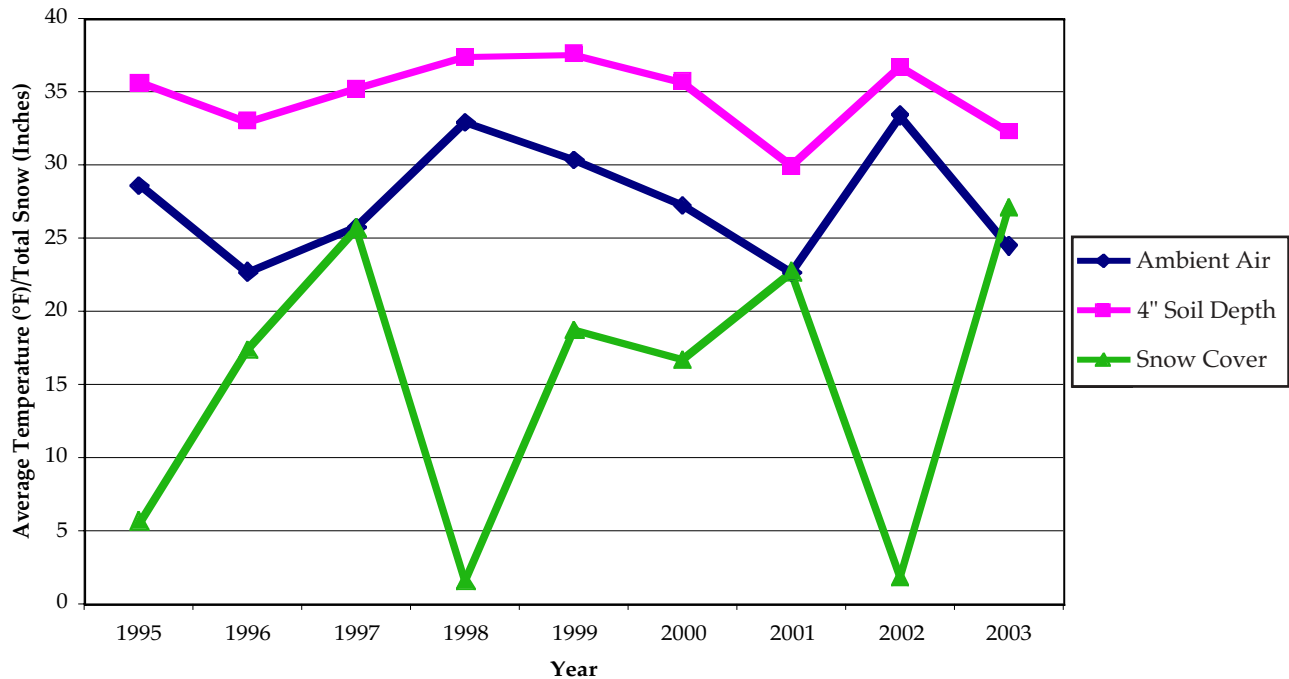
Winter Temperatures and Field Crop Insects – (John Obermeyer, Rich Edwards, and Larry Bledsoe) –

- Temperature is just one factor that impacts an insect's winter survivability
- Spring temperatures and moisture generally have a greater influence on insect numbers and subsequent crop damage
- Production practices, such as date of planting, tillage type, and herbicide application, are often what makes or breaks an insect infestation

Even the most casual weather observer can't ignore the fact that the weather this fall and winter has been cold and snowy. Will this equate to fewer insects and reduced crop damage this coming season? As you probably already guessed...it depends! Insect predictions are as reliable as Big 10 basketball rankings. Although we can't tell you for sure what will happen with these critters coming out of this winter, we can give you some information on insect/environment/crop interactions that might clear the picture some.

Overwintering insects utilize various biotic and abiotic mechanisms to keep them from dying during the long winter months. Survival tactics include, but are not limited to, lowering metabolic rates, chemical changes in bodily fluids, and finding "cozy" microenvironments. Predictive models for some overwintering insects exist but it is impossible to measure all environmental variables that individual insects are subjected to in their wintering location. The graph on the following page compares ambient air and four-inch depth soil temperatures with snowfall recorded at the Agronomy Research Center in West Lafayette for nine winters. This represents how soil temperatures, though warmer, follow air temperature trends. However, as snowfall amounts decrease, the temperature differential is less between the air and soil (e.g., 2002, 1998). It comes as no surprise that snow cover provides an insulating blanket for wintering insects at or below ground level. Though the differences may seem minor to us, to a small, cold-blooded insect, it may make the difference between life and death.

**Winter Conditions, December to mid-February
W. Lafayette, Indiana**



Above Ground Insects:

Bean Leaf Beetle

Overwintering stage – adults under leaf litter, grass clumps, etc.

Expected overwintering success – moderate to good depending on snow cover

Crop damage increases with early planted/emerging soybeans. Early in the spring beetles will feed on wild and cultivated legumes. Bean leaf beetle will then colonize the first emerging soybeans.

Concerns – besides potential reduced stands from damage to hypocotyls, cotyledons, and unifoliolate leaves, this beetle is a vector of the Bean Pod Mottle Virus. Early season inoculation of this disease will have the greatest impact on yield.

Considerations – beetle numbers were relatively low going into overwintering sites.



Early bean leaf beetle damage

Corn Flea Beetle

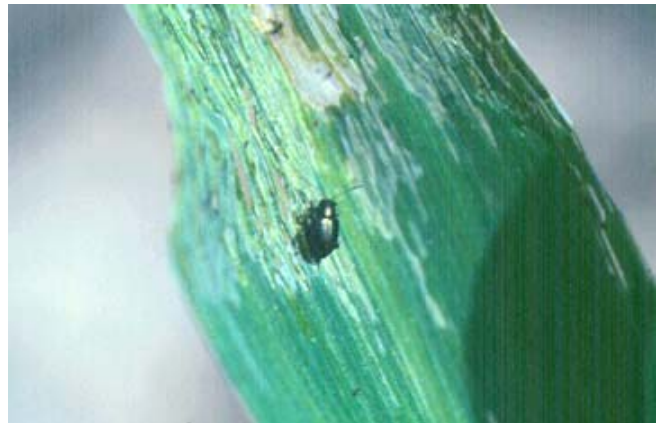
Overwintering stage – adults in grassy areas or woods

Expected overwintering success – poor to moderate (see next month's *Pest&Crop*)

Crop damage increases with early planted/emerging corn. Early in the spring beetles will feed on grasses. Corn flea beetle will then colonize first emerging corn. Some corn hybrids and inbreds are more susceptible than others.

Concerns – besides potential reduced stands from damage to emerging seedlings, this beetle is a vector of Stewart's disease. Stewart's disease is a greater threat to certain inbred lines of corn, some pop/sweet corn varieties, but rarely a concern in yellow dent corn.

Considerations – beetle numbers were relatively low going into overwintering sites except in some eastern portions of the state.



Corn flea beetle and leaf scarring

European Corn Borer

Overwintering stage – larvae in corn stalks and possibly stalks of weed residue

Expected overwintering success – good

Crop damage increases due to first generation corn borer with – early planting and the tallest corn within an area, usually around the first week of June.

Concerns – high yielding/fast growing hybrids (“race horse”) planted early in highly productive soils are often targeted by first generation egg laying moths.

Considerations – except for northwestern and northeastern Indiana, populations going into overwintering were relatively low. A mild, moist spring may encourage corn borer diseases that could drastically reduce overwintering larval numbers. Rainy, stormy weather during the mating and egg-laying period is detrimental to moths.



Corn borer larva inside stalk to overwinter

Black Cutworm

Overwintering stage – doesn't overwinter in the Midwest

Crop damage increases with large moth flights into Indiana. Moths carried into the state on storm fronts from the southwestern United States and Mexico.

Concerns – winter annuals growing on agricultural lands are targeted egg laying sites for arriving female moths. Burn-down herbicides applied during or shortly after planting will force hatching black cutworm larvae to move from the dying weeds to emerging crops.

Considerations – a hard freeze after egg laying may reduce black cutworm survivorship. Timing and number of moths arriving into the state is quite variable from year to year. Clean fields are less likely to have problems. Winter annuals may be less abundant this spring after a colder winter.



Egg laying attraction site for black cutworm moths

Alfalfa Weevil

Overwintering stage – adults under crop residue and eggs in stems

Expected overwintering success – highly variable, depends on freezing and thawing cycles.

Crop damage increases with unseasonably warm early spring temperatures

Concerns – mild spring temperatures will accelerate egg hatch and adult egg laying. This will increase the number of weevil larvae feeding over a longer period of time. However, extreme spring temperatures can kill exposed adults and newly hatched larvae and can decrease concerns.

Considerations – a hard freeze after early spring growth may reduce early hatching larval populations.



Early alfalfa weevil larval feeding

Below Ground Insects:

Western Corn Rootworm

Overwintering stage – eggs in the soil (from just below the soil surface up to a foot or more deep)

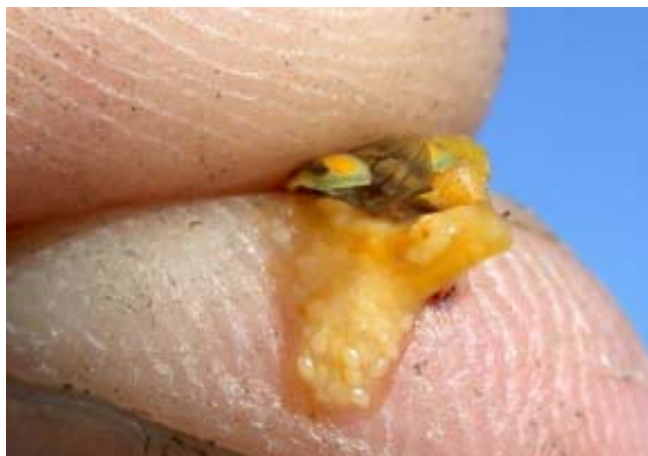
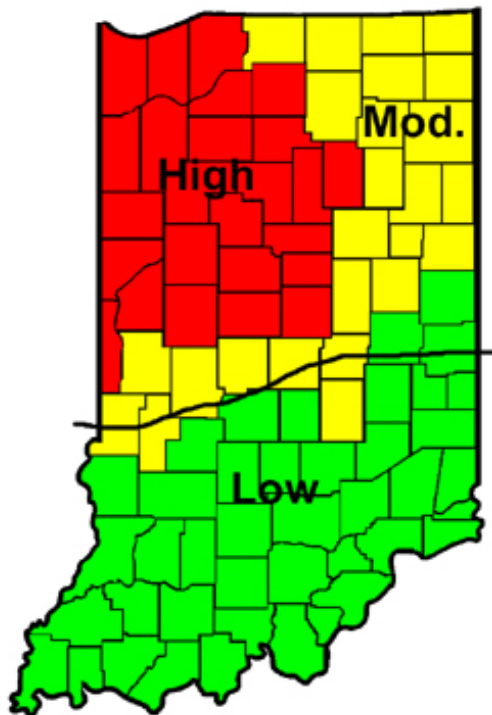
Expected overwintering success – good

Crop damage increases with where rootworm beetles laid numerous eggs in last year's corn, soybean, or alfalfa crop and the field will be planted to corn in 2003.

Concerns – large numbers of western corn rootworm beetles were observed in soybean fields last summer, especially in northwestern and north central counties of Indiana (see map of “Perceived Corn Rootworm Risk Area, 2003”).

Considerations – soil insecticides applied during very early corn planting may have reduced efficacy by the time the rootworm eggs hatch in late May to early June. Cold winter temperatures have little effect on rootworm egg survival.

Perceived First-Year Corn Rootworm Risk Areas, 2003



Eggs squeezed out of western corn rootworm female

White Grubs

Overwintering stage – larvae/grubs in the soil

Expected overwintering success – moderate to good

Crop damage increases with early planting. Delayed crop emergence and growth will increase the opportunity for grubs to come into contact with and feed on seedling roots.

Concerns – Japanese beetle is the predominant grub species in cultivated cropland in Indiana. Areas that experienced high numbers of Japanese beetles last year potentially have a higher risk of grub damage this spring.

Considerations – High organic matter soils may sustain large grub populations without significant crop damage since grubs can feed on dead and/or decaying

plant matter. Because last fall's temperatures were cool, fewer late-hatched grubs may have survived this winter and the size of overwintering larvae may be reduced.



Different sizes of white grubs



Click link below to view animations of several of these insects at our Field Crops IPM Website:

<http://www.entm.purdue.edu/entomology/ext/fieldcropsipm/animation.htm>

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Rootworm Insecticide Classifications and Consistency of Performance - (John Obermeyer Rich Edwards, and Larry Bledsoe) -

- The following table lists registered rootworm soil insecticides by chemical class
- Follow label uses and restrictions
- Many factors should be considered before selecting a product

Click to view extension publication E-49 "Managing Corn Rootworms - 2003" <http://www.entm.purdue.edu/entomology/ext/targets/e-series/fieldcro.htm>.

TABLE 3. FACTORS TO CONSIDER WHEN CHOOSING A CORN ROOTWORM SOIL INSECTICIDE*

Insecticide Class	Organophosphates**				Pyrethroids			Fiproles	Nicotinoids
	Chemical Name	chlorethoxyphos	chlorpyrifos	tebupirimphos & cyfluthrin	terbufos	bifenthrin	tefluthrin		
Trade Name & Formulations(s)		Fortress 5G (smart box)	Lorsban 4E generics	Aztec 2.1G Aztec 4.6G (smart box)	Counter CR	Capture 2E	Force 3G ProShield (treated seed)	Regent 4SC	Prescribe (treated seed)
Factors:									
Performance: test plots- band application Root damage rating ¹ Consistency of performance (%) ²		Fortress 5G 2.9 73	Lorsban 15G 2.7 82	Aztec 2.1G 2.2 94	Counter CR 2.2 94	Capture 2E -- --	Force 3G 100	n/a	n/a
Performance: test plots- infurrow application Root damage rating ¹ Consistency of performance (%) ²		Fortress 5G 2.7 83	Lorsban 15G 2.6 85	Aztec 2.1G 2.2 91	Counter CR 2.4 85	n/a	Force 3G 2.1 100	Regent 4SC 2.7 93	n/a
Performance: test plots- treated seed Root damage rating ¹ Consistency of performance (%) ²		n/a	n/a	n/a	n/a	n/a	n/a	ProShield -- --	Prescribe -- --
Technical information Registered for use a cultivation Registered for popcorn/seed corn/sweet corn Human hazard (signal word) Granular formulation Liquid formulation Restricted-use pesticide Labeled for control of other soil pests at the rootworm rate ³ billbugs cutworms nematodes seedcorn beetle seedcorn maggot white grubs wireworms	N PES D n/a Y N Y N N Y Y Y	Y ES C W N Y Y N Y Y Y Y	N PES W n/a Y N Y N Y Y Y Y	Y PES D n/a Y Y N Y Y Y Y Y	Y PES D n/a Y Y N Y Y Y Y Y	N PE n/a W Y N Y N Y Y Y Y	N PES C n/a Y N Y N Y Y Y Y	N E n/a W Y N N N Y Y Y Y	n/a E n/a n/a N N N N Y Y Y Y

*Key to symbols: -- = inadequate information, n/a = not applicable, D = danger, W = warning, C = caution, Y = yes, N = no, P = popcorn, E = seed corn, S = sweet corn.

**See "Insecticide/Herbicide Plant Interaction" on page 5.

¹Average root damage rating (Hills and Peters 1-6 scale) in 11-19 tests over five years (1997, 1999, 2000, 2001, 2002), where damage in the untreated plots exceeded 3.5 or greater will likely predispose plants to significant yield losses. The untreated plots averaged 4.79.²Percentage of tests where average damage rating was less than 3.5 when the untreated equaled or exceeded 3.5. Tests from 1997, 1999, 2000, 2001, 2002.³Insecticide not included if label states "for suppression," "reduction of," "aids in control," or "control of light to moderate infestations only."

2003 Indiana Weed Management Update – (Bill Johnson, Glenn Nice, and Tom Bauman) -

New Herbicides for Corn

Guardsman Max (dimethenamid-p 1.7 lb/gal + atrazine 3.3 lb/gal) from BASF will eventually replace Guardsman in the market. This product can be used EPP, PPI, PRE and POST on corn up to 8 inches tall. Guardsman Max contains the resolved isomer dimethenamid also found in Outlook. Use rate is 4 pt/A which provides 0.85 lb/A of dimethenamid-p and 1.65 lb/A of atrazine. Labeled in 2002.

Guardsman Max Lite (dimethenamid-p 2.25 lb/gal + atrazine 2.75 lb/gal) from BASF also contains the resolved isomer of dimethenamid and is loaded with less atrazine. This product can be used EPP, PPI, PRE and POST on corn up to 8 inches tall. This product is designed for use on sandy soils in N. Indiana and in the northern cornbelt states (MI, WI, MN). Labeled in 2002.

Option (foramsulfuron + safener) 35% WG from Bayer is a postemergence herbicide for control of grass weeds in field corn. It is not recommended for use on seed corn and not labeled for use on sweet or popcorn. It is an ALS inhibitor designed for use on grass weeds up to 3 inches tall (crabgrass up to 2 inches tall) and corn up to 16 inches or V5. Drop nozzles can be used on corn 16 to 35 inches tall. Use with MSO or ESO + UAN or AMS adjuvants. It can be used after the following soil insecticides: Regent, Aztec, Force, Lorsban 15G and tankmixed with Ambush, Asana, Pounce, and Warrior. Labeled in 2002.

Equip (foramsulfuron + iodosulfuron) from Bayer is another postemergence herbicide for corn. Equip is a premix of the grass control component of Option (foramsulfuron) plus iodosulfuron which provides some activity on broadleaf weeds. Use rates will range from 1.25 to 1.5 oz/A on corn up to 20 inches tall. Adjuvants required include MSO and AMS. Label expected 1st quarter of 2003.

Keystone (acetochlor 3 lb/gal + atrazine 2.25 lb/gal) from Dow AgroSciences is another atrazine + grass herbicide premix. Labeled for use on field and seed corn EPP, PPI, PRE and POST up to 11 inch tall corn. Use rates are 2.4 to 3.4 qt/A which will provide 1.8 to 2.6 lb/A of acetochlor and 1.35 to 1.9 lb/A of atrazine.

Keystone LA (acetochlor + atrazine) from Dow AgroSciences is a product similar to Keystone with a lower atrazine load. This product is designed for use

on sandy soils in N. Indiana and in the northern cornbelt states (MI, WI, MN). Label expected in 2003.

There are now at least four products available that contain acetochlor + atrazine from basic chemical manufacturers. There is at least one product (Confidence, from Agrilience) available from a distributor. The following table shows the amount of acetochlor and atrazine present in each commercially available product available from basic chemical manufacturers.

Table 1. Acetochlor + atrazine products from basic chemical manufacturers labeled for use in corn.

Herbicide	Product Rate/A	Acetochlor	Atrazine
Keystone	2.67 qt.	2 lb.	1.5 lb. ai.
Fultime	3.75 qt.	2.25 lb.	1.5 lb. ai.
Degree Xtra	3.7 qt.	2.5 lb.	1.24 lb. ai.
Harness Xtra 5.6	2.4 qt.	1.9 lb.	1.5 lb. ai.

Cinch, *Cinch ATZ* and *Cinch ATZ Lite* are products Dupont has obtained from Syngenta and will be marketing under their trademark. Cinch is Dual II Magnum, Cinch ATZ is Bicep II Magnum, and Cinch ATZ Lite is Bicep II Magnum Lite

Yukon (halosulfuron + dicamba) from Monsanto is a postemergence herbicide for use on corn up to 36 inches tall. Use rates are 4 to 8 oz/A with 4 oz/A providing 2/3 oz/A of Permit and 4 oz/A of Banvel. Adjuvants required include either NIS or COC. Label granted in 2002.

Lumax (s-metolachlor 2.68 lb/gal + atrazine 1 lb/gal + mesotrione (0.27 lb/gal) from Syngenta is a product that can be used PPI, PRE, or POST on field, seed, or silage corn up to 5 inches tall. Use rates are 2.5 qt/A on soils with less than 3% organic matter and 3 qt/A on soils with greater than 3% organic matter. The 3 qt/A rate provides 2 pt/A of Dual II Magnum, 0.75 lb/A of atrazine and 6.4 oz/A of Callisto – 3 different modes of action. 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. Warrior is the only insecticide mentioned as a tankmix partner on the label. Labeled in 2002.

Camix (s-metolachlor 2.68 lb/gal + mesotrione (0.27 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.

New Herbicides for Soybean

Phoenix (lactofen) from Valent is a new formulation of Cobra with an adjuvant system designed for less crop response. Labeled in 2002.

Valor (flumioxazin) 51% WDG was labeled in 2002 for fall, EPP, and PRE applications in soybean. This product is a PPO inhibitor, similar to Authority/Spartan with good activity on small seeded broadleaf weeds such as pigweeds/waterhemp, lambsquarter, and annual nightshade species. Use rates are 2 to 3 oz/A. The label does not allow this product to be tankmixed with chloroacetamide herbicides (Lasso, Dual II Mag, Frontier, Define, Boundary) because the risk of crop response is enhanced.

Labeled in 2003.

Gangster is a co-pack of Valor (flumioxazin) + FirstRate (cloransulam) co-marketed by Valent and DowAgroSciences. The addition of FirstRate adds activity on ragweeds, maretail, morningglories, velvetleaf and cocklebur to the activity of Valor. Registration expected 2nd quarter of 2003.

Glyphosate formulations. There are now over 30 formulations of glyphosate labeled for use in Roundup Ready crops in Indiana. Monsanto will introduce a product called Roundup Original II, which is a 3 lb ae/gal isopropylamine salt that does not contain the Transorb adjuvant package. Label allows the use of additional adjuvants. Monsanto will also be phasing out Roundup Ultramax and replacing it with Roundup Weathermax as their primary glyphosate product for Roundup Ready Soybeans. Roundup Weathermax is a potassium salt of glyphosate with 4.5 lb of acid equivalent (ae)/gal. Use rates of Roundup Weathermax will be 22 oz/A.

In Table 2, we have listed four 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. 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 2. Glyphosate salt and formulations of four 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
Rup Ultramax (isopropylamine salt)	3.75 lb ae/gal	13 oz	26 oz
Rup Wmax (potassium salt)	4.5 lb ae/gal	11 oz	21 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 Table 3 is the result of this years experiment at the Purdue University Agronomy Farm. Essentially no differences were observed between the six products evaluated in this trial.

Table 3. Weed control in soybean with various glyphosate formulations in Purdue University research in 2002.

Herbicide	Rate (oz/A)	Giant foxtail	Ivyleaf morningglory	Velvetleaf
Roundup WeatherMax	21 oz	96	84	96
Roundup UltraMax	26 oz	96	84	99
Touchdown IQ	32 oz	95	88	95
Glyphomax Plus	32 oz	96	84	98
Clearout 41 Plus	32 oz	96	83	92
LSD = 0.05		ns	ns	ns

New Herbicide for Alfalfa

Raptor (imazamox) 1S has received federal approval for use on established alfalfa (2 trifoliate or more) in the fall, winter, or spring to dormant or semi dormant alfalfa or between cuttings (less than 3 inches of regrowth) in non-dormant alfalfa and in-season use on other edible legumes. The formulation of imazamox labeled for alfalfa will be called Raptor. Raptor controls a similar spectrum of weeds compared to Pursuit, with better activity on grasses and lambsquarter, but less soil residual activity. Pursuit will provide better soil residual activity. Use rates are 4 to 6 oz / A with COC (1% v/v) or NIS (0.25% v/v) + AMS (12-15 lbs/100 gallons).

New Herbicide for Wheat

Beyond (also imazamox) 1S will be labeled for use on Clearfield (imidazolinone resistant) wheat. Beyond can be applied at 4 to 6 oz / A in the fall or spring from the 3rd leaf stage of wheat up until before jointing. NIS and AMS or UAN are the required spray additives. Beyond will control ryegrass, brome grass and many winter annual weeds. Seed supply will be limited in 2003.

New Herbicide for Grass Pastures

Dupont will introduce a product called *Cimmaron* 60 DF (metsulfuron) for broadleaf weed control in grass pastures. It is essentially the same product as Ally with no haying or grazing restrictions.

New Herbicide-Resistant Weeds

Glyphosate-resistant marestail (horseweed) has been identified at two sites in Jackson county in southern Indiana. Glyphosate resistant marestail has also been identified in Ohio and Kentucky. A number of additional sites in Indiana have also reported difficulty in controlling this weed with glyphosate this past year. We will be doing some more work in the greenhouse to determine how well other herbicides control these suspect populations.

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WeedSOFT 2003 – A New Weed Management Decision Aid for Indiana – (Bill Johnson) -

We are pleased to announce that we will be releasing a version of WeedSOFT 2003 for Indiana this year. WeedSOFT is an easy to use computer-based decision support system that brings the very latest technical weed management information of leading University Weed Scientists throughout the Midwest to crop advisors and growers. WeedSOFT was originally developed by the University of Nebraska and has now evolved into a regional project in cooperation with the University of Missouri, Kansas State University, University of Illinois, Purdue University, Michigan State University and University of Wisconsin. Purdue University Weed Scientists have made a number of changes and upgrades to the program adapt this program to the weeds and crop growing conditions of Indiana. We feel we have a program that will supplement many of the weed management tools currently available and meet many of the needs of Indiana's crop managers.

WeedSOFT 2003 for Indiana consists of 2 individual modules.

ADVISOR is a diagnostic and analytical decision support system to help you select the best management solution to a specific weed problem. You provide data to the model such as crop, rotational crop, soil moisture, soil properties, and number, type, and size of weeds and ADVISOR will analyze these conditions and recommend effective treatments. The available scenarios recommended include soil applied herbicides, postemergence herbicides, soil applied followed by postemergence herbicides, soil applied herbicides followed by cultivation, and postemergence herbicides followed by cultivation. These scenarios will provide you with a strategic tool that allows you to take a proactive, pre-season weed management approach as well as reactive measures in season. In addition, for each recommendation, ADVISOR will calculate the cost of each treatment versus the expected dollar loss if the crop goes untreated. You may also include costs associated with custom application and herbicide resistant seed (Roundup Ready, Liberty Link, Clearfield) which allow you to make complete economic comparisons.

WEEDVIEW is a picture data base for weed identification. This module allows you to display a text description and various images of weeds common to Missouri. WEEDVIEW offers detailed descriptions and photograph of 64 weed species so you can confirm the identity of your specific weed problem.

WeedSOFT is easy to use. If you are familiar with running Windows on your system you will find

WeedSOFT easy to install and operate. Computer system requirements:

1. Free disk space – 80 mb during installation, 20 mb after installation. Setup will remove temporary installation files after setup is complete.
2. CD-ROM drive
3. Memory – 16 mb minimum, 32 mb or greater is recommended
4. Processor – 80486 processor minimum. Pentium is recommended

5. Operating system – Microsoft Windows 95 or better with Microsoft Internet Explorer 4.01.

6. Video – 256 (8 bit) color video. 800x600 screen resolution recommended

To order WeedSOFT, fill out this order form and mail to the address listed at the bottom.

WeedSOFT® 2003 Order Form:

Name: _____

Address: _____

City/State/Zip: _____

Signature: _____

Phone: _____

E-mail**: _____

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Lincoln, NE 68583-0918

**** Your e-mail address will be used to notify you of maintenance releases and updates to WeedSOFT. It will NOT be given to any other vendors.**

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Bug Scout



That will teach you not to run around outdoors in the winter wearing those silly short pants!

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