Pest & Crop

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In This Issue

Insects, Mites, and Nematodes

Alfalfa Weevil Management Guidelines and Control Products – (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) –

- Reports from southern Indiana indicate that alfalfa weevil are quite active
- Use damage and heat unit accumulation information as a guide in making management decisions

Last week's sampling results and pest manager reports from southern counties point to the possibility that alfalfa weevil damage my equal or even exceed last year's tremendous levels. As mentioned in last week's *Pest&Crop*, their development and damage is ahead of the heat unit model that normally accurately predicts weevil activity. This is especially true on south facing slopes or fields with sandier soils.

The management guidelines listed below should be used as a guide in determining when alfalfa weevil should be controlled in southern Indiana. The times for sampling and the need for and timing of controls are based on accumulated heat units (HU) at a base temperature of 48∞F and percentage tip feeding. Refer to HU information in each week's *Pest&Crop* "Weather Update." This HU information will help one determine when management steps should be taken.

Alfalfa Weevil Management Guidelines, 2002 Southern Indiana

Heat units	% Tip feeding	Advisory*
200		Begin sampling.
300	25	Re-evaluate in 7-10 days using the appropriate HU or treat immediately with a residual insecticide if 3 or more larvae are noted per stem and % tip feeding is above 50%.
400	50	Treat immediately with a residual insecticide.
500	75	Treat immediately.
600	75+	If cutting delayed more than 5 days, treat immediately.
750		If harvested or harvesting shortly, return to the field in 4 -5 days after cutting and spray if 1) there is no regrowth and weevil larvae are present OR 2) feeding damage is apparent on 50% of the stubble and weevil larvae are present.

Insecticides For Alfalfa Weevil Larval Control [1,2]

Insecticide	Formulation and Amount per Acre	Harvest or Pasture Restriction	Remarks
carbofuran (Furadan)[1,2]	1/2 pt. 4F 1 pt. 4F 2 pt. 4F	7 days 14 days 28 days	Use only on pure stands of alfalfa. Use higher rate where residual control is needed. Do not make more than one application per season.
chlorpyrifos (Lorsban)[1,2]	1 pt 4E 2 pt. 4E	14 days 21 days	Some yellowing may be observed on young, rapidly growing alfalfa. Alfalfa will outgrow the yellowing and no yield loss should occur.
cyfluthrin (Baythroid 2)[1]	1.6 - 2.8 fl oz. EC	7 days	Use higher rates for heavy populations. Do not use on alfalfa grown for seed.
cyhalothrin (Warrior)[1]	2.56 - 3.84 fl oz. EC	1 day-forage 7 days-hay	Use higher rates for increased residual control. Avoid application when bees are actively foraging.
permethrin (Ambush)[1] (Pounce)[1]	12.8 oz. 2EC 8 oz. 3.2EC	14 days 14 days	Avoid application when bees are actively feeding. Do not apply more than 12.8 ounces (2EC) or 8 ounces (3.2EC) per acre per cutting. Do Not use in fields with more than 2 larvae per stem and before 600HU (base 48∞F) have accumulated.
zeta-cypermethrin (Mustang)[1]	2.4 – 4.3 fl oz. EW	3 days	Use higher rates for increased residual control.

1 Restricted use pesticide.
2 Highly toxic to bees.

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What About Seed Attacking Insects? - (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) -

- Early planting and slow germination increases seed damage from insects
- High residue and cool, wet field conditions may warrant the use of seed protectants
- Seed protectants most often only protect the seed, not the roots
- Don't use both a seed treatment containing an insecticide and a soil insecticide at planting

Most of our attention to soil insects is given to corn rootworm, what about those other critters? Wireworms, grubs, maggots and seedcorn beetles occasionally damage seed and seedlings. Obviously, the longer that germination is delayed, the greater the chance for insect damage to occur. How about the seed that will be planted during the next window of opportunity, should it receive a seed treatment to protect from these occasional pests? The following discussion is for these other soil insects, NOT ROOTWORM.

Planting in fields with less than adequate drainage, in set-aside acreage (such as CRP land), or fields with high crop residue or where high rates of manure have been applied, the use of a seed protectant may be a good investment against seed attacking insects. Seed protection will be critical if our cool weather pattern continues and soil temperatures remain at less than ideal levels for rapid seed germination and plant growth.

Planter box seed treatments, such as Kernel Guard Supreme and KickStart VP are registered for both corn and soybean. The insecticide permethrin, same active ingredient in the foliar insecticides Ambush and Pounce, in these seed treatments should provide adequate control of seed maggots and beetles. In limited trials, permethrin has shown some protection from wireworms. Because seed treatments do not protect the plant once it sprouts, there is *no control* of white grubs, cutworms, rootworms, or high populations of wireworms.

Pre-applied insecticide seed treatments are now available for corn producers. Industry and university trials have shown some promising results with Gaucho, Prescribe, and ProShield against wireworms and seedcorn maggot. As well, the systemic activity of Gaucho and Prescribe provides some early suppression/control of corn flea beetle. Certainly the biggest question for producers and researchers is how effective these products are against white grubs. Limited trials have shown a mixed bag of results. Most likely there will be some suppression of grubs, but not control.

Where rootworm soil insecticides are applied at planting, the use of a planter box or pre-applied seed treatment is not necessary.

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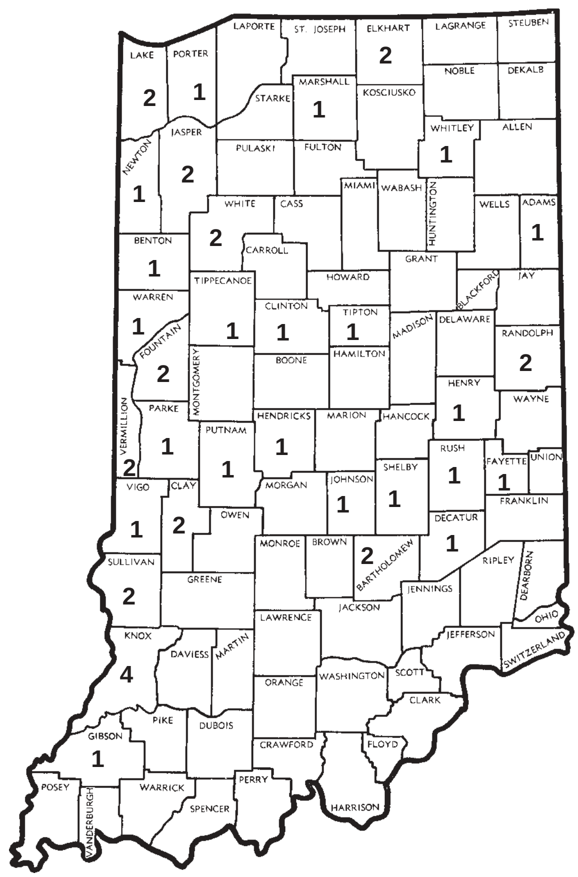
Black Cutworm, They're Here - (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) -

- Moths making their annual arrival into the Midwest
- Impregnated moths are seeking weedy fields to lay their eggs
- Early weed control goes a long way in suppressing this pest

Several black cutworm intensive captures, 9 or more moths caught over a 2-nights, have been captured during the week of April 8 (see "Black Cutworm Adult Pheromone Trap Report" and "2002 Black Cutworm Pheromone Trap Locations"). This correlated well with the warmer temperatures from the Southwest that swept across the Midwest and brought black cutworm moths from Mexico and Texas. The timing of their arrival is normal, the moth flights of mid to later April are usually the ones we carefully monitor.

New arriving moths are looking for the perfect place, i.e., winter annuals, for egg laying. Fields that are now covered in chickweed, mustards, etc. are at highest risk for cutworm damage. Remember, corn and soybean are not the black cutworm's food of choice. These are normally the only plants remaining by the time larvae have hatched and weeds are dead. Research has shown that cutworm larvae starve if weeds are destroyed 2-3 weeks before corn emergence. This says something for early burn-down herbicides in the management of this pest. Look for updated pheromone trap captures and heat unit tracking of cutworm development in future issues of the *Pest&Crop*.

2002 Black Cutworm Pheromone Trap Locations (#/County)



Black Cutworm Adult Pheromone Trap Report
Week 1 = 3/28/02 - 4/3/02 Week 2 = 4/4/02 - 4/10/02
(Ron Blackwell)

County	Cooperator	BCW Trapped		County	Cooperator	BCW Trapped	
		Wk 1	Wk 2			Wk 1	Wk 2
Adams	Roe/Price Ag Services	0	7	Lake	Kliene (1)	0	1
Bartholomew	Ludwig/Growers Service	7	7	Lake	Kliene (2)	0	1
Benton	Schellenberger/Jasper Co. Co-op	0	0	Newton	Babcock/Jasper Co. Co-op	0	0
Clay	Smith/Growers Co-op (Bzl)	0	2	Parke	Rule/Midland Co-op	0	10*
Clay	Smith/Growers Co-op (CC)	0	2	Porter	Mueller/Agriliance	0	1
Clinton	Blackwell/Purdue	2	4	Putnam	Nicholson Consulting	4	1
Decatur	Miers Farm/Pioneer	0	16*	Randolph	Jackson/Davis-Purdue Ag Center (S)	0	5
Fayette	Schelle/Falmouth Farm Supply	1	4	Randolph	Jackson/Davis-Purdue Ag Center (N)	0	3
Gibson	Hirsch Farms	13*	11*	Rush	Peggs/Pioneer	7	6
Fountain	Mroczkiewicz/Syngenta	0	0	Sullivan	Smith/Growers Co-op (W)	2	2
Fountain	Hutson/Purdue	0	5	Sullivan	Smith/Growers Co-op (E)	3	6
Hendricks	Whicker/Midland Co-op	0	6	Tippecanoe	Obermeyer/Purdue	2	2
Henry	Schelle/Falmouth Farm Supply	1	2	Vermillion	Hutson/Vermillion Co. Ext. (N)	0	10*
Jasper	Manning/Jasper Co. Extension (S)	1		Vermillion	Hutson/Vermillion Co. Ext. (S)	0	12*
Jasper	Manning/Jasper Co. Extension (Ctrl)	0		Vigo	Smith/Growers Co-op	0	4
Johnson	Truster/Ag Excel Inc.	4	2	Warren	Shields/Jasper Co. Co-op	0	1
Knox	Smith/Growers Co-op (Oaktown)	0	5	White	Reynolds/Orville Redenbacher 1K	0	4
Knox	Smith/Growers Co-op (Edwardsport)	0	9*	White	Reynolds/Orville Redenbacher 2P	0	4
Knox	Smith/Growers Co-op (Whtlnd 1)	0	1	Whitley	Walker/NEPAC	1	6
Knox	Smith/Growers Co-op (Whtlnd 2)	2	6				

* = Intensive Capture.... An intensive capture occurs when 9 or more moths are caught over a 2-night period.

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Southwestern Corn Borer Spring Survey – (*Ric Bessin, Lee Townsend, Wayne Mattingly, and Mike Smith, University of Kentucky*) -

Southwestern corn borers spend the winter as larvae in galleries at the base of corn stalks. Stubble in cornfields can be checked during early spring for damaged plants and surviving borers. This can provide an indication of what the first generation may be like for 2002. A survey of southwestern corn borer damage and larval survival was conducted in Caldwell, Daviess and Henderson counties on March 14 and 15. These counties were selected because of the past infestation history. The purpose was to estimate the extent of SWCB damage, as evidenced by basal stalk girdling. In addition, we wanted to estimate the survival of the overwintering larvae in the crowns of these damaged plants. In each county, three to five non-Bt corn fields were evaluated. Within each field, 10 to 12 groups of 10 plants were examined for girdling damage and presence of live SWCB larvae. An additional 50 damaged plants were examined for the presence of live SWCB larvae.

2001 SWCB Spring Survey Results

	Damaged plants (%)	Live SWCB per girdled stalk (%)
Daviess Co.		
Farm #1	6.0	1.9
Farm #2	5.0	19.2
Farm #3	5.0	8.5
Farm #4	28.0	6.0
Farm #5	5.0	1.9
Henderson Co.		
Farm #1	10.8	1.4
Farm #2	15.8	1.7
Farm #3	10.8	1.7
Farm #4	13.3	0.0
Farm #5	9.2	17.4
Caldwell Co.		
Farm #1	17.0	4.0
Farm #2	8.0	4.0
Farm #3	19.0	4.0

This is the fourth year that we have conducted such a survey. In comparison to the previous winters, we had the lowest levels of girdled plants and survival of overwintering larvae. Fewer girdled stalks were to be expected, because planting conditions in April 2001 were excellent. This allowed growers to get their corn crop in the ground on time and enabled early harvest. Delayed harvest allows SWCB time to migrate to the bottom of the stalk and girdle the plant. Early planted corn may also be less attractive for lateseason egg laying.

Observed levels of survival in the girdled crowns was surprising. Survival this spring is less than what would have expected considering the relatively mild winter. Of the girdled crowns sampled this spring, a large proportion had evidence of bird activity with the larva having been removed. Relatively few crowns had dead larva remaining in the overwintering chamber. The number of live SWCB larvae per stalk is a small fraction of what we estimated in other years. This survey indicates that there are potentially fewer SWCB moths to begin the season as compared with the past three years.

Year	Girdled stalks (%)	Survival/girdled stalk (%)	Overall Survival/ stalk (%)
2002	11.78	5.31	0.63
2001	40.58	9.66	3.92
2000	20.73	26.85	5.57
1999	35.89	10.14	3.64

Keep in mind that overwintering survival is just one of the variables that will, in part, determine the potential for SWCB problems in 2002. Historically, the date of planting of individual fields has been a key variable contributing to the potential for late season SWCB damage. Although early season numbers seem to be very low, favorable conditions, may allow SWCB numbers to rebound by the second and third generations. Typically, fields planted after May 10 have an increased potential for this type of damage.

What we can conclude:

- Despite a mild winter, we found low survival levels of SWCB larvae in each of the counties surveyed.
- Birds seem to feed heavily on SWCB larvae during the winter.
- Winter conditions were not sufficient to eliminate SWCB larvae.
- We expect low first generation SWCB pressure for those areas surveyed.
- Date of planting is still important. Corn planted after May 10 could be at risk to late season SWCB activity.

Reprinted from *Kentucky Pest News,* Number 943, March 18, 2002.

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Bug Scout

"How much longer do we feed these birds before they reach market weight?"

Reprinted with permission from *Prairie Farmer* Magazine.

Soil, So What? – (*Glenn Nice and Thomas Bauman*) -

What many of us call "dirt" is a diverse and complex medium involving physical and chemical processes driven in part by a multitude of living organisms. As could be expected, the soil is a highly variable environment that is effected by its history, weather patterns, chemical and mineral makeup. Soils are also dynamic, meaning that they are in a constant state of change. Components are added and lost through time. With this diverse medium compounded with the diversity found in herbicide make up, it is no surprise that herbicides may react in many different ways when applied to soils. Below are some of the interactions that might take place with a herbicide and the soil. These interactions may lead to persistence problems or a decrease in herbicide efficacy.

Adsorption vs. Absorption

In both cases, the herbicide can be taken out of the soil solution decreasing herbicide activity. Further more, in both cases the herbicide can be put back into the soil solution. The difference between the two terms is that adsorption refers to the collection of the herbicide on the soil particle surface. Absorption refers to the taking in of the herbicide into plants or microbes.

Adsorption is one of the most important ways in which a soil applied herbicide is made unavailable to do its job. The attraction is fueled by the electrostatic charges found on the soil particles. Depending on the charge of the herbicide molecule in the soil, adsorption can occur on either the organic particles or the inorganic particles. This is why some herbicides have higher use rates or are not recommended for soils with high organic matter. Ion exchange can also lead to the adsorption of an herbicide's active ingredient. Dry soils may have a higher rate of adsorption than wetter soils. The measurement K_d represents a herbicides inclination to adsorb to a soil. This is the ratio of herbicide bound to a soil and the amount that is still in solution. K_d is often used in models to predict a herbicide's potential to movement through soil. The greater the K_d the greater the tendency to bind to a soil. Note glyphosate's high K_d value (Table 1). This gives some explanation as to why glyphosate is not to be considered to have any residual soil activity. For a list of K_d values, see the Herbicide Handbook released by the Weed Science Society of America <www.wssa.net>.

Absorption of herbicides into plants and microorganisms is another way in which a herbicide can be rendered benign. Once taken up by the organism, it is temporarily out of the soil medium. In some cases, a portion of the herbicide is not changed in the living organism and can be released back into the soil.

The release of an adsorbed or absorbed herbicides is called desorption. This can be good in the sense that the herbicide can have some residual activity. However, it can be bad in the case of persistence (carry over).

Table 1. K_d values for common active ingredients found in herbicides.

Active Ingredient	K_d	Soil Type
Atrazine	0.2 2.49	Sand with 0.9% OM, 2.2% clay, and pH 6.5 Clay with 4.8% OM, and pH 5.9
Fluometuron	0.079 1.13	Sand with 0.39% OM, 3.2% clay, and pH 5.9 Clay with 2.41% OM, 55.2% clay, and pH 5.7
Nicosulfuron	0.16 1.73	Soil with 1.1% OM and pH 6.6 Soil with 4.3% OM and pH 5.4
Glyphosate	324-600	Silty clay loam and a loamy sand

Source: Herbicide Handbook; Weed Science Society of America, 1994.

Leaching

Leaching is the movement of the herbicide while in the water solution through the soil. A small amount of movement is needed to get the herbicide in the zone of germination. This is obtained by a small light rainfall event or with some herbicides (such as Treflan) incorporation. However, too much movement is a cause for concern. Leaching is most associated as being a problem due to groundwater issues, but there are other problems that arise due to leaching. Movement of the herbicide from the zone of germination results in reduced weed control. The lateral movement of a herbicide can increase accumulation in the seed furrow resulting in an injurious concentration. In dry conditions, the upward movement of soil moisture can bring the herbicide to the soil surface resulting in increased evaporation. Some of the herbicides that have high leaching potentials are atrazine; dicamba; imazaquin; and picloram. However, some of the herbicides that have moderate leaching potentials are clomozone; linuron; pendamethalin; and trifluralin.

Several factors have an effect on a herbicide's likely hood to leach. Soil texture and permeability influence can influence leaching. Herbicide movement through coarse textured soils is one of the reasons atrazine products are not recommended for sandy soils with shallow water tables for fear of drinking water contamination. As might be expected the volume of water flow and direction (up or down) have a strong influence on a herbicides potential to leach. If the herbicide will be adsorbed to the soil and its water solubility also has a large influence leaching.

Chemical Reactions

There are several reactions that can occur between a herbicide and the elements of the soil. Oxidation-reduction reactions can create electrically charged molecules which in turn will be made unusable by the plant or adsorb to oppositely charged soil elements. These oxidation-reduction reactions involve the donation of an electron either to or from the herbicide. The charged herbicide particles are then likely to form bonds with other soil components. The bonds formed with calcium (in a high calcium soil) can form water insoluble salts, making the herbicide unavailable to control weeds. Also, complexes can be formed with some of the metals found in the soil, such as cobalt, copper, and iron. These complexes are also useless as a herbicide.

One of the main ways in which sulfylureas are broken down is through hydrolysis. Herbicides molecules can react with water in hydrolysis. Herbicide molecules break and ionic components (H+ or OH-) of water bond to the broken molecules. The new molecules formed generally don't have the herbicidal activity.

Microbial Degradation

The soil is a living microcosm including bacteria, fungi, algae, nematodes, protozoa, worms, and insects. However, in the breakdown of herbicides, it is predominantly the task of bacteria and fungi. In their constant search for food, microorganisms will take in organic compounds, including herbicides. Like our own digestive track, bacteria and fungi produce a multitude of enzymes to break down complex molecules. It is these enzymes that degrade herbicides. W. P. Anderson list in <u>Weed Science Principles and Applications</u> (1996) some of the alterations that occur due to enzymatic reactions; dehalogenation; dealkylation; amide or ester hydrolysis; beta-oxidation; ring hydroxylation; ring cleavage; and reduction of nitro groups under anaerobic conditions.

The rate of herbicide degradation is directly related to the population numbers, rate of metabolism, other available nutrients, and the type of herbicide present. Factors that affect the microorganisms are soil moisture, temperature, oxygen (aeration), mineral nutrient supply, organic matter content, and soil pH. Temperatures between 75 and 90°F are generally optimum for microorganisms, below 40°F will reduce metabolism. Many of the microbes involved in herbicide breakdown require oxygen, therefore increasing aeration can promote breakdown. Although water is required for a substrate, if a field remains underwater for a good portion of the year, an anaerobic (lacking oxygen) condition may occur, resulting in decreased breakdown and possibly carryover. However, this is not the case with the dinitroanalines (trifluralin, pendimethalin) which are readily broke down in anaerobic conditions.

pH

Soil pH can either decrease or increase a herbicides activity. Soil pH influences herbicide activity by having an effect on all of the processes mentioned above. Often it is associated with carry over problems. The pH value refers to the concentration of H+ ions in solution. This is an inverse relation, so if the soil is acidic (low pH) there is a high concentration of H+ in the soil solution and if it is basic (high pH) then the concentration of H+ is low. Optimum pH values for crop production generally lie between 5 and 7.

The soil pH affects the amount of ionized herbicide molecule in solution. The pH will also affect the amount of charge that will occur on the soil particles. This in turn will have an effect on the amount of a herbicide that will adsorb to soil particles. If less herbicide is adsorbed to soil then more of the herbicide is available to leach. Soil pH has a strong influence on many of the chemical reactions that degrade herbicides in the soil. In the case of sulfonylureas, a high pH results in decreased hydrolysis leading to a possible carry over situation. As may be expected, pH also influences the growth and activity of living organisms. Many of the soil microbes have optimum growth between pH 6.5 to 8. Table 2 lists some of the herbicides that are affected by soil pH and the resulting effect the pH has on it.

For more information on Herbicide and Soils interactions, the following books are a good source.

R. J. Hance, ed. Interactions Between Herbicides and the Soil. Academic Press. New York: 1980.

Thomas J. Monaco, Stephen C. Weller, and Floyd M. Ashton. Weed Science Principles and Practices. Fourth ed. John Wiley & Sons, Inc. New York: 2002

Wood Powell Anderson. Weed Science Principles and Applications. Third ed. West Publishing Company. St. Paul: 1996.

Table 2. Soil pH influences on corn and soybean herbicides.

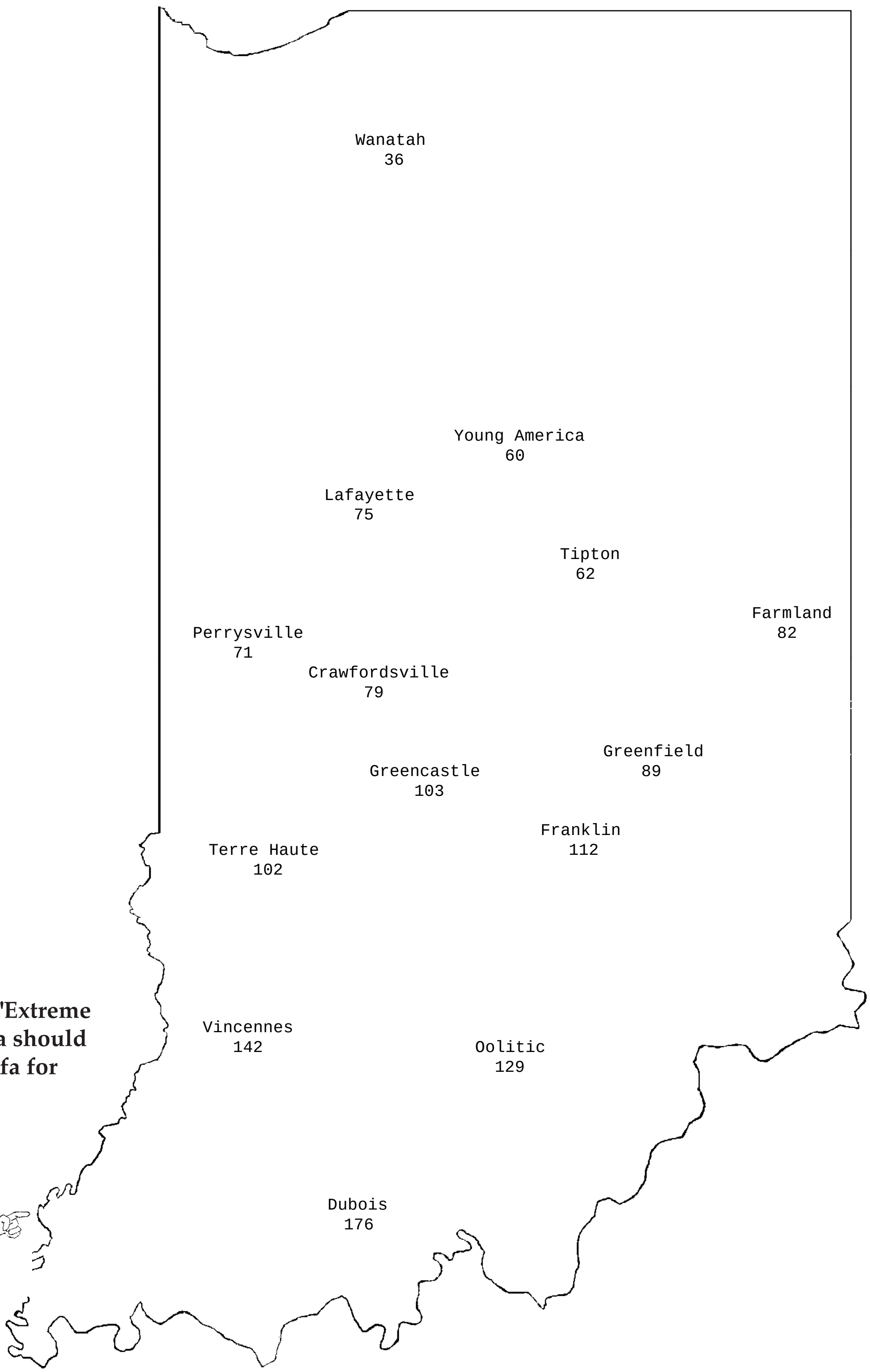
Herbicide	Soil pH	Influence	Result
Corn Herbicide			
Accent Celebrity Plus, Steadfast	>7.5	hydrolysis of herbicide is slowed	more available to carryover to sorghum
Atrazine	<5.5	herbicide absorbed to soil - "tied up"	reduction in weed control
Atrazine	>7.0	herbicide released into soil solution	better weed control; possible carryover
Balance	>7.5	degradation of herbicide is slowed	better weed control; highly probable corn injury
Products with atrazine	<5.0	herbicide absorbed to soil - "tied up"	reduction in weed control
Products with atrazine	>7.0	herbicide released into soil solution	better weed control; possible corn injury
Broadstrike+Dual	>7.8	herbicide released into soil solution	possibility of increased corn injury
Exceed	>7.8	hydrolysis of herbicide is slowed	more available to carryover
Hornet WDG	>7.8	herbicide released into soil solution	possibility of increased corn injury
Lightning	<5.5	action unknown	possibility of increased carryover
Princep	<5.0	herbicide absorbed to soil - "tied up"	reduction in weed control
Princep	>7.0	herbicide released into soil solution	better weed control; possible carryover
Spirit	>7.8	hydrolysis of herbicide is slowed	more available carryover
Soybean Herbicides			
Broadstrike+Dual, Broadstrike+Treflan	>7.8	herbicide released into soil solution	possibility of increased soybean injury
Canopy Canopy XL	>6.8	hydrolysis of herbicide is slowed	more available to carryover
Classic, Synchrony STS	>7.0	hydrolysis of herbicide is slowed	more available to carryover
Command Command Xtra	<5.5	action unknown	possibility of increased carryover
FirstRate Amplify, Gauntlet	>7.8	hydrolysis of herbicide is slowed	more available to carryover
Pursuit, Scepter, Backdraft, Extreme	<5.5	action unknown	possibility of increased carryover
Sencor, Lexone, Axiom, boundary	<5.0	herbicide absorbed to soil - "tied up"	reduction in weed control
Sencor, Lexone, Axiom, Boundary	>7.0	herbicide released into soil solution	possibility of increased soybean injury

Weather Update

MAP KEY
Location HU48

Temperature Accumulations from Jan. 1 to April 10, 2002

HU48 = heat units at a 48ºF base from Jan. 1, for alfalfa weevil development (begin scouting at 200)



4" Bare Soil Temperatures 4/10/02

Location	Max.	Min.
Wanatah	53	41
Columbia City	47	40
Winamac	52	39
W Laf Agro	52	42
Tipton	47	43
Farmland	49	39
Perrysville	51	46
Crawfordsville	45	40
Liberty	53	44
Terre Haute	56	42
Oolitic	52	51
Dubois	60	43

Bug Scout says, "Extreme southern Indiana should be scouting alfalfa for weevil damage."

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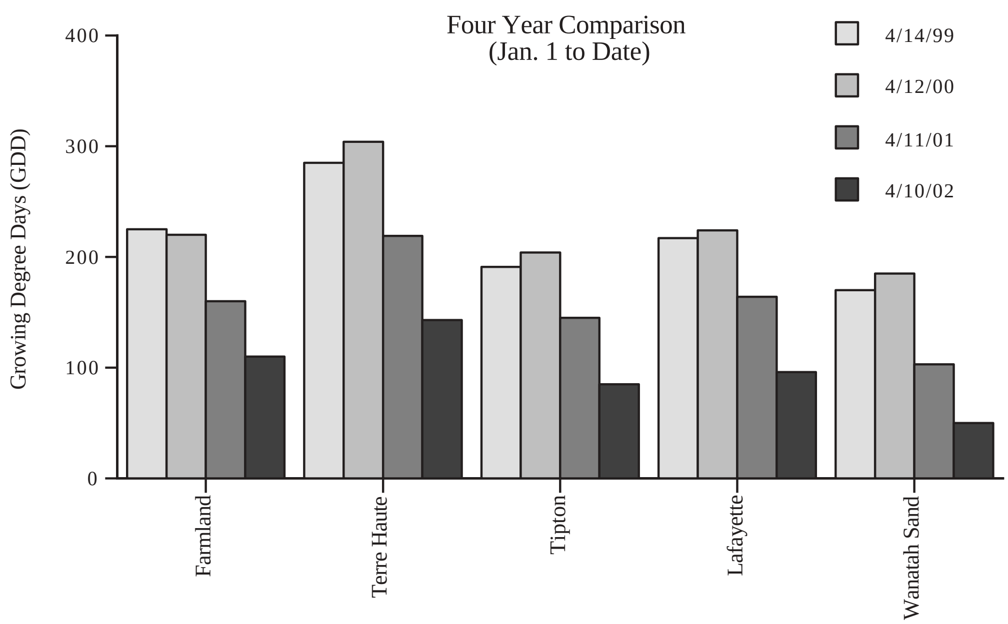
http://www.entm.purdue.edu/Entomology/ext/targets/newslett.htm



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