Purdue Cooperative Extension Service

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In This Issue

Purdue Extension Specialist Listing for 2006

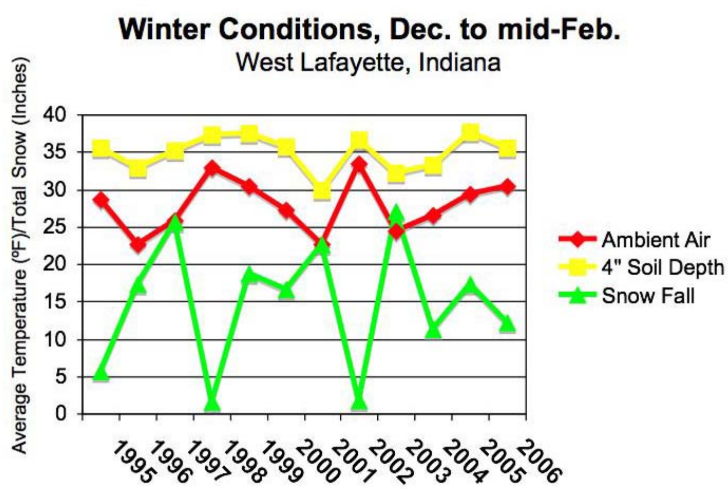
Insects, Mites, And Nematodes

Winter Temperatures and Field Crop Insects – (*John Obermeyer, Christian Krupke, and Larry Bledsoe*)

- Temperature is just one factor that impacts an insect's winter survival.
- 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.

We've had a cold and snowy December, mild January, but February has been a roller-coaster ride. Will this equate to more/fewer insects and greater/reduced crop damage this coming season? As you probably already guessed…it depends! 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 somewhat.

Overwintering insects utilize various behavioral and physiological 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 of the environmental variables that individual insects are subjected to in their overwintering locations. The graph below compares ambient air and 4"soil depth temperatures with snowfall recorded at the Agronomy Research Center in West Lafayette for twelve winters. This depicts how soil temperatures tend to 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 overwintering 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.

Above Ground Insects:

Bean Leaf Beetle

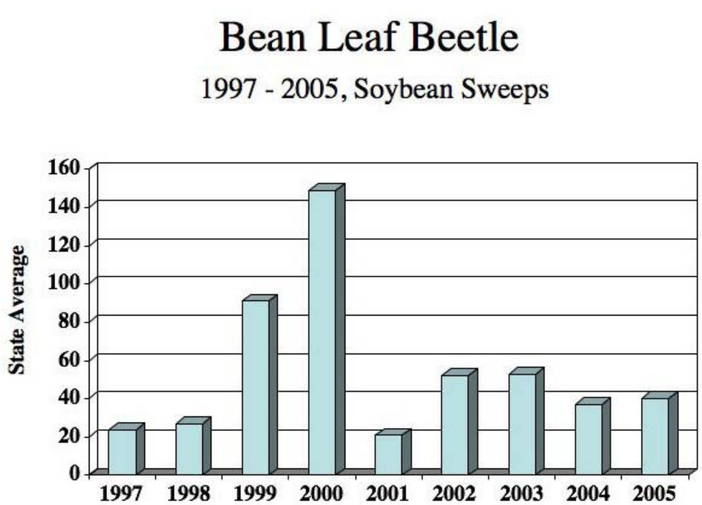
Overwintering stage – adults under leaf litter, grass clumps, etc

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 with this disease will have the greatest impact on yield.

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



Corn Flea Beetle

Overwintering stage – adults in grassy areas or woodlots

Expected overwintering success – poor to excellent (more details in 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 the earliest 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.

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 egglaying moths.

Considerations – Overall populations going into overwintering were relatively low. A mild, moist spring may encourage corn borer pathogens that could drastically reduce numbers of overwintering larvae. Rainy, stormy weather during the mating and egg-laying period is detrimental to the moths. Second generation corn borer will typically cause the most damage, this has very little to do with the overwintering larvae but more to do with late-season growing conditions.

Black Cutworm

Overwintering stage – doesn't overwinter in the Midwest

Crop damage increases with large moth flights into Indiana. Moths are 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. Early corn planting followed by favorable growing conditions during seedling establishment may out-compete larvae attempting to establish in a field.

Alfalfa Weevil

Overwintering stage – adults under crop residue and eggs in stems

Expected overwintering success – highly variable, depends on freezing/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.

Below Ground Insects:

Western Corn Rootworm

Overwintering stage – eggs in the soil (from just below the soil surface to a depth of 12-15")

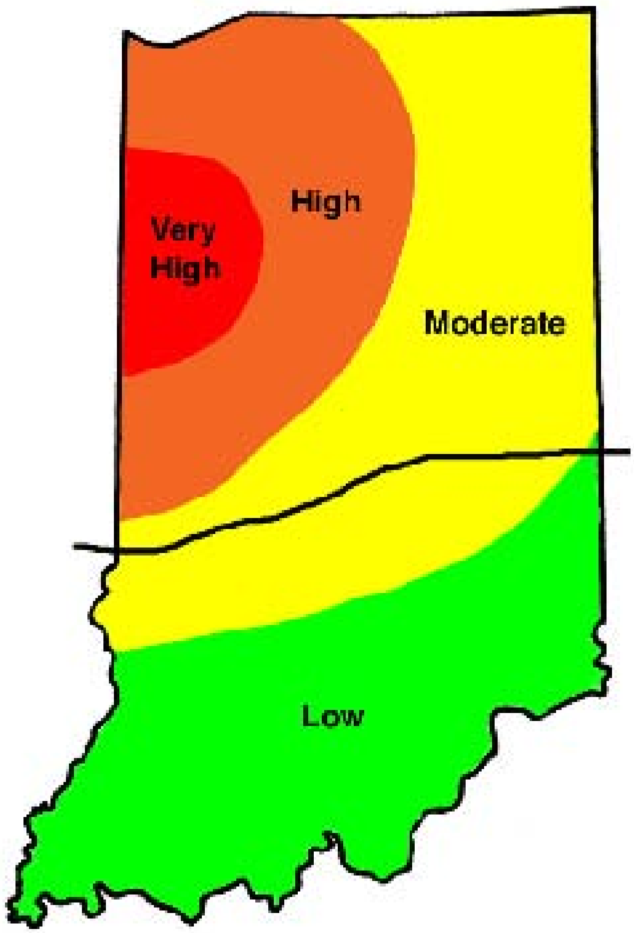
Expected overwintering success – good

Crop damage increases with where rootworm beetles laid numerous eggs in previous year's corn, soybean, or alfalfa crop and the field will be planted to corn in 2006.

Concerns – significant numbers of western corn rootworm beetles were observed in soybean fields last summer in northwest and west central counties (see map of "Perceived First-Year Corn Rootworm Risk Areas")

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



White Grubs

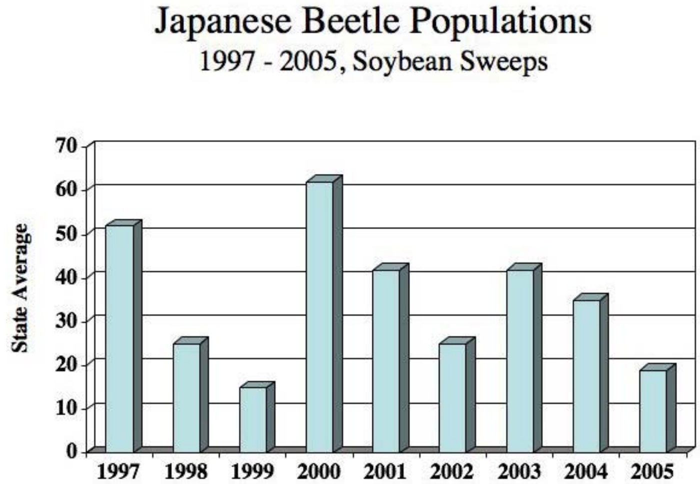
Overwintering stage – larvae/grubs in the soil

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 – beetle numbers were relatively low last year. High organic matter soils may sustain large grub populations without significant crop damage since grubs can feed on dead and/or decaying plant matter.



Rootworm Insecticide Classifications and Consistency of Performance - (*Christian Krupke, Larry Bledsoe and John Obermeyer*)

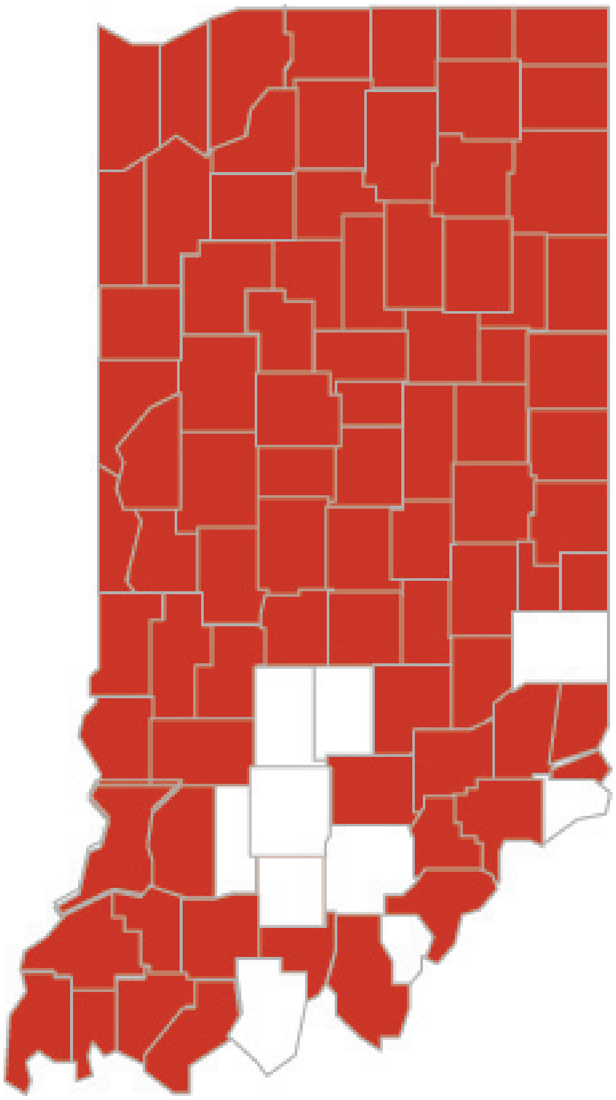
- The following table lists registered rootworm soil insecticides by chemical class.
- Follow label uses and restrictions.
- Many factors should be considered before selecting a product.

See the following table "Factors to Consider when Choosing a Product for Corn Rootworm Protection" on page 5.

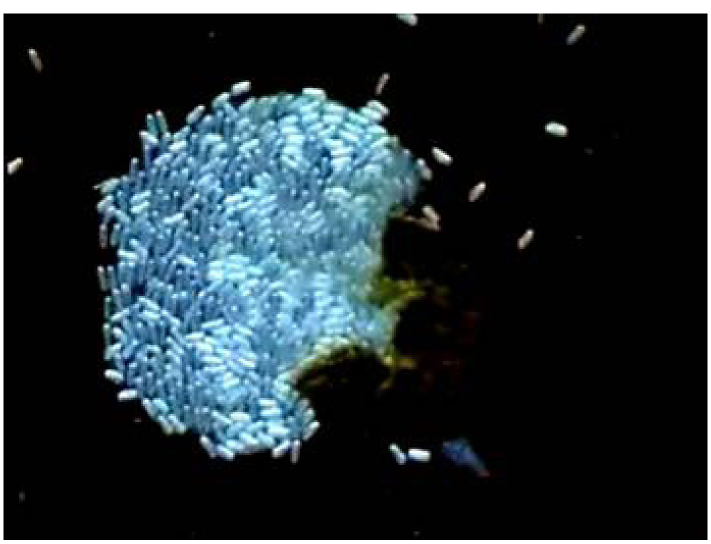
Nematode Update - Seed and Soil Testing Available for Soybean Cyst Nematode - (*Jamal Faghihi and Virginia Ferris*)

- Some SCN resistant soybean may no longer be effective in infested fields.
- Testing the field's soil for SCN and resistance of intended cultivars is available at a nominal fee.
- Samples submitted soon can be completed before 2006 planting.

As we eagerly wait for another planting season to begin, most producers have decided on what soybean cultivars they are going to plant. Where problems have occurred with soybean cyst nematode (SCN) in the past, they have probably chosen one or more of the "cyst-bean" cultivars to plant. Our recent field observations have shown that some of these cultivars may no longer be as effective as desired. To allow producers to check this situation and to make prudent SCN management decisions, we provide a service to check in the greenhouse the degree of resistance for these resistant cultivars.



Shown in red are counties with confirmed infestation of soybean cyst nematode in Indiana



A broken cyst revealing hundreds of eggs inside

The test requires about a gallon of infested field soil and about 100 seeds from each cultivar intended to be planted in a given field, we then expose those seeds to SCN extracted from the field soil and provide the resistance data. If there are enough SCN in the soil that you provide, this process will take about 6 weeks to complete and cost about $50 for up to five soybean cultivars. We charge $10/each additional cultivar. We also perform a race test, for an additional $50/test.

There is still time to perform any of these tests for the upcoming growing season, assuming we are able to extract enough SCN from your soil to conduct the test. If SCN are lacking in your field soil sample, we have to increase them in the greenhouse. This additional task will add another 6 weeks time to the process and add $20 cost/sample.

The best way to manage SCN is to monitor populations by sampling each field at least every 4 years. You can observe the white or yellow females on the roots only during the growing season, but you can sample the soil anytime of the year and get an accurate account of the SCN population. This is a very crucial step in SCN management and should not be neglected. As we mentioned in our articles late last year, the Indiana Soybean Board has decided to no longer pay for the soil processing fee as of January 1, 2006. However, we will continue to provide this service to growers at the cost of $10/sample, for which the submitter will receive an invoice unless we are instructed otherwise.

Factors to Consider When Choosing a Product for Corn Rootworm Protection*

Insecticide Class	Organophosphates			Pyrethroids		Fiproles	Nicotinoids	Transgenic
Chemical Name	**chlorethoxyphos**	**chlorpyrifos**	**tebupirimphos & cyfluthrin**	**bifenthrin**	**tefluthrin**	**fipronil**	**clothianidin**	**Cry3Bb1**
Trade Name & Formulations(s)	**Fortress 2.5G Fortress 5G (SmartBox)**	**Lorsban 15G Lorsban 4E generics**	**Aztec 2.1G Aztec 4.6G (SmartBox)**	**Capture 2E**	**Force 3G**	**Regent 4SC**	**Poncho (treated seed)**	**YieldGard RW**
Factors:								
Performance: test plots - band application	Fortress 5G	Lorsban 15G	Aztec 2.1G	Capture 2E	Force 3G	n/a	n/a	n/a
Root damage rating[1]	2.3	2.4	2.1	2.4	2.3			
Consistency of performance (%)[2]	82	72	84	68	82			
Performance: test plots - infurrow application	Fortress 5G	Lorsban 15G	Aztec 2.1G	Capture 2E	Force 3G	Regent 4SC	n/a	n/a
Root damage rating[1]	2.2	2.3	2.2	2.5	2.2	2.6		
Consistency of performance (%)[2]	76	76	90	62	76	61		
Performance: test plots - treated seed	n/a	n/a	n/a	n/a	n/a	n/a	Poncho	n/a
Root damage rating[1]							2.1	
Consistency of performance (%)[2]							87	
Performance: test plots - genetically modified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	YGRW
Root damage rating[1]								1.5
Consistency of performance (%)[4]								95
Technical information								
Registered for use at cultivation	N	Y	N	N	Y	N	n/a	n/a
Registered for popcorn/seed corn/sweet corn	PES	E	PES	PES	PES	E	PS	n/a
Human hazard (signal word)								
Granular formulation	D	C	W	n/a	C	n/a	n/a	n/a
Liquid formulation	n/a	W	n/a	W	n/a	W	n/a	n/a
Restricted-use pesticide	Y	N	Y	Y	Y	Y	N	N
Labeled for control of other soil pests at the rootworm rate[3]								
billbugs	N	Y	N	N	N	Y	N	N
cutworms	Y	Y	Y	Y	Y	N	Y	N
nematodes	N	N	N	N	N	N	N	N
seedcorn beetle	N	Y	Y	Y	Y	Y	N	N
seedcorn maggot	Y	Y	Y	Y	Y	Y	Y	N
white grubs	Y	Y	Y	Y	Y	Y	Y	N
wireworms	Y	Y	Y	Y	Y	Y	Y	N

*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.

[1]Average root damage rating (Hills and Peters 1-6 scale) where damage in the untreated plots exceeded 3.0 or greater that will likely predisposed plants to significant yield losses. The untreated plots averaged 4.3.

[2]Percentage of root masses where damage rating was less than or equal to 3.0 when the untreated equaled or exceeded 3.0. Tests from 1002-2005.

[3]Insecticide not included if label states “for suppression,” “reduction of,” “aids in control,” or “control of light to moderate infestations only.”

[4]2004-2005 Data only.

Weeds

Can Proactive Herbicide Resistance Management Pay? – (*Chris Boerboom, Ext. Weed Scientist and Paul Mitchell, Ext. Ag. Economist, University of Wisconsin*)

Additional cases of glyphosate-resistant weeds in the Midwest should have Wisconsin growers thinking about management options to delay or prevent resistance. However, most growers probably think the options will cost more money compared to using low cost glyphosate in Roundup Ready crops. They might be right. But on the other hand, a glyphosate-resistant weed might be expensive to control in the future too. So in regards to resistance management, the question is: Is it more profitable to pay now or to pay later?

Another way to consider this question is to ask if a grower wants to wait until a resistant weed problem develops and react at that time by adding another herbicide or switching to a different herbicide. Reactive management is like "using a tool until it breaks, then finding a new tool". It is reasonable to assume that the cost of weed control will increase after resistance develops because an additional herbicide will be needed or weed control may not be as good. In addition, yield losses may occur during the year or two when glyphosate fails to control the weed and other herbicide options are applied too late to achieve adequate control.

Alternatively, a grower could be proactive and use options to delay resistance. This would be like "using a tool carefully so it doesn't break". Proactive management likely increases the current cost of management if the tactics used to delay resistance include herbicide tank mixtures or preemergence herbicides. Even herbicide rotations may increase short-term costs depending on the herbicide programs used. However, this increased short-term cost comes with the benefit of lower costs in the long run because resistance does not develop.

The economic choice between these two strategies depends on the number of years that it takes for resistance to develop, the cost of the options, the cost of controlling the resistant weed after it develops, and the interest rate. With this information, the most profitable choice can be calculated. Reactive management is most profitable if resistance is not likely to occur for a long time into the future. However, investing in proactive management makes sense if the cost of controlling a herbicide resistant weed is high.

Examples of these economic choices are summarized in the following table based on a paper by Mueller and others (2005). Consider these examples.

1. If it costs $10/a for a more expensive herbicide rotation to be proactive and it only costs an extra $2.50/a to add a tank mix partner to control a glyphosate-resistant weed, proactive management would never pay.

2. If the proactive option only costs an extra $2/a and the extra cost to control the glyphosate-resistant weed is only $2.50/a, the resistance would have to happen very soon (within 3 years) for the proactive management to pay.

3. If the proactive option only costs an extra $2/a, but the extra cost to control the glyphosate-resistant weed is very expensive ($20/a), the extra $2/a would be money well spent even if the glyphosate-resistant weed didn't develop for 29 years.

Proactive management pays if resistance occurs before the number of years listed in the table.

Additional annual cost to control the glyphosate-resistant weed	Additional annual cost for proactive management				
	$2/a	**$4/a**	**$6/a**	**$8/a**	**$10/a**
$2.50/a	3 yr	-	-	-	-
$5/a	11 yr	3 yr	-	-	-
$10/a	20 yr	11 yr	6 yr	3 yr	-
20/a	29 yr	20 yr	15 yr	11 yr	9 yr
This example assumes a discount rate of 8%.					

This suggests that weeds that are currently difficult or expensive to control without glyphosate , such as waterhemp, giant ragweed, and perhaps common lambsquarters, may be the best targets for proactive management.

Perhaps a more realistic way to consider these options and costs is to use an example with glyphoste-resistant waterhemp. In the next table, we outlined weed management programs with four levels of resistance management that ranged from none to quite high. These examples suggest that glyphosate-resistant waterhemp may be one of those weeds that could be very expensive to control. Plus, we think it suggests that there are cost effective, proactive options that can be used such as using preemergence herbicides or rotating glyphosate with other herbicide modes of action. (Note that no additional costs are included to control volunteer RR corn in the soybeans if required.)

Cost of weed management programs considering potential glyphosate-resistant waterhemp.

	Cost/a
Low cost program that has high risks for selecting glyphosate-resistant weeds and high risk of yield loss because of poorly timed applications; **not recommended**	
RR corn/glyphosate/application	$20
RR soybean/glyphosate/application	$12
Average across rotation	$16
Program that reduces risks of resistance and yield loss by adding a pre herbicide in corn	
RR corn/Harness/glyphosate/2 applications	$42
RR soybean/glyphosate/application	$12
Average across rotation	$27
Program that further reduces risk of resistance by rotating herbicide modes of action in the corn year	
Conv. corn/Lumax/application	$45
RR soybean/glyphosate/application	$12
Average across rotation	$28.50
Program with the most proactive management; herbicide rotation plus a pre herbicide before glyphosate in soybean	
Conv. corn/Lumax/application	$45
RR soybean/Valor/ glyphosate/2 applications	$29
Average across rotation	$37
Program that may be required to control glyphosate-resistant waterhemp in Roundup Ready crops	
RR corn/Harness/ glyphosate+Clarity/2 applications	$52
RR soybean/Valor/ glyphosate+Cobra/2 applications	$37
Average across rotation	$44.50

Prices assumed. The herbicides and prices are just used as an example. You can adjust the prices and herbicides based on your situation to make more accurate comparisons.

Roundup Ready corn (extra $20/bag)	$8/a
Roundup Ready soybean (used in all examples)	$0/a
custom application	$7/a
preemergence Valor at 2 oz/a	$10/a
preemergence Harness at 1.5 pt/a	$15/a
preemergence Lumax at 3 qt/a	$38/a
postemergence Clarity at 1 pt/a	$10/a
postemergence Cobra at 8 oz/a	$8/a

Source: Mueller, T. C., P. D. Mitchell, B. G. Young, and A. S. Culpepper. 2005. Proactive versus reactive management of glyphosate-resistant or –tolerant weeds. Weed Technol. 19:924-933.

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