Pest & Crop

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We would appreciate you taking a few minutes to fill out the *Pest&Crop* Survey on-line. Please click the button below to go to the survey. Thanks!!

Pest&Crop **Survey 2004**

Insects, Mites, and Nematodes

Survey of Overwintering European Corn Borer and Management Considerations for 2005 - (*John Obermeyer and Larry Bledsoe*)

- 2004 statewide corn borer activity was lower than average
- This year's overwintering larvae are next year's corn borer threat
- Early-planted corn may attract first generation moths
- Second generation corn borer generally attacks late planted/pollinating fields
- Return on investment with Bt corn may depend on planting date along with other production practices/inputs

The annual survey of overwintering European corn borer (ECB) is complete and according to the results, statewide corn borer numbers and damage were rather unimpressive (see accompanying graphs and table). These data correlate well with reports of low flights of moths and low infestations levels that we received throughout the season. Statewide, it seems as though ECB was adversely affected by the rain events of 2004. What implications will this have for 2005?

ECB larvae now nestled in crop and weed residue will form the bulk of next year's threat to Indiana corn. However, environmental factors during the growing season, more than anything else, will determine whether this insect becomes a serious threat in 2005. It is very difficult to accurately predict if an insect such as ECB will reach its biotic potential. Because under optimal environmental conditions, each female moth can produce over 400 eggs spread over many plants and fields. This damage potential was conspicuous during our last major outbreak in 1991.

What about using Bt-ECB corn in 2005 to protect from yield losses? A major drawback with using this excellent pest management technology is that to consistently realize economic gain, producers must assess the potential field risk to ECB moth attraction, egg laying, and subsequent larval damage before the corn crop is even planted. Knowing how the ECB's biology is related to the risk of infestation to corn helps growers make purchase and use decisions.

First brood ECB females are generally attracted to, and have greatest survival on the tallest, greenest corn for egg laying - normally this is early-planted corn. Many producers traditionally plant certain fields first, e.g., fields close to the farmstead, well drained fields, etc. If these fields are ahead in their growth and development compared to neighboring corn during the first week in June, then there is a greater likelihood of return on investment in Bt corn.

Predicting second generation populations and damage is very difficult due to an extensive list of variables that affect ECB survival during the growing season. Our advantage when dealing with second generation ECB is that we understand the pest's behavior enough to know that the later flights are most attracted to actively pollinating, late-planted or late-maturing corn. Of the relatively few instances of significant infestation that occurred this year, many of the fields appeared to be later plantings and later generation ECB. For late-planted fields, Bt-ECB may be a good investment.

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2004 Western Corn Rootworm Sweep Net Survey In Soybean - (*Larry Bledsoe and John Obermeyer*)

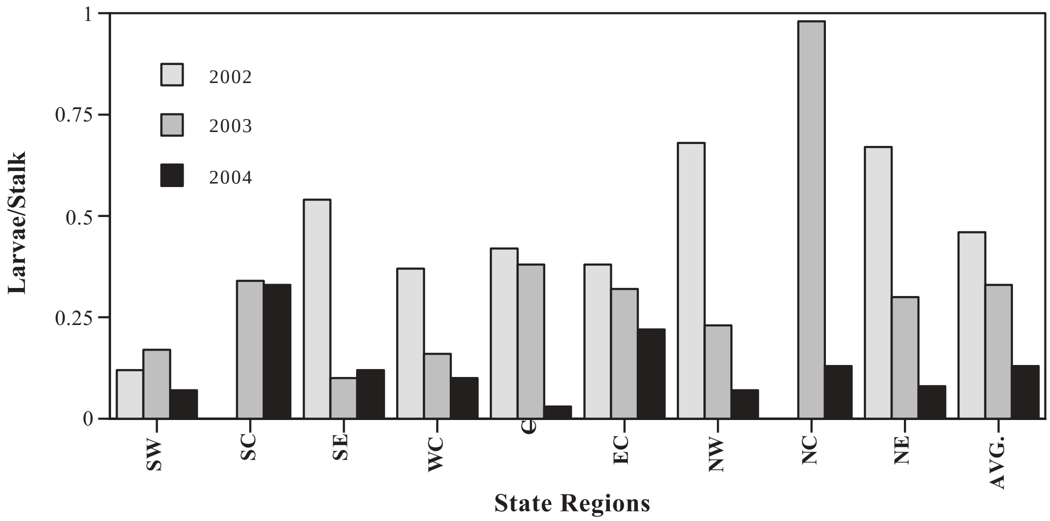
Once again most of Indiana counties were visited in late summer to obtain a "snapshot" of the distribution and abundance of western corn rootworm adults in soybean during a critical period of rootworm egg deposition. The relative abundance of rootworm adults found in soybean in 2004 provides regional estimates of the risk of injury to corn roots in 2005. The state map figure on page 4 shows the total number of adult western corn rootworm beetles captured in 100 sweeps (five sets of twenty sweeps) using a 15 inch diameter net per field. County boundaries should be considered artifacts of sampling. Only one to three data points per county are not sufficient to compare risks on a county basis. Likewise, the numbers should not be used to infer infestation risks for particular fields. Growers still need to assess individual fields to refine treatment decisions. See the publication titled "Monitoring and Decisions Rules for Western Corn Rootworm Beetles in Soybean" at <http://www.entm.purdue.edu/entomology/ext/targets/e-series/EseriesPDF/E-218.htm>. Although, no statistical correlation of the beetle numbers and resulting crop injury has been completed, empirical observations over many years has allowed us to estimate regional risk levels using the annual data as a guide. The primary goals of the annual survey are to compare regional risks of infestation over several years and assign general risk levels of injury to the subsequent crop by state region.

European Corn Borer Survey Results, Fall 2004.

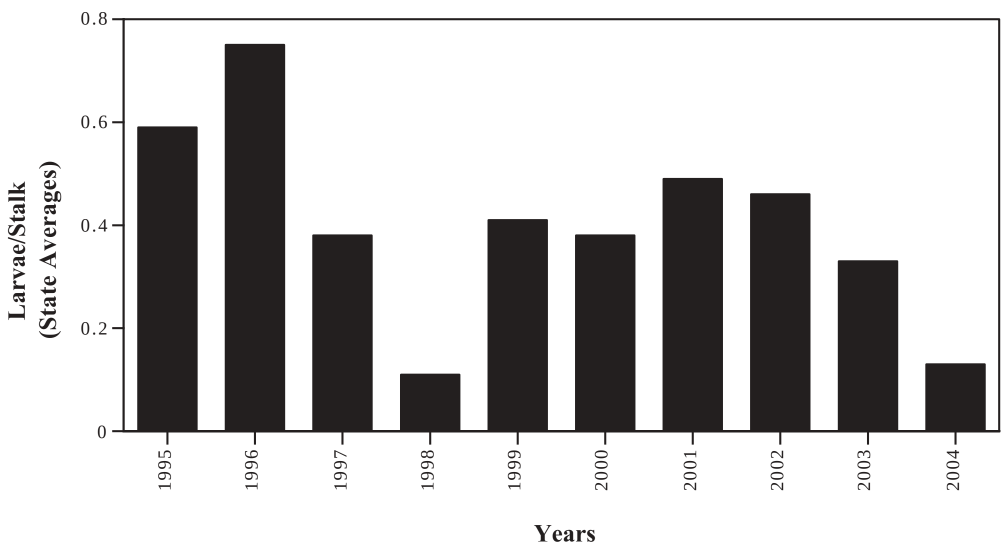
Region	Fields Surveyed	Borer Entries/Tassel[1,2]	Borer Entries/Above Ear Zone[1,2]	Borer Entries/Ear Zone[1,2]	Borer Entries/Below Ear Zone[1,2]	Borer Entries/Ear Shank[1,2]	Total Borer Entries/Plant[1]	Overwintering Larvae/Plant[3]
SW	6	0.01	0.10	0.16	0.18	0.08	0.52	0.07
SC	6	0.00	0.24	0.27	0.13	0.07	0.70	0.33
SE	6	0.01	0.13	0.14	0.03	0.01	0.33	0.12
WC	6	0.01	0.12	0.14	0.09	0.11	0.47	0.10
C	6	0.01	0.06	0.08	0.05	0.08	0.28	0.03
EC	6	0.00	0.14	0.18	0.18	0.11	0.61	0.22
NW	6	0.00	0.15	0.18	0.08	0.10	0.51	0.07
NC	6	0.00	0.08	0.11	0.13	0.05	0.37	0.13
NE	6	0.00	0.04	0.08	0.09	0.04	0.25	0.08
AVG.		0.00	0.12	0.15	0.11	0.07	0.45	0.13

[1]Counts made on 20 plants/field
[2]Plant zones are as follows: Tassel; Ear Zone, includes 2 nodes above and 2 nodes below primary ear; Above Ear Zone, includes all nodes between tassel and ear zone; Below Ear Zone, includes all nodes between ground and ear zone; Ear Shank, includes primary ear only.
[3]Numbers based on 10 plants dissected/field

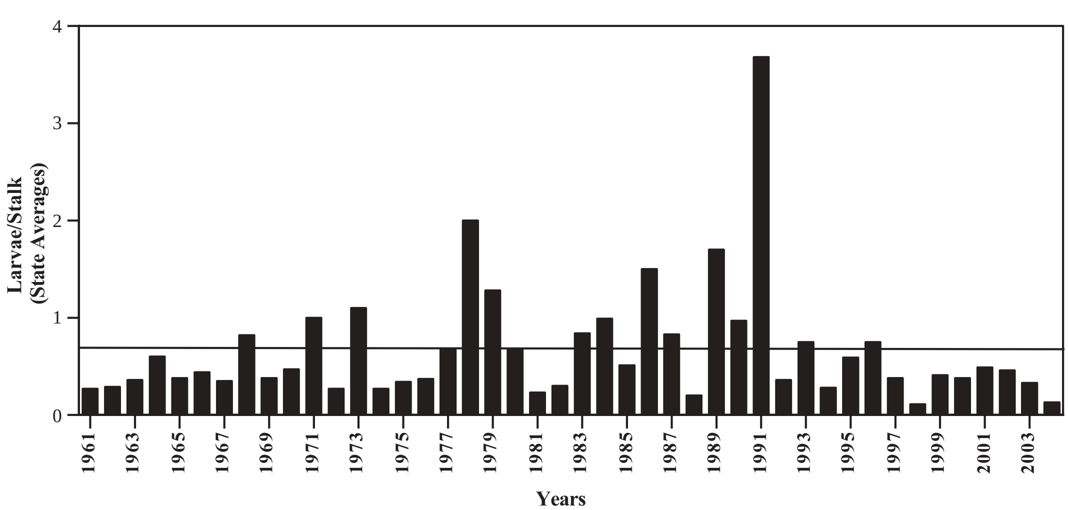
Overwintering European Corn Borer 2002 - 2004



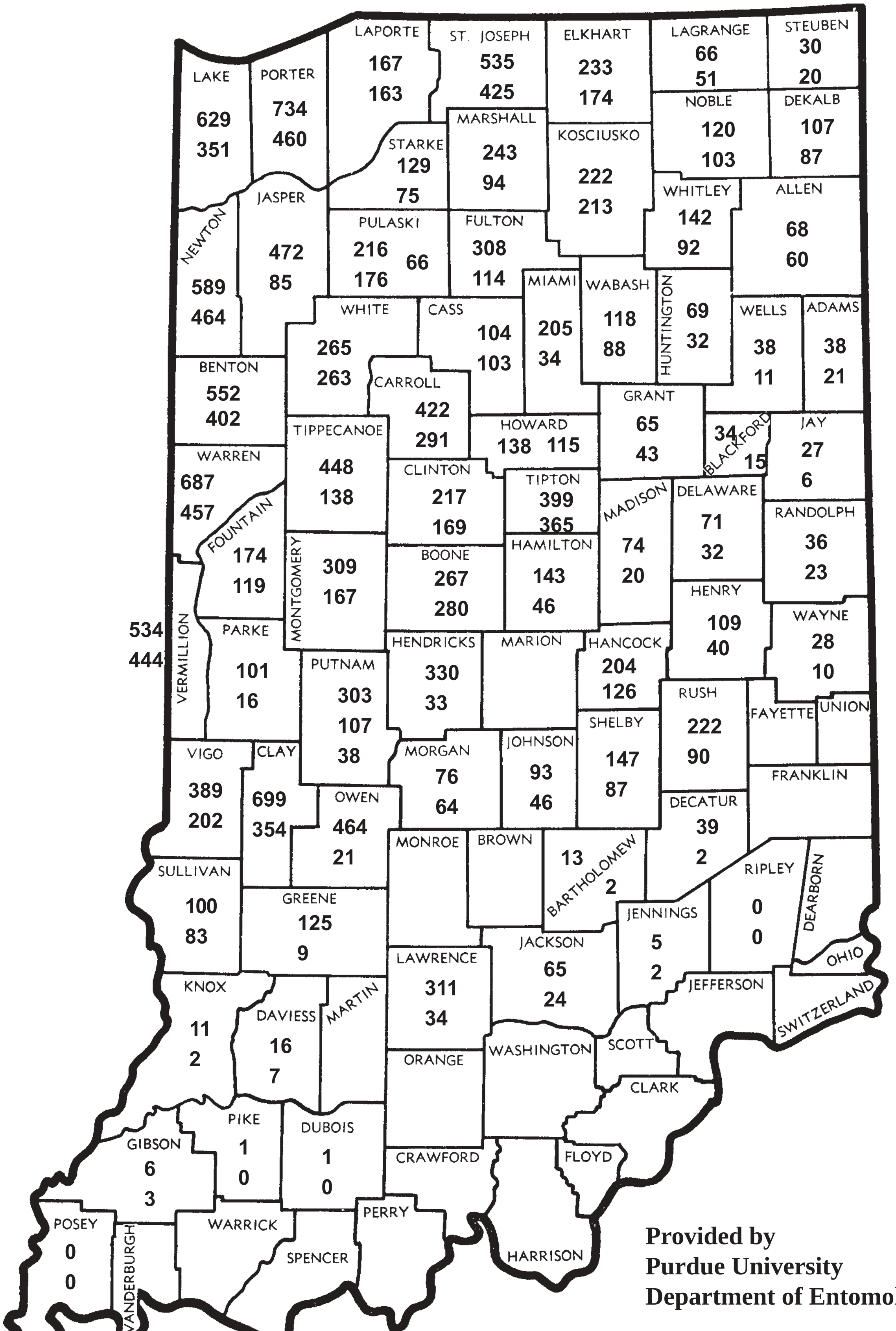
Indiana Fall Corn Borer Survey 1995 - 2004



Indiana Fall European Corn Borer Survey 1961 - 2004



2004 Western Corn Rootworm Sweep Net Survey in Soybean (Number/100 Sweeps)



Provided by
Purdue University
Department of Entomology

Data collected July - August, 2004

Estimated Economic Losses from European Corn Borer in 2004 - (*John Obermeyer and Larry Bledsoe*)

The following chart shows estimated economic losses to Indiana's corn from European corn borer (ECB) damage in 2004. This estimation uses the statewide, 2004 fall ECB survey information from non-Bt cornfields. This is an attempt to make plant injury data from the fall survey more meaningful to Indiana's producers. The chart shows the average and range of potential economic impact that occurred within specific areas of the state.

Potential dollar losses were calculated using estimated values assigned to physiological stresses due to the number of ECB larvae boring into a plant. It cannot be stressed enough that corn hybrids differ greatly in their reaction to ECB damage. The estimated dollar loss should be compared to the expense of preventing or lowering ECB damage with Bt corn or insecticides. From the data below, most areas in 2004 didn't warrant preventive measures unless on the high end of the damage range. If nothing else, this data supports the need for scouting and determining infestation levels in each field.

2004 Estimated $ Loss/Acre from ECB Damage

Region	# of Fields	Mean $ Loss/Acre[1]	$ Loss Range/Acre[1]
SW	6	3.88	0.00 - 15.69
SC	6	4.12	0.00 - 9.90
SE	6	1.36	0.00 - 3.34
WC	6	3.21	0.00 - 7.52
C	6	2.10	0.00 - 3.87
EC	6	4.54	0.00 - 10.22
NW	6	3.53	0.00 - 7.88
NC	6	2.64	0.91 - 4.53
NE	6	1.86	0.00 - 3.13
State	54	3.10	0.00 - 15.69
5 Year Average		6.12	
10 Year Average		6.13	

[1] Assumes a 2.5% yield loss for each ECB entry.
Only stalk entries from two nodes above the ear to the ground are considered affecting yield.
Includes first and/or second generation ECB damage.
Uses October District Yield Estimates from Indiana Agricultural Statistics Service.
Uses $2.25 market price for corn.

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Winter Annuals and Management of Soybean Cyst Nematode - (*Jamal Faghihi, Bill Johnson, and Virginia Ferris*)

Our studies, as well as those of others, identify several annual winter weeds like henbit and purple deadnettle as excellent hosts for the soybean cyst nematode. SCN requires soil temperatures higher than 50°F for extended periods of time to complete their life cycle. The optimum temperature for the soybean cyst nematode is 75°F while their physical activities begin at 50°F. At 75°F they require about one month to complete one life cycle. The winter annuals in Indiana typically germinate in late fall and mature in early spring. During this time period Indiana soil temperature seldom reaches and stays at the required temperature under normal conditions. However, because of unusual cool weather conditions this July and August, we have found many winter annuals germinating in August and several have developed into well established seedling plants or rosettes at this time. In addition, September weather conditions this year have been relatively warm. With well established winter weeds and warm temperatures this year, having the required soil temperatures to complete a life cycle is a possibility. Based on their greenhouse studies, Ohio State University researchers are recommending control of winter annuals in the fall. With variation in soil temperature in most of Indiana, we presume that in some years the soil temperature might stay high enough for an extended period of time to allow SCN to complete its life cycle, thus acting as a host. However, in some other years the cool soil temperature might allow nematodes to hatch and invade the weed roots but not reach the desired temperature to complete a life cycle, and thus the winter annuals might be beneficial, acting as a trap crop. With funding from the Indiana Soybean Board and USDA CSREES, Purdue scientists have undertaken comprehensive field studies to answer these questions and be in a position to make better recommendations on this matter in the future. We have made good progress so far but a lot of questions still exist and need to be answered before making a definitive recommendation on winter annual weed control. At this point, we know that under certain circumstances, controlling winter annual weeds can provide small reductions in spring SCN population densities. But we don't have conclusive evidence yet indicating that control of winter annual weeds will always lead to lower SCN numbers

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Proper Grain Storage Part II: Insect Pest Management Practices - (*Linda Mason and Dirk Maier*)

Sanitation in and around stored grain facilities is the most effective and economical management practice to prevent insect infestations in stored grain. Prior to storing grain, all surfaces that may come in contact with the newly harvested grain should be cleaned. In addition, storage bins with false floors and aeration ducts may need to be fumigated or treated with diatomaceous earth. The grain and dust that accumulate in these areas are excellent sources of insect infestations. If fumigation is selected as the optimal procedure, seek a licensed applicator to do the job. Fumigants are highly toxic to humans and must be applied with proper protective equipment.

After the storage area is cleaned, an approved residual insecticide should be applied on both the outside and inside bin walls and on floors. As the grain is binned, preventative measures include applying a protectant if the grain will be in storage for more than a year. Grain protectants kill insects as they crawl about or feed on the treated grain. However, grain protectants should not be applied to high moisture grain or above 90°F because they can lose their effectiveness.

After binning, some grain protectants can be applied as a surface treatment ("top-dress") to protect the grain from surface feeders such as Indianmeal moth and invading beetles. Legal tolerances can be exceeded if a product is applied both as a grain protectant and top-dress, so the label MUST be read and followed.

Storages should not be overfilled. Furthermore, insecticide treatments, aeration, and fumigation cannot be done effectively when the grain surface is not level. Above 55-60°F, the grain should be inspected at least every two weeks for insect activity. Plastic grain probe traps are excellent sampling devices that can help determine insect activity below the grain surface. To prevent stored grain insects, effective measures can be as simple as maintaining grain temperatures below 60°F or above 100°F.

Mold and Mycotoxin Management

Grain spoilage is the result of microorganisms using the nutrients within the grain for their own growth and development. During this process they produce heat and increase the temperature of the surrounding grain, which may result in hot spots. Heat damage significantly reduces grain quality. If environmental conditions in the grain are right, the major storage mold may produce mycotoxins such as aflatoxin, fumonisin, DON, and zearalenone. These may cause serious illness and even death when consumed by livestock or humans. The presence of mold does not mean mycotoxins will be present, but rather that the potential for their development exists given the right combination of temperature, moisture content, and storage time. Even more frustrating is the fact that the absence of mold does not guarantee a mycotoxin-free commodity. This is because the growth of the mold may not be extensive enough to cause visible damage, but nevertheless it can still produce toxins. Generally, broken, ground, and dead grain are more vulnerable to fungal attack than whole grain; stored grain dried at high temperatures is more vulnerable to molding than is grain dried at low temperature; and grain stored for long periods of time is more vulnerable than freshly harvested grain. Although molds are diverse in their requirements, all mold growth can be prevented by low moisture, low temperature, and low oxygen environmental conditions.

Summary

Maintaining stored grain quality requires an integrated approach by the stored grain manager that incorporates a number of tools and pesticides to prevent quality deterioration. Relying on a single tool to take care of a problem is an approach of the past that is doomed to fail in the future. Single solutions, especially if they are chemical in nature, are under intense public and regulatory scrutiny and will continue to be a limited option. Prevention is the only acceptable way to maintain grain quality.

Table 1. Examples of residual insecticides for empty grain bins in Indiana

Diatomaeceous
EarthReldan 4E
Storcide (does NOT have CODEX MRLs)
Tempo SC Ultra

Table 2. Examples of grain protectants approved for application to stored corn in Indiana

Actellic
Diacon II
Diatomeceous Earth type products (Insecto, Protect It Dryacide)
Malathion 6% grain dust or Malathion 5EC

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Weeds

New Weed and Crop Identification DVD - (*Bill Johnson*)

A new software program, the "Interactive Encyclopedia of North American Weeds" may be of interest to you. It offers more than 2,400 photographs covering 447 of the most important weeds and crops in the United States and Canada. The illustrated glossary of 565 botanical terms is a program in itself! A unique illustrated interactive identification key now covers all of the weeds in the program. The professionally narrated lessons provide nearly three hours of interactive instruction on the basics of plant taxonomy needed to identify plants.

After 12 years of development, the program provides a balanced and fully integrated teaching and reference resource for weed, crop, and plant identification. The DVD is an excellent resource for teaching plant taxonomy and weed identification courses, basic botany, agronomy, and horticulture courses, and high school biology and vocational agriculture courses. A presentation maker feature allows an instructor or presenter to create a custom path through the program. Professional agronomists, horticulturalists, grounds keepers, landscapers, turf managers, gardeners, herbalists, botanists, and all manner of plant enthusiasts will enjoy the extensive descriptions, distribution maps, habitat key, World of Weeds weed history articles, and the unique visual weed and crop identification key.

The best way to see if it might be of value to you is to view a demonstration weed home page and obtain more information on the DVD-ROM at the following link: <www.thundersnow.com/weedid.htm>.

The Interactive Encyclopedia of North American Weeds - Version 3 DVD-ROM can be ordered through the North Central Weed Science Society by clicking on the following link: <www.ncwss.org/info/weedncwss.pdf>. Or you can call Bob Schmidt directly to place an order at: 217 352-4212. The price is $59.95 each plus $5.00 shipping and handling.

Agronomy Tips

Rethinking Rotations: More Corn and Less Soybean in the Corn Belt? - (*Tony J. Vyn*)

Many Corn-Belt farmers I have had contact with during this past year have discussed switching away from the traditional 50% corn and 50% soybean rotation to something involving a higher percentage of their land area in corn. Some farmers simply intend to have some of their acreage (e.g., the fields with the highest corn yields) in a rotation of 2 years corn, 1 year in soybean while keeping most of their acreage in the traditional corn-soybean rotation. Other farmers want to switch all of their fields into a rotation of 2 years corn and a single year of soybean. Still other farmers are very intrigued about continuous corn production.

Some common reasons I am given by cash-crop farmers for considering more corn after corn are:

1. The soybean yields on my farm in recent years have been disappointing.
2. In the one field where my neighbor grew corn after corn, yields went over 200 bushels per acre in 2004.
3. With high cash rents for land, and corn yields approaching 200 bushels per acre, corn production is simply more profitable than soybean production.
4. It is easier to complete harvest in a timely fashion with a higher percentage of corn in the acreage mix (because of the increased number of days, in the fall of the year, that a farmer can harvest corn versus soybean).
5. Some record corn yields have "apparently" been achieved by other Corn-Belt farmers in continuous corn production systems.
6. There is a lower yield risk with corn versus soybean.
7. The increased capacity for soybean production in South America means that the long-term prospects for maintaining competitive marketing prices for commodity soybean are less likely than for corn.
8. Rootworm management (whether with transgenic hybrids or insecticides) is just as costly for corn after soybean as it is for corn after corn in a progressively bigger portion of the Corn Belt each year.
9. Today's corn hybrids are more stress tolerant than those of 20 or 30 years ago.
10. Unlike the situation in the 1970's, continuous corn production in 2005 doesn't have to lead to poor soil structure.

Space doesn't permit addressing the validity of all of the reasons above. Some are more speculative than others. One that is not mentioned, but which may be valid, is that soybean yields may increase if it were planted every third or fourth year rather than every second year. However, the rotation yield advantage one assumes for corn after soybean is perhaps the key factor in making the economic decisions about rotation changes. One common question from farmers who are rethinking their rotation is whether the accepted standard of a 10% yield reduction for corn after corn still applies today.

My first answer to the latter question (and to some doubters) is that the rotation yield advantage for corn is still just as evident today as it was 10 or 30 years ago. My second answer is that the rotation yield advantage for corn after soybean versus corn after corn has always been dependent on the tillage system that is being assumed. My third answer is that even when corn yields are over 200 bushels per acre, the extent of the rotation advantage can still be the same as for corn yielding less than 150 bushels per acre.

The long-term data from two ongoing experiments in Indiana provide some solid evidence for the 3 conclusions above.

In Table 1, which summarizes results from a 30-year study on a dark prairie soil with high organic matter, the rotation advantage ranged from 5% in a moldboard plow system to 18% in a no-till system. Even in 2004, a year with above-normal yields, the rotation advantage was still from 5 to 16% depending on tillage system.

Table 1. Corn Yields Responses* to Tillage and Rotation from 1975 to 2004 in West Lafayette, Indiana (Chalmers silty clay loam)

Tillage System	1975 - 2003		2004		Yield Gain for Rotation (%)	
	Corn/Soy	Cont. Corn	Corn/Soy	Cont. Corn	1975-2003	2004
	------------------------Yield (bu/acre) -------------------					
Moldboard Plow	176.4	168.5	213	201	5	6
Chisel Plow	176.9	164.0	209	198	8	5
No-till	172.5	146.2	207	179	18	16

*Yield data from a cooperative project involving T.D. West, T.J. Vyn and G. Steinhardt of the Agronomy Department.

In Table 2, results from an 8-year study in Northern Indiana again confirm the 8 to 14% yield advantage for corn after soybean instead of corn after corn. In 2004, even when corn after corn yielded around 210 bushels per acre, there still was a 20 bushel (or 9-11%) yield advantage for corn after soybean. Yes, it is hard to fault a farmer's management when he or she achieves yields of 210 bushels per acre. But from my perspective, 230 bushels is still more profitable than 210 bushels.

Table 2. Corn Yields Responses* to Tillage and Rotation from 1997 to 2004 in Wanatah, Indiana (Sebewa loam)

Tillage System	1997 - 2003		2004		Yield Gain for Rotation (%)	
	Corn/Soy	Cont. Corn	Corn/Soy	Cont. Corn	1997-2003	2004
	------------------------Yield (bu/acre) -------------------					
Fall Chisel	188	174	230	210	8	9
Fall Disk	189	170	234	211	11	11
No-till	184	161	224	206	14	9

*Yield data from a cooperative project involving T.D. West, T.J. Vyn and G. Steinhardt of the Agronomy Department.

The information in both Tables 1 and 2 also emphasize that there is more need for tillage when corn follows corn than when corn follows soybean in sequence. In fact, other than the economic cost of reduced yield, the biggest economic loss associated with corn after corn is that it virtually rules out a no-till system. Moldboard plowing may become more commonplace in the Corn Belt simply because it is such an attractive option for corn after corn on high clay and high organic matter, poorly drained soils. But such a development would involve its own short-term and long-term costs. The short-term costs include equipment depreciation, fuel, and time; the long-term costs include more soil erosion and reduction in future crop productivity. Chisel plowing is not much better; it still leaves just 20 to 25% surface residue cover after planting for corn after corn.

Another economic cost of corn after corn is simply the cost of the additional N fertilizer. Recommended N rates are at least 40 pounds per acre higher for corn after grain corn than for corn after soybean.

Some conservation-minded corn farmers have asked about fall strip tillage for corn after corn. Indeed, our experiments show that strip tillage can yield superior to no-till and just as well as chisel plowing for corn after corn (data not shown). Similar strip tillage operations after soybean have not tended to result in higher yields than the no-till system, though they have enabled much earlier planting in spring and accelerated early growth of corn relative to no-till corn. But even so, corn after corn means more tillage. Furthermore, more tillage also means generally later fall tillage operations than would be the case after soybean harvest.

There are many other agronomic issues involved for the best possible management in corn after corn. For instance, in corn after corn systems, hybrid selection needs to involve much more attention to susceptiblity to certain foliar diseases that can increase without rotation. But before Corn-Belt farmers concern themselves with the details, they should consider the major costs of switching to a more corn dominant rotation.

Summary:

Even with the high yields achieved in Indiana in 2004, corn in rotation with soybean yielded from 5 to 15% higher than corn after corn. These increases in corn yield for rotation are in line with those for the last 30 years. Any rethinking of corn-soybean rotations in the Corn Belt must be done with an accurate assessment of the overall costs. Chief among the increased costs that need to be considered for corn after corn are:

1. Yield loss (e.g., 11 to 23 bushels per acre in 2004 alone)
2. Higher tillage costs (no-till no longer possible)
3. Associated higher soil erosion costs
4. Higher optimum nitrogen fertilizer rates
5. Higher pest control costs

My advice: Think very hard, and consider all the costs for any changes in rotations.

Bits & Pieces

Shawn Conley - New Soybean Extension Specialist -

Welcome to Shawn Conley who joined the Purdue University Department of Agronomy in October of 2004 as an assistant professor and Soybean Extension Specialist. Dr. Conley received his B.S., M.S, and Ph.D. from the University of Wisconsin, Madison. Dr. Conley was an Assistant Professor at the University of Missouri where he was a State Extension Specialist with cropping systems. His new responsibilities here at Purdue will include a statewide Extension/Outreach curriculum in the sustainable soil fertility and crop nutrient management systems relevant to producers throughout Indiana and the Midwestern U.S.