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COOPERATIVE EXTENSION SERVICE

CORN AND SOYBEAN SCIENCE GROUP NEWSLETTER

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<u>2002 UNIVERSITY OF KENTUCKY, COLLEGE OF AGRICULTURE FIELD DAY</u>, Research and Education Center, Princeton, KY. Thursday, July 18, 200
Corn and Soybean Grain Tours: There will be several studies of interest discussed on these tours. Some of the topics will be: 1. Planting date and its effect on yield of Bt corn, 2. New developments in genetically engineered corn for rootworm, earworm, and stalk borer resistance, 3. How to reduce the loss from Diplodia ear rot, 4. Effect of soybean pubescence on the aphid population and soybean mosaic virus, 5. Effect of fall compaction on corn and soybean yields, and 6. Several stops on precision agriculture. Make your plans now to attend.

<u>Free Conversion Kits for Vole and Rodent Control by Lloyd Murdock, Extension Soils Specialist</u>

Voles and rodents can be a problem in high residue, no-till conditions. Zinc phosphide in the row at planting is an effective control of them. John Pickle with United Agri-Products Company called about free conversion kits for growers to enable them to use zinc phosphide in the row.

Loveland Industries (1-800-356-7202) is providing growers with free conversion kits for their planters, so they can legally apply zinc phosphide pellets for rodent control at planting. In furrow application at planting is the only approved application method for zinc phosphide pellets in no-till and reduced tillage situations. The kits are called positive placement kits (PPK). The metering wheel replaces the present metering wheel in the bottom of the insecticide box. A divider can be used to allow both (insecticide and zinc phosphide) to be used in the same box.

The kits have a $50 value per row, but they are free in order to stimulate the use and sale of zinc phosphide in fields where rodent threshold levels and damage occurs. The offer is open to growers and researchers. Just call (1-800-365-7202) and give the receptionist the following information: Name, shipping address, phone number, make and model of planter, and number of rows. Growers should be able to purchase PROZAP zinc phosphide pellets from their local Ag chemical dealer.

<u>Kentucky Corn and Soybean Production Contests for 2002</u> by Morris Bitzer and James Herbek, Grain Crops Research and Extension Specialists.

Start making plans now for those corn and soybean production contest entries for 2002. Entry rules and forms will be mailed to County Extension Offices and Company Representatives in June after all your corn and full season soybean are planted. The rules for the corn contest require that the field must be at least 10 acres, agronomic information must be provided for each entry, and at least 1.25 acres from this area must be harvested and weighed with approved supervisors. For soybean contest, a minimum of 3 acres in one block must be harvested with proper supervisors. If you want to enter the Kentucky Contests, please contact your County Extension office. The 2002 NCGA Corn Yield Contest has several deadlines (July 15 - Aug. 15) for entries and the entry fee increases for each deadline. If you want an entry form for the NCGA contest, call 314-275-9915 or contact your corn or soybean representative. There is no official entry form for the Kentucky contests, however; if you enter the NCGA contest, your completed forms, both the Entry Form and the Harvest Form, will be accepted for the Kentucky contest. Be sure and get a copy of your National Forms to your local County Extension office to be sent in for the Kentucky contest.

Soybean Cyst Nematode Update by Donald E. Hershman, Extension Plant Pathologist

Soybean cyst nematode (SCN) exits virtually everywhere soybean is grown in Kentucky. The pest is insidious in that significant yield damage often occurs without the appearance of visible disease symptoms. This is an extremely important point, because it suggests that farmers are frequently unaware that SCN is active and doing damage in a field. When lower-than-expected yields are encountered by farmers, they often attribute the situation to causes other than SCN.

A development in recent years has been the almost exclusive use of SCN resistant varieties anytime SCN is known to exist in a field. This is a logical line of thinking since the use of resistant crop varieties in disease management programs is usually at the top of the recommendation list. In fact, the use of SCN-resistant soybean varieties is an essential component of any successful SCN management program. However, there is a catch in regards to the use of SCN resistance. Planting SCN-resistant varieties too often, even every other year as many soybean producers do, can result a populations of SCN that are capable of significant reproduction on available resistant varieties. The vernacular for this is called a “race shift”, and it is due to a biological process called selection pressure. The net effect is that overuse, or the improper use, of resistance genes can ultimately lead to difficulty in managing SCN using many resistant varieties.

In a study we conducted on a “race 3" field population of SCN in Christian County from 1994 to 1999, SCN populations began to significantly increase on the “resistant” varieties the third time a specific variety was grown. That is, there was a dramatic increase in SCN in year three for continuous soybean, and year six when soybean was grown every other year in rotation with corn. Since so many farms with SCN are being planted to the same (or similar) SCN-resistant soybean varieties every other year, this situation could be the cause of yield stagnation or declines in a field over a few crop cycles. It is a possibility worthy of consideration.

A much less risky use of SCN-resistant soybean is to alternate different resistant varieties, each based on a different source of SCN resistance. Our work has shown that this practice will delay “race shifts” and problems with resistance effectiveness; however, the risk of population shifts, over time, still exists. For example, in the same study referred to above, we looked at continuous soybean, but alternating sources of resistance. We detected a developing problem with managing SCN in year six of the study. Obviously, inserting corn or some other non-host crop into the equation, and planting different resistant soybean varieties every other year, might eliminate this concern from a practical perspective.

Another aspect of SCN resistance that is not widely understood, is that not all SCN-resistant varieties are equally effective in managing SCN. For example, individual SCN field populations will each respond differently when exposed to a range of SCN-resistant varieties. This is true even for varieties marketed as having the same SCN resistance (e.g., race 3,14). Depending upon the variety, SCN populations will either go down, up, or stay about the same as the season progresses. Yield results will also be highly variable. Variability is mainly an artifact of breeder technique, biological and experimental variation, the source(s) of resistance used, and the extent of greenhouse/field evaluation during variety development. Genetic variation in SCN populations from farm to farm only makes matters worse. The net effect is that two varieties, each reported to be resistant to the same "race" of SCN, may impact SCN and yield quite differently. In other words, there could be a great deal happening on the farm that relates simply to which variety is being grown.

With the above performance variables, what is a producer to? One approach is to generate farm-specific data on how different resistant varieties perform. To do this, one could plant and measure yield on a "strip trial" of resistant varieties in a field infested with SCN. For anyone who does this, I recommend taking soil samples for SCN analysis at planting and at the end of the season, for each strip planted. This will give you some indication how each variety impacted SCN populations and how yield related to those populations. This situation is not ideal because the strips would not be replicated, and, thus, there would be no estimate of experimental variability. However, basing decisions on strip trial data is superior to making "blind" variety selection decisions. The second best approach would be to plant multiple soybean varieties on the farm and, again, keep track of yield and SCN populations over time. At a minimum, ask your seed dealer for an assurance that the variety they propose to sell you has been thoroughly tested under a range of conditions. Ask them questions. Ask for data; this includes university data from other states as well as company data.

You may have heard of a new soybean breeding line, CystX, which is resistant to all known races of SCN. The basis of CystX resistance is PI437654. This resistance was first incorporated into the variety 'Hartwig' almost a decade ago and later in 'Anand'. The big advantage with CystX is that many negative agronomic characteristics associated with PI437654 were eliminated. This makes CystX easy to use in developing new SCN-resistant varieties in a range of maturity groups. These are all positive developments. Any variety based on PI437654 resistance is, in fact, highly effective in managing SCN, at least in the short term. However, PI437654 resistance is not a "silver bullet" for managing SCN. There is already evidence (and a great deal of concern among nematologists) that over time many SCN field populations will adapt to, and be able to reproduce on, soybean with PI437654 resistance genes. The history of SCN proves that it is a highly adaptable pest. In fact, Lawrence Young, a USDA nematologist in Stoneville, Mississippi has been working with a SCN population that reproduces on "Hartwig" at moderate levels.

One final note. Perhaps my greatest concern is that very few producers are periodically testing their fields for SCN population changes over time. Most producers are just assuming that what they are doing is working and they have moved on to other concerns. The problem here lies in making the assumption that SCN populations are being manipulated as desired. The simple fact is that in many cases, SCN populations are NOT being effectively managed. My main exhortation here is for producers to sample all SCN-infested fields at least once every four years for SCN analysis. More frequent sampling may be necessary when specific management questions exist. Instructions for sampling fields and submitting samples for SCN analysis can be obtained at your local County Extension office. The cost is $8.50 per sample.

<u>BT CORN MAY SOMETIMES REDUCE FUMONISIN CONTAMINATION</u> by Paul Vincelli, Extension Plant Pathologist

Corn kernels in which certain molds have grown can sometimes be contaminated by *mycotoxins* (toxins produced by fungi). Studies show that fumonisins are the most frequent type of mycotoxin in corn in our region and in the U.S. Fumonisins (fumonisin B_1 and related fumonisins) cause luecoencephalomalacia in horses (ELEM, also called blind staggers and moldy corn disease) and pulmonary edema in swine. Studies also have raised concerns about possible cancer-promoting activities of fumonisins in humans. Because of these concerns, the U.S. Food and Drug Administration last November published its recommendations for maximum levels of fumonisins in corn and corn by-products.

The fungi that cause Fusarium kernel rot and produce fumonisins are called *Fusarium* *verticillioides* and *Fusarium proliferatum*. *F. verticillioides* is widespread in the midwestern and southeastern U.S., and the biology of this fungus is relatively well-understood. Kernels may become infected by *F. verticillioides* in several ways: via the silk channel; via systemic infection through the pedicel; and/or via the feeding activities of European corn borers. The role of the European corn borer is particularly important relative to this article for two reasons: (1) the feeding activities of this insect pest can both spread spores from plant to plant, and (2) the wounds created in kernels by feeding (by this or other insect pests) can allow kernel infection and high levels of fumonisin contamination in the kernels. For more information on the biology and symptoms of Fusarium ear rot, see the Extension Publication ID-121, "Mycotoxins in Corn Produced by *Fusarium* Fungi".

It is known that high levels of ear-feeding insects can enhance fumonisin levels in corn. Therefore, controlling insects that damage kernels can help reduce fumonisin contamination. Researchers at Iowa State University have shown that, under conditions of high pressure from the European corn borer, the use of Bt corn hybrids that express the endotoxin in the kernels themselves (MON810 and BT11 events) substantially reduced levels of Fusarium ear rot as well as levels of fumonisins. There was no consistent reduction in Fusarium ear rot or fumonisins for Bt hybrids with event 176, which expresses the endotoxin in green tissues and in pollen but not in kernels. In the Iowa studies, event DBT418 did not consistently reduce fumonisin levels either. Although event DBT418 is expressed in the kernels, the researchers attributed the lack of a benefit to generally poor late-season corn borer control with that event.

<u>Significance for Kentucky Corn Producers</u>

The Bt endotoxin is very active against both the European corn borer and southwestern corn borer, which both can create wounds on kernels that potentially allow *F. verticillioides* to invade. If a producer expects high levels of activity from corn borers–either European corn borer or Southwestern corn borer–use of a corn hybrid that expresses high levels of the Bt endotoxin in kernels and provides good late-season corn borer control (the MON810 and BT11 events, for example) may result in lower levels of fumonisin contamination in the harvested grain. As a guideline, the greatest threat from these borers is in late-planted corn. Use of Bt corn does not assure the producer freedom from kernel-feeding insects, since the Bt endotoxin only provides suppression against the corn earworm and it provides no control at all of fall armyworm. However, use of Bt corn hybrids in fields where high insect pressure is expected may reduce fumonisin contamination in some cases. Understand that the use of Bt corn that expresses the endotoxin in green tissues and pollen only (event 176, for example) would not be expected to consistently reduce fumonisin levels.

<u>Biotechnology Update</u> by Ric Bessin, Extension Entomologist

The interest on the part of the media, positive or negative, with respect to biotech crops seems to run in cycles. However, there is a lot that is continuously going on with the development, commercialization of new crops and marketing approval of existing crops. Lack of market approval and reduced markets for some biotech crops has limited their use in parts of Kentucky. This has been particularly true for specialty corn such as white corn in the Green River area. However, in others parts of the state, Bt corn use is wide spread. This article summarizes some of the developments with biotech crops in the last year.

<u>BT Corn</u>

Out with the old, in with the new. At least that is partly true with respect to the types of Bt corn that are marketed or to be marketed soon. There has been some turn over in the types of Bt corn, such as the phase out of the DeKalb Bt-Xtra, and Novartis Knock Out. Although both of these were approved for all food and feed uses, these companies will market the YieldGard Bt corn that provides full-season control in their place. The Bt-xtra and Knock-out, while highly effective against early-season corn borers, did not demonstrate the high level of season-long corn borer control as with YieldGard Bt Corn. The other type of Bt corn that was lost in the fall of 2002 was StarLink. This was voluntarily removed when traces were found in various processed foods, as this particular Bt corn was never approved for human food due to concerns about potential human allergenicity.

In September of 2001, EPA's conditional registration of Bt corn expired. Over that last few years, the various companies which have developed these products have been required to submit additional data from various field studies. This has included studies that evaluated the impact of Bt corn on monarch butterflies and strategies for insect resistance management. The EPA has reviewed this information and granted a new 7-year extension to the conditional registration for Bt corn. With respect to the impact on monarch butterflies, the EPA concluded that at worst the impact on monarchs was minimal and with reductions on foliar insecticides, Bt corn may even have a positive effect on monarch populations.

In May of 2001, DowAgro Sciences, Pioneer Hybrid, and Mycogen won commercial approval from the EPA to commercialize Herculex I Bt corn. This Bt corn uses a different Bt protein, Cry1F, to provided season-long protection not only against corn borers, but also has shown excellent control of black cutworm in Kentucky trials. It also protects against fall armyworm and corn earworm control. Although fully approved for all uses in the US, the three companies that have co-developed Herculex I have chosen not to market this Bt corn until certain approvals have been reached with export markets. This Bt source may be widely available in 2003.

Additional types of Bt corn are currently being developed to control other insects not controlled by the current Bt-corn types on the market. In field testing, several new types of Bt corn are showing high levels of corn rootworm control. These have not yet been approved by the EPA and will not be available in 2002. One area of concern with Bt corn targeting corn rootworm will be the development of an effective resistance management strategy for corn rootworm that would be compatible with those strategies that are already being used against European and southwestern corn borer.

Chinese Import Regulations Modified

But there have been some positive developments with respect to overseas markets. One recent development has been China's announcement of a temporary certification scheme for imports of biotech foodstuffs. These new regulations replace existing regulations that were to go into effect in March. Under the prior set of regulations, all biotech food exports to China would be required to apply for safety certificates that would certify that they are safe. It would have taken up to 270 days to obtain these permits.

Under the new procedure, temporary safety permits would be issued if the foods are approved in other countries. These new permits will be issued within 30 days. Currently, China is the world's largest soybean importer, and these modified requirements will ensure that our farmers will be able to continue to market our soybeans there. Prior to these new regulations, U.S. soybean exports to China had virtually halted due to the tough Chinese biotechnology regulations.

Best N Rates for No-Till Corn on Well Drained Soils by Lloyd Murdock and John Grove

In 2001 a number of N trials for no-till corn grown on well drained soils were completed in Kentucky. The objective of these trials was to determine the most economical N rate. This is important since most of the corn grown in the state is no-till planted and well drained soils are an important percentage of the soils on which corn is grown.

The University of Kentucky has received a number of questions concerning the most economical rate of N. The high state-average corn yields the last several years may be one of the reasons for this concern as well as the USDA ARS 590 Code which indicates that the UK fertilizer recommendations will be used in the administration of some of the environmental laws.

Method

All of the trials were no-tilled and the amount of N that was added preplant is reflected in the first N rate entry at each location in the table below. All N rates higher than that put on as preplant N was side dressed. The economic returns for each rate of N were compared to the lowest N rate. The yield difference between the two treatments was multiplied by $2.50/bu minus the product of the N rate (lb/a) for the treatment and $0.25/lb.

Results

The yields were very high at the Caldwell and Breathitt County sites where moisture was not limiting. The Trigg site had some moisture stress but yields were still high. The Hardin County site was unusually dry and yields were low. Soybean was the previous crop at all sites except Breathitt Co., where corn was the previous crop. The corn yields after soybean were much higher at the lowest rate of N than when after corn.

The yield of corn increased rapidly with the addition of N up to 160 lb/ac N rate at Caldwell and Breathitt counties. Of the rates applies, the 160 lb/ac N rate was the optimum rate for yield and economic returns. It is interesting to note that the economic returns were almost identical for the 120 and the 200 lb N/ac rates. Even with lower yields at the 120 lb/a N rate, the economic return is still as good as when the N was applied at 200 lb n/ac. One might expect the corn at the 120 lb N/ac rate to show deficiency symptoms on the lower leaves during grain fill.

The Trigg County site had an optimum rate of N of 106 lb/ac. This is lower than one would expect, as the field did not have a history of manure application. The economic return was also highest at the 106 lb N/ac rate. The 166 lb N/ac rate resulted in a $7 loss when compared to lowest rate of N (36 lb/ac.). This indicates that on fields which tend to supply above normal amounts of background N, the economic advantage for N can be lost quickly as the applied N rate increases. Though it is difficult to know the background N supplied by a field, an over application of N for insurance was not an economically good decision here.

The Hardin County site did not respond to added N due to the drought. Yields tended to decrease as the N rate increased. The economic returns were negative and became more so as the N rate increased. The application of N is costly in these kinds of low yielding situations.

Summary

The optimum rate of N for no-till corn on well drained soils at the four sites tested ranged from 0 to 160 lbs/ac N.

The high yielding sites required 160 lb/a N for maximum yield and economical returns. Hardin County and Trigg County required lower rates of N (0 or 106 lb/a) for maximum yield and rates of 160 lb/ac N resulted in significant economic losses. It is important to apply N rates that will result in the maximum economic return. However, these rates will vary with conditions. Under higher yielding conditions, a small under application resulted in a similar economic return to that of a small over application, but under low yielding conditions an over application was more costly.

It appears from these results that it is economically beneficial not to apply insurance N which will always result in applying more N than is needed.

Effect of Nitrogen Rates on No-Till Corn				
N Rate * Lb/ac.	**Yield Bu/ac**	**Returns** $/Ac**	**Yield Bu/ac**	**Returns** $/ac**

	Caldwell Co.		Breathitt Co.	
0	116.3	0	41.6	0
40	149.6	73	80.5	86
80	176.9	132	120.1	176
120	189.1	152	162.7	272
160	201.9	174	178.0	301
200	193.8	144	170.5	272
240	188.6	121	172.2	266
	Hardin Co.			
30	96.2	0		
70	82.4	-44		
110	73.0	-78		
150	77.4	-77		
190	65.4	-117		
230	71.5	-112		
	Trigg Co.			
36	139.6	0		
106	150.9	11		
136	151.7	5		
166	150.0	-7		
*The first N rate at each location was the amount of N applied as a preplant broadcast. All additional N was side dressed 4 to 6 weeks after planting.**Returns compared to lowest N treatment with corn = $2.50 and N = $0.25/lb.				

James H. Herbek, Grain Crops Ext. Specialist