Soybean Cyst Nematode Update

By

Donald E. Hershman
Extension Plant Pathologist

Soybean cyst nematode (SCN) exists 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 in 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 1994-99, SCN populations began to significantly increase on the “resistant” varieties tested 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 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 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 yield 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, would be subject to experimental variability. However, basing decisions on a 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 breeders 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.

CORN

BT CORN MAY SOMETIMES REDUCE FUMONISIN CONTAMINATION

Paul Vincelli

Corn 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 B₁ 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 fumisin 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.

Significance for Kentucky Corn Producers
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.

Kentucky Corn and Soybean Production Contests for 2002: It is never too early to start planning for those corn and soybean contest entries for 2002. Entry Rules and Forms will be mailed to the County Extension Offices and Company Representatives sometime in June after all your corn is in the ground. The basic rules for the contest are that the field must be at least 10 acres, agronomic information will be required on each entry, and at least 1.25 acres from a 5 acre area must be harvested and weighed with approved supervisors. If you want a form for the Kentucky Contest, please contact your County Extension office. The 2002 NCGA Corn Yield Contest has several deadlines for entries and the entry fee increases for each deadline. Those deadlines are June 15, July 1, and August 1, 2002. If you want an entry for the NCGA contest, call 314-275-9915 or contact your corn representative. There is no official entry form for the Kentucky contest; 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.