Purdue Cooperative Extension Service

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Insects, Mites, And Nematodes

Entomologist: Winter Not Likely to Slow Corn Pest's Advance – (*Christian Krupke and Jennifer Stewart for Ag Answers*)

Corn farmers who might have hoped that a new insect threat would be slowed by this winter's frigid temperatures could be disappointed, says a Purdue University Extension entomologist.

The western bean cutworm is likely to emerge from winter in numbers capable of exacting a toll on Indiana's corn crop this summer, said Christian Krupke.

"A question I've gotten a lot from farmers is, with the colder-than-average winter will we have a lot of mortality of the overwintering larvae?" Krupke said. "The answer is probably not. That's not because of the temperature of the air; it's more because we've had so much snow and relatively few days without snow, especially in those northwestern counties where overwintering western bean cutworm caterpillars are located."

Snow cover insulates cropfields and "keeps the temperature in the soil higher than it would be if the soil were bare, which actually helps the larvae survive," he said.

Fortunately, timely scouting of fields, insecticide treatments and some biotech (Bt) corn varieties have proved successful in controlling the bug.

Western bean cutworm (WBC) caterpillars feed on pollen and, if not controlled, the corn ear itself. That process begins after the female moths lay eggs on corn leaves about a week before corn reaches the pollination stage.

The insect was first detected in Indiana in 2006 after migrating from western Corn Belt states. Crop damage reached a peak this past year, with the most severe cases occurring in northwestern Indiana counties. WBC is most common in continuous corn and corn grown in sandy soils and no-till cropping systems.

"One caterpillar per ear in a field can cause up to 4-5 bushels per acre yield loss," Krupke said. "With commodity prices being what they are, producers are extremely reluctant to risk even lower levels of damage.

"This pest has come under fairly heavy scrutiny because it's new, some of the Bt hybrids don't work and infestations are so heavy in some parts of the state that a lot of growers have learned about it on the fly."

Krupke urged corn growers to plan now to carefully inspect their fields during moth flight and be prepared to apply a pyrethroid-based insecticide if conditions warrant. WBC caterpillars look similar to corn earworms but have two distinctive dark rectangles separated by a cream-colored line behind their heads.

"Growers should scout for this pest the last two weeks of June and first two weeks of July. That's when the moths are flying, mating and laying eggs," he said. "Right now they're overwintering in the soil.

"Scouting is usually very effective if done at the appropriate time. We recommend an economic threshold level of 5 percent. So if you scout 20 plants and you see an egg on just one of them, you're over the threshold and you're going to want to treat with an insecticide."

WBC caterpillars are highly vulnerable to insecticides. In one field Krupke visited in late June 2010, 50 percent of the corn plants were infested with the pest. The farmer ground-applied a pyrethroid insecticide.

"When we went back to that field in September, we could not find a single kernel on a single ear that was damaged," Krupke said. "The control level was 100 percent, and you won't hear that too often in pest management of insects."

For more information, visit the Purdue Extension corn insects scouting page at http://extension.entm.purdue.edu/fieldcropsipm/corn.php and click on the western bean cutworm bar.

Weeds

Glyphosate's Impact on Field Crop Production and Disease Development – (*Jim Camberato, Shaun Casteel, Peter Goldsbrough, Bill Johnson, Kiersten Wise, and Charles Woloshuk*)

The U.S. Department of Agriculture's recent decision to approve Roundup Ready alfalfa renewed a debate about the safety of genetically modified crops and the use of glyphosate in the environment.

This is not a new controversy, but many statements released in recent weeks by groups opposed to the use of genetically modified (GM) crops have claimed that glyphosate use and Roundup Ready® technology will be disastrous and that glyphosate has damaged crop production by decreasing nutrient availability to plants, reducing nutrient content of food and livestock feed, and increasing plant susceptibility to disease (Zerbe, 2011). There also are claims that glyphosate is contributing to an increase in more than 40 plant diseases that may also affect human and animal health (Smith, 2011; Zerbe, 2011). However, evidence to support these claims has neither been presented to nor evaluated by the scientific community.

As scientists, we are equally concerned about the health of the environment and the sustainability of agricultural production. We have previously addressed questions on the impact of glyphosate and manganese (Mn) interactions on soybean <http://www.btny.purdue.edu/weedscience/2010/GlyphosateMn.pdf>. In this article, we discussed the limited research available on the impact of glyphosate and glyphosate-resistant crops on Mn nutrition of soybeans, and encouraged producers to avoid "insurance" applications of Mn for the sole purpose of counteracting perceived plant health damage due to glyphosate use. However, the most recent press releases around this issue are focused on the impact of glyphosate on plant and human disease development. This article is intended to clarify the relationship between glyphosate and plant disease development.

The claim that herbicides, such as glyphosate, can make plants more susceptible to disease is not entirely without merit. Research has indicated that plants sprayed with glyphosate or other herbicides are more susceptible to many biological and physiological disorders (Babiker et al., 2011; Descalzo et al., 1996; Johal and Rahe, 1984; Larson et al., 2006; Means and Kremer, 2007; Sanogo et al., 2000; Smiley et al., 1992). Our research with glyphosate-susceptible weeds has shown that some weeds die more rapidly after they have been sprayed with glyphosate when grown in soil that contains certain soil-borne fungi. This suggests that some soil fungi are more effective in infecting a weed after it has been weakened by glyphosate. Herbicides with other modes of action, such as ALS inhibitors and dinitroanilines, can influence fungal growth and disease severity of some soybean pathogens (Bradley et al., 2002; Harikrishnan and Yang, 2001; Sanogo et al., 2000). Based on observations from our research, we speculate that this happens when weeds are exposed to ACCase inhibitors as well.

Despite the potential for herbicides to increase disease levels in certain plants, plant pathologists have NOT observed a widespread increase in susceptibility to plant diseases in glyphosate-resistant corn and soybean. There is limited research data available to suggest that disease is of greater concern in GM or Roundup Ready® soybean and corn, compared with non-GM soybean and corn. In fact, research indicates that glyphosate-tolerant soy-

bean and wheat are no more susceptible to soil-borne fungal diseases than conventional glyphosate-sensitive varieties, regardless of whether or not glyphosate is applied (Baley et al., 2009; Njiti et al., 2003). The target of glyphosate is an enzyme (5-enol-pyruvul shikimate 3-phosphate synthase or EPSPS) that aids in the synthesis of aromatic amino acids. This enzyme is present in plants, fungi, and bacteria, but not in humans or animals (Kishore, 1998). Therefore, glyphosate may inhibit fungal development as well as the growth of weeds. Research on glyphosate-resistant wheat and soybean indicates that applications of glyphosate have the potential to control or suppress stripe and leaf rust of wheat, and soybean rust (Anderson and Kolmer, 2005; Feng et al., 2005). This research is limited, and therefore we do not advocate applications of glyphosate for disease control. The research simply demonstrates that glyphosate may also have the ability to inhibit growth of certain fungi, and indicates that additional research is necessary to fully understand the interactions between glyphosate, fungal diseases and plants.

Although some research indicates there is an increase in disease severity on plants in the presence of glyphosate, it does NOT necessarily mean that there is an impact on yield. The most important point to make about the majority of research available on glyphosate-disease interactions is that the research does not always quantify the effect of glyphosate-influenced disease development on yield. Despite claims linking glyphosate use to increases in yield-limiting diseases such as Goss's wilt of corn, or sudden death syndrome (SDS) of soybean, we are not aware of published research that fully examines the impact of glyphosate on disease development and yield under disease pressure. Previous research examining the effect of herbicides, including glyphosate, on disease development in soybean has been conducted in greenhouse or limited field trials, and has not examined the effect of these interactions on yield (Bradley et al., 2002; Sanogo et al., 2000). **All plant diseases do not have an equal impact on yield.** Plants have natural defense systems that are able to limit infection and prevent yield loss in some cases. Disease-causing organisms exist naturally in the environment, but only cause infection when a susceptible host and a favorable environment are present. Even when infection occurs, the disease must reach a level in the host where the plant is weakened enough to cause yield loss.

The claim that plant disease has "skyrocketed" due to glyphosate usage is also unfounded. **Many factors influence the level and type of disease present in any given year.** For instance, reduced tillage or no-till operations have become more common across the Midwest. Many fungi and bacteria that cause plant disease survive from year to year on crop residue or in the soil. An increase in residue and a reduction in soil disturbance can favor disease development in certain diseases (Cotton and Munkvold, 1998; Flett et al., 1998; Workneh et al., 1998). In the past, disease management recommendations focused on using hybrids and varieties with strong disease resistance packages. The current push for high-yielding varieties and quick variety turnover in the market means that some varieties may not have resistance to all major diseases, and disease resistance is not always a high priority when producers are selecting hybrids or varieties. These practices increase the likelihood that disease could develop in a given year.

It is also important to note that crop yields have been protected from yield-robbing weeds by many different herbicides for more than 50 years. Use of herbicides has not been linked to yield-limiting disease outbreaks during that time. In fact, glyphosate has been used extensively for more than 30 years and no yield-limiting disease outbreaks have been attributed to glyphosate use prior to these recent reports.

The articles and websites state that fungi in the genus Fusarium cause not only plant diseases but also disease outbreaks in humans and animals. **In fact, very few pathogens infect both plants and animals.** Some fungi can produce toxic compounds called mycotoxins that can be harmful to animals and humans (Desjardins and Proctor, 2007). However, only certain species within the genus Fusarium have been shown to produce mycotoxins. The majority of Fusarium fungi that produce mycotoxins are pathogens of corn and wheat. Wheat and food-grade corn are non-GMO crops, meaning that mycotoxin development in these crops would not be directly linked to glyphosate usage or interactions. Plants and grain affected by the fungus that causes SDS, Fusarium virguliforme, have not been shown to be toxic to humans or livestock. Additionally, the United States Food and Drug Administration has set levels for the amount of mycotoxins that can be in animal feed, and in food for human consumption, and these markets are closely regulated to prevent introduction of mycotoxin-contaminated grain into the market.

Overall, the claims that glyphosate is having a widespread effect on plant health are largely unsubstantiated. To date, there is limited scientific research data that suggest that plant diseases have increased in GM crops due to the use of glyphosate. Most importantly, the impact of these interactions on yield has not been demonstrated. Therefore, we maintain our recommendations of judicious glyphosate use for weed control. We encourage crop producers, agribusiness personnel, and the general public to speak with University Extension personnel before making changes in crop production practices that are based on sensationalist claims instead of facts.

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Plant Diseases

Successful Disease Management Means Looking at Field History – (*Kiersten Wise and Jennifer Stewart for Ag Answers*)

Controlling crop diseases starts with keeping accurate field records even before the seeds are planted and continuing through harvest, a Purdue Extension specialist advises.

The majority of yield-limiting diseases can be managed most effectively through good selection of seed varieties, said crop specialist Kiersten Wise. Producers should work with seed dealers to choose varieties that have strong resistance to previously recorded diseases.

"Good disease management starts with knowing what diseases are already present in the field," Wise said. "For example, the fungus that causes sudden death syndrome in soybeans survives in the soil and can affect the next soybean crop if conditions are favorable for disease development."

Weather conditions, planting conditions, hybrid selection and field history factor into a disease's level of damage. Farmers should check for diseases as soon as planting starts, looking at the conditions under which crops were planted and monitoring throughout harvest.

Wise recommended using the Corn and Soybean Field Guide for help in identifying diseases.

"If a producer is out in the field and sees a symptom, they can flip through the photographs in the guide to help narrow down what the issue might be," Wise said.

For a small fee, producers still uncertain of a disease can send a sample to the Purdue Plant and Pest Diagnostic Laboratory for diagnosis within a few days.

Action plans should depend on the type and level of disease present and potential impact on yield. There is not always a simple solution to controlling a disease once it is in the field, Wise said.

"With diseases like gray leaf spot of corn, we can reduce the risk of disease development through good hybrid selection and crop production practices," Wise said. "But if throughout the season there are weather conditions that favor disease development and gray leaf spot could reach a damaging level, fungicides are available to help manage this disease."

Producers should check for disease presence before applying fungicide because of the inconsistent economic benefit of the application.

"Keep in mind we see the most consistent economic benefit to a fungicide application when it is based on a disease threat," Wise said. "Applying fungicide in the absence of disease, or a disease threat has a less consistent yield response and a higher cost factor."

Wise said she cannot predict the major diseases for this season but we can monitor possible threats such as southern corn rust, a disease in corn that over- winters in the South and blows up on wind currents during the year.

"If it comes to Indiana at a time where we would need to manage it, we can let producers know how to best manage the disease at that time," Wise said. "Ultimately, what diseases will be problematic will depend entirely upon the weather, but keeping good records of field history and using preventative management practices based on past history will help minimize losses due to disease."

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