Science Societies

How to anticipate pests from cover crops migrating into cash crops

By Susan Winsor

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Slugs are among the most challenging pests faced by Mid-Atlantic no-till growers. Source: Penn State.

Cover crops have been proven to reduce soil erosion and weeds and to improve soil structure, moisture drainage, and storage. On the negative side of the ledger, they can be attractive environments for pests to lay eggs or overwinter. This article provides some general tips to reduce pest problems as well as advice specific to controlling stink bugs, slugs, and bean leaf beetles.

Cover crops have been proven to reduce soil erosion and weeds and to improve soil structure, moisture drainage, and storage. On the negative side of the ledger, they can be attractive environments for pests to lay eggs or overwinter. Soybeans are more vulnerable to this, university entomologists agree, especially for stink bugs and slugs. Because slugs aren't insects, but mollusks, their control measures differ from insects.

Stink bugs, such as these green stink bug nymphs, have piercing-

sucking mouthparts that penetrate the plant and remove fluids from multiple plant parts. Stink bugs can feed on soybean stems, pods, and seeds and corn seedlings and kernels. Source: Adam Sisson, Iowa State University Extension and Outreach.

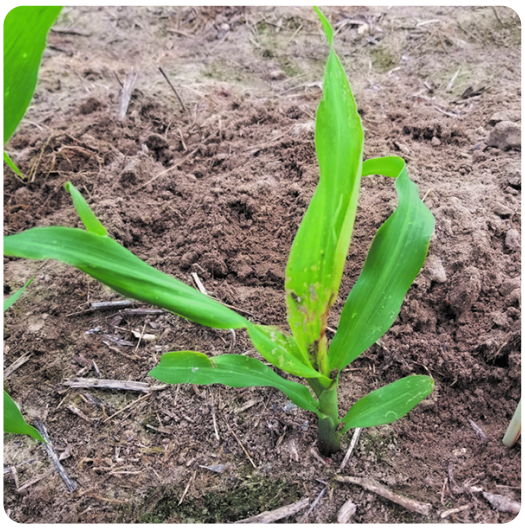
Of course, details vary greatly by geography and tillage system. No-till and conservation tillage systems can be more favorable environments for cover-crop-dwelling insects than bare soil or conventionally tilled fields. Similarly, incompletely closed planter furrows can be a virtual pest highway in cash crops because pests can access seed and seedling growth points, says Virginia Tech Extension Entomologist Sally Taylor.

Taylor worked on a research project that found a 50% corn yield hit (65 vs. 130 bu/ac) from insect pests/stink bugs moving from the preceding 10-species cover crop mix (oats, triticale, rye, forage radish, rapeseed, phacelia, crimson clover, winter pea, and hairy vetch) into corn. It appears insect feeding caused excess corn tillering, lowering yield, says study lead Mark Reiter, Virginia Tech Assistant Professor, Soils and Nutrient Management. The research project is a long-term rotation with 12 different tillage and cover crop treatments. These results occurred 2015; the same effect was not measured in 2016.

“This (yield hit from cover-crop-based insects) has been observed before with winter peas, but stink bugs have a broad host range, including wheat and barley (common in covers), so there’s lots of potential for damage,” explains Scott Stewart, University of Tennessee IPM Extension Specialist.

General Tips to Reduce Pest Problems

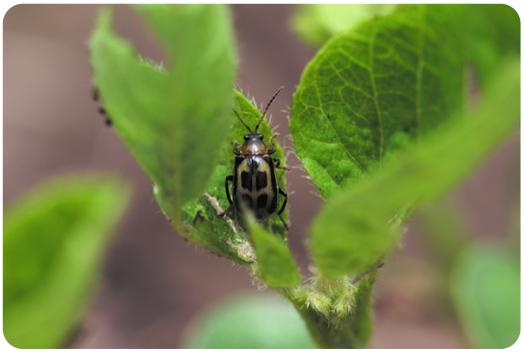
Although more research is under way to determine how and when cover crop insects damage cash crops, university entomologists have these pointers to reduce these pest problems:



This is characteristic stink bug damage in corn. Note the discoloration where stink bugs have pierced the leaves. This plant will have a twisted appearance as it continues to grow and may put on several tillers. Compared with a healthy plant, this plant is five times more likely to not develop grain. Source: Sally Taylor, Virginia Tech.

Select cover crops from families other than your cash crops. Taylor and Stewart both advise avoiding legume cover crops like vetch, clover, and winter peas in front of soybeans. “The pea weevil, for example, can gnaw seedling soybean plants to the ground behind a cover crop of Austrian winter pea or vetch,” Taylor says. She’s also observed threecornered alfalfa hoppers damage soybean seedlings when planting into a winter pea cover crop (hosts for this insect). Stewart adds, “Southern corn rootworm isn’t typically a soybean pest, but we’ve seen serious damage when there’s a legume cover crop going into soybeans, particularly when the burndown was applied late.”

Allow at least three to four weeks between cover crop burndown and seeding cash crops. Stewart and Purdue Entomologist Christian Krupke recommend avoiding a green bridge that allows pests to move from weeds or cover crops directly into the crop. “Planting into green vegetation is asking for it, and you need to take steps to mitigate problems when that occurs,” Stewart says.



This adult bean leaf beetle isn't any more of a threat as a result of cover crops preceding cash crops, according to Scott Stewart, University of Tennessee IPM Extension specialist. The larval stage is found in the soil and feeds on roots, including soybean, while adults feed on foliage and pods and may transmit the damaging disease bean pod mottle. Source: Scott Stewart, University of Tennessee IPM Extension specialist.

John Tooker, Penn State Entomology Extension Specialist, disagrees, in the case of slugs. His research (**http://bit.ly/slugs_PA**) found that "planting green" can provide slug control benefits when IPM is followed. "This means that insecticides should not be used preventatively," Tooker says. "Insecticidal seed treatments and insecticide broadcast applications can exacerbate slug populations because these insecticides do not kill slugs, which are mollusks, not insects. Rather, insecticides limit populations of predators, like ground beetles, that can eat slugs, limiting their populations."

Stewart says when burndown herbicides are applied too late or are ineffective, spider mites can jump from vegetative cover, or winter weeds like henbit, into a crop. If insect risk is high, he recommends a broadcast insecticide spray when terminating the cover crop.

"Pyrethroid insecticides are generally effective and inexpensive options that can control cutworms, threecornered alfalfa hoppers, and some other pests, but they will not affect soil larvae or grubs," he says. "Soybean insecticide seed treatments will have a higher potential benefit when planting into green cover crops."

- **Scout, scout, scout!** Economic thresholds have yet to be established in many cases, "but knowing which pests are present in a cover crop and detecting

problems quickly in the subsequent cash crop can help you make timely management decisions," Taylor says.

- **Move residue away from emerging seedlings with row cleaners or tillage** to
- reduce potential slug and insect habitat.
- **Transition to cover crops gradually** to learn more about insect pests in your locale and perfect this new agronomic system.

The further South you are, the more pest risk there is, Taylor says, because pests, like cutworm, must migrate from southern states each season.

Soybeans Most Vulnerable

Soybeans are vulnerable to pests from cover crops for several reasons. Their growing point is aboveground, and pests destroying the seedlings' two cotyledons can kill the plants. When grown without seed treatments, soybeans can prove more vulnerable to insect pests migrating from cover crops. This scenario may favor soybean seed treatments, university entomologists say.

The threecornered alfalfa hopper is an occasional problem in soybean, alfalfa, and some other crops, but it does not affect corn. It's primarily found in the southern U.S. and usually in no- or reduced-tillage fields. Source: Scott Stewart, University of Tennessee IPM Extension specialist.

However, Penn State University research shows that insecticidal soybean seed treatments offer no protection against slugs and may actually worsen slug problems. Results vary geographically, but they are often not needed in the absence of cover-crop-born insect pests, previous university research shows.

These wireworms are feeding on a corn root; note the feeding hole. Cover crops can aggravate wireworm damage in corn by providing a yeararound food source. Source: Scott Stewart, The University of Tennessee.

Unlike soybeans, corn's growing point lies belowground, protected until the V6 stage from insect pests, which may migrate from cover crops. One exception to this is an incompletely closed planting furrow/faulty press wheels, which can allow pests to penetrate that belowground corn growing point, Taylor says.

Corn is also generally less vulnerable to cover-crop-hosted pests because its seed treatments protect against some cover crop pests, like stink bugs, Taylor says. And, Bt traits protect against some caterpillar/Lepidoptera early-season corn feeding that may come from cover crops.

A soybean–wheat–corn sequence can be especially prone to stink bug damage, according to research out of Kentucky and adjacent states. Stink bug population can build up in soybeans during pod fill. Wheat cover crops provide an attractive early spring host for the insects, and then they feed on emerging corn. Stink bugs may overwinter in wheat stubble, or they may leave for overwintering sites and return in the spring, according to the University of Kentucky Extension.

Generally, corn seed treatments protect against early-season, soil-dwelling insect pests like click beetle larvae (also known as wireworms) in corn, Stewart says.

Stink Bug Pointers

Little is known about stink bugs' true impact on corn, says Purdue's Krupke. Several stink bug species may attack corn. Overwintered adults move to corn when small grains mature or when cover crops or weeds are treated with herbicides.

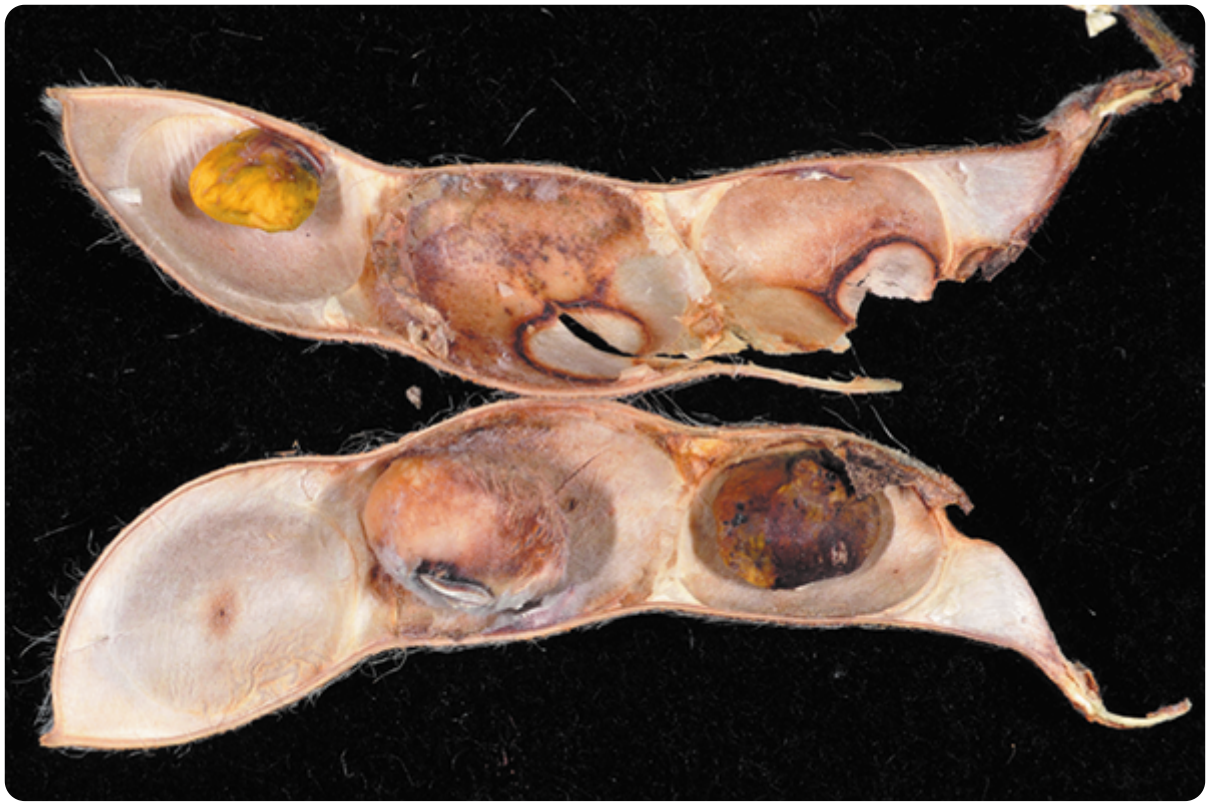
"Stink bugs stick their straw-like mouth parts into plant tissue and inject a digestive enzyme," Krupke says. "Plant damage is most evident after approximately V5." Common corn seedling deformities from stink bug feeding are window pane leaf injury, irregular stalk twisting, and tillering/suckers, he says.

Plants will often have round to elongated holes of various sizes in the rapidly expanding leaves, Krupke says.

"The holes are often ringed with yellowed plant tissue, and the edge of the hole is generally transparent. Although these holes may appear to have been caused by a chewing insect, a closer examination reveals that they are caused by a piercing of the leaf while it was small and rolled up in the stalk or whorl. The holes get larger as the leaf expands." The holes are similar to those caused by billbugs; however, leaf tissue has not been removed by chewing on the leaf, Krupke says.

Late whorl-stage plants are fed on below the leaf through the leaf sheath, according to Krupke. This feeding has been reported to sometimes cause injury to the leaf sheath and developing ear behind the sheath. As the ears emerge, the bugs shift their feeding activity to the lower outside portion of the ear. Feeding there may abort individual kernels. Since feeding occurs on only one side of the ear, the ear could curve away from the stalk as it grows. Discoloration is usually apparent on the shuck surrounding the ear.

Gray garden slug eggs commonly occur in small clumps and are mostly laid in autumn but persist until spring when juvenile slugs typically emerge. Eggs can be common in no-till corn or soybean fields, usually found under crop residue. Source: Penn State.



Characteristic stink bug soybean damage. Source: John Obermeyer, Purdue University Extension Entomology.

"This type of ear damage begins mainly in late July through August. Soybean damage appears to be limited mainly to field edges in most cases," Krupke says. "If brown stink bugs or their damage are found in corn, evaluate 20 consecutive plants, beginning with a randomly selected plant in each of five areas of a field." In corn, from emergence to mid-whorl, record the percentage of damaged plants and note the damage severity: plants with holes in leaves, plant deformity, slits in the stalk, or dying plants.

"Also, determine if the bugs are still present—they are often active and feeding during the daylight hours and easy to see. Note if they are at ground level, on stalks, or in whorls." In corn, from late whorl through silking, Krupke recommends recording the percentage of plants showing stink bug feeding damage, either on the leaf, ear sheaths, or developing ears.

“A field can be made less attractive to stink bugs by tilling the field, eliminating the plant cover that can harbor them. However, this negates some of conservation tillage’s benefits,” Krupke says.

Slugs

“Slugs are among the most challenging pests faced by Mid-Atlantic no-till growers,” says Penn State’s Tooker.

Slugs can overwinter in cover crops and damage cash crops. They flourish in cover crops’ cool environment, and they’re hard to find when scouting during warmer times of day. They hide by day, so it is not easy to find them then.

“Timely cover crop burndown and tillage are cultural measures to reduce slug populations, Taylor says. “You want fast plant emergence and growth—feeding damage is rarely a concern past corn’s four-leaf stage.

“Their signature when scouting is mysterious narrow or irregular feeding lines on leaves, holes in leaves, or the entire plant is cut off.”

To scout, Taylor recommends placing roofing shingles in the field and checking below them early in the day before warmer temperatures.

“Bait is the only effective slug treatment, and it is pretty expensive when used at 10 lb/ac,” Taylor says. “And by the time you know you have a problem, it may be too late to save your stand.”

Taylor advises closing the seed furrow at planting and not unnecessarily using insecticides since slugs “flourish in the absence of natural enemies.”

Don’t Ignore IPM Principles

Penn State research has revealed that “neonicotinoids can indirectly increase slug damage to crops by poisoning insects that eat slugs,” Tooker says. This lowers crop yields.

“Our research found that slugs were unaffected by fungicides and by neonicotinoid insecticides, likely because they are mollusks and not insects. But the slugs did transmit the insecticide to the (predatory) ground beetles, impairing or killing more than 60% of the beetles.”

A brown stink bug on wheat.
Source: Scott Stewart, University of Tennessee.

Tooker and his team found that neonicotinoid treatments depressed insect predator activity, thereby relaxing slug predation and reducing soybean densities by 19% and crop yield by 5%. These results also confirm that predatory insects can provide significant slug control.

Kirsten Brichler, a master’s student in Entomology at Virginia Tech, has preliminary data on slug control echoing this—that “broadcast, preplant insecticides not only don’t inhibit slug populations, they actually encourage their growth,” she says.

Brichler scouted more than 3,500 ac and tracked slug numbers on 19 Virginia farms. She is measuring different crop management strategies’ impact on slug damage and three potential slug predators: harvestmen (daddy longlegs), ground beetles, and wolf spiders. “It appears that preplant broadcast-applied insecticides negatively impact harvestmen and ground beetles, two slug predators, allowing slugs to thrive,” she says.

Slugs have set back no-till adoption in her region, Brichler. She's researching slugs' response to agronomic practices. "While slug damage might not be the Number 1 problem for all my local (Virginia) farmers, I think it is the number one thing keeping most of them from switching to no-till," she says.

Bean Leaf Beetles

Bean leaf beetles can overwinter in clover and broadleaf cover crops before soybeans. They feed on soybean roots, foliage, and pods, and carry the damaging disease bean pod mottle. "But they aren't any more of a threat as a result of cover crops preceding cash crops," says University of Tennessee's Stewart. "Adult bean leaf beetles leave small holes in young plant tissue, feeding primarily on leaf undersides. Adults can defoliate young plants and damage pods. They're occasionally seen in corn but not at economically damaging levels. The adult is the primary damaging stage."

Bean leaf beetles have multiple generations each year and overwinter as adults, Purdue's Krupke says, "They feed vegetative soybean portions early in the season and then switch to green pods.

"Bean leaf beetles scar the pod surface but only occasionally feed through the pod to the developing seed," Krupke says. "During pod maturation, the remaining protective membrane cracks, leaving an entry hole for moisture and airborne plant pathogens that may cause discolored, moldy, shriveled, or diseased beans."

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Back to issue

Back to home