Biology and Management of Cucurbit Insect Pests

Rick Foster
Purdue University

The cucurbit crops are attacked by a wide variety of insects. Cucumber beetles tend to be the most important pests of cucumber and muskmelon, spider mites are a serious problem in some years on watermelons, and squash bugs and squash vine borers are the most damaging pests of squash and pumpkins.

Seed Maggots

Seed maggots can be responsible for considerable loss of young plants under certain environmental and cultural circumstances. There are several generations per year, but the first is usually the only economically significant generation. Adult seed maggots, which resemble small houseflies, are grayish-brown and emerge from the soil and begin flying in early spring. The maggots are pale, yellowish-white, and legless and reach a maximum length of 1/4 inch. They overwinter as larvae within a dark brown puparium in the soil.

Damage

The maggots bore into seeds or into the developing hypocotyls of young plants. Damaged seeds may not germinate, or may produce stunted plants. Seedlings with seed maggot feeding will wilt and die within a few days.

The conditions that favor seed maggots include high levels of decaying organic matter and cool, wet weather. The flies can be attracted to fall-seeded rye, or any other cover crop, that is disked down shortly (less than 3 weeks) before planting, or they can be attracted to the commercially prepared soilless growing mix used to start seedlings in the greenhouse. Both represent the type of highly organic material preferred by the adult flies as egg-laying sites. Manure, either composted or not, can also attract seedcorn maggot flies to lay more eggs. Warm, dry weather reduces the threat of continued seed maggot damage. In general, the flies will not lay eggs in soils with temperatures above 70^{o}F.

Management

Melons, cucumbers, or squash that are planted in fields of disked down rye, or another cover crop, are at greatest risk for seedcorn maggot damage. However, using the cover crop is an advisable field practice and should not be discouraged because of fear of seed maggot damage. The cover crop should be disked or plowed down at least 3-4 weeks before planting to allow sufficient time for green manure to decompose. Maggot control in the greenhouse, and especially on wagons used for raising seedlings, also represents a concern. Treating seed with an insecticide is an inexpensive way of reducing seed maggot injury. Avoiding cool, damp conditions in seedling production facilities also may lessen the chance of adult flies laying their eggs in the organic growing mix. There are several planting time soil insecticides available that will provide a moderate level of control of seed maggots. However, during periods of cool weather, when seedcorn maggots are most problematic, systemic insecticides may not be taken up by the plants in sufficient quantities to prevent maggots from killing the plants. Pumpkins and other late planted cucurbits are not vulnerable to maggot damage.

Wireworms

Wireworms are the larvae of click beetles. The adults are large, brown beetles that make a clicking sound when they attempt to right themselves after being on their backs. Wireworms are cylindrical, hard-bodied, wire-like larvae. They are shiny, brownish-yellow and 1/2 to 11/2 inches long. The larval stage damages the plant. Depending on species, larvae can live 3 to 7 years in the soil. In the winter, larvae move deeper into the soil and move back up toward the soil surface in the spring.

Damage

Wireworm damage usually occurs in the early part of the season when transplants are first placed into the field. Larvae feed on the roots and stems of transplants causing the plants to become stunted and wilt. Stems may have shallow oval feeding scars or deep, circular holes where wireworms have drilled into the stem.

Adult beetles prefer to lay eggs in grassy sod or small grains, such as wheat, rye, or oats. Wireworms prefer cool, moist soil conditions**.** Wireworms may be more of a problem on heavier soils than in sandy soils because the darker soils stay cooler and moist longer. Wireworms are most likely to be a problem following sod or small grains. Fields that had corn or soybeans in them last year are less likely to have many wireworms.

Management

The presence of wireworms in a field can be determined before the season begins with bait stations. Three to 4 weeks before planting, four or five bait stations should be placed in each field. A station consists of digging a hole 6 inches deep and placing a handful of untreated wheat and corn in the hole. Cover the hole with soil and mark with a flag. In 2 to 3 weeks, dig up the bait with a shovel, place on a tarp, and check for the presence of wireworms. If there is an average of 1 wireworm per station, then treatment with a soil insecticide, such as carbofuran, is probably justified.

Wireworm larvae are difficult to control with available insecticides. Wireworms cannot stand hot soil conditions. If plastic mulch is used in sandy soil, the soil beneath will heat up quickly, driving the wireworms deeper into the soil. Once the soil is warmed up, most wireworm problems will disappear. There is no effective rescue treatment once plants are in the field.

Cucumber Beetles

Two species of cucumber beetles, striped and spotted, attack cucurbits, with the striped cucumber beetle being the more important. Both the striped and spotted cucumber beetles are about 1/5 inch long, 1/10 inch wide and yellow-green. The striped cucumber beetle has three black stripes along the length of the body and the spotted cucumber beetle has 12 black spots on its back.

Adult striped cucumber beetles look similar to western corn rootworm adults that may also be found in cucurbit fields. One easy way to tell them apart is to turn them over and look at their undersides. Striped cucumber beetles have black abdomens and western corn rootworms have yellow abdomens. It is important to distinguish between the two because the western corn rootworm does not carry the wilt bacteria and will cause no real damage to cucurbit plants.

Striped cucumber beetles overwinter as adults in protected areas near buildings, in fencerows, or in woodlots. The beetles become active in mid-spring, when temperatures begin to increase. Currently, there is no reliable method for predicting when the beetles will become active. The adults feed and females deposit eggs in the soil at the base of cucurbit host plants. The eggs hatch and larvae feed on roots. These larvae will pupate in the soil and, later, the next generation of beetles will emerge. These beetles also will feed on cucurbit plants, including the fruit. These beetles will overwinter until the next spring. Spotted cucumber beetles do not overwinter in northern areas and must migrate from southern states each year. They usually do not arrive until later in the season and, therefore, are not nearly as serious as striped cucumber beetles.

Damage

Cucumber beetle larvae feed on roots and stems and can cause considerable damage, especially if feeding occurs before vines begin to grow vigorously in the spring. Cucumber beetles can stunt or kill seedlings or young transplants when populations are high. The beetles also feed on fruit late in the season, causing cosmetic damage that may contribute to a reduction in market quality. Cucumber beetles are a major concern to muskmelon and cucumber growers because the beetles transmit the bacterium (*Erwinia tracheiphila*) that causes bacterial wilt, a serious infectious disease of cucurbits. Pumpkins are only susceptible to bacterial wilt when they are seedlings. Watermelons and most varieties of squash are not susceptible to bacterial wilt.

When beetles become active in the spring and begin feeding on melon and cucumber plants, they spread the bacteria either through their feces or from contaminated mouthparts. Initially, very few beetles are able to infect a plant, although the percentage increases through the season, and infection rates depend on the amount of time beetles are allowed to feed on the plant.

Beetle feeding on young leaves or cotyledons opens entry points for the pathogen. Once the bacteria are inside the plant, they reproduce rapidly in the vascular system, creating blockages that cause the leaves to wilt. Plants will begin to show wilt symptoms between 7 and 21 days after infection. A beetle feeding on an infected plant can pick up the bacteria and carry it to healthy plants.

The first symptom of bacterial wilt on cucumber and muskmelon is a distinct flagging of lateral and individual leaves. Beetle feeding is not always obvious on wilted leaves. Soon, adjacent leaves and the entire vine will wilt. The wilting spreads as the multiplying bacteria move within the water conducting tubes (vascular system) of the plant. Eventually, the entire plant wilts and dies. Once a plant is infected with the bacteria, nothing can be done to save that plant. The only way to avoid bacterial wilt is to prevent the beetles from feeding on the plant. Fruit produced on a wilting plant usually will not be marketable.

The disease can be diagnosed in the field by cutting through the stem at the base of the plant and holding the two cut ends together for 10 seconds. As they are slowly pulled apart, a white viscous “sap” will appear as a string between the two cut ends. This stringy sap is the bacteria that are reproducing in the water conducting tubes.

Management

The first management decision a grower must make is whether to apply a systemic soil insecticide at planting. Imidacloprid (Admire) will provide reasonably good protection against cucumber beetle feeding. Thiamethoxam (Platinum) which is labeled for control of other pests on cucurbits, also results in reduced damage by cucumber beetles.

Carbofuran (Furadan) is available for use on cucurbits in some states, including Indiana and Illinois. Research has shown that watermelon responds to planting time applications of carbofuran with increased yields, especially early yields, of as much as 25% to 50%. This response may be the result of the chemical acting as a plant growth stimulant in addition to its insecticidal effects. So, using carbofuran on watermelons at planting is a good management practice. Carbofuran is not registered as a foliar insecticide.

The use of carbofuran at planting on cantaloupe and cucumber is more questionable. Some research has shown carbofuran to provide 4-6 weeks of control, while other data indicate that control may only last 1 to 2 weeks, especially during rainy weather. High beetle populations (>20 beetles per plant) may overwhelm the ability of the insecticide to control beetles quickly enough to stop them from transmitting the bacterium that causes wilt. Carbofuran is not recommended for use on squash or pumpkins for striped cucumber beetle/bacterial wilt control.

If you plan to scout your fields regularly (2-3 times per week), or if you intend to begin foliar sprays shortly after planting, using carbofuran at planting may not improve your control of the beetle and wilt. As you make this decision, consider any potential damage from seed maggots that may be avoided by using carbofuran.

Population densities of cucumber beetles vary greatly during a season and between seasons. There are times during the season when very few beetles are present. Foliar insecticide applications should be targeted at those times when beetle populations are high. Applying insecticides before the beetles become active is a waste of money. During the period of peak beetle activity, applications of foliar insecticides may be required twice per week because of the short residual activity of some insecticides (such as some formulations of carbaryl) and because the plants may be growing rapidly. Pyrethroid insecticides have given very good protection for 7 days.

After beetle populations have returned to low levels, insecticides should be used sparingly. Frequent use of insecticides may result in reduced early fruit set because some insecticides can cause abortion of flowers. In addition, insecticides may kill beneficial arthropods that keep aphids and mites under control. Insecticides may be necessary to control the second generation of beetles if the beetles are feeding on the fruit.

Because watermelon, pumpkins, and squash are not susceptible to wilt, protection is necessary only when plants are small and beetle populations are high or when beetles are feeding on the fruit. Regular field scouting should contribute to the most efficient use of insecticides for managing cucumber beetles on these crops.

Thresholds for striped cucumber beetles depend on the susceptibility of the crop to bacterial wilt. For muskmelons and cucumbers, treatment is justified when beetle populations reach an average of 1 beetle per plant. For the less susceptible crops, watermelons, pumpkin, and squash, insecticide treatments should be made when populations reach 5 beetles per plant.

Aphids

Aphids are small, soft-bodied insects that feed by sucking fluid from the plant. Infestations begin when winged adults fly into fields from weeds or other crops in spring or summer. They can reproduce without mating. During the summer, female aphids give birth to live female aphids. These newly born females may produce live young themselves within a week during hot weather.

This is why aphid problems can develop rapidly, and are usually more common during hot weather.

Damage

Aphids feed in colonies on the undersurface of leaves. They use their piercing/sucking mouthparts to remove sap from the leaves, which weakens the plant and may affect fruit production. Initial signs of aphid injury appear as a downward twisting of affected leaves and a puckering of cupping of the affected areas. Further injury appears as a severe distortion of leaves or stems, a general mottled appearance or necrotic spots on leaves, and stunting of the plant.

Besides this feeding damage, aphids excrete a sticky substance called honeydew that is deposited onto leaves in the lower canopy of the crop, giving some leaves a wet or shiny appearance. The honeydew also causes stickiness on fruit surfaces and contributes to unattractive, lower quality melons or cucumbers.

Aphid infestations can cause injury and loss to watermelon, but rarely affect muskmelon or cucumber. Aphids also can serve as vectors that transmit infectious viruses that may result in yield losses as high as 50%. Virus diseases are particularly worrisome for pumpkin growers.

Management

An assortment of beneficial insects feeds on aphids in cucurbit fields. Rapid increases in aphid populations often are associated with the use of insecticides that kill their natural enemies, or accelerate their reproductive capability. Insecticides used for cucumber beetle control, such as carbaryl and permethrin, should be applied on an as-needed basis rather than at regularly scheduled intervals, especially after plants have become well established and vines are growing rapidly and beetle populations are relatively low. Insecticides that are effective against aphids should be used cautiously, and only when and where this application is justified by critically high population levels**.** Insecticide applications intended to reduce the transmission of virus particles through aphid control are not effective because infection occurs rapidly before the insecticide can kill the aphid.

When an infestation is discovered, the grower should look for predators and parasitized aphids. Common predators in cucurbit fields include lady bug adults and larvae, lacewing larvae, and syrphid fly larvae. Parasitized aphids appear brown and are 2-3 times larger than normal aphids. Mark the infestation with flags and return to inspect it in 5-7 days. If the beneficial insects are keeping the aphid population from increasing, no treatment is necessary.

If the aphid infestation is continuing to spread, treatment may be justified. If only one or two areas in a field have high aphid populations and predators are not reducing their numbers, then spot spraying the infested area is an effective way of controlling aphids while maintaining predator populations. If you treat only a portion of the field, treat about 100 feet beyond the edges of the infestation.

Twospotted Spider Mites

The twospotted spider mite, an arthropod closely related to spiders, is a common pest of many plants. The adult is very small, just barely visible with the naked eye. The body is green-yellow with two dark spots on the back.

Mites have four life stages: egg, larva, nymph, and adult. The egg is very small, spherical, shiny, and straw-colored. Eggs are often difficult to see because of the webbing produced by the mites on the undersides of leaves. A single leaf may support hundreds of individual mites. The 6-legged, colorless larva resembles the nymph and adult, but is only the size of an egg. The 8-legged nymph looks like an adult, but is smaller and not sexually mature. Adult females have 8 legs and are about 1/60 inch long, compared to 1/80 inch for males. Under optimum conditions of high temperature and low humidity, they can complete their life cycle in 5-7 days.

Damage

Damage caused by mites is usually limited to watermelons. Mites can be a problem on cucumbers near the very end of the harvest period. Mites feed on the undersurface of leaves. They suck the sap from the plant and, in hot dry weather, can defoliate vines in a few weeks. Fruit from severely infected plants are often unmarketable because defoliated plants tend to yield small, poor quality fruit.

Mite infestations usually occur first at the edge of a field, frequently next to a gravel road or a grassy area. Dusty conditions favor mite development. Infestations are usually only problems after mid-season, when temperatures rise. Colonies establish themselves at the crown of the plant. As populations increase, infested leaves turn yellow and become visible from a distance. Close inspection of affected leaves reveals a distinct interveinal yellowing (chlorosis) on the upper surface. The underside of affected leaves appear tan or yellow and have a crusty texture. Fruit from mite-infested watermelon plants have characteristically coarse surfaces that are readily discernible from the smooth rind of healthy plants. Mites can be identified by shaking leaves in question onto a sheet of white paper and watching for moving specks, or by observing infected leaf areas with a 10x hand lens.

Hot, dry weather (>80^{o}F and <50% RH) for an extended time favors the buildup of mites for several reasons: (1) it increases the rate of reproduction, (2) it increases the rate of feeding, (3) it provides more nutritious food due to dry soil conditions, (4) it reduces pathogen levels, and (5) it increases movement when populations are high.

Management

Many natural enemies of mites normally inhabit Midwestern cucurbit fields. Natural enemies consist of predatory thrips, minute pirate bugs, and predatory mites. Their existence is important to maintenance of low mite populations. Many insecticides used for cucumber beetle control also kill beneficial organisms that keep mite populations in check. Also, many pyrethroid insecticides have been shown to increase the reproductive rate of some mites. Therefore, apply insecticides for cucumber beetle control on an as-needed basis rather than at regularly scheduled intervals, especially after plants have become well established and vines are growing rapidly and beetle populations are relatively low. Heavy rains can reduce mite populations because they wash mites from the leaves and increase relative humidity in the field. If a heavy mite infestation is found during a hot/dry period, one miticide application should be followed by another within 5 days. The first will kill all mite stages except eggs. Eggs will hatch and become adults in 5 to 7 days in the summer heat, then they will lay eggs and begin the cycle over again. The cycle usually can be broken with two applications.

Miticides are available but should be used only where and when the application is justified by

mite population levels. As with aphids, mark infested plants with flags, and check them again every 3 or 4 days. If the infestation is not spreading, treatment will not be required. Because mite populations often are localized, spot spraying may be effective. If you spray only a portion of the field, spray a buffer zone of 100 to 200 feet beyond the mite infested area.

Squash Bug

The squash bug is probably the most consistent pest of pumpkins and squash, and its control is usually difficult. The key to management is early detection and control of nymphs. Adults are 1/2 to 3/4 inch long and dark to grayish brown. Adults are somewhat flattened, or flat-backed, with wings not covering the orange and brown striped edges of the abdomen. Newly laid eggs are 1/16 inch long and orange to yellow, but turn metallic bronze in a few days. Eggs usually are deposited in clusters of 7 to 20 in rows on the leaf undersides in the angle formed by two veins. Egg laying usually begins in mid-June. Eggs hatch in 7-10 days under early summer conditions. Newly hatched squash bugs are wingless and pale-green to white with reddish-brown heads and legs. Larger nymphs are grayish-white with black legs.

Squash bugs usually have five nymphal stages, and take 4-6 weeks to reach maturity. Young nymphs feed in close groups on the underside of leaves. Because of the prolonged egg laying habit of the female, all stages of squash bugs can be present on a plant. Females appearing in late July do not mate or lay eggs, but enter diapause, an inactive stage. As fall approaches, adults may seek shelter in field debris, or move out of fields into nearby woods or field borders to overwinter. Nymphs present in late fall will die and only the unmated adults overwinter. These adults initiate the following spring's infestation. Squash bug adults are very mobile and can move easily from plant to plant or field to field. They spend most of their life within the plant canopy around stems or on the underside of leaves.

Damage

Squash bugs prefer squash and pumpkins over other cucurbits. Adults and nymphs feed by sucking sap from the plant. Squash bugs may inject a toxin into plants as they feed. Feeding sites develop into small yellow specks that later turn brown. If feeding is severe, the damaged leaf turns brown and dies. When vines are fed upon, they wilt from the point of attack to the end of the vine; leaves first turn brown, then black, and eventually dry up. Large numbers of overwintering adults can cause severe damage and stand loss to newly transplanted or emerged seedlings. Young nymphs tend to feed in groups near where they hatched, but older nymphs spread out over the entire plant. Squash bugs will not kill or cause plants to wilt rapidly. However, large populations can cause plants to wilt under hot, dry conditions. The plant may not recover if squash bugs are not controlled quickly enough. Squash bugs also can feed on squash and pumpkin fruit. When populations are high, they can cause fruit to collapse or be unmarketable.

A relatively new disease of cucurbits, Cucurbit Yellow Vine Decline (CYVD) or Yellow Vine is a serious disease of cucurbit crops that is primarily found in Oklahoma and Texas. Recently, however, there have been scattered reports of the disease in other states throughout the U.S. Squash bugs are vectors of the causal agent *Serratia marcescens*, a phloem-colonizing bacterium. Disease symptoms usually take 4 weeks or more to appear after initial infection. Symptoms include the general yellowing of the entire vine within a 2 or 3 day period, with no root rot or crown lesion associated with it like other vine declines. A cross-section of the crown at ground level reveals a yellow to honey-brown discoloration of the phloem tissue. Plants usually collapse 10-14 days before fruit maturity. The infection is likely to show up in squash and pumpkin

before watermelon and cantaloupe due to squash bug feeding preferences. Once a plant is infected and shows symptoms, nothing can be done.

Management

Squash bug is difficult to control because it feeds on the underside of leaves in a plant canopy that is very dense at flowering. There are two critical times when plants need to be protected from squash bugs. The first is when the plants are seedlings. Root systems on these plants have not developed and feeding by moderate to large numbers of overwintered adults can kill the plants. The occurrence of large, damaging squash bug populations in the early part of the season is unusual. Growers, however, should watch closely newly transplanted or germinated squash and pumpkin for any wilting. If wilting is observed, the underside of leaves should be checked for the presence of squash bug adults or their feeding. One or two applications of a pyrethroid insecticide at this time provide excellent control of the adults.

The second critical period for squash bug control is at early flowering. Squash bug populations must not be allowed to increase at this stage or they will damage plants, reduce yield, and become too numerous to control. Foliar insecticide applications are needed for control of squash bug nymphs if the average number of egg masses per plant, before or at flowering, exceeds 1 to 1 ½ per plant. Small nymphs are much easier to control with insecticides than large nymphs or adults, so sprays should be timed to kill the small nymphs. When checking for egg masses, the underside of the lower leaves of a plant should be examined. Do not scout for squash bug nymphs or adults as a primary way to make spray decisions. Look for nymphs and adults only to assess the level of control achieved with insecticides. When plants are examined for adults, both the plant and the soil surface around the plant should be checked. Hubbard and most winter squash can be severely damaged by squash bugs compared with other squash types or pumpkins.

Squash Vine Borer

Squash vine borer (SVB) occurs in low numbers in most large, commercial fields of squash or pumpkin, but it can be important in some fields. The presence of the borer is often not noticed by growers until after the damage is done to the crop. The SVB moth looks remarkably like a wasp and often is not recognized as a potential pest. The adult is a “clear wing” moth that is slightly more than 1/2 inch long. Its wings (1¼ to 1½ inch wing span) are a cloudy greenish-brown. The hind wings are transparent, with a fringe of reddish-brown hairs. The body is generally reddish-white with bands of black on the abdomen. Squash vine borers overwinter as pupae in the soil and appear in mid-June through July. The moth is a daytime flier that lays eggs singly at the base of the plant, or on petioles or stems, when cucurbits begin to bloom.

The small, flattened brown eggs (1/20 inch) hatch in 7-10 days, and the larva immediately bore into the stem of the plant, leaving behind a tell-tale sign of sawdust-like frass at the entrance hole. Frass may also be found along the stem near additional holes. Larvae spend 14-30 days feeding inside the stem. Once they are full-sized, larvae leave the vine, burrow into the ground, and create a silken cocoon in which they overwinter. In warm and long summers, such as 2007, there may be a partial second generation of squash vine borers that will attack the fruit.

Damage

SVB larvae tunnel in vines and destroy the water and food-conducting tubes, causing the vines to wilt and eventually die. Once inside the vine, little can be done to control the pest. Squash vine

borers tend to cause the most damage in winter squash, especially Hubbard, but very little in butternut or green striped cushaw. Although vines are the preferred feeding site, second generation SVB may feed on fruit in warmer than normal seasons.

Management

From mid-May through August, growers should watch for the borers' frass at entrance holes. Once frass is found, stems should be split to check for young borers. Very early signs of larval feeding indicate eggs have been laid and more eggs likely will hatch within a few days. Two insecticide applications directed at the base of the plant that are spaced 5-7 days apart will control the majority of the newly hatching larvae before they enter vines. Scheduled weekly sprays should not be used because most fields will not have an economic problem with this pest. The poor timing of scheduled sprays usually results in inadequate SVB control. SVB moths can be monitored using pheromone traps near squash or pumpkin fields. However, these traps attract many clearwing borer species and proper identification of the moths is necessary. Currently, there are no thresholds for the number of plants with borer frass or moths caught in traps to indicate the need for chemical control. Fields that have been severely attacked in the past are more likely to have economic damage during the current growing season.

Picnic and Sap Beetles

Picnic beetles are observed in mid-summer and are black, 1/4 to 1/2 inch long, with two yellow spots on their backs. Most sap beetles are the same size, but all black. Both adults feed at the stem end of cantaloupe and on the fruit. Picnic and sap beetles are attracted to fermenting plant fluids, such as decaying melons. Because they feed on souring plant sap, they are rarely primary pests, but are simply feeding on previously damaged or over-ripened fruit in the field.

Management

There are no thresholds for picnic or sap beetles. If you notice large amounts of these beetles in your field, it is likely that either the fruit has been damaged previously by something else and the picnic beetles are feeding on the damaged fruit, or the fruit is overly ripe. In either case, the beetles should not have to be controlled. However, if beetles are found feeding into harvestable fruit, then an insecticide application is advisable. Insecticides used to control cucumber beetles should give good control of picnic and sap beetles.

Pollination and Honey Bees

Growers need to be aware that pollinators such as honey bees are essential for cucurbit production. Without these pollinators, no fruit will be produced. For maximum fruit production, the usual guideline is 2-3 bee hives per acre for cucumber and muskmelon, 1-2 hives per acre for watermelon, pr 1 hive per acre for squash or pumpkins.

Growers also should be aware that certain pesticides and pesticide application practices pose a serious hazard for honey bees. Applications made in late evening or at night pose the least hazard to bees, because flowers are closed and the worker bees have returned to the hive. Applications in early morning are second best. The application of a single pesticide is usually less dangerous than combinations. Soil insecticides and IGRs are usually very safe to honey bees. Emulsifiable or water soluble formulations are safer than wettable powders of the same material. The use of Sevin

has been shown to reduce early yields, but not overall yields, possibly resulting from bee kill, flower abortion, or both.

Putting the Programs Together

Melons and Cucumbers

The first insect management decision growers must make is to decide when to plant. Particularly for muskmelons and watermelons, early harvested fruit receive a premium price, so many growers like to plant part of their crop early. This decision increases the likelihood that seed maggots will be a problem. For early melons, growers should take action to avoid seed maggot problems by plowing down cover crops early and using a planting time soil insecticide, carbofuran if labeled, or else imidacloprid or thiamethoxam. These products will also provide some control of the next major insect problem, striped cucumber beetles. Shortly after planting, growers should begin scouting 2-3 times per week for striped cucumber beetles, concentrating on the edges of fields, especially near wooded areas. Usually growers know where beetles tend to show up first each year. When beetles are found on field edges, the entire field should be scouted. Treatment should be made if the economic threshold is exceeded. Sprays should be minimized as much as possible to avoid creating problems with aphids and mites. Starting in July, fields should be scouted for aphids and mites and treatments applied when necessary. When harvest commences, sap beetles can occasionally become a problem that requires treatment, but usually is not a major problem.

Squash and Pumpkins

Pest management must start at the end of the previous season. Vines and remaining fruit should be destroyed at the end of harvest. If not promptly destroyed, squash bug and squash vine borer overwintering populations will build. Cover crops should be plowed down 2-4 weeks before planting which should not occur until soils have warmed. If virus problems are frequent and yield limiting, earlier planting and resistant varieties need to be considered. If CYVD is a problem in your area, squash bug populations must be controlled with weekly applications of pyrethroids. If CYVD is not a problem, squash bug populations need only be controlled if they are significantly damaging small plants. Cucumber beetles are a threat as soon as plants emerge or are transplanted. Fields should initially be scouted 2-3 times per week. A neonicotinoid (Admire or Platinum) soil application at transplanting will protect young plants from beetle and squash bug feeding for 4-6 weeks. Squash vine borer adults and their eggs need to be watched for when vines begin to run. Insecticide applications directed at the base of the plant can be used if any eggs or adults are observed. At flowering, even if CYVD is not a problem in your area, treatment for squash bugs may be needed. As plants become larger, cucumber beetles become less of a threat while aphids and mites become greater potential problems. This is especially true if weekly applications of pyrethroids are made for squash bug control. The undersides of leaves should be examined for mite or aphid activity, concentrating on the edges of fields and along dirt roads. Initial virus infections cannot be controlled to any extent by spraying for aphids. As fruit form, they should be inspected for any beetle or squash bug feeding.