

## Insect Pest Management in Potato

Potato production in Maryland continues to grow and has more than doubled in the last 5 years, while in surrounding states it has declined. About 50% of the potatoes harvested in Maryland are for the fresh market while the other half goes for processing. Because of its value growers frequently apply pesticides too often in order to protect their investment. This often leads to the development of insect resistance, environmental contamination, worker and food safety concerns and poor management of pests. The key to any successful pest management program is to develop a regular scouting plan to gain information on insect pest populations that may be used to determine if insecticide applications are needed. Monitoring can consist of sampling groups of 10 plants which are randomly selected at five to eight different locations in a field. Samples should be evenly distributed throughout the field so that plants close to the edges and middle of the field are represented. It is critical to properly identify the pest to be controlled and to determine its potential for damage. The only way to obtain this information is through the routine scouting of fields. The purpose of this guide is to serve as a reference for insect pest identification and for general management guidelines. Specific information on insecticides is available from [EB-236](#) the pesticide recommendation guide for the mid-Atlantic region. Cultural controls, reduced risk pesticides as well as other pesticides are recommended for each pest.

**Colorado potato beetle** (*Leptinotarsa decemlineata* (CPB)) is the most serious insect pest of potatoes in Maryland and will also



attack eggplant, tomato and pepper in that order of preference. Both the adult striped beetle and the black-spotted, hump-backed red larvae are



foliage feeders. Their feeding damage can greatly reduce yield and in some cases kill plants. The



Colorado potato beetle has the ability to rapidly develop resistance to insecticides that are used repetitively for their control. This has been a serious problem on east coast potato fields for many years. Colorado potato beetles overwinter as adults in the soil. They become active in the spring as temperatures rise and begin to feed on weeds or early planted potatoes, even entering the soil to attack emerging foliage. Female beetles lay

elongated oval orange-yellow eggs on the underside of foliage. Each female can lay 500 or more eggs over a 4-5 week period. Eggs hatch in four to nine days and the larvae begin to feed on potato foliage. They usually feed in groups and damage can be severe. The larval stage lasts two to three weeks. Full grown larvae burrow into the ground to pupate. In five to 10 days, the adult beetle emerges. This insect can go from egg to adult in as little as 21 days. The newly emerged adult female feeds for a few days before egg laying begins. There are two full generations each year. Damage by the adults, but especially the larvae is through defoliation of potato plants.

**Management** Insecticides in the same chemical class usually have the same method of killing the insect. Resistance develops more rapidly when that insecticide is used repeatedly as the only control measure. Overuse of one insecticide may favor the development of resistance to other insecticides in the same chemical class. Consequently, to delay or prevent resistance it is important to avoid repeated use of one particular insecticide by rotating the insecticides used (see EB-236, CPB under white potatoes). Timing of sprays is critical for control. Overwintering beetles are attracted to fields over a period of several weeks; in the early season adults do not fly, but must walk to the nearest food source. That is why rotating fields at least ¼ mile away from previous potato fields works so well. Potato plants can withstand 10-15% defoliation at flowering and considerably more after flowering (30%) without yield loss. Generally, insecticides do not need to be applied unless there is more than one beetle or larva per plant. An organic pesticide that can be used for small larvae control is Btt: *Bacillus thuringiensis tenebrionis* (Novodor). It is only useful on small larvae. The first application should be made when 30% of eggs hatch. Treatment must be repeated at 5 to 7 day intervals for as long as small larvae are present. Pre-plant (Cruiser seed treatment) or at-planting (imidacloprid, Platinum, or Radiant) insecticides work well in protecting plants. DO NOT use any of the at-planting or pre-treatment chemicals again during the season. Foliar chemicals include Actara, Agri-Mek, Assail, Rimon, and SpinTor.

**European corn borer (ECB)** (*Ostrinia nubilalis*) is an occasional pest in potatoes. European corn borer eggs are laid in small flat masses, each with about 20 white eggs. Each egg mass is about 1/4 inch in diameter. Larvae are creamy white to light pinkish brown with several light brown spots on each segment and often with two faint white lines down the back. They have a small, dark brown head. Larvae start out about 1/16 inch long, and they reach a length of about 7/8 inch when fully grown. The European corn borer overwinters as fully grown larvae inside corn stalks or corn cobs. In the spring, they go through the pupal stage and emerge as adult moths. European corn borer moths begin emerging after about 450 degree-days starting from January 1<sup>st</sup>. Moths spend most of their time in moist grassy areas, where they



rest during the day and mate at night. After sundown, female moths fly to nearby fields of young corn or potatoes and lay eggs. After feeding for about 4 weeks larvae are fully grown and pupate for 2 weeks. New adults begin to emerge in July and these moths lay eggs on corn, peppers or potatoes. Early-season adults deposit eggs on the underside of young plant leaves. First instars bore into stems but also feed on the foliage. Second and third instars enter potato stems by tunneling through the leaf axil at the node and the remainder of larval development takes place in the potato stem. The presence of frass, at leaf axils and wilting or dying leaves are good indications of European corn borer larvae. In Maryland the second generation of moths may lay eggs before harvest, but the resulting larvae will not reach maturity due to termination of the potato crop as it becomes senescent. Although larval damage can be found throughout the plant, most damage occurs in the lower third of main stems. Tunneled stems are weakened and often break during heavy rain and wind. ECB larvae create an average of 5 tunnels during their developmental period. European corn borer rarely reduces marketable yield in the absence of diseases even under heavy infestations. However, European corn borer damage may predispose the potato plant to bacterial soft rot and blackleg diseases (blackleg disease occurs more often in fields that are infested with European corn borer).



**Management** ECB seldom causes yield losses in Maryland potato fields. However at times, if populations are great enough and plant rot diseases have been a problem in the past it may be prudent to reduce ECB populations. There are two main methods of managing ECB in potatoes. Field scouting should look for entry holes and frass in stems of potatoes. If 10% (fresh market potatoes) or 25% (processing potatoes) of stems have ECB damage then insecticide applications over a 2-3 week period are needed. The other method to monitor ECB is to trap the adult moths. The Maryland Department of Agriculture (MDA) maintains a black light trapping network throughout Maryland and posts the information at their web site: <http://www.mda.state.md.us/plantspests/plantprotectionweedmgmt/plantpestsurveydetection/interactivemaplinksdailycountsatindividuallocations.php> If there has been a history of ECB damage in potatoes and more than 150 moths/week are caught in black light traps then an insecticide application should be applied. Additional applications are only necessary if adult moth populations remain at or above 25/night. The organic pesticide Entrust or the reduced risk pesticides Confirm or SpinTor can be used as well as Pyrethroids for control.

**Wireworms** (*Melanotus communis* and *Conoderus spp.*) Wireworms (and at times white grubs) are more of a problem in potato fields in which the soil has been in sod, pasture, or CRP for several years. Wireworms are the larvae of several species of click beetles and are responsible for the damage to potatoes. Adults are large (1/2-1 inch long) reddish-brown beetles that make a clicking sound when they try to right themselves after being turned over. Wireworm larvae are very

small and white during the early stages of development, which lasts one to two years. As larvae mature they become hard-shelled with dark transverse bands along the length of their shiny yellow to rust-colored bodies. There are six meager legs toward the head region, which has a pair of protruding jaws. Wireworms are 1/2 to an inch long when fully mature. Maturation of larvae takes two to six years (depending on species). When full maturity is reached during the summer,



Mature wireworm larva

larvae pupate in the soil, and adults emerge after a few days. Adults are relatively common in the summer and are often attracted to lights at night. After mating, adult click beetles begin to lay eggs in grassy areas like pastures or other grassy areas. For this reason larvae are most likely to be a problem in fields that have recently been in a continuous grass cover. The beetles also may lay eggs in cereal crops. Eggs hatch in a few days to weeks, and the larvae emerge. During the season depending on temperature wireworms will move up and down in the soil profile. They prefer soil temperatures of 50° to 60° F. Adult beetles overwinter in the soil 2-3 ft deep. Wireworms damage potato by feeding primarily on tubers. The damage appears as straight, round holes with smooth walls. Early in the season around planting, wireworms may drill into seed tubers or seed-pieces thereby weakening them. For potato, the major damage is later in the season when tubers are maturing after bulking. Late-season damage occurs when larvae feed on tubers causing feeding scars or feeding tunnels. Feeding damage is the result of larvae that are greater than two years old, although larvae of several ages can be found in an infested field. This feeding damage does not affect seed production as seed vigor is not diminished, but does cause culling for the fresh market. In processing potatoes, chips will show gaps where the hole was located.

**Management** Because of problems with the length of wireworm life cycles and biology growers need to be aware of the cropping history of a field and also the severity of grassy weed problems in field areas. Wireworm (and white grub) damage is almost always spotty, with only some areas of the field containing damaging levels. Crop rotations do not generally work well unless there is frequent tillage to reduce wireworm/white grub populations. Delaying planting for as long as is reasonably possible will reduce wireworm damage. If a field has been in grass for a period of time bait traps can be used to see if wireworms (but not white grubs) will be a problem. Traps consist of soaking untreated wheat and corn seed in water for 24 hrs and burying the seed mixture 4-6 inches deep in the soil in the fall or early spring. Bait traps should be placed in 10 areas of the field, covered with soil and left for one week before checking for the presence of wireworm. Any trap with a wireworm means treatment is necessary. If there is an average of 2-4 wireworms/trap this is a very high population. If the traps have more than an average of four wireworms, the level is considered extreme and potatoes should not be planted in that field. When using chemical treatments for

wireworm suppression, pesticide applications should be delayed in the spring as long as possible in order for soil temperatures to increase to a point where wireworms are active in the upper soil regions (50°- 60° F). Mocap can be used as a pre-plant application. At-planting applications include: bifenthrin, Mocap, Regent, and Thimet.

**Aphids** There are many different species of aphids that could be found in a potato field and all cause similar types of damage. Aphids are small, soft-bodied insects that vary in color from pale yellow to red to green to black, depending on the species (with one species capable of having several colors), the host plant, and time of season. Usually wingless, they are about 1/8 inch long and have a pair of long, slender tailpipe-like appendages known as cornicles. Adult females give birth to live young, called nymphs during the summer. Although slightly smaller than adults, nymphs are similar in color and shape. Three species of aphids can be found on potato in Maryland, the melon, potato and green peach aphids. The green peach aphid (*Myzus persicae*) is



pear shaped and pale yellow to green with cornicles that are light in color and much shorter than the potato aphid. Melon aphids (*Aphis gossypii*) vary in



color from yellow to dark green, but have dark colored cornicles (red arrow). Potato aphids (*Macrosiphum euphorbiae*) are soft-bodied, elongated tear-shaped insects that may be solid pink, a green-pink mottle or light green with a dark stripe. Green peach aphids overwinter in the south and migrate into Maryland each year. Potato aphids overwinter as eggs on wild and cultivated rose plants, and certain weed species including lambsquarters, yellow mustard, and redroot pigweed. Melon aphids overwinter in weeds and cold-tolerant crops. Direct-feeding damage by aphids is rarely severe enough to kill plants. They pierce plant tissue with needlelike mouthparts and suck plant sap which may result in curling or stunting of new growth. Damage is usually worst in May and June, and again in the fall. Aphid infestations commonly begin in small scattered areas over the field. Green peach aphids favor mature lower leaves, while potato aphids are found primarily on terminal leaves and young stems. Infested leaves curl downward and may turn brown and die. When infestations are heavy, aphid damage can reduce plant vigor, size and yield. Aphids can cause a yield loss of approximately 30% under very heavy infestations. There is no evidence that aphids transmit viruses to any extent in potatoes in the Mid-Atlantic region. **Management** Aphids are

present every year in Maryland potatoes, but usually are not an important pest unless excessive pesticide applications have been made. Pyrethroid and carbaryl insecticides, if used too often, can cause an outbreak of these pests in potato. These pesticides are broad-spectrum and kill many beneficial insects. These beneficial insects or natural enemies, such as predators (lady beetles and their larvae, syrphid fly and lace wing larvae), and parasitic wasps keep aphid populations under control most of the time unless their populations are disrupted. If aphid populations do increase to damaging levels there are several reduced-risk pesticides available that will give excellent control: Actara, Assail, Fulfill, imidacloprid, Platinum and Movento. During periods of drought apply insecticides two to three days after irrigating crop. Coverage of the foliage (under-side of leaves) must be thorough in order for best control of green peach aphids.

**Potato Leafhopper** (*Empoasca fabae*) adults are about 1/8 inch long, wedge-shaped and greenish-yellow.



“Hopper burn” on potato

The potato leafhopper has wings that are transparent green and are folded back when at rest. They also have a variable number of white spots on top of their head and along their thorax.



Potato leafhopper adult and nymph

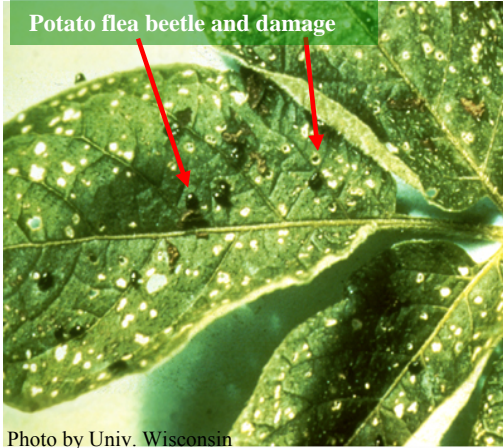
Eggs are white and elongated and are laid inside the veins on the underside of leaves hatching in 7-10 days. A female leafhopper lives about one month, producing one to six eggs per day. Nymphs are light green and cannot fly. They mature in about two weeks, after which mating occurs 48 hours later. Three or four generations are produced each year. Leafhoppers

overwinter in the Gulf States and move up on fronts from the south over the spring and summer. Leafhoppers feed on more than 100 cultivated and wild plants, including bean, potato, alfalfa, soybean, and peanut. Both nymphs and adults feed on the undersides of the leaves. Adult leafhoppers are primarily responsible for the feeding injury to potato plants. Injury starts with a yellowing along leaflet margins with a slight rolling. This injury is soon followed by a gradual browning starting at the leaflet's tip and margin (“hopper burn”-red arrows), and expanding until the entire leaflet is dead. Defoliation can occur that results in a reduction in yield. These symptoms are sometimes confused with drought stress and are common on potato when leafhoppers feed too extensively.

**Management** Monitor fields for populations and correctly identify the leafhopper. There are many other leafhoppers that do not damage potato. One method is to use a sweep net and take 30-50 sweeps in 5 areas of a field. Another method to monitor leafhoppers is to sample 30-40 leaves in 3-5 areas of a field for leaf hopper nymphs. A threshold for sweep net counts is when there is more than one adult per sweep. For nymphal counts the threshold is one nymph per 10

leaves. Controlling leafhoppers after hopper burn is observed in the field is too late- yield has already been lost. Reduced risk pesticides that will control leafhoppers include: at planting, Admire and Platinum. Reduced risk foliar treatments include Actara and Provado. Other chemicals include: pyrethroids, Vydate, Thimet and Thiodan.

**Flea beetles** All solanaceous plants are susceptible to flea beetle attack, but eggplant is especially vulnerable and to a lesser extent potato. There are many different species of flea beetles that will attack solanaceous crops. The more common species are the eggplant (*Epitrix fuscula*), tobacco (*Epitrix hirtipennis*)

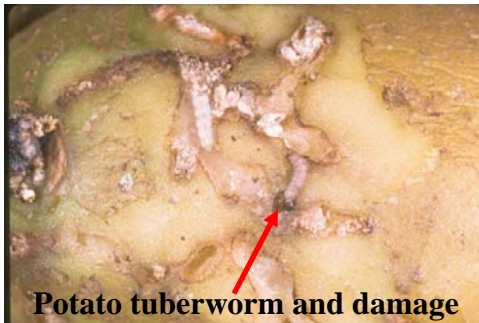


and potato (*Epitrix subcrinata*) flea beetles. Potato flea beetles are the most common flea beetles found in potato fields in Maryland. The potato flea beetle adult is an oval, black; 1/10 inch long beetle that has thickened, "jumping" hind legs. Its antennae are about 2/3 the length of its body. The eggplant flea beetle resembles the potato flea beetle, but has black legs and slightly hairy wing covers. The tobacco flea beetle is about the same size as the potato flea beetle, but is yellowish brown with a dark band across its wings. All eggs of these species are  $\leq 1/250$  inch long and pointed at

one end. Eggs are white at first, but gradually become yellowish-gray. A typical flea beetle larva is white with a brown head and three pairs of brown legs near its head. Larvae become 1/16 inch long when fully grown. In general, flea beetles overwinter as adults in soil or crop debris and emerge from hibernation in mid- to late March. Weedy hosts such as horsenettle and pokeweed are infested until crop hosts become available. Eggs are laid in soil near the base of plants and hatch in about one week. Larvae emerge from the eggs and feed on roots or tubers for 2 to 3 weeks. After developing through three instars, larvae pupate in the soil. The pupal stage lasts 7 to 10 days. Beetles emerge from the soil, and feed on leaves for 2 months or more. Flea beetles complete 2-3 generations each year in Maryland. Adult flea beetles feed on both leaf surfaces but usually on the underside where they chew small, circular holes (red arrow) through to the upper cuticle. The circular holes give the plant a "shotgun" appearance; large numbers of these shotgun holes may destroy entire leaves. Potato flea beetles can transmit early blight and bacterial ring rot in potato. Flea beetles can be serious pests early in the season when plants are small, less than six inches tall. As plants grow larger they can withstand substantial flea beetle damage without loss of yield. **Management** Flea beetles very rarely cause yield loss to potatoes in Maryland. Cultural practices such as destruction of crop residue, weed control and late planting help minimize flea beetle problems. The removal of crop residue reduces the number of favorable overwintering sites for flea beetles. Control of weeds such as horsenettle and pokeweed around field sites eliminates

important early beetle food sources. Delayed planting favors the development of host plants over the establishment of flea beetles in potatoes. If defoliation becomes severe on small or medium sized plants one application with a pyrethroid insecticide should take care of the problem.

**Potato Tuberworm** (*Phthorimaea operculella*) adults are small, slender moths with fringed gray forewings with brown spots. Larvae are pale yellow to white with a dark brown head. As larvae mature they vary from green to pink. Potato tuberworms can only overwinter as larvae or pupae in the soil or in potatoes that



**Potato tuberworm and damage**

do not freeze. Therefore they have not been much of a problem in Maryland except for the last few years as non-freezing soil temperatures have slowly been moving north. Moths are active at dusk and dawn when females deposit their eggs over a 4 day period. Eggs usually are placed on rough surfaces such as the underside of a leaf. Hatch occurs 3 to 6 days later and larvae

feed and mature in 7 to 10 days. Fully grown larvae leave the potato plant and pupate in the soil near the base of plants. Five or six generations occur each year in the SE United States. The potato tuberworm feeds and tunnels between the upper and lower surfaces of a leaf causing translucent dirty-white blotches which become brown and brittle. Tuberworm injury is usually concentrated on the older, lower leaves. Under some circumstances larvae move from foliage to the tubers; dropping to the soil where they bore into and on the surface of tubers. The tunnels sometimes can be black as they are filled with excrement and secondary rot fungi. **Management** tuberworms are more of a problem for fall planted potatoes in Maryland as it takes some time for moths to migrate north from their overwintering sites. At this time the damage is sporadic and rarely economical. If there has been a history of damage from tuberworm especially if fields are located in southern Maryland than treatment may be necessary when 20-25% of foliage becomes blotched. Pyrethroids and Lannate can be used for control and should be directed at the adults, i.e., sprays should go out at dusk.

**Cutworms** (several different species) are minor pests of potatoes in Maryland, but there are several species that will feed on potatoes. Cutworms are caterpillars that curl their body into a tight curl when disturbed (red arrows). They have a smooth skin and a damp texture. The variegated cutworm is grayish brown and

Variegated cutworm larvae



lightly speckled with darker brown and has

a single row of pale yellow dots along the sides and top of its body. The black cutworm is shiny gray or black with faint lighter stripes and a granular appearance. The spotted cutworm has a dark stripe along each side



of its body and several pairs of triangular-shaped black spots on the sides of its last 5 body segments. Full grown cutworms are two inches long. They are active mainly at night, and hide in soil or debris during the day. Variegated cutworms feed primarily on potato foliage on lower stems. Black cutworms feed mainly on stems at or below the soil surface, but will also feed on foliage. First generation larvae can attack young plants. In Maryland most cutworm species overwinter as late instar larvae except for the black cutworm, which probably overwinters farther south. Adults emerge in early to mid summer, or fly up from southern regions and are present in our area June through August. Females deposit eggs on grasses, or weeds. Weedy or minimum-tillage fields are preferential egg-laying sites. Eggs hatch in 5 to 10 days. Larvae develop through several instars, feeding on plants for weeks before pupating in the soil. Cutworms may also attack exposed tubers through cracks in the soil, leaving shallow feeding holes. One to three generations occur each year in Maryland. Moth populations fluctuate considerably from year to year as well as from region to region.

**Management** Cutworms usually are not an economic pest in Maryland potatoes; however cutworms that feed below ground are difficult to manage after the damage is discovered because neither foliar nor systemic insecticides are effective. In fields where high cutworm populations are expected, a broadcast incorporated insecticide may be worked into the soil prior to planting. Fields should be scouted for cutworm damage after plant emergence. Protective sprays are applied if more than 6 variegated cutworms are found per plant, or if more than 10% feeding damage has occurred. Pyrethroids, Lannate, Sevin and Sevin bait can be used to control cutworms.

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