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EC1565

Biology and Management of Potato Insects

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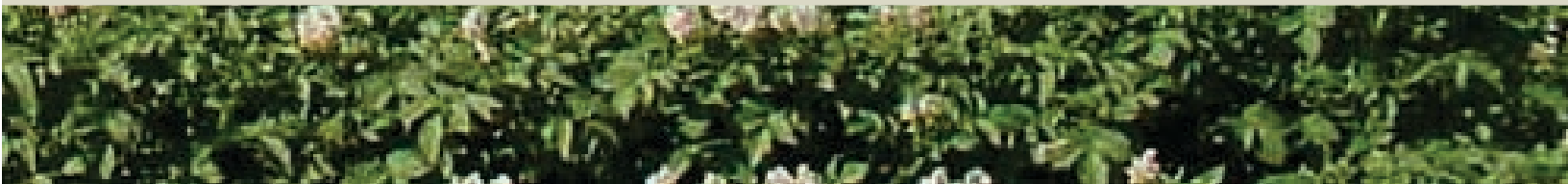
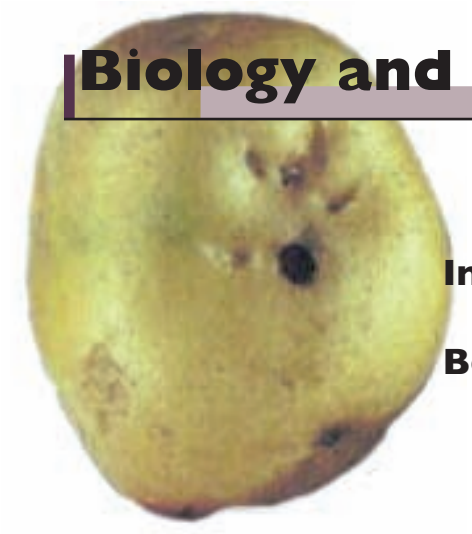


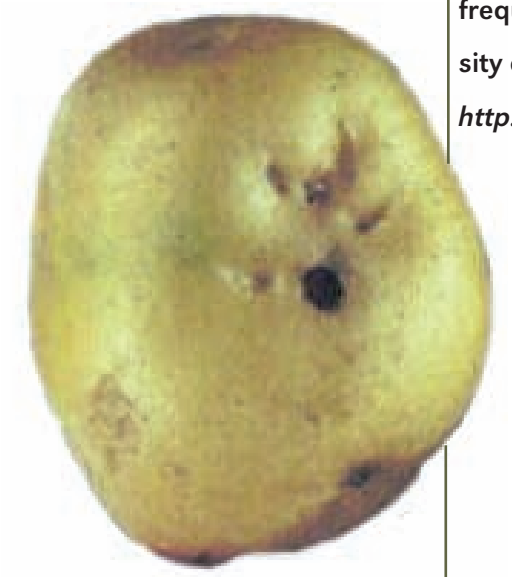
Biology and Management of Potato Insects



A variety of insects can damage potatoes in Nebraska. Insects may feed directly on the tubers and damage the harvestable crop, or they may indirectly damage the crop by feeding on leaves or stems. If severe enough, indirect damage may reduce harvestable yield and quality. Insect feeding also may be important because some insects (e.g., aphids) may transmit plant diseases such as viruses when they feed, or others (e.g., psyllids) may inject toxins.

The type of potato production (i.e., processing, seed, fresh market) influences insect management strategies, due both to crop value and to specific quality needs for different uses. Because of the higher crop value and the lower tolerance for insect-transmitted viral diseases and defects, there is a much lower tolerance for insect damage in seed production.

This publication reviews the identification, biology, and management of common insect pests of potatoes in Nebraska. The basis for a successful integrated pest management (IPM) program for potatoes is regular monitoring of the crop. Pest managers should develop a plan to monitor for the major pests and be on the alert for other potential insect pests. Chemical control options change frequently; current information is available on the Web at the University of Nebraska–Lincoln Department of Entomology's website at *http://entomology.unl.edu/.*



Belowground Pests

Several soil insects feed on seed pieces, young plants, or developing tubers, including wireworms, white grubs, flea beetle larvae, and seed corn maggots.

Wireworms

Wireworms are shiny, brown to copperish, smooth beetle larvae that reach 1 to 1 1/2 inches in length (*Figure 1*). The adult beetles are 1/4 to 3/4 inches long, hard-shelled, brown to nearly black, with the body tapering toward the rear end. The adults are commonly called click beetles because when they are turned on their backs they will quickly flip into the air to right themselves, causing a clicking noise.

Several wireworm species can damage potatoes in Nebraska. They vary somewhat in appearance and life cycles, but most take two to six years to complete their immature development in the soil. Adults emerge in the summer and are attracted to grassy plants or crops, where they lay eggs in the soil. The eggs hatch during the summer and newly hatched wireworms typically feed on fine root hairs of potatoes and do not cause economic damage. As they grow larger, in the second or later summers of their life cycle, they are more likely to damage the potato tubers themselves.

Wireworms may feed on all belowground parts of the potato plant — stems, roots, and tubers — as well as the seed piece. Wireworms feeding on the seed piece may reduce vigor of young potato plants and provide entry points for bacterial or fungal rot infections. The most common injury is when wireworms feed on developing tubers. Depending on the age of the tuber when damaged, wireworm feeding may produce deep pits or narrow holes lined with periderm (potato skin). This damage may reduce the quality and, thus, the marketable yield.

Crop rotations influence the severity of wireworm problems in potatoes. Wireworm beetles prefer to lay eggs near grassy plants, including small grains, sod, grass pasture, or grassy weeds in crops. When potatoes are included in rotations with these crops, there is a greater likelihood of damage from wireworms. Because of the length of the larval stage, if you have damage to other crops or potatoes one year, there is a high likelihood of damage if potatoes are planted in that field the next year. Wireworm populations often decline

Figure 1. *Wireworm larva*

Additional information on these insects is available in NebGuide *G1023*, *Insects That Attack Seeds and Seedlings of Field Crops* **(*http://www.ianr.unl.edu/sendIt/g1023.pdf*).**

when alfalfa is included in the rotation, unless grassy weeds are abundant in the alfalfa. Corn and sugarbeets are moderately favorable host crops for wireworms.

Monitoring wireworms to determine the need to treat is relatively labor intensive. Two approaches are used: soil baiting and soil sieving. Soil baiting is less labor-intensive but is influenced by soil conditions, such as temperature, moisture, and soil organic matter. Exact comparisons between fields may not be possible if soil conditions differ. Soil sieving (digging up a sample of soil and sieving it to find wireworms) is more accurate, but is probably not practical for most people because of the high number of soil samples needed to sample wireworms accurately.

Soil baiting involves burying a handful of equal portions of corn and whole wheat grain in the soil. Germinating seeds give off carbon dioxide and plant chemicals that are attractive to wireworms. University of Idaho extension entomologists recommend using about one bait location per acre of field. Using too few bait locations in a field may result in an unreliable estimate of risk for wireworm injury because wireworm infestations can be very spotty.

At each location, bury a handful of grain 4 to 6 inches deep in the soil. Effectiveness is increased if seed is soaked with water overnight before use. To promote drainage of moisture, mound soil 4 to 5 inches over the top of the grain. Baits do not work well unless soil temperature at a depth of 6 inches is at least 45°F, and the soil is moist. A clear plastic sheet over the top of a black plastic sheet is placed over the top of the bait to act as a solar heater to warm the soil underneath. Depending on local soil temperatures, baits may be put out in the fall or spring before planting. Dig up the baits and the surrounding soil after 5 to 10 days, and examine for wireworm larvae.

Compare the average number of wireworms per bait location with numbers in *Table I* to estimate the risk of economic damage. This guide was developed by University of Idaho extension entomologists.

Table I. *Risk of economic damage from wireworms. Economic damage is assumed to be 3 percent of the tubers damaged at harvest.* (*From E. J. Bechinski et al. 1994.* Integrated Pest Management Guide to Wireworms in Potatoes, *University of Idaho Cooperative Extension*.)

Average number of wireworms per bait location	Risk of economic damage (= 3% of tubers damaged at harvest)
0	Less than 10% chance
up to 0.5	10-33% chance
0.5-1.0	34-50% chance
1-2	50-74% chance
2-4	High; 74-90% chance; use insecticide at planting
more than 4	Extreme; do not plant potatoes

Figure 2. *White grub*

Figure 3. *Sand chafer*

Figure 5. *Flea beetle*

Figure 6. *Plant damage caused by flea beetles*

White grubs

White grubs are C-shaped larvae with whitish skin, large brown heads, visible jaws, and six legs (*Figure 2*). When fully grown they may be more than 1 inch long. The grubs are immature stages of scarab beetles. The typical species of white grubs found in Nebraska, the common May/June beetles (*Phyllophaga* spp.) and masked chafers (*Cyclocephala* spp.), seldom damage commercial potatoes.

Over the last several years, a related species of annual white grub has been reported injuring corn and potatoes in Nebraska. Potatoes following corn seems to be the most commonly associated crop with injury from this insect in Nebraska. This insect is the "sand chafer" or "false Japanese beetle" (*Strigoderma arboricola*) (*Figure 3*). These annual white grubs complete their life cycle in a single year. Adults are active in late June through mid-July and egg laying occurs in the soil during this time. Larval feeding during July and early August is minimal and confined to root tissue. However, in late August and September when vine-killing herbicides kill the roots, the larger sand chafer grubs switch to feeding directly on tubers, causing shallow gouges in the tubers (*Figure 4* on next page). In late September or early October, the grubs cease feeding for the year and the potential for damage ends.

Because they overwinter in the final larval stage and feed little in the spring, they avoid exposure to early season insecticide applications. The only potential insecticidal control options are to apply foliar insecticides after adult emergence or to make soil applications during larval development before tuber damage occurs. There is little research on the efficacy of insecticides, and there are no economic thresholds for this insect.

Flea beetles

The tuber flea beetle (*Epitrix tuberis*) and related *Epitrix* species occasionally may damage potatoes. Adult flea beetles are 1/16 inch long and shiny black, with enlarged hind legs that enable them to jump like fleas, thus the common name (*Figure 5*). Flea beetle larvae live in the soil. The larvae are whitish, elongate, soft-bodied grubs, with a yellowish or light brown head and six small legs. They are up to 1/4 inch in length. Adult flea beetles overwinter in weeds or debris outside of the field. The adults chew small circular holes in leaves, giving them a "shot hole" appearance (*Figure 6*). This damage is usually not economically important, unless severe defoliation occurs. Eggs are laid in the soil around potato plants. The larvae feed on roots, underground stems, and tubers. Feeding on the tubers produces narrow, straight tunnels about 1/32 inch in diameter (*Figure 4*). Extensive tunneling makes tubers unsuitable for processing. Feeding also may produce surface damage on the tubers.

Flea beetle infestations are sporadic and economic thresholds are not available. Soil-applied and foliar insecticides used against other pests often will suppress flea beetles below economically damaging levels.

Figure 4. *Potatoes showing flea beetle scars (two upper left tubers), white grub damage (two upper right tubers), and wireworm holes (three bottom tubers).*

Figure 7. Seedcorn maggots

Seedcorn maggots

The seedcorn maggot (*Delia platura*) occasionally may damage potato seed pieces prior to plant emergence. Adults are about 1/5 inch long gray flies, which hold their wings crossed above their back while at rest. Female flies prefer to lay their eggs in locations with recently incorporated green manures and animal manures. Immature seed corn maggots live in the soil and eat germinating seeds of many plants. Larvae are whitish, without legs, and have a characteristic cylindrical shape that tapers at one end (*Figure 7*). Full grown larvae reach 1/5 inch in length. Larvae can be found inside damaged seed pieces or in the soil nearby. Seedcorn maggots cause damage by eating portions of the seed piece or seedlings. Damage is most common in early plantings while the soil is cool and when the soil contains high levels of recently incorporated organic matter.

Control is rarely needed. As a cultural control, later plantings, when soil conditions are warmer, will reduce damage from seedcorn maggot.

Aboveground Pests

Chewing Insects

Several insect pests of potatoes have chewing mouthparts and feed on leaves or stems. Their main effect is to reduce the leaf area available for photosynthesis, which, if severe enough, may reduce tuber yield or quality.

Colorado potato beetle

Adult Colorado potato beetles (*Leptinotarsa decemlineata*) are oval-shaped, 3/8 inch long, with narrow black stripes over a yellow-orange background (*Figure 8*). Beetles overwinter in the soil near potato fields and become active about the time potatoes begin to emerge. Female beetles lay bright yellow, football-shaped eggs in masses on the undersides of potato leaves. Eggs hatch in 4 to 14 days, depending on temperature. Immature potato beetles go through four larval stages. Newly emerged larvae are dark red and later stages are light orange (*Figure 9*). When larvae have completed feeding, they burrow in the soil, pupate, and after two to three weeks emerge as adults. After mating, a second generation is usually produced.

Figure 8. *Adult Colorado potato beetle (Photo courtesy of Clemson University)*

Crop rotation can be an effective cultural control practice for Colorado potato beetles. The farther a field is separated from the previous year's potato field, the greater the benefit of rotation. Rotation reduces the number of overwintering beetles able to colonize a field and delays the beginning of the infestation. Both of these factors reduce the potential for economic damage.

Colorado potato beetles can only reproduce on members of the Solanaceae plant

Figure 9. *Colorado potato beetle larva*

family. Destruction of solanaceous weeds (e.g., nightshades, horsenettle, buffalo bur) in areas near potato fields will reduce potential alternate sites for feeding and reproduction of potato beetles.

Both the larvae and adults feed on potato foliage and if abundant, may cause heavy defoliation of potatoes. Economic thresholds for Colorado potato damage are 20 to 30 percent defoliation in preflowering potatoes, 5 to 10 percent defoliation in flowering potatoes, and 30 percent defoliation during tuber formation.

Since economic thresholds are based on damage levels, scouting should focus primarily on estimating current defoliation levels and the potential for future defoliation by adults and larvae. Early in the season it is important to monitor field borders where Colorado potato beetles may be initially colonizing the field. Observations should be made on which life stages are present. Newly emerged larvae are most susceptible to insecticides, and become less so as they increase in size. About 70 percent of all larval feeding is done during the fourth (last) larval stage. If control is needed, it should be timed before many of the larvae have reached the fourth stage. Infestations may be restricted to field edges during the first potato beetle generation; if control is needed, only a portion of the field may need to be treated.

Cutworms

Several cutworm species (e.g., black [*Agrotis ipsilon*], *Figure 10*, and variegated [*Peridroma saucia*], *Figure 11*) occasionally may damage potatoes. Cutworms are the immature stage of several species of miller (noctuid) moths. Most cutworms are 1 to 2 inches long at maturity. They vary in color but most appear smooth-skinned and curl up into a C-shape when disturbed. Most species are nocturnal feeders and may be hard to find during the day when they hide in the soil or underneath plants on the soil surface. Feeding usually results in ragged holes in the leaves, often in the lower part of the canopy. Occasionally, cutworms cut stems off near the soil surface

Figure 10. *Black cutworm*

Figure 11. *Variegated cutworm*

or chew shallow holes in exposed tubers. Cutworms rarely need to be controlled with insecticides, but if 5 to 10 percent or more of total leaf area is damaged during mid-season (flowering), it may be profitable to treat. Potatoes are more tolerant of leaf feeding earlier and later in the season.

European corn borer

European corn borers (*Ostrinia nubilalis*) can complete their development on over 200 cultivated plants, including potatoes, corn, sorghum, peppers, and snap beans, as well as a number of weeds. In Nebraska there are two generations of corn borers each year; corn borers spend the winter as a mature larva usually within the plant on which they developed. In years when they are abundant, they may economically damage potatoes.

On potatoes, European corn borer egg masses are laid on the underside of leaves. Eggs are white,

flattened, and circular and laid in an overlapping pattern like fish scales (*Figure 12*). There are usually 15 to 35 eggs in a mass. Eggs hatch in four to nine days, depending on temperature. Larvae are light tan with dark brown heads and are about 1 inch long when fully grown (*Figure 13*). Newly emerged larvae feed on leaf tissue for five to seven days. Second and third stage larvae bore into the stems where they complete their development. External signs of corn borer feeding include the presence of sawdust-like frass at leaf axils and wilting and dying leaves. A variety of other causes may result in wilting; check for the presence of corn borer to confirm diagnosis. Most damage occurs in the lower third of the main stems. Larval tunneling results in wilting and eventual death of leaves in affected portions of the plant.

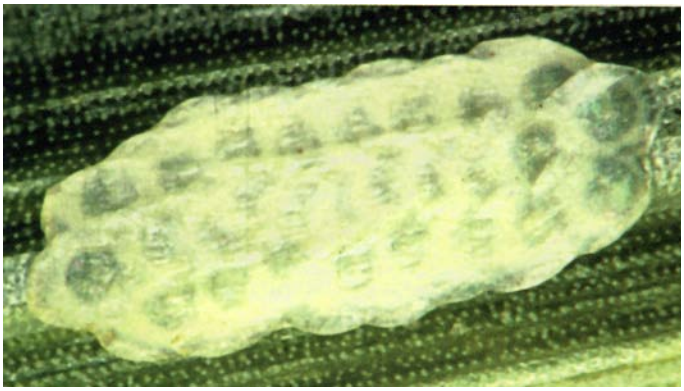


Figure 12. *European corn borer egg mass*

Figure 13. *European corn borer larva*

Figure 14. *European corn borer moth*

To monitor for European corn borer, use blacklight traps, pheromone traps, or visual observations. European corn borer moths are light tan, with dark brown wavy bands across the wings. They have a wingspan of about 1 inch (*Figure 14*). Once it is known that corn borer moths have emerged and begun flying, fields should be monitored 7 to 10 days after the first moths were observed. A total of 50 potato stems should be randomly selected from throughout the field and examined for feeding damage and presence of egg masses and live larvae. Timing of corn borer moth flights varies from year-to-year and by location. In southeastern and south central Nebraska, first generation moth flights begin in mid to late May, and second generation moth flights begin in mid to late July and continue into August. As you go farther north and west in the state, flights occur somewhat later. University of Nebraska–Lincoln Extension entomologists and educators manage light traps at various locations across the state. Data from these traps can be accessed on the Web at: *http://entomology.unl.edu.*

Research has shown that European corn borer tunneling does not reduce potato yield in the absence of disease even with heavy levels of damage (up to 38 tunnels per plant). However, tunneling by corn borer larvae may predispose the plant to infection with bacterial soft rot or blackleg diseases, both caused by *Erwinia* spp. bacteria. Also, studies have shown that corn borer larvae may transmit soft rot bacteria to healthy tissue as they move from stem to stem. Because of these concerns, the suggested treatment threshold for corn borer is when 10 to 25 percent of the stems are infested with corn borers. This assumes that there still are unhatched eggs or small corn borer larvae feeding on exposed

locations. Once corn borers have entered stems, they cannot be controlled with insecticides. Treatment timing is often difficult because of the extended moth flight period and relatively short residual activity of many insecticides.

Corn borer larvae do not successfully overwinter in potato fields. In most areas of Nebraska, corn borers emerging from corn fields are the source of infestations in potatoes. Potatoes planted near corn fields are more likely to be damaged than those farther away. Potatoes will be especially vulnerable if nearby corn has not reached the mid-whorl stage during the first moth flight. If potatoes are planted in rotation with corn, volunteer corn in potato fields should be minimized since corn is a preferred host and may increase the attractiveness of the field to moths.

Other foliar pests

Cabbage loopers are occasional pests of potato. The greenish caterpillars make ragged holes in the foliage and are usually found on the upper parts of plants (unlike cutworms). A variety of other leaf feeding insects may occasionally damage potato foliage (grasshoppers, armyworms, blister beetles) but rarely need to be controlled with insecticides. These insects may initially cause damage to plants in the field border rows (grasshoppers, armyworms) or in isolated spots in a field (blister beetles). If detected early, a border or spot treatment may be possible, reducing the cost of control and preventing the insects from moving farther into the field. Generally, the same defoliation thresholds can be used as described for the Colorado potato beetle.

Piercing-sucking Insects

Several insect pests of potatoes have piercing-sucking mouthparts and feed by sucking sap from potato leaves. Injury is caused by removal of sap and nutrients from the plant, or direct injury to plant cells around the feeding site. Additionally some species (e.g., potato psyllid) inject a salivary toxin into the plant while feeding, which directly injures leaf tissue. Other species (green peach aphid, potato aphid) may injure the plant by transmitting viral diseases. Because of these factors, relatively low numbers of certain insects may cause economic damage. Also, many have a relatively rapid reproductive rate and can multiply to damaging levels quickly, so regular monitoring of potato fields is an important aspect of integrated pest management programs for potatoes.

Figure 15. *Green peach aphid*

Aphids — green peach and potato

Two species of aphids (green peach aphid and potato aphid) are commonly found feeding and reproducing on potatoes. Other aphid species, such as buckthorn aphids, can cause damage by feeding and transmitting diseases but cannot complete their life cycles on potato. Aphids may occur as winged or wingless adults or wingless nymphs. Most aphids can reproduce both sexually, producing eggs, and asexually, producing live offspring. They produce many generations during a summer and populations can build rapidly.

The green peach aphid has an oval to almond-shaped body, and the legs and cornicles are the same color as the body (*Figure 15*). When fully grown, they are 1/14 inch long. Typically, they are light blue-green but also may be pink or orange. Green peach aphids either overwinter as eggs on *Prunus* spp. trees (plum, chokecherry, sand cherry, and related species), migrate from more southern locations as winged adults, or may be introduced on vegetable or bedding plant transplants.

The potato aphid is slightly larger when fully grown (1/8 inch long), and more elongate in shape (*Figure 16*). In the adult, the antennae are longer than the body. The color may vary from light green to pink.

Both green peach aphids and potato aphids transmit two important viruses: potato leafroll virus (PLRV) and potato virus Y (PVY). The green peach aphid is an efficient vector of PLRV, which can be a major problem in Nebraska. Once green peach aphids acquire PLRV, they are capable of transmit-

Table II. *Economic thresholds for aphids on potatoes. (Source: Vegetable Insect Management, Foster and Flood, 1995.)*

Production system	Aphids per 25-leaf sample
Fresh market or processing	Early season: 50 wingless aphids (all species) After bloom: 100 wingless aphids (all species)
Fresh marketing or processing in seed production areas	7.5 green peach aphids 50 aphids (all species)
Seed potatoes for potato leaf roll virus management	2.5 green peach aphids (PLRV susceptible varieties) 7.5 green peach aphids (PLRV resistant varieties) 25 potato aphids

Figure 16. *Potato aphid adults and nymphs (Photo courtesy of Jack Kelly Clark, © University of California Regents)*

Figure 17. *Adult and nymph potato leafhopper*

ting it for their entire life. Other viruses like PVY are only retained for a few hours after feeding on an infected host.

A variety of natural controls commonly reduce the survival of aphids on potatoes. Lady beetles, syrphid fly larvae, lacewing larvae, parasitic wasps, and fungal diseases all may contribute to slowing aphid population growth. Use of a variety of control measures (crop rotation, planting virus-free seed) can minimize the need for insecticide use. Where insecticides are applied, use of economic thresholds to determine the need for treatment also can help conserve these natural controls.

To sample for aphids, examine 25 leaves at each of five sites within a field. Count the total number of aphids (winged and wingless) present. Compare this number to those in *Table II*, which provides economic thresholds for different potato production systems (fresh market/processing or seed production). PLRV thresholds for seed potatoes are based on Russet Burbank, a variety that is highly susceptible to net necrosis caused by PLRV.

Potato leafhoppers

The adult and immature (nymph) stages of the potato leafhopper are very similar in appearance (*Figure 17*). They are light green, slender, and wedge-shaped in appearance. The adults are approximately 1/8 inch long. Both adults and nymphs have piercing-sucking mouthparts on the underside of the head that they insert into the plant to feed on plant juices. The wingless nymphs move quickly backwards and sideways in a crab-like fashion on the leaf surface. Eggs are laid in plant tissue and are difficult to observe in the field. Potato leafhoppers feed on a variety of crops including alfalfa, dry beans, and potatoes.

Potato leafhoppers overwinter in the Gulf states and move northward in the spring. On their own, they can fly up to a few miles. Long distance movement is associated with large-scale weather systems that move Gulf moisture northward in the spring. Since these small

insects move with weather systems, their distribution patterns vary tremendously from year to year. They are most common in eastern Nebraska but may be found throughout the state in some years. In Nebraska, several generations are possible each summer.

Potato leafhoppers damage plants by their feeding, which causes a condition referred to as "hopperburn" (*Figure 18*). The first symptom is a brown triangular area at the tip of an infested leaflet. With time, the injured area expands backward into the leaflet. It is not known whether potato leafhoppers inject a toxin when they feed or whether the damage is caused by direct physical blockage of the phloem vessels at feeding sites. Both adult and nymphal leafhoppers injure potato leaves when feeding, but late instar nymphs cause twice as much yield loss as an equal number of adults. Potato leafhoppers are not known to transmit any diseases.

Adult potato leafhoppers are best monitored using a sweep net. Nymphal leafhoppers are monitored by examining potato leaves. A minimum sample size of 25 sweeps per field for adult leafhoppers or 35 leaves per field for nymphs is recommended. Samples should be taken at several locations in a field. Economic thresholds are shown in *Table III*.

Figure 18. *Plant damage caused by potato leafhopper*

Figure 19. *Aster leafhopper (Photo courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org)*

Aster leafhopper

The adult aster leafhopper (*Macrosteles quadrilineatus*) is a light green, slender insect that is about 1/4 inch long (*Figure 19*). It is distinguished from most other leafhoppers by the presence of paired dark spots on its head (giving it a second common name, the six-spotted leafhopper). As adults, aster

Table III. *Economic thresholds for potato leafhoppers. (Source: Vegetable Insect Management, Foster and Flood, 1995.)*

Potato leafhopper abundance	Action recommended
<0.5 adult per sweep	Do not treat unless >0.1 nymph per leaf.
0.5-1 adult per sweep	Treat if adults persist at this level for 10-14 days or if nymphs are present
1-1.5 adults per sweep	Treat within 5-7 days if no nymphs are present, or treat immediately if nymphs present.
1.5 adults per sweep	Treat as soon as possible.

Figure 20. *False chinch bug (Photo courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org)*

Figure 21. *Adult tarnished plant bug*

leafhoppers feed on a variety of plants, including potatoes; however, they do not lay eggs on the plants. The primary threat to potato from aster leafhopper is the transmission of a mycoplasma disease called aster yellows. This disease, however, has not been common in Nebraska.

As with potato leafhopper, sampling for adults is done with a sweep net. A suggested sample size is 25 sweeps per field. Samples should be taken at several locations in a field. The economic threshold usually assumes a 2.5 percent infectivity rate for aster yellows and is equal to 5 aster leafhoppers in 25 sweeps.

False chinch bug

Adult false chinch bugs (*Nysius raphanus*) are about 1/10 inch in length with long, narrow, gray-brown bodies (*Figure 20*). Their nymphs are similar in appearance with faint reddish markings on the body. Their common name refers to their similarity in appearance to the chinch bug, a pest of grain crops. They can be distinguished from the true chinch bug by the absence of a conspicuous black triangle on the outer wing margin and by a head that is about the same width as the thorax (shoulder).

These bugs usually occur in high numbers in spots. They may build up on broadleaf weeds (often cruciferous plants) in alfalfa or pasture areas and then migrate to bordering crop fields after alfalfa cutting, or as their original host is killed. Feeding on potatoes can result in wilting, then browning, and death of young leaves. However, these infestations rarely mandate treatment unless severe when potato plants are very small, or in the early tuber-bulking stage.

Tarnished plant bug

Adult tarnished plant bugs (*Lygus lineolaris*) (*Figure 21*) have a characteristic shiny yellow to brown-black color with a distinctive clear, yellow triangle on the posterior third of the forewing. They are about 1/4 inch long. The adults overwinter in Nebraska and may be early season pests that can complete their life cycles on potato. The green nymphs are small, wingless, and move very quickly when disturbed. They look somewhat like aphids when they are small, but they move rapidly and lack cornicles ("tail-pipes" on the end of the body).

Tarnished plant bug damage to potato is generally confined to flowers and leaflets. Feeding causes upper leaves to wilt and flowers to be aborted; however, these effects do not cause market loss. Feeding by adults and nymphs on older leaves produces irregular holes and lesions on the petiole or midrib, causing distinctive distortion or twisting of leaflets. Tarnished plant bugs also have been linked to transmission of potato spindle tuber virus, which results in oblong-shaped potatoes.

Monitoring may be done using a sweep net. An economic threshold for tarnished plant bugs in potato is 25 bugs in 25 sweeps. Samples should be taken at several locations in a field.

Figure 22. *Potato psyllid (Photo courtesy of Jack Kelly Clark, © University of California Regents)*

Potato psyllid

Potato psyllids (*Paratrioza cockerelli*) are small (1/8 inch long), winged insects that, as adults, resemble cicadas (*Figure 22*). They are related to aphids and leafhoppers. Light-yellow, elongate eggs are attached individually to leaves on a short stalk (1/16 inch long). Immature stages (nymphs) are wingless, pale yellow-green, flattened, scale-like insects. They are differentiated from whitefly nymphs by the presence of external wingpads. Psyllids possess wingpads but whiteflies do not. Psyllids do not overwinter in Nebraska, but adults fly north each summer from overwintering areas in Texas, New Mexico, and Arizona. Psyllids complete a generation in about four weeks. Their optimal temperature for development is about 80°F, but if temperatures exceed 90°F, development ends.

Psyllids feed similarly to aphids, sucking plant juices with their needle-like mouthparts. Nymphs feed on the underside of leaves and move about very little. During feeding, psyllid nymphs inject a salivary toxin that causes a symptom known as psyllid yellows. Feeding by adult psyllids has little effect. Symptoms on affected plants vary by leaf stage. Young leaves are abnormally erect, often colored red or purple, with their basal portions cupped. Older leaves become thickened, roll upward, and turn yellow. Plants may be severely stunted or die if infested early in the season. Affected plants produce abnormally small and/or irregularly shaped tubers, which prematurely produce abnormal (hair) sprouts in storage. Tubers from affected plants are not suitable for use as seed.

Psyllids are not able to withstand freezing temperatures, and, thus, do not overwinter in Nebraska. As a result, crop rotation has no effect on psyllid populations. The pattern of psyllid movement into Nebraska results in the greatest risk of psyllid presence in the western half of the state; however, severe psyllid damage may be seen across the entire state. Populations in Nebraska vary greatly from year to year with some years showing little or no psyllid presence. Psyllids normally begin to enter Nebraska potato fields in late June and July.

Monitoring for this insect is difficult because of its small size and the damage potential of limited populations. Scouting of solanaceous plants (e.g., tomatoes and peppers from gardens, nightshades, and early planted potatoes in fields) may provide early warning of psyllid populations in an area. Sweep net sampling can be used to detect the presence of adults in potato fields. Once psyllids are known to be in an area, more extensive sampling for nymphs should begin in potatoes. Because of the extreme damage potential from this insect and the difficulty in controlling it with foliar insecticides, evidence of psyllids in an area indicates an insecticide application is needed if no soil-applied protection has been applied.

Although control of psyllids with foliar insecticides is difficult, foliar insecticides can provide good control; however, degree of control can be variable. Since nymphs feed on the undersides of the lower leaves, thorough coverage with foliar insecticides that penetrate the entire canopy is necessary for adequate control. Also, because nymphs are difficult to sample and relatively low numbers of nymphs can cause significant damage, it is difficult to properly time foliar insecticide applications. Newly registered soil-applied liquid systemic insecticides (containing imidacloprid and thiamethoxam) have provided good early season control of psyllids. Currently, this is the most effective and reliable method to control psyllids in commercial potatoes.

Whiteflies

Whiteflies may be found feeding on potato. Whiteflies are tiny (1/12 inch long) yellowish insects with white powdery wings, which are found primarily on the undersides of leaves. Immature stages (nymphs) are wingless, pale yellow-green, flattened, scale-like insects resembling psyllid nymphs. After the first molt, the larvae lose their legs and antennae, and become attached to the leaf. At their last stage, which is often called a pupa, they have red eyes (the most easily identified stage). Whiteflies feed like aphids and leafhoppers by piercing the plant and siphoning liquids. Populations of whitefly can become very high (more than five per leaf), but potatoes can tolerate high levels of infestation without being damaged and no treatment thresholds currently exist.

Additional Sources of Information

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