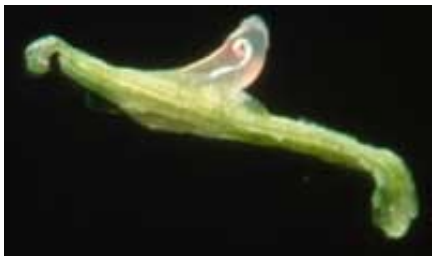
Penn State Extension

Potato Leafhopper on Alfalfa

The potato leafhopper is the most destructive insect to alfalfa in Pennsylvania, causing average annual losses of approximately $15 million. It reduces yields, quality (especially lower protein content), and stand longevity. The stress leafhoppers trigger has increased root rot and stand failures. This damage is especially evident in new seedings.

Description and Behavior

Adult and nymph stages of potato leafhoppers



Potato leafhopper egg

Meadow spittlebug

Adult potato leafhoppers are pale, yellowish green, slightly wedge-shaped, about 1/8 inch long, and have wings. Nymphs are similar to the adults, but are yellow to cream colored (with a faint tinge of green), smaller, and have no wings. Eggs are found in the alfalfa stem and appear clear and gelatinous. Meadow spittlebugs are often misidentified as leafhoppers.

Life History

Potato leafhoppers are migratory insects that overwinter primarily in the states along the Gulf of Mexico, although some may overwinter in southern states along the Atlantic Ocean, because cold winters in the northern United States kill them. During early to late May, storm fronts develop in the Gulf of Mexico, move northward into the Midwest and then eastward into Pennsylvania. These storms transport the leafhoppers. A low-pressure system will stimulate the adults to fly into updrafts that draw them into clouds, where they move with the direction of the storm. Models suggest that these storms can transport the pest from the Gulf to Pennsylvania within five days. Research shows that the down drafts in front of these storms drop adult leafhoppers onto fields. Because of this movement, scouting for this pest after each storm system passes during late spring is a good idea.

Only the adults migrate northward. Immature leafhoppers do not have wings, so they cannot fly into updrafts. During the spring migration north, about 70 percent of the adults are gravid females. They deposit their eggs in alfalfa stems and leaf veins as soon as they reach a field. In warm weather, the insects will mature in about three weeks and very large populations of leafhoppers can build up in a short time. Adults are very active and will fly above the plants when disturbed. Nymphs are also active and will quickly move, usually sideways, when bothered.

Injury / Damage

Both the adults and nymphs feed on alfalfa. They insert their mouthparts into the plant tissue to extract the juices. This feeding process distorts and blocks the tiny tubes that distribute nutrients within the plant, which causes yellow triangles on the leaves ("hopper burn") and stunted plants (insert a picture of their damage). The alfalfa may also turn a reddish or purplish color. Stunted plants do not recover until the stems have been harvested, after the leafhoppers are eliminated. The buds will then begin to grow. Although potato leafhoppers can be found from late May until frost, the bulk of damage is done from mid-June to mid-August during the second, third, and fourth cuttings. Normally, the adults stop reproducing and populations drop off sharply after mid-August.

Sampling Information

When to Sample for Potato Leafhoppers:

On new spring seedings: Start sampling about June 5, or when the plants are 3 inches high (if this occurs after June 5). Resample at weekly intervals until the field is sprayed, or until 10 days before harvest.

On new summer seedings: Limited information exists on leafhopper damage to July and August seedings. To be safe, start sampling when the plants are 2 inches high and resample at weekly intervals until mid-September.

On all second and third cuttings: Start sampling when plant regrowth is 2 to 3 inches high. Resample at weekly intervals until the field is sprayed, or until 10 days prior to harvest.

Equipment Needed:

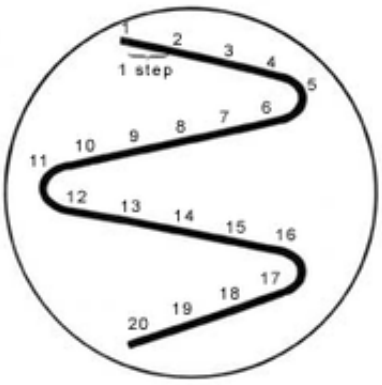
To sample alfalfa, you need an insect net with a 15-inch diameter hoop and a tightly knit bag such as muslin. Satisfactory nets can be homemade (see below). A yardstick can measure the plants height.

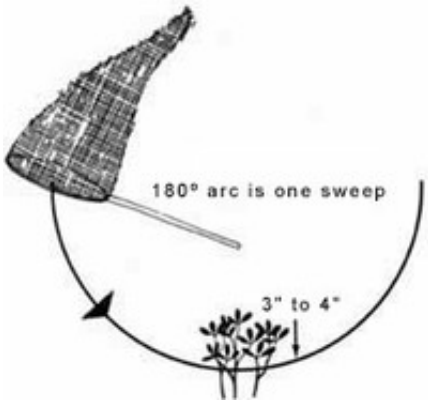
Sampling Procedure for Potato Leafhopper:

In square or rectangular fields, follow a "U" pattern. In narrow strips, an "I" pattern will work best. Sample five sites in each in either the "U" or "I" pattern. You can sample the fields any time of the day when the alfalfa is dry. Avoid sampling in cold or windy weather or when the alfalfa is wet.

Step 1: Make 20 pendulum sweeps with the net at each site, sweeping 3 to 4 inches below the tops of the plants. Don't stop swinging until you complete 20 sweeps. Collect samples from each site following a zigzag pattern, and take one or two steps between each sweep.

Possible pattern to make 20 sweeps at each site. (get image from the Field crop IPM manual for potato leafhopper sampling).

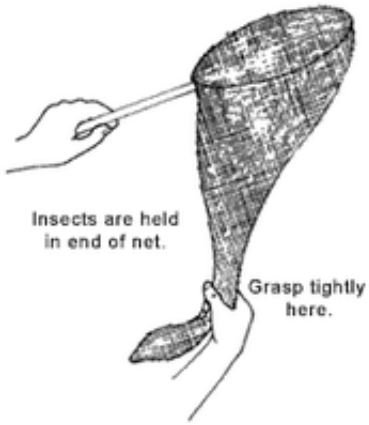




Possible pattern to make 20 sweeps at each site.

Step 2: When you complete 20 sweeps, continue swinging the net several times to force the insects into the small end of the bag. Quickly grab the bag about 10 inches from the small end to trap the insects.

Step 3: Count and identify the potato leafhoppers you collected. Remember, only count the pale green (nymphs are yellowish green) leafhoppers and disregard any brown ones. You must be alert when opening the net: adult leafhoppers are very active and can easily escape without being noticed. Unfold the net slowly and let the insects escape a few at a time, counting them as they appear. Be careful to check the interior walls of the net for nymphs. They cannot fly and will be walking or clinging to the cloth.



It may be easier for you to kill the insects before counting them.

Make a note of the total number of leafhoppers. Repeat the same procedure at the next four sites, which completes your 100 sweeps of the field.

Step 4: Calculate the average number of leafhoppers per sweep. For example, if you collected a total of 60 leafhoppers, find the average per sweep by dividing 60 by 100, which equals 0.6 leafhopper. When the leafhopper population is high (40 or more in 20 sweeps) at the first site, spending time sampling the other four sites is of little value.

The sequential sampling method can also reduce time spent scouting a field. See the Department of Entomology's Field Crop IPM Manual at (insert Web address) for instructions and sequential sampling tables.

How to Make an Insect Sweepnet

A sweepnet is necessary to monitor potato leafhopper populations in a field. Insect nets can be purchased for approximately $15, but are not widely available. Materials to make a net can be found on most farms.

Use a solid piece of wood about ¾-inch in diameter and 2 ½ to 3 feet long as the handle. A broom handle cut to length is suitable.

The hoop can be a piece of heavy-gauge wire or thin steel rod. You need a piece 53 inches long. Securely fasten the ends of the hoop to the wooden handle by tightly

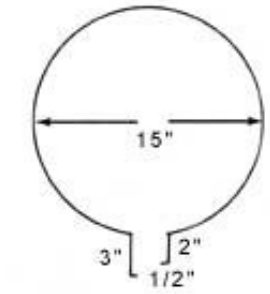
wrapping them together with light wire, such as baling wire, or by slipping a metal sleeve

onto the handle and over the hoop ends.

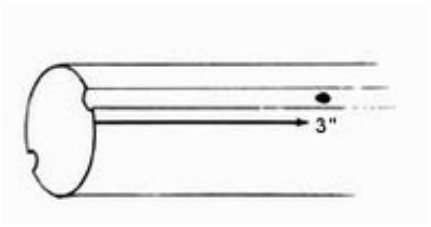
To make the net, you need two pieces of cloth measuring 24 x 36 inches. Heavy muslin or tightly woven nylon cloth will do.

Step 1: Form the hoop into a 15-inch circle and bend the ends as shown. Bend one end 2 inches from the tip and the other about 3 inches from its tip. Now bend ½ inch of both tips toward the insect.

Step 2: Groove and drill the handle for the ends of the hoop. Cut the grooves no wider or deeper than the diameter of the wire: you want a snug fit. One hole will be approximately 2 inches and the other 3 inches from the end. Check placement of the holes with your hoop before drilling. Drill two holes through the handle for the hoop tips.



Step 1



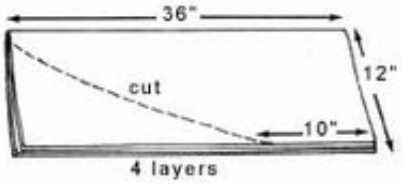
Step 2

Step 3: Construct the net by placing the pieces of cloth (24 x 36 inches) on top of each other. Fold both pieces lengthwise and cut the cloth in an arc from the point of the fold to 10 inches from the top. Unfold into two bullet-shaped pieces. Sew the edges using a ½ inch seam. Do not sew the top 10 inches on either side.

Take the top half of the net and double down the loose top 5 inches. Double it down again and sew securely using a 1/2 inch seam. This process has made a channel to slide the hoop through.

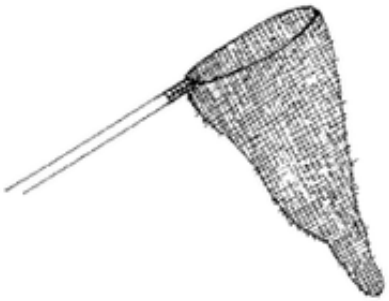
Repeat this process on the other half of the net. Your net is now constructed. You may wish to double sew all seams to reinforce the stitching.

Step 4: Assemble the sweepnet. Slide the hoop through the channel at the top of the net. Fit the hoop ends into the grooves and holes on the handle. Secure the hoop to the handle with wire or metal sleeve.



Step 3

Step 4



Step 5: Your net is ready for use.

Determining Economic Injury Threshold

Four factors help determine whether an insecticide application for potato leafhopper control will be profitable: (1) the number of pests present in the field, (2) the development of the plants, (3) the value of the crop, and (4) the costs of the control application.

1. An insect net is the most practical method developed to obtain the number of leafhoppers present in the field. By following the monitoring procedures previously described, you can get a reasonable leafhopper estimate. The table is calculated on the average number of potato leafhoppers in one sweep, counting both adults and nymphs. If you make 100 sweeps and collect 50 leafhoppers, the average per sweep is 0.5 leafhopper.

2. The height of the plants indicates their development. A relatively low number of leafhoppers can inflict high losses to the crop if they are present in the field when the plants are small. Greatest crop losses occur before the alfalfa plants reach 6 inches in height. Plants

12 inches and taller can better tolerate leafhopper feeding.

3. The higher the crop value, the lower the economic injury threshold. With equal pest populations, spray protection will be more profitable on a crop valued at $140 per ton than on a crop valued at $60 per ton.

4. As the costs of applying control measures increase, losses from pests can also rise before an application is profitable.

The variability of each of these factors shows the fluctuation of the economic injury threshold. The pest injury threshold should be adjusted to compensate for each of these changes. These adjustments have been calculated in Table 1.

A few factors should be taken into account when deciding to spray or harvest alfalfa over 12 inches tall. If the leafhopper injury threshold is reached and the alfalfa is less than 50 to 60 percent in bud, a spray is suggested immediately. However, if the crop is 60 percent or more in bud, it will probably be more advantageous to harvest the field within a week rather than spray.

Table 1: Economic injury level of potato leafhoppers: average number of leafhoppers per net sweep.

How to use the table below: 1. Use the plant height category that reflects your fields (Leafhopper sprays are seldom profitable for plants over 12 inches). 2. Estimate the value of your crop in dollars per ton of hay and calculate the cost to spray per acre. 3. From the monitoring field, find the average number of leafhoppers per net sweep. 4. The number in each small box is the average amount of potato leafhoppers per sweep for a spray application to be profitable in the given situation.

Example: Plants in field no. 1 are 3 inches high, hay is valued at $100 per ton, cost of spray is $10 per acre, and you have 35 leafhoppers in 100 sweeps (average of .35 per sweep). The number in the box is 0.3. The leafhopper population in your field is slightly above the injury threshold so spraying will be profitable. If the leafhopper population averaged less than 0.3 per sweep, spraying would not be profitable.

NOTE: The economic injury levels in this table are based on limited research and are intended to be used only as an aid to predict when estimated losses from leafhoppers will exceed the cost of control spray application.

Economic Threshold for Potato Leafhopper

Average Number of Leafhoppers/Sweep

Value of Hay ($/ton)	Plant Height (inches) 0 to 4				4 to 8				8 to 12			
	$12	$14	$16	$20	$12	$14	$16	$20	$12	$14	$16	$20
120	.34	.37	.38	.50	.50	.53	.69	.85	1.42	1.73	2.10	2.49
140	.30	.32	.35	.43	.43	.45	.57	.70	1.21	1.49	1.78	2.08
160	.27	.29	.30	.38	.38	.38	.49	.60	1.05	1.31	1.55	1.77
180	.25	.26	.27	.33	.33	.34	.42	.52	.93	1.16	1.37	1.54
200	.23	.24	.25	.30	.30	.30	.37	.46	.84	1.05	1.23	1.36
220	.21	.22	.23	.27	.27	.27	.33	.41	.76	.96	1.11	1.22
240	.20	.20	.21	.25	.25	.26	.30	.37	.69	.88	1.01	1.10
260	.19	.19	.20	.23	.23	.24	.27	.34	.64	.81	.93	1.00
280	.18	.18	.19	.21	.21	.22	.25	.31	.59	.76	.86	.92
300	.17	.17	.18	.20	.20	.21	.23	.29	.55	.71	.80	.84
320	.16	.16	.17	.19	.19	.20	.21	.27	.51	.66	.75	.78
340	.15	.15	.16	.17	.17	.18	.19	.25	.48	.63	.70	.73
360	.14	.14	.15	.17	.17	.17	.18	.23	.45	.59	.66	.68
380	.14	.14	.15	.16	.16	.16	.17	.22	.43	.56	.62	.64
400	.13	.13	.14	.15	.15	.15	.16	.20	.41	.53	.59	.60

Cost of Insecticide & Application Per Acre

Management Tactics

Several options exist to manage leafhopper population in alfalfa: insecticides, resistance cultivars, and early cutting. The Penn State Agronomy Guide (agguide.agronomy.psu.edu) has up-to-date lists of insecticide products, recommended rates, and other guidelines. For alfalfa producers who prefer to avoid insecticides, the use of potato leafhopper resistant plant varieties is a good option. These strains have better agronomic characteristics and a similar yield potential to nonresistant types. The cost of these varieties has decreased, making them more economical.

Some of the earlier releases were not as hardy and tended to require insecticide applications when leafhopper pressure was high. Only 40 to 60 percent of these cultivars were resistant; more than 70 percent of new strains are resistant. This resilience is the result of multiple factors, including dense hair that exudes a sticky substance to bar nymphs. This substance could have insecticidal properties. Potato leafhopper resistant alfalfas are not the same as non-yellowing varieties. These strains only hide damage symptoms and do not prevent yield loss. Early cutting can be used if the economic threshold has not been reached until after the alfalfa is 12 inches high. At this point, traveling across the field will cause an equal or greater stand loss than early harvesting. It is best to harvest about five days early, when protein levels are high, to offset the total yield loss.

Some alfalfa producers like to spray the plants' stubble because they feel it reduces losses

from the tractor tires and allows them to spray for potato leafhopper at the same time they apply an herbicide or fertilizer. Although this technique sounds good, stubble applications seldom provide good leafhopper control. (Individuals define stubble differently. Some refer to alfalfa that has 2 to 4 inches of regrowth as stubble. Spraying an economic infestation when alfalfa is 2 to 4 inches tall will provide good leafhopper control.)

Warning

Pesticides are poisonous. Read and follow directions and safety precautions on labels. Handle carefully and store in original labeled containers out of the reach of children, pets, and livestock. Dispose of empty containers right away, in a safe manner and place. Do not contaminate forage, streams, or ponds.

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