



Alfalfa IPM: Sampling Alfalfa Insects

Bill Hutchison
Entomology

Goals of Sampling

Correct identification and efficient sampling methods for beneficial and pest insects are two critical steps toward implementation of integrated pest management (IPM) programs. IPM includes the use of all feasible control tactics (e.g., crop rotation, resistant hybrids and chemical control) to manage pests within a profitable, yet environmentally sound production system. Efficient sampling methods are necessary for making accurate and timely evaluations of insect population (infestation) levels. These estimates can then be used for comparison with economic thresholds and consideration of appropriate management tactics.

To assist in identifying alfalfa insects and damage symptoms see FS-0571, *Common Forage Legume Insects* (color photographs), FS-0582, *Some Important Chewing Insect Pests of Alfalfa* (line drawings with a key), FO-5510, *Blister Beetles in Alfalfa*, or contact a Minnesota Extension Service (MES) county office. Current economic or action thresholds are available at MES county offices. Also refer to BU-0500, *Insecticide Suggestions to Control Insect Pests of Field Crops* (revised annually).

Early Detection—Insect mortality can result from starvation, desiccation and exposure (conditions which often occur when alfalfa is cut), as well as from predators, parasites, disease and insecticide applications. Most insects are more vulnerable to each of these factors when they are young. The lowest labeled rates of insecticides can often provide effective control when treating young (immature) insects. Hence early detection is advantageous. Nevertheless, control action is still appropriate only when yield and quality savings justify control costs.

Sampling Frequency

For production of high yielding, high quality alfalfa, the crop should be checked weekly. In cooler weather sampling can be done less frequently. In hot weather, however, sampling frequency should be increased (insects develop, feed and reproduce faster under warmer conditions). Shorter sampling intervals are also necessary as insect populations and/or damage approach economically damaging levels. The scouting schedule on page 4 summarizes when sampling should be directed toward particular insect pests.

Sampling Methods

Three methods of sampling are recommended in Minnesota for scouting alfalfa insects: 1) sweep net sampling; 2) stem sampling; and 3) ground area sampling (e.g. square foot, yard, meter, etc.).

Samples from several different locations in a field are necessary. This ensures that insect populations sampled are representative of insects in the field as a whole. Five locations are usually advised, but more may be necessary in fields with a wide range of diversity in soil type, crop maturity, slope, etc. Choose sampling locations in proportion to the relative area in the field of each condition. **Figure 1** illustrates one way to obtain a representative sample.

Sweep Net Sampling—This is currently the most convenient method of estimating many of the pest and beneficial insect populations in alfalfa. Although it provides only a *relative* estimate of insect density, it is sufficient and cost effective for most above ground insect pests of Minnesota alfalfa. Sweep net sampling *is not* recommended for determining absolute estimates of alfalfa weevil, cutworm, armyworm, grasshopper, or aphid populations. However, the sweep net is often useful for detecting initial low-density populations of alfalfa weevil larvae and pea aphids.

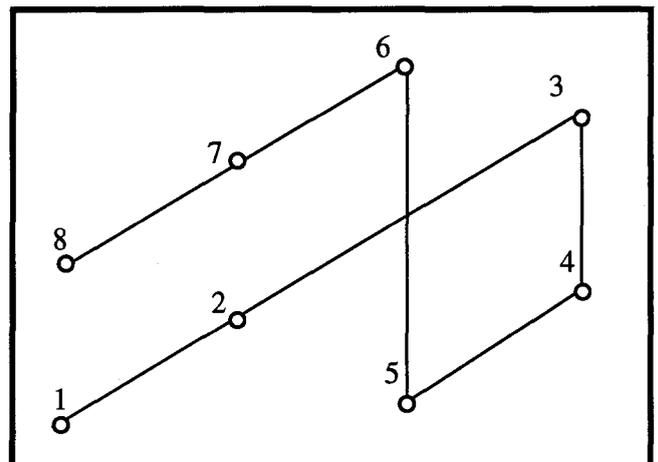


Figure 1. Suggested sampling plan for obtaining representative estimates of alfalfa insect populations. Circular or "W" shaped patterns may also be used.

A 15" diameter heavy duty sweep net is required if results are to be comparable with the thresholds provided. In Minnesota, threshold data is expressed in numbers per pendulum sweep. With this method the net is swung from side to side on a more-or-less vertical axis sweeping down into the alfalfa first in one direction and then the other (2 sweeps). It is important to have the net as low to the ground as practical (or top 2/3 of canopy in tall alfalfa) and to walk briskly when sampling. 180-degree sweeps, which are more horizontal and wider, are used by some workers, but most thresholds used in the midwestern states are based on pendulum sweeps.

After 10 or 20 pendulum sweeps, quickly shake the net contents to the bottom of the bag. Grasp the net bag firmly above the sample to prevent escape. The sample may then be emptied into a plastic bag for later identification and counting, or counted in the field. Insects can also be counted in the net. For this the insects are allowed to escape very slowly, as the base of the net is gradually opened. It is useful to carry small vials to collect insects requiring further identification.

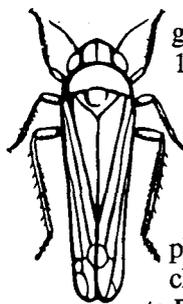
Stem Sampling—Stem sampling is used for monitoring tip injury in alfalfa, and obtaining more accurate estimates of alfalfa weevil and pea aphid abundance than is possible from sweep samples. The only tool needed for this method is a carton or bucket in which to place the stems, or a tray onto which to shake the aphids or larvae from the stems.

Ground Area Sampling—Grasshoppers need to be estimated as the number per square yard; cutworms, armyworms and post-harvest alfalfa weevils as the number per square foot. A sampling frame, 1 foot square, made of heavy wire, plastic or wood, and painted a bright color to reduce the likelihood of loss, is useful for square foot sampling of insects as well as for measuring alfalfa stand density.

Weather affects sampling efficiency—Do not take sweep samples when the alfalfa is wet, or under extremely windy conditions; the results will be meaningless. Sampling in still air is preferable to sampling in a light breeze, but is not often possible. Wind has been shown to reduce the efficiency of sweep-sampling adult potato leafhoppers (PLH); see PLH section for details. Sampling in winds of more than 10 mph is not advised. Insects are more active, and hence more visible and catchable, in warm weather. Cool conditions reduce the efficiency of sweep sampling adult PLH (see PLH section for details). Other insects are similarly affected; consider this when interpreting numbers caught.

Although there are several sources of sweep nets, two common sources for standard 15" diameter sweep nets are: Wards Natural Science Estab., Inc., P.O. Box 92912, Rochester, NY 14692-9012, 1-800-962-2660; and Pest Management Supply, Inc., P.O. Box 938, Amherst, MA 01004, 1-800-272-7672.

Potato Leafhopper



When—Potato leafhopper (PLH) migrates into the state each spring (May 1 - June 15). Consequently, only second and third cuttings or recently established stands should be monitored. Monitoring for PLH may be concluded 7-10 days before harvest, since PLH cause little injury to more mature growth. First growth of spring planted seedling alfalfa should be checked closely for PLH, as it is much more sensitive to PLH injury.

Table 1. PLH Sequential Sampling Plan

Crop ht. (in.)	Cumulative number of PLH/10 sweeps				
	Sample (site) #	Don't treat (\leq)	Continue sampling	Treat (\geq)	
<3	3	2	3-8	9	
	4	4	5-10	11	
	5	5	6-12	13	
	6	7	8-14	15	
	7	9	10-15	16	
	8	11	12-17	18	
	9	13	14-19	20	
	10	15	16-21	22	
	3-7	3	9	10-19	20
		4	14	15-24	25
5		18	19-29	30	
6		23	24-34	35	
7		28	29-39	40	
8		33	34-44	45	
9		38	39-48	49	
10		43	44-53	54	
8-12		3	19	20-40	41
		4	29	30-49	50
	5	39	40-59	60	
	6	49	50-69	70	
	7	59	60-79	80	
	8	69	70-89	90	
	9	79	80-99	100	
	10	89	90-109	110	
	>12	3	44	45-74	75
		4	64	65-94	95
5		84	85-114	115	
6		104	105-134	135	
7		124	125-154	155	
8		144	145-174	175	
9		164	165-194	195	
10		184	185-214	>215	

How—Recent research from Cornell University indicates that, on average, 3-5 sets of 10 sweeps each will provide accurate estimates of PLH density. In very early regrowth, in which it is difficult to standardize sweeping efficiency, at

least four 10-sweep samples should be taken per field. The sequential sampling plan for PLH is shown at left (Table 1). As indicated, a minimum of three 10-sweep samples must be taken (also see Figure 1). The plan is very useful when PLH populations are low or high, with an average time savings of 50% when compared to a traditional 100-sweep sample (ten 10-sweep samples). As with our traditional thresholds for PLH (Table 2), the sequential plan accounts for differences in plant height. When using the plan, if the total (cumulative) number of PLHs caught falls in the "continue sampling" column, you must move to at least one more site to take an additional sample before a treatment decision can be made. Whenever the total number of PLH falls in the "Don't treat" categories, then you can stop sampling and advise the producer accordingly.

Table 2. PLH Economic thresholds

Plant ht. (in.)	PLH/Sweep
<3	0.3
3-7	0.5
8-12	1.0
>12	2.0

Weather—Cool conditions reduce the efficiency of sampling adult PLH; at 60° F the catch is 56% of that at 77° F. The table below shows the effect of wind on the efficiency of sweep-sampling adult PLH. Also, 180-degree sweeps are much more severely affected by wind. Use pendulum sweeps, and do not sweep-sample when winds are over 10 mph. When sampling in a light wind a small, hand-held anemometer will enable you to adjust catch figures upward according to windspeed.

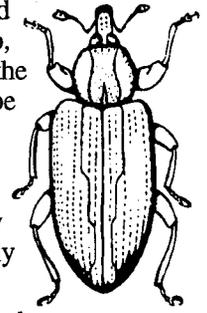
Table 3. Effect of wind on efficiency of sweepnet sampling potato leafhoppers (from Cherry, Wood & Ruesink, Illinois)

Wind speed (mph)	% Catch by	
	Pendulum sweeps	180 degree sweeps
0	100	100
5	66	41
10	43	16
15	29	7—Avoid sampling

What to count—Sweep sampling does not sample potato leafhopper nymphs as effectively as adults, but as yet there is no other method convenient enough for commercial use. When examining the sweepnet contents, open the bag carefully since many of the adult leafhoppers will readily escape. Total the numbers of both adults and nymphs to determine the average number of leafhoppers/sweep. More emphasis should be placed on samples taken during 3-7 and 8-12 in. plant growth stages.

Alfalfa Weevil

When—Alfalfa needs to be checked for weevils before harvest of the first crop, and post-harvest, on the stubble after the first cutting. The earliest larvae tend to be found on south facing slopes, as early as May 1 in years with an early spring. Generally larvae are rare or absent by the time of second cut. Some larvae may hatch from fall-laid eggs, but these rarely reach economic levels.



How—A variety of methods are used in different parts of the U.S. to determine whether economically damaging levels of alfalfa weevil are present. The Illinois method, which measures and integrates crop growth stage, intensity of weevil infestation, and progress of the infestation, is the most accurate, but has not yet been calibrated for Minnesota conditions.

Meanwhile, monitoring tip injury is often recommended as a pre-harvest method. This method is relatively simple to do and appears to be adequate for management purposes. It provides a good rule of thumb estimate for the pre-harvest damage potential of alfalfa weevil.

Fifty to 100 alfalfa stems, (10 to 20 randomly selected stems from each of 5 locations) are collected and examined for whether they show obvious feeding damage—pinhole or more severe feeding—in the rapidly growing tip leaves and leafbuds.

The number of stems with recent tip injury is divided by the total stems collected, converted to a percent, and compared with the threshold. **Do not** confuse percent of tips showing feeding damage with percent of stems defoliated.

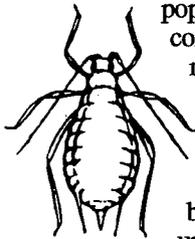
For post-harvest, it is necessary to monitor regrowth and potential stubble infestation. After the hay has been picked up, the stubble and early regrowth in 20, one square foot samples (4 randomly chosen from each of 5 locations) is searched. As harvesting often concentrates weevil larvae in the windrow areas of the field it may be useful to sample first (or only) from windrows. When regrowth after harvest is sufficiently long to make square-foot counts too difficult, revert to monitoring tip injury.

Table 4. Alfalfa Weevil thresholds

Before 1st Cutting
35% (weak stand) plants with feeding damage
40% (vigorous stand) plants with feeding damage and/or
2 live larvae/stem
After 1st Cutting
8 or more larvae/ft ² , (6/ft ² on sandy soil); or larvae are suppressing regrowth

Pea Aphid

When—The immature nymphs and subsequent adults arise from overwintered eggs (northern states). Early spring populations are often heavily parasitized by braconid wasps. Generally it is not necessary to monitor or control pea aphids earlier than 2-3 weeks before alfalfa harvest. Aphids are usually maintained below economically damaging levels by natural enemies. Locally higher densities are generally reduced by predators, parasites and disease. However, under dry, warm conditions, pea aphid infestations may increase rapidly. If aphids are extremely abundant on seedling alfalfa or early regrowth, control may be necessary.

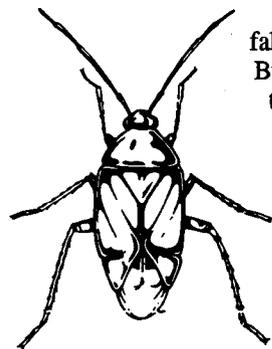


Alfalfa can tolerate fairly high pea aphid populations. Stem counts need not be taken until about 1/4 cup of aphids are found per 20 sweep sample. **Threshold:** Insecticide treatment for pea aphid is justified if populations 14 days prior to harvest exceed an average of 1.2/stem.

How—The simplest and most accurate method of taking actual counts of pea aphids is to estimate numbers per stem. This is somewhat similar to stem sampling for monitoring tip injury due to alfalfa weevil. Six to 10 stems randomly selected from each of 5 field locations are shaken in a carton or over a tray and the average number of aphids/stem calculated. The stems must be very carefully cut and handled since pea aphids readily fall from the plant when disturbed.

Plant Bugs

Three species attack Minnesota alfalfa: Tarnished Plant Bug, Alfalfa Plant Bug and Rapid Plant Bug. Of the three, the Tarnished and Alfalfa Plant Bugs are the more consistent pests. Both the immature nymphs and adults (wings) suck plant juices from the stems, leaves and flower buds. Subsequent damage may be characterized by crimped leaves (feeding notches from either side of the leaves), stunted plants or aborted flower buds.



When—Plant bugs overwinter as adults. Significant nymphal populations are usually not present until late-May to early-June, as the spring crop approaches maturity. Populations are usually highest on the second and third regrowth cycles.

How—Although plant bugs are often considered significant pests in seed production fields, recent research (University of Wisconsin) suggests forage yields may also be reduced by their direct feeding on vegetative growth. Action thresholds resulting from this research range from 3-5 bugs/pendulum sweep (nymphs + adults of both species combined). If the Alfalfa plant bug is the dominant species, the threshold should be lowered to 2-3/sweep. Check for plant bugs when sampling potato leafhopper; for plant bugs, 4-5 sets of 10 sweeps each should provide a representative sample.

Seasonal Schedule for Insect Scouting in Alfalfa

Spring Growth

Estimate percentage of terminals injured by alfalfa weevil and check for live larvae. Sweep net sample for pea aphid; if abundant, stem sample. Observe if unusual numbers of spittlebug nymphs, plant bugs, grasshoppers, cutworms or other occasional pests are present.

Second and Third Growth

Check stubble to see if alfalfa weevil larvae are feeding on and retarding growth. Sweep net sample for potato leafhopper. Stem sample for pea aphid 2 weeks prior to harvest if large numbers are detected in sweep net samples. Observe if unusual numbers of cutworms, plant bugs, grasshoppers or other occasional pests are present.

Fourth Growth (if applicable)

Sweep net sample for potato leafhopper. Stem sample for pea aphid if large numbers are detected in sweep net samples and alfalfa is drought stressed. Observe if alfalfa weevil adults or larvae are present, or unusual numbers of cutworms, plant bugs, grasshoppers, or other pests.

Newly Seeded Alfalfa

Intensify all surveys since seedling stands are more susceptible to injury than established stands. Recent research in Minnesota indicates that in some years, up to two insecticide treatments may be needed to prevent yield and quality losses to PLH on spring-seeded alfalfa during the establishment year. Good PLH management during the first year may also be important for long-term health and productivity of the stand.

Summary

Because it is very difficult to predict each year what insect pests will be most important, several Minnesota Extension specialists contribute timely agronomic and pest (insects, diseases and weeds) related articles to the *Plant Pest Newsletter*, published weekly during the growing season. Articles in the newsletter will alert you to specific times and locations within the state where specific pest problems are developing. The annual fee will quickly pay for itself. To order, send a \$20.00 check made payable to the University of Minnesota to:

Plant Pest Newsletter
University of Minnesota
Dept. of Plant Pathology
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