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Michigan State University

Cooperative Extension Service

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Issued April 1976

4 pages

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NO. 11

Management for Alfalfa Weevil Control

Extension Bulletin E-739 • April 1978

Cooperative Extension Service • Michigan State University

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The alfalfa weevil is a European species that entered the United States twice; in 1904 in Utah, and in 1950 in Maryland. The weevil spread westward from Maryland and was discovered in Michigan in 1966. It increased rapidly and now threatens alfalfa throughout the state.

The rapid increase of the weevil occurred, in great part, because the weevil arrived in the New World without the natural enemies (parasites, predators, and diseases) that suppress its numbers in Europe. Some of these natural enemies from Europe have now been introduced into Michigan. A small wasplike parasite, *Microtonus aethiopoides*, appears to be especially promising against the weevil. *M. aethiopoides* has been distributed throughout Michigan with the cooperation of extension agents and growers. It has increased very well and should reduce weevil numbers in the near future.

Alfalfa varieties that are less damaged by the weevil than the present commercial varieties have been developed. The resistant varieties are effective in states to the south, but are not well adapted to Michigan conditions. Varieties of alfalfa are under study and will be recommended when a well-adapted, resistant variety is found.

It will be several years, perhaps, before parasites, resistant varieties, or new means of protecting our alfalfa from the weevil can be proved. Until these better methods are available, we will have to rely on management practices and insecticides to reduce our losses. Knowledge of the weevil and an analysis of your own operations are needed to plan for this. The identification, time of appearance, means of checking the fields, indices of the numbers of weevils needed to justify control, and alternative control methods are outlined in this bulletin. We urge you to study the alternatives and select the one that best fits your operation.

Recognizing the Alfalfa Weevil

Alfalfa weevils overwinter as adults in alfalfa fields, fence rows, woodlots, and other sheltered places. Adult weevils (Figure 1) are gray to brown snout beetles, $\frac{1}{4}$ inch long, with a broad dark band extending to the middle of their backs. They become active on the first warm days of spring and are most active on warm nights and cloudy, windless days. They feed on alfalfa as soon as growth begins, but do not lay any eggs until they have fed for approximately two weeks. They

feed by chewing holes through the young leaves of alfalfa.

Females chew small holes in dead or living stems of alfalfa or other plants and lay up to 50 small, round, yellowish-to-brownish eggs inside the hollow stems. The young grubs which hatch from these eggs move out of the stems and feed on the tips of alfalfa. As they grow larger, they begin eating the leaf tissue, leaving only the veins which gives damaged leaves a skeletonized appearance (Figure 2). Weevil grubs have a black head and a legless, cylindrical, wrinkled body. They are nearly white just after hatching, but become green with a prominent white stripe down their backs as they grow larger. When full grown, they are about $\frac{3}{8}$ inch long (Figure 3). Alfalfa weevil adults and grubs feed on other plants, but their damage is restricted to alfalfa.

Full grown grubs make a coarse silken cocoon (Figure 4) on or near the plant where they transform to a quiet stage (the pupa). Adults emerge from their cocoons from mid-June to mid-July and begin feeding on alfalfa. These new adults feed only a short time and ordinarily cause no damage. After feeding, most adults leave the field, seek sheltered places, and become quiescent. Some adults settle near the crowns of the alfalfa itself for the hot summer months. Most of the adults remain quiet until the following spring, but some become active and feed and lay a few eggs in the alfalfa during the fall. These eggs do not survive our winters. The adults all become active in the



Figure 1. Adult alfalfa weevil.

spring and those that were out of the alfalfa return to begin a new cycle.

Checking the Fields

Timing. About half of Michigan's alfalfa is threatened by the weevil. The *only way* to know if your alfalfa will need protection or not is to check the fields for the pest. The field checks should start early, as the weevil must be spotted in time to *prevent* its damage. The weevil does not appear in all fields at the same time and can increase rapidly under the proper conditions. The fields should be checked regularly to avoid surprises from the pest.

The weevil can damage the first cutting and regrowth following the first cutting. Checks for the weevil should continue until the regrowth for the second cutting is well established (roughly, six inches tall). The time of the first bud is an especially critical time to check for the weevil grubs. If the eggs are hatching well, some small grubs and their feeding can be seen at the first bud stage. Little damage is done at this time, however, and there is time to prevent damage if the weevil is detected at the first bud stage. We strongly urge that the alfalfa be especially well checked at the first bud stage.

Areas. The weevil can be more abundant in one field than in another field, and in one area of the field than in other areas of the same field. Checks should, therefore, be made in several areas of each field. Areas that differ in slope, soil, drainage, or in some other factor that affects the growth of the alfalfa should be checked separately for the weevil. Young regrowth from early green chopping is especially vulnerable to weevil damage. Green chopped areas should be checked carefully for weevil damage.

Adults. The presence of the adults is an early warning of weevil problems. Make frequent checks of the young leaves for the round-to-elongate holes made by the adults starting with the first warm spell (temperatures of 50°F. or more) in the spring. The adults themselves may be out on the leaves or hidden near the bases of the plants. Fields where adults or their damage are common should be held suspect and checked especially frequently for the grubs.

Grubs. The grubs can also be detected by their damage. Pick samples of 20 stem tips from several different areas of the field, and look for the small holes or skeletonized areas made by the grubs and for the grubs themselves. The small grubs may be hidden in the bud and have to be shaken out. Count the number of the 20 tips showing any damage of the weevil as an index of the weevil infestation.

Sweep Net. An insect sweep net is the best means of detecting weevils and of estimating their numbers. An insect sweep net is described in Extension Bulletin E-986 "Construction and use of an insect sweep net," available from your county extension agent. An estimate of expected loss from the weevil can be made from a sweep sample (see below). Samples of 20 sweeps each should be taken and the number of grubs found in the sample counted. Many other pests of alfalfa (see Extension Bulletin E-827 "Insect control

in hay, forage and pasture crops") can also be detected readily with an insect net. Use a standard 15-inch diameter insect net if alfalfa is important in your operation.

Alfalfa Weevil Management Alternatives

STRATEGY 1. THE GENERAL PROGRAM.

As noted, about half of our alfalfa is actually threatened by the weevil, but there may well be no need to spray your alfalfa. Much of the loss from the weevil occurs after the plants approach late bud stage. Early cutting can, therefore, reduce the losses from the weevil. This early cutting is strongly recommended by agronomists as a means of obtaining top hay quality and managing a three-cut or four-cut system. Early cutting to avoid weevil loss is really a bonus for good management.

A good general program is to start checking your fields early for adults to spot possible weevil problems. Then check tips for grubs, especially in those fields where adults are common. A rule of thumb is that spraying is needed if $\frac{1}{4}$ or more of the tips show damage *and* the alfalfa will not be cut for a week or more. This is a rough guide only to the probable need for protection. A sweep net can be used (see Alternative 2 below) to obtain an estimate of the benefit from a spray.



Figure 2. Damage of the alfalfa weevil.



Figure 3. Alfalfa weevil grub.

There are several things that you can do if the criteria for the above rule of thumb are exceeded, depending on the value of the alfalfa to your operations, the urgency of other farm needs, and the weather.

1. Cut the hay as soon as possible to avoid some loss.
2. Spray the hay with one of the insecticides cited in Table 2.
3. Do nothing and absorb the loss. We are not being facetious on this point; many growers, knowing that their alfalfa was threatened, have decided that the threatened loss was not worth the cost, time, and trouble of the control.

We have had rather poor control with insecticides used against heavy infestations of weevils in mature alfalfa. If the alfalfa is heavily infested at the time the weevil is detected, cut it immediately without spraying. The hay should be removed from the field as soon as possible. Check the stubble and regrowth for grubs and apply a spray if the grubs are easily found.

STRATEGY 2. COST/BENEFIT ANALYSIS.

Samples of 20 sweeps with an insect net taken at the first bud stage can be used to obtain fairly accurate estimates of loss. Deducting the costs of the control from this expected loss will give the expected net benefit from the control. This alternative has some limitations in that a sweep net must be used, the sample must be taken at the first bud stage, and there is little lead time between the sampling and the application if it is needed. We strongly recommend the use of this alternative, however, as it does give you a firm base for your decision on whether to spray.

The computations involved and an example of them are shown in Table 1. They are also available as a "Weevilcost" computer program available from some county extension agents. The table can be used by:

A. Taking samples of 20 sweeps each from 4 to 5 different areas of the field at the time of the first bud, counting the number of weevil grubs in each sample, and determining the average number of grubs per sample;

B. Deciding whether the alfalfa will be cut closer to first flower, or closer to full bloom stage of development;

C. Looking up the expected daily loss in Table 1 that corresponds to the average number of grubs in the sweep samples and the expected time of cutting;

D. Estimating the expected number of days between application of the insecticide and cutting;

E. Multiplying the expected daily loss by the number of days to estimate the potential loss in pounds per acre;

F. Estimating the value of the hay in dollars per pound;

G. Multiplying the potential loss by the estimated value to obtain the expected monetary loss in dollars per acre;

H. Determining the cost of the insecticide in dollars per acre;

I. Determining the direct costs of application in dollars per acre;

J. Estimating the dollar per acre indirect costs (such as loss from delay in corn planting while spraying the alfalfa);

K. And estimating the benefit, in dollars per acre, by subtracting the application costs from the expected monetary loss.

The cost figures can be derived from normal farm accounting procedures. The value of the hay can be based upon market value figures or from the computerized ration formulation programs such as those available from your county extension agent. The "bottom line" in Table 1 can be used in making your decision on whether to spray.

STRATEGY 3. PREVENTIVE SPRAYS.

An early spray of carbofuran (Furadan) at $\frac{1}{4}$ pound active carbofuran per acre is recommended *where* maximum yield protection is needed, *adult* feeding or the adults themselves are easily seen in the field, *and* the first cutting will be taken at late bud or first flower stages. The spray will fully protect the alfalfa for two weeks and give partial protection for an additional week. The spray, therefore, should be applied no earlier than two weeks in advance of the expected cutting date.

This alternative should be considered in fields that have a history of heavy weevil damage. We do not now have solid guidelines for predicting the need for this spray. There is a chance that the spray could be applied without real need. This risk must be balanced against the amount of adult feeding at the time of application and the need for maximum protection.

Protecting Stubble and Regrowth.

When abundant, the grubs can damage the small (less than about 6 inches tall) regrowth following the first cutting. No matter what program is used to protect the first cutting, the stubble and regrowth should be carefully examined for grubs and their damage and an insecticide (Table 2) applied if the grubs are easily found.

Selecting and Applying the Insecticide

Insecticides are poisons — handle, store, and apply them with great care. The label of the insecticide container has full instructions for the safe, effective use of that specific insecticide. READ THE LABEL before buying any insecticide. The insecticides noted as "hazardous" should be used only by experienced operators in fields remote from buildings and livestock.

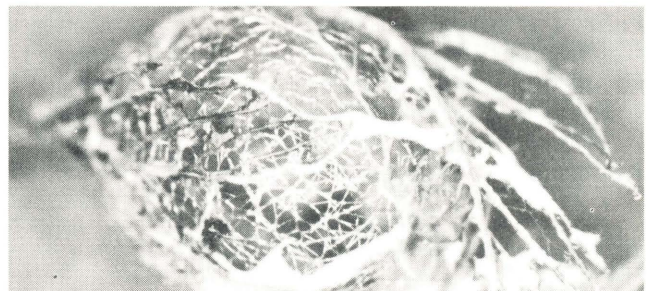


Figure 4. Alfalfa weevil cocoon.

Insecticides recommended for alfalfa weevil control can be effectively applied using aerial or ground equipment. Ground equipment should be carefully calibrated to uniformly cover the plants. About 12 to 15 gallons of spray per acre is adequate in stubble and small plants, and 20 gallons per acre is sufficient to cover larger plants with ground spray rigs. The amount of spray necessary for aerial application will depend on the special equipment that an aerial contractor uses. One gallon per acre is sufficient in stubble and small plants, and two gallons per acre is sufficient to cover larger plants when conventional aerial equipment is used.

The insecticides recommended for control of the alfalfa weevil are given in Table 2, and the effectiveness of these insecticides against other pests of alfalfa is shown in Table 3.

In selecting an insecticide, first check the time needed between applications and cutting or grazing of the alfalfa. Select only those that will fit your time

Table 1. Expected daily loss of dry hay, in lb./A, for different numbers of grubs per 20 sweeps at first bud stage.

Avg. # grubs at first bud	Expected daily loss at first flower	Full bloom
50/20 sweeps	24 lb/A	47 lb/A
100	43	55
150	62	68
200	81	82
250	100	95
300	119	109
350	138	122
400	157	136
450	176	150

An example of estimating benefits derived from alfalfa weevil control based on the expected daily loss.

A. Average number of grubs per 20 sweeps at first flower bud stage.	156
B. Alfalfa to be cut closer to first flower or full bloom stage.	
C. Expected daily loss of hay per acre (from Table 1).	62 lb.
D. Estimated days between application and cutting.	10 days
E. Potential loss (C × D).	620 lb.
F. Value of the alfalfa. \$40/ton	\$0.02/lb.
G. Monetary loss per acre (E × F).	\$12.40
H. Cost of insecticide per acre.	\$2.15
I. Direct costs of application per acre.	\$2.35
J. Indirect costs per acre.	—
K. Benefit per acre (G — H — I — J)	\$7.90

schedule. Next, check for insecticides that will control other pests present in the field (if there are any) as well as the alfalfa weevil. Finally, decide on the one that you can handle safely. Note that insecticides listed as "hazardous" should be used only by experienced operators in fields remote from buildings and livestock.

Table 2. Insecticides Recommended for Alfalfa Weevil Control.

INSECTICIDE	Lbs. Active Insecticide/A	Days Between Applic. & Harv.	Notes
azinphosmethyl (Guthion)	1/2	16	hazardous
methyl parathion	1/2	15	hazardous
Supracide	1/2	10	hazardous
malathion plus methoxychlor	1 + 1	7	
Imidan	1	7	
"Alfa-Tox" ¹	2 qts. ¹	7	
carbofuran (Furadan)	1/4	7	hazardous
malathion	1 1/4	0	
malathion	6/10	5	ULV aerial spray
carbaryl (Sevin)	1 1/2	0	
methoxychlor	1 1/2	7	safest for honeybees

¹"Alfa-Tox" is a commercial mixture of diazinon and methoxychlor. The amount to be applied per acre is given in quarts of this commercial product.

Table 3. Effectiveness of Alfalfa Weevil Insecticides Against Other Pests of Alfalfa.

INSECTICIDE	Pea Aphid	Spittlebug	Cut-, Army, & green clover-worms	Potato leaf-hopper	Plant Bugs	Grasshoppers
malathion	+	+	+	+	+	+
malathion plus methoxychlor	+	+	+	+	+	+
methyl parathion	+	+		+	+	+
carbaryl (Sevin)	—	+	+	+	+	+
"Alfa-Tox"	+	+		+	+	
Supracide	+			+	+	+
carbofuran (Furadan)	—			+	+	+
methoxychlor		+		+	+	
azinphosmethyl (Guthion)	—	+		+		+
ULV malathion	+				+	
Imidan	—			+		+

(+) insecticide is known to be effective against the insect.

(-) insecticide should not be used to control the alfalfa weevil if the other pest is present in the field.