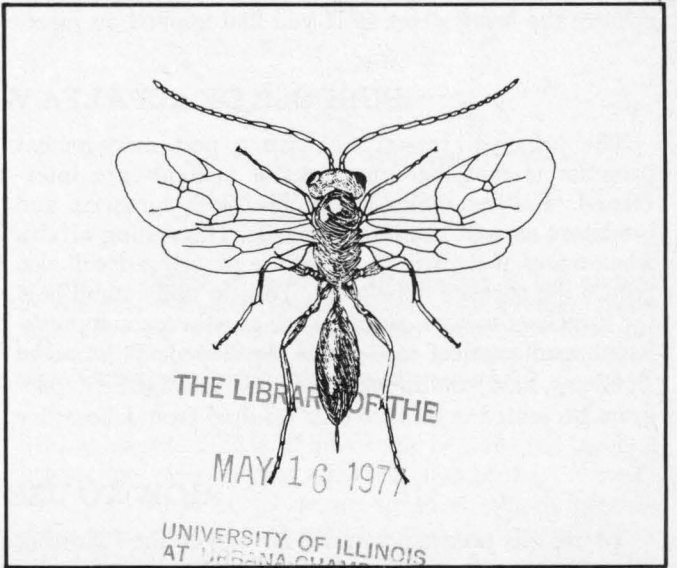
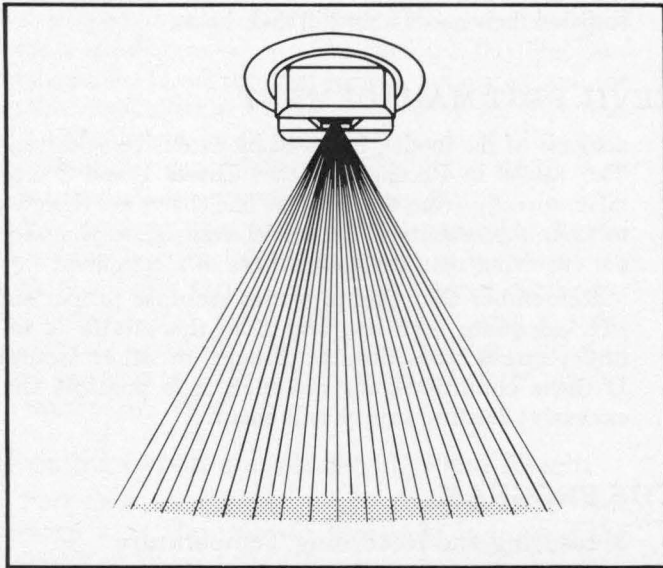
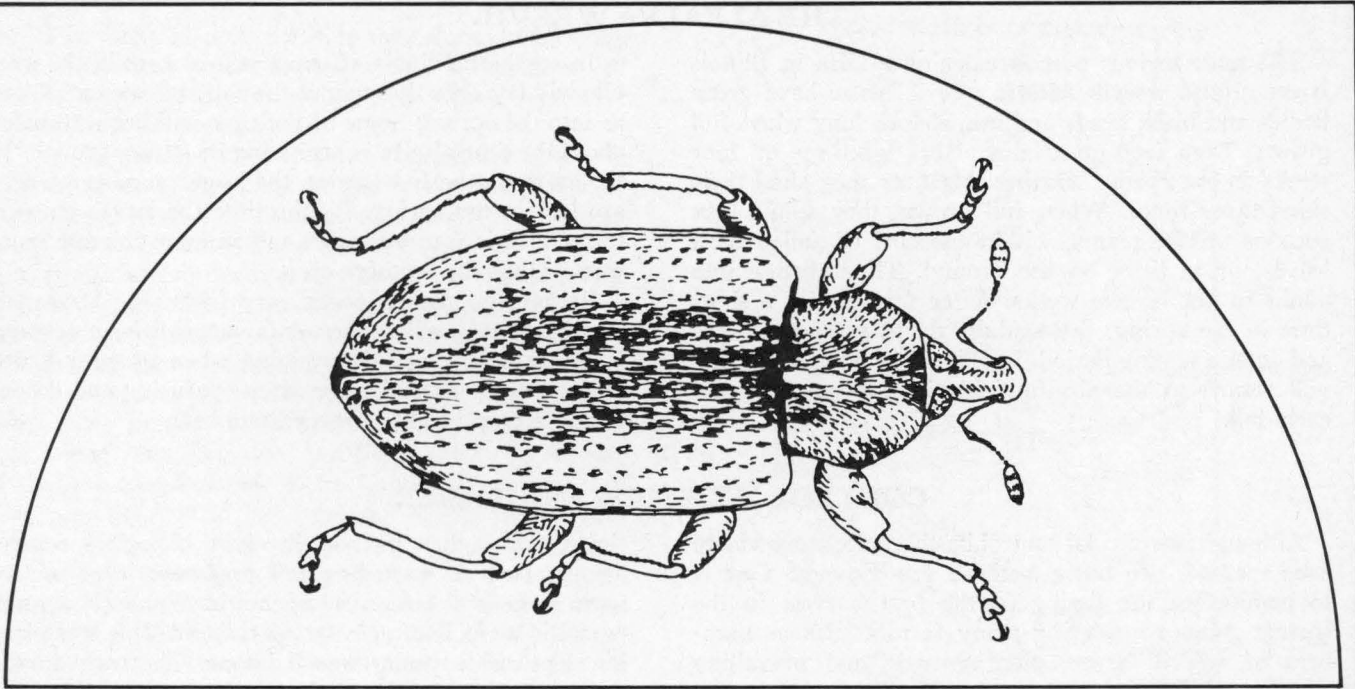
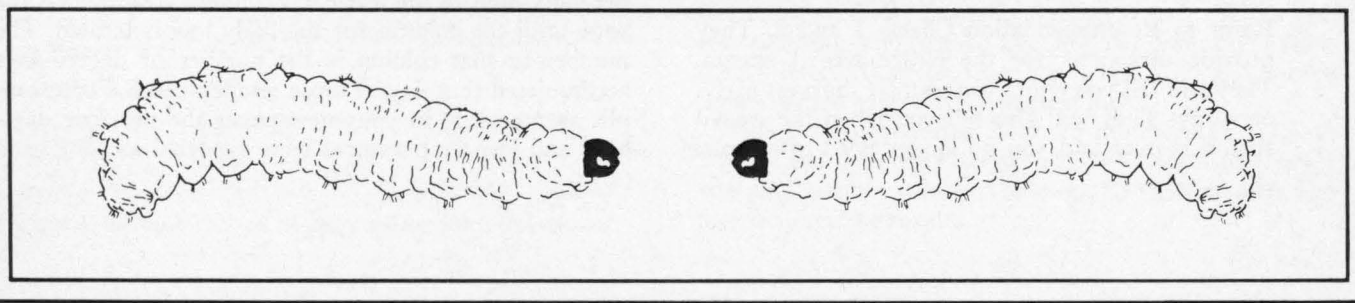


30.7
E6c



Alfalfa Weevil Pest Management Program

University of Illinois at Urbana-Champaign • College of Agriculture
Cooperative Extension Service • Circular 1136



THE ALFALFA WEEVIL

The most serious pest threatening alfalfa in Illinois is the alfalfa weevil. Alfalfa weevil larvae have green bodies and black heads and are $\frac{3}{8}$ inch long when full grown. They feed on alfalfa plants for three or four weeks in the spring. During this time they shed their skins three times. When full grown, they spin silken cocoons on the plants, within the curl of fallen dead leaves, or in litter on the ground. They change into adults in one or two weeks. After feeding for a short time in the spring, these adults fly to protected areas and enter a resting period. In Illinois, most of the adults will return to the alfalfa fields in late summer and early fall.

In southern Illinois, if temperatures permit, the weevils will lay eggs throughout the fall and winter as well as into the spring. Some of the eggs will begin to hatch about the time alfalfa is beginning its spring growth. In the more northerly counties, the larger number of eggs are laid in the spring. By the time the larvae emerge, the alfalfa is 6 to 10 inches tall and can tolerate more weevils than the southern crop.

Because population peaks vary from year to year, it is difficult to predict when spraying will be necessary. Existing methods of determining when to spray (such as percent tip feeding) are often confusing and do not consider crop height or weevil numbers.

CONTROL METHODS AVAILABLE

Although insecticidal control has been the most widely used method, two other methods are common. One is to manipulate the timing of the first harvest in the spring. After considering many factors such as numbers of weevil larvae, plant growth, and prevailing weather conditions, you can time the cutting date and achieve the same effect as if you had applied an insecticide.

The other method involves biological control agents, such as parasites and predators. One of the most successful biocontrol agents in Illinois is a small parasitic wasp, *Bathyplectes curculionis*. This wasp lays its eggs inside young weevil larvae. The wasp larvae develop inside the weevil larvae, and when they have satisfied their needs, they kill their hosts.

PURPOSE OF ALFALFA WEEVIL PEST MANAGEMENT

The principal reason we have a pest management program is that the three control methods are inter-related. For example, insecticides kill parasites and predators as well as alfalfa weevils. Harvesting alfalfa when many of the weevil larvae are parasitized will also reduce the parasite population. To help understand how the three methods of control work together, a computer-based mathematical model was developed. This model simulates field conditions. The pest management program presented in this circular resulted from laboratory

analysis of the model, followed by extensive field trials. The values in Recommendation Charts 1 and 2 were taken directly from these trials. The charts are designed to make the benefits of the model available to you without requiring that you have access to a computer.

Remember that this program assumes proper soil pH, adequate fertility, and that the alfalfa is not under stress from drouth, disease, or other factors. If these conditions are not met, it is possible that excessive feeding injury will occur.

HOW TO USE THE PROGRAM

To use this program you will have to do the following things:

1. Calculate degree-day accumulation by recording daily high and low temperatures from January 1 until the end of the alfalfa weevil season in late spring or by using the alternative method described on the next page.
2. Count the number of larvae on a 30-stem sample.
3. Measure the height of 10 stems from the original 30.
4. Refer to Recommendation Charts 1 and 2. They provide directions for the entire weevil season. They will tell you either to resample, harvest early, or spray. They will also tell you when the weevil season is over and you no longer need to sample.

Measuring and Recording Temperature

A record of daily high and low temperatures should be kept from January 1 until the end of the alfalfa weevil season. You can obtain this information from the daily newspaper, local weather stations, radio or television information, specialized county Extension information systems, and so on. Once the daily high and low have been obtained, the next step is to convert this information into degree-days (see Table 1). Locate the daily high in the left-hand column. Read across the page until the column for the daily low is located. The number in that column is the number of degree-days accumulated that day at those temperatures. For example, assume that in your newspaper the previous day's high and low temperatures were reported as 65°F. and

46°F. In Table 1, locate 65°F. in the column under daily high, then read across the page until the column for 46°F. is located. In this example, 8 degree-days were accumulated the previous day.

The degree-days used in this program are based on a developmental threshold of 48°F., since at temperatures lower than this little or no weevil development takes place. (Note that the degree-days used to calculate alfalfa weevil development are not the same as the degree-days quoted in weather reports.) If you live in an area where alfalfa weevils lay eggs in the fall and winter (southern Illinois), your field sampling must begin when a total of 200 degree-days has accumulated since January 1. In areas with no fall or winter egg laying, sampling need not begin until 400 degree-days have accumulated. Your County Extension Adviser can tell you if you have fall egg laying in your area.

A simple chart (see Figure 1) can be used to tally degree-day accumulation and remind you when to begin sampling. According to Figure 1, a total of 107 degree-days had accumulated by the morning of April 28. On the morning of April 29, the previous day's high and low temperatures of 75°F. and 38°F. were obtained from a weather report and recorded. At this high/low combination, 11 degree-days were accumulated, and the total accumulation as of the morning of April 29 was 118 (107 degree-days plus 11 degree-days). The process continues until the termination of the alfalfa weevil season in late spring or early summer.

You may not want to bother with recording degree-days from January 1 until late spring or early summer. Figure 2 shows various zones of expected degree-day accumulation by a given date. You may wish to delay degree-day calculation until the date indicated for your zone and assume that you have accumulated the number of degree-days listed.

Counting Larvae and Measuring Plant Height

Each time you take the 30-stem sample in a field, walk through it as illustrated in Figure 3, or in a similar pattern that allows you to sample as much of the whole

Date	Daily high	Daily low	Degree-days	Total degree-day accumulation
1-1	40	35	0	0
1-2	36	32	0	0
~~~~~				
1-14	54	22	1	1
~~~~~				
4-27	67	41	8	97
4-28	72	40	10	107
4-29	75	38	11	118

Figure 1. Sample record of degree-day accumulation.

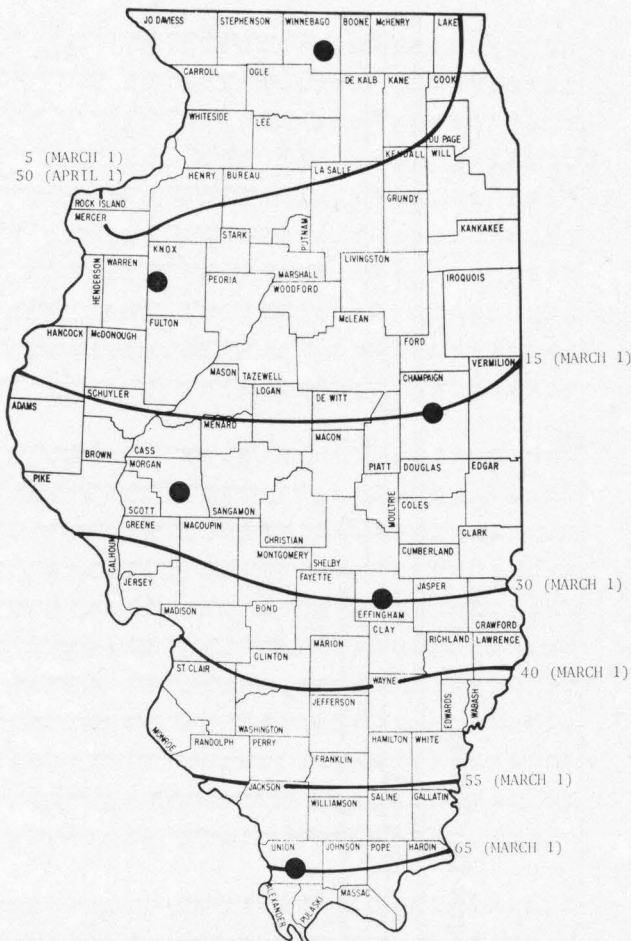


Figure 2. Zones of expected degree-day accumulation by the date indicated (based on a 10-year average). You will have to estimate degree-day accumulations for areas between the lines. Black dots indicate locations of weather stations used to develop the zones.

field as possible. This is important because the level of infestation varies across a field. For example, the problems will often be worse on southern slopes because these areas tend to be more protected during the winter and will warm up sooner in the spring. Avoid field edges because they will give you inaccurate samples. If possible, stay at least 50 feet from the edges.

At 30 evenly spaced intervals, carefully pick an entire stem (without dislodging any larvae) and place it in a 2- to 3-gallon container. Stems at each location must be selected at random, and this can be done by picking the first stem the hand touches. Next, beat the 30 stems vigorously against the inside of the container for a few seconds. Transfer the larvae to a shallow pan for counting and record the number you find. Randomly select 10 stems from the original 30 and record their average length to the nearest inch.

This process requires 20 to 25 minutes for a 15- to 20-acre field. In very large fields (40 acres or more), you may want to take two or more 30-stem samples and then average the results.

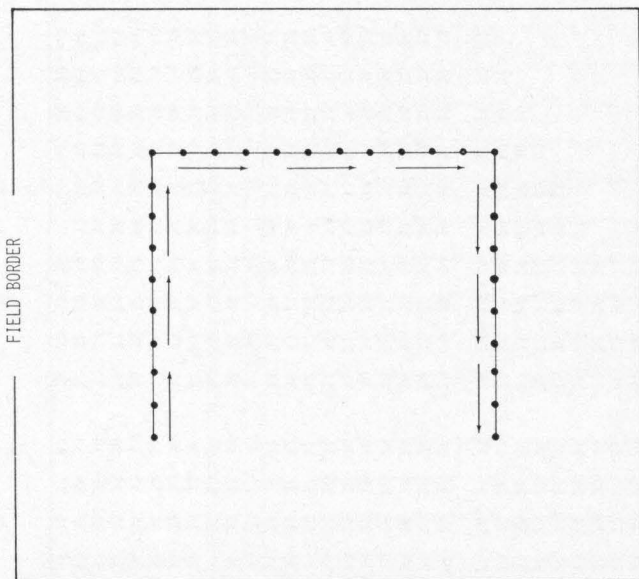


Figure 3. Sampling pattern in a 10- to 15-acre field. Dots indicate the approximate locations of stems used to make the 30-stem sample.

Decision-making

Each time you finish sampling an alfalfa field, Recommendation Chart 1 or 2 must be consulted to determine if spraying is needed. For example, if during your first sampling of the season 44 larvae were found on alfalfa that averaged 3 inches tall, Chart 1 would tell you to resample in 50 degree-days (240 to 260). If 47 or more larvae were found, the recommendation would be to spray (see Chart 1). Note that in the total degree-day column a range of 190 to 210 rather than 200 degree-days is listed. This means that you can conduct your first sample anytime between 190 and 210 degree-days. If, in the previous example, the field was sampled at 206 degree-days, it is important that the field be re-sampled as close to 256 degree-days as possible (50 degree-days later).

You must resample a field 100 degree-days after spraying. This is to make sure the spray was effective. Assume that one of your samples was taken at 259 degree-days and Chart 1 recommended that you spray. Assume also that 265 degree-days had accumulated by the time you were ready to spray. When you sample the alfalfa 100 degree-days later (365 degree-days), you will be between sampling ranges in Chart 1 (340 to 360 and 390 to 510). Since the midpoints of the degree-day ranges (190 to 210, 240 to 260, and so on) are separated by increments of 50 degree-days, there are no directions for the period between 361 degree-days and 389 degree-days. Therefore, in this situation, sampling should be accomplished between 340 and 360 degree-days, although it is a little early. In other words, use the range closest to your value.

Although the portion of the chart from 390 to 510 degree-days appears to be a wide range, it must be remembered that sampling is still done at intervals of 50

or 100 degree-days, depending upon plant height and larval numbers (for example, within 390 to 410, 440 to 460, and so on).

It is possible to completely skip a range on the chart. For example, one of the alternatives listed while sampling in the range from 340 to 360 degree-days is to "resample in 100 degree-days." This means that the sample that would normally be taken between 390 and 410 degree-days would be skipped and the field wouldn't be sampled until the 440 to 460 sampling period was reached. Note that when Chart 2 is used, alfalfa height is no longer considered. Instead, the increase or decrease in larval numbers is used to determine if control is necessary.

Insecticide Use

Timely and proper use of pesticides is an important part of pest management. Recommendations for 540 degree-days to harvest (see Chart 2) list harvest as a possible alternative to spraying. If you choose to spray at this time, the preharvest waiting period for various insecticides is a very important part of the selection process. Cooperative Extension Circular 899, *Insect Pest Management Guide—Field and Forage Crops*, lists the preharvest interval for insecticides recommended for alfalfa weevil control in Illinois. This information can also be found on the insecticide label. **Always read the label before using any pesticide.**

Postharvest Sampling

You will have to sample an alfalfa field 100 degree-days after harvest. This is to make sure larval numbers are not high enough to retard growth of the new crop.

Watch for feeding injury by adult alfalfa weevils while collecting the postharvest sample. Adult feeding results in feathering of the leaf (see Figure 4). Although this feeding is seldom significant, it is advisable to spray the stubble if you find an extensive amount of this kind of injury.

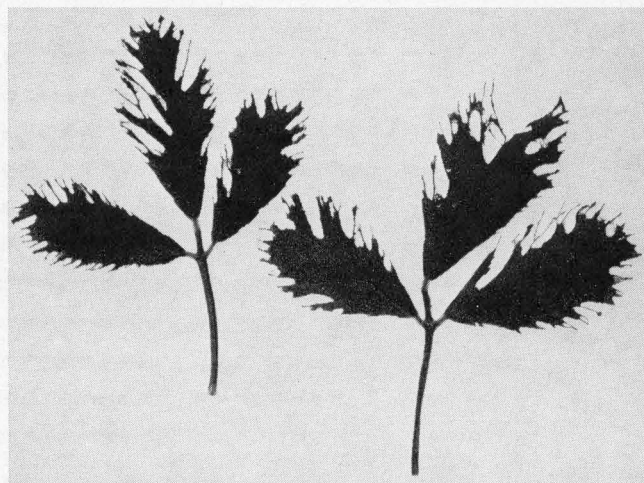


Figure 4. Feathering of leaf margins caused by adult alfalfa weevils.

Alfalfa Weevil Pest Management Recommendation Chart 1
Number of larvae collected from a 30-stem sample

Total degree-days (<i>dd</i>)	Alfalfa height (inches)																
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 or more
190-210																	
SPRAY	27	47	67	85	100	115	130										
Resample in 50 <i>dd</i>	0-26	0-46	0-66	0-84	0-99	0-114	0-129										
240-260																	
SPRAY	21	30	39	47	55	62	69	69	69								
Resample in 50 <i>dd</i>	0-20	0-29	0-38	0-46	0-54	0-61	0-68	0-68	0-68								
290-310																	
SPRAY		25	37	52	67	75	83	94	105	105	105						
Resample in 50 <i>dd</i>		0-24	0-36	0-51	0-66	0-74	0-82	0-93	0-104	0-104	0-104						
340-360																	
SPRAY					82	82	82	82	82	82	82	82	82	82	82		
Resample in 50 <i>dd</i>					14-81	14-81	14-81	14-81	14-81	14-81	17-81	17-81	17-81	17-81	17-81		
Resample in 100 <i>dd</i>					0-13	0-13	0-13	0-13	0-13	0-13	0-16	0-16	0-16	0-16	0-16		
390-510																	
SPRAY									52	52	58	64	68	72	76	80	
Resample in 50 <i>dd</i>									8-51	8-51	8-57	14-63	14-67	14-71	18-75	18-79	
Resample in 100 <i>dd</i> ^a									0-7	0-7	0-7	0-13	0-13	0-15	0-17	0-17	
540 to harvest	(See Chart 2)																
100 after harvest																	
SPRAY ^b	23	33	43	48	53	58	63										
Resample in 50 <i>dd</i>	17-22	17-32	17-42	20-47	23-52	23-57	23-62										
Resample in 100 <i>dd</i> ^c	0-16	0-16	0-16	0-19	0-22	0-22	0-22										
150 or more after harvest	(See Chart 2)																

^aIf this field was sprayed more than 7 days ago, you can wait 200 degree-days to resample.

^bSee comment in text about windrow effects.

^cIf last preharvest sample had less than 30 larvae, the weevil season is over and you can quit sampling.

Alfalfa Weevil Pest Management Recommendation Chart 2

Total degree-days (<i>dd</i>)	Change in number of larvae since last sample		
	Decreased 10 or more	Within 10	Increased 10 or more
540 to harvest			
SPRAY or harvest	73	63	53
Resample in 50 <i>dd</i>	23-72	18-62	13-52
Resample in 100 <i>dd</i> ^a	0-22	0-17	0-12
150 or more after harvest			
SPRAY	78	58	48
Resample in 50 <i>dd</i>	28-77	18-57	0-47
Quit sampling	0-27	0-17	

^aIf sprayed more than 7 days ago, you can wait 200 degree-days to resample.

If during harvest the alfalfa was windrowed, the 30-stem sample should be picked from the windrow area whenever possible (after removal of the hay). If there are enough larvae on these stems to recommend spraying, it would be well to pick another 30 stems avoiding windrow areas. If on these stems there are so few larvae that spraying is not recommended, you may wish to spray only the windrow areas and save on the cost of insecticide.

Sampling Frequency

You will take samples more frequently early in the season than toward the end of the season. Expect to visit a field an average of every 7 days during the weevil season. With an extremely early spring, a field could be sampled as many as 11 times or more.

A sample that is preceded by frost or beating rains can result in underestimation of population density. Numerous larvae may be found on the ground following

This program is offered as an alternative for deciding when to spray alfalfa weevil. Older methods are really no better than rules of thumb and are often confusing. As a result, treatment thresholds will vary greatly with the observer.

Although the Alfalfa Weevil Pest Management Program has received extensive testing, it should be re-

membered that it is a continuing program that will receive further testing, revision, and refinement. With this in mind, it is offered to the farmer, pest management consultant, dealer, and other interested persons as a program to compare with existing indirect methods of determining timing of insecticide application for control of alfalfa weevil.

Unusual Situations

Although the recommendation charts are designed to allow decision-making in a routine fashion, unusual weather conditions may require a few modifications. If you have several alfalfa fields, unseasonably warm weather early in the season (such as during February) could make it difficult to finish sampling all of your fields within the prescribed degree-day ranges listed in Charts 1 and 2. In this case, starting or finishing 5 to 10 degree-days on either side of the range will not be detrimental. However, subsequent sampling should be adjusted to coincide with the next range on the chart. This situation will be rare. Usually the rate of weevil development and plant growth varies enough from field to field that, after the first sample of the season, you will rarely sample all of your fields on the same day.

SUMMARY

membered that it is a continuing program that will receive further testing, revision, and refinement. With this in mind, it is offered to the farmer, pest management consultant, dealer, and other interested persons as a program to compare with existing indirect methods of determining timing of insecticide application for control of alfalfa weevil.

This circular was prepared by J.L. WEDBERG and W.G. RUESINK, assistant professors of agricultural entomology and assistant entomologists, Illinois Natural History Survey; E.J. ARMBRUST, associate entomologist, Illinois Natural History Survey, and associate professor of agricultural entomology; and D.P. BARTELL, formerly assistant professor of agricultural entomology and assistant entomologist, Illinois Natural History Survey.

The authors thank and acknowledge Mr. Wilbur D. Smith, Washington County Extension Adviser, for locating alfalfa fields used during the trial phases of this program and for providing administrative assistance. They also thank the growers who let them use their alfalfa fields during the research phase of this program.

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. JOHN B. CLAAR, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign. The Illinois Cooperative Extension Service provides equal opportunity in programs and employment. (April, 1977)

8M-4-77-37299-MN