Egyptian Alfalfa Weevil in Alfalfa Production

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Abstract: The Egyptian alfalfa weevil continues to be a serious pest of alfalfa, despite several decades of research to control this pest. Current studies are focusing on evaluating selective materials and reduced pesticide rates for weevil control, biocontrol, and the development of weevil tolerant varieties. Weevil control programs should consider the use of chemicals that have minimal disruption to beneficial insects, as these natural enemies can provide good control of pests that develop later in the season.

Keywords: Egyptian alfalfa weevil, biology, damage, sampling, management

Introduction

The Egyptian alfalfa weevil (EAW) is the most serious pest of alfalfa in California, as it causes millions of dollars in yield losses each year. Alfalfa weevils have likewise devastated range land burr clover, the plant most prized by ranchers as forage for livestock. The weevil was introduced into Arizona from the Middle Eastern area of the Old World in 1939, and became widespread throughout California by the 1960's. Current research projects are focusing on an integrated approach to weevil management which includes biocontrol, use of selective materials that have minimal effects on non-target organisms, use of cultural practices that reduce weevil populations, and evaluation of tolerant varieties.

Biology

The EAW usually has one generation per year, with a partial summer generation in some years. Adult weevils migrate into alfalfa fields during late fall and early winter, where females lay eggs into green and dried stems and ground debris. When the eggs hatch, developing larvae move to feed on the terminal buds. Larvae feed for about 3 weeks, then pupate in the soil, and later emerge as adult weevils. The entire life cycle from egg to adult takes about 4 to 6 weeks. Adults usually remain in the fields feeding and developing fat reserves until April, then migrate to nearby resting sites until the following winter. During the summer months, weevils may be found under loose tree bark, in bark fissures, or wherever there are cracks or crevasses, such as buildings.

Egyptian alfalfa weevil damage

The larval stage of the weevil causes the most serious damage to alfalfa as extensive feeding results in skeletonizing of whole plants. Direct damage occurs to the first cutting, but yields may be reduced in later cuttings from damage to regrowth buds and early depletion of plant reserves. Larval damage can also weaken stands, allowing weeds to move in (especially summer annual grasses late in the stand life). Adult feeding causes scaring on the stems, but seldom causes significant damage.

Sampling for Egyptian alfalfa weevils

Proper timing of insecticide treatments is essential for maximum control. Treatments applied too early may lose their effectiveness before the majority of the larvae are present. Conversely, applications made too late may result in considerable damage and loss of hay before larvae are controlled. To time applications properly, it is important to watch the fields closely. Fields should be sampled weekly as soon as larvae appear (mid to late February), and more frequently as the season progresses. Peak larval populations usually occur between March and April, depending on the location and weather conditions. At least 10, 180^o sweep net samples should be taken in several parts of the field. Treatment is recommended when larval counts reach an average of 20 per sweep. On stubble or short regrowth that cannot be swept, treat when growth is retarded because of weevil feeding. Use of the stem sampling method to assess weevil populations is not recommended in California at this time as there is not any reliable information linking the number of weevils per stem and yield losses for this area.

Management Techniques

Chemical

One of our research objects is to look for good weevil control materials that have minimal effects to non-target organisms. The following tables summarize the results of an insecticide trial for EAW control in Yolo County, CA (L. Godfrey, R. Freeman, and W. Johnson, 1993).

All treatments reduced the larval population well below the economic threshold of 20 larvae per sweep. Adult weevils were not common enough to reach any conclusions regarding control. Beneficial insects were relatively common in all plots, but tended to be lowest in the pyrethroid treated areas. Pea aphids were common in the plots, especially at the later sampling dates. The best pea aphid control was given by Imidan+Pounce, with intermediate control provided by Pounce, Furadan, and Lorsban alone.

Imidan works best under acidic conditions, so in water with a pH > 7.0, a buffer should be used. The Sevin XLR Plus treatment caused some bleaching of the alfalfa foliage.

Number of Egyptian Alfalfa Weevils per Sweep

		sample date– post treatment		
	lbs ai/A	7 days	14 days	20 days
Pounce 3.2EC	0.15	0.7 e	0.7 de	2.2 bcd
Furadan 4F	0.75	3.0 cd	0.4 e	0.3 d
Imidan 50WP	0.75	1.8 cde	2.0 cd	2.8 abc
Lorsban 4E	0.75	3.6 c	1.0 cde	0.5 d
Guthion 3F	0.50	2.5 cde	2.3 c	2.0 bcd
Sevin XLR Plus	1.25	6.9 b	7.8 b	4.7 a
Imidan+Pounce	0.75+0.1	1.2 de	0.7 de	0.9 cd
Untreated	—	23.5 a	10.4 a	3.8 ab

Number of Pea Aphids per 10 Sweeps

	lbs ai/A	sample date– post treatment 7 days	14 days	20 days
Pounce 3.2EC	0.15	33 bc	21 b	116 cde
Furadan 4F	0.75	14 bc	56 b	136 bcd
Imidan 50WP	0.75	31 bc	160 a	202 abc
Lorsban 4E	0.75	27 bc	66 b	150 bcd
Guthion 3F	0.50	33 bc	173 a	228 ab
Sevin XLR Plus	1.25	43 ab	186 a	270 a
Imidan+Pounce	0.75+0.1	2 c	25 b	71 de
Untreated	—	68 a	184 a	298 a

Number of Beneficials* per 10 Sweeps

	lbs ai/A	sample date– post treatment 7 days	14 days	20 days
Pounce 3.2EC	0.15	1.3 ab	1.0 c	2.8 a
Furadan 4F	0.75	1.3 ab	4.3 abc	3.5 a
Imidan 50WP	0.75	2.0 ab	5.5 ab	3.3 a
Lorsban 4E	0.75	2.3 ab	5.5 ab	3.8 a
Guthion 3F	0.50	2.8 a	5.0 ab	3.8 a
Sevin XLR Plus	1.25	2.3 ab	5.8 ab	2.3 a
Imidan+Pounce	0.75+0.1	0.8 ab	2.3 bc	2.5 a
Untreated	—	1.8 ab	6.0 a	5.0 a

*Beneficials include big-eyed bugs, minute pirate bugs, damsel bugs, lady beetles, and spiders.

Biocontrol

Parasites have been released against the EAW since it was first found in Arizona, but as yet this weevil has still not come under any good biocontrol. Several reasons include host incompatibility (weevils internally kill wasp eggs), inability of parasites to adapt to our climate, late season parasitization of weevils, and the use of chemicals that disrupt parasite populations.

Current research is focusing on the release of an adult weevil parasite known as *Microctonus aethiopoides* for control of the weevil in burr clover. These wasps lay eggs in the new generation of adult weevils in the spring, and emerge the following year when the weevils migrate back to the fields. All female and male weevils are rendered sterile as soon as they are parasitized. The wasps show some promise for control of weevils in burr clover (nearly 50% parasitism in one area), however, they do not appear to survive well in alfalfa.

We are optimistic that the EAW will be controlled biologically in the future in California if the research is supported. With biocontrol of this weevil, fewer insecticides will be needed, and hay fields will become major insectaries for natural enemies of alfalfa pests and surrounding crops.

Cultural

Choice of variety

Several alfalfa varieties have been evaluated for tolerance to the EAW. Although resistance has not been found, differences in tolerance are known to occur. Mechanisms for tolerance include non-preference where fewer eggs are laid on some varieties, slower development time by larvae on certain cultivars, and a greater degree branching in response to feeding damage by the larvae that somewhat compensates for foliage loss.

Dormancy classification can also effect the degree to which weevils infest fields. In general, non dormant varieties are more susceptible to weevil attack as the larvae begin to feed earlier in the season. In an alfalfa variety trial conducted at UC Davis in 1992-1993, Mecca (9 dormancy) had the highest weevil numbers per plot with 44 larvae per sweep followed by Yolo (7) with 26 per sweep, Sutter (7) with 24 per sweep, and CimarronVR (5) with 19 per sweep. Mecca had the highest visible plant damage in the trial.

Weed management

Dormant weed control programs with oil will frequently reduce and delay peak weevil populations during the first cutting by 1 to 2 weeks, but will not necessarily eliminate the need for weevil control. The presence of weeds does not increase weevil numbers.

Early harvest

Serious damage to alfalfa by weevil larvae can sometimes be prevented by cutting the crop as soon as most of the plants are in the bud stage.

Predictive model

A computer program that provides guidelines for controlling adult weevils during the winter to prevent damage by larvae in the spring has been developed, but is still in the experimental stage. This model uses fall field counts of adult weevils and daily temperature to predict whether or not individual fields will have economically damaging larval populations. If high numbers are expected, the adults can be treated before they lay most of their eggs.

In some fields this program has accurately predicted the weevil life cycle, however in other areas there is no similarity between simulated and actual events. Part of the difficulty has been with determining when the weevils break their summer dormancy period.

We are optimistic that with continued work and funding on this project we will be able to forecast reliably whether or not winter treatment of adult weevils is necessary to prevent economic damage by larvae in the spring. This approach to weevil management would help reduce larval damage, and would avoid toxic effects to natural enemies.

Conclusion

Current research programs are focusing on an integrated management approach for weevil control that includes biocontrol, evaluation of weevil tolerant varieties, use selective pesticides (including reduced rates of these materials), and a predictive model used to monitor weevil activity. We are optimistic that with continued funding on these alternative management practices we will be able to provide good economic control of the weevils with minimal disruption to non-target organisms.

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