INTEGRATED WEED AND INSECT MANAGEMENT IN ALFALFA; RESEARCH UPDATE AND PROSPECTS.

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Weeds in an alfalfa field are part of that agroecosystem. Their very presence can modify the environment for all other organisms present in the field; this can be through alteration of local temperatures, humidity, light, and shelter. They may also act as a direct (insect feeds on the weeds) or indirect (predator feeds on insects that eat weeds) food source for pests in the field. When herbicides are used to control weeds there may be non-target effects of these chemicals on other organisms present in the field. Removal of weeds then has the potential to alter the populations of other organisms in the field whether they are good or bad.

In previous years I have reported that there are interactions between weeds and the Egyptian alfalfa weevil (EAW) (Hypera brunneipenis Boh.). Since these earlier reports (1972 and 1975 California Alfalfa Symposia) there has been continued research into how weeds could be influencing the population of the EAW.

Many experiments have been conducted. The basic set of treatments have essentially been the same for all the experiments. Treatments consisting of with or without weed control and with or without insect control have been applied to alfalfa during the late winter (weeds) and the early spring (weevils). The numbers of EAW eggs, larvae and adults have been determined, and weed and alfalfa biomass has been harvested. In some experiments insects other than the EAW were counted. All experiments were conducted in established alfalfa fields. The herbicide used for weed control was usually diuron plus dinitrophenol, although paraquat, terbacil and other herbicides have been used in some experiments. Carbofuran was used for insect control in all cases.

Removal of weeds from alfalfa has resulted in slight increases in EAW numbers when only a few weeds were present, to over a three-fold increase when large quantities of weeds were present. The increase in numbers of EAW larvae, as determined by sweep-net count, does not appear to be related to the type of herbicide used for the weed control. The increase in EAW numbers following weed removal is therefor due to changes in the ecosystem rather than a direct effect of the herbicides. The increase in EAW larvae following weed removal has been demonstrated from Merced to Sutter counties. In several experiments the larvae have been counted by instar; such counts have shown that the increased number of larvae in response to weed control has already occurred by the first larval instar. There does not appear to be any major difference in larval mortality between instars in relation to weed management. It now seems unlikely that the effect of weed removal on EAW larval numbers can be explained on the basis that weed removal alters the food supply for the insects.

The above noted results have thus indicated that the effects of weeds on EAW occurs prior to the appearance of the first instar larvae on the alfalfa. Research is now focussed on the adults and the numbers of eggs layed. The numbers of eggs will also be related as directly as possible to the numbers of first instar larvae. Preliminary results have indicated extreme variability in numbers of eggs, and considerable effort is now being placed towards developing reliable techniques for sampling and counting eggs. The most important finding is confirmation that nearly all the eggs are layed in dead alfalfa stems; almost no eggs have been found in green alfalfa or in the weeds. Once accurate determinations of adult EAW numbers have been made in relation to eggs and first instar larvae then it will be possible to establish if weeds alter the way that the adults lay eggs, or alter the survival of the eggs and or first instar larvae.

Other insect numbers have been assessed in a limited number of experiments. Counts of aphids have not indicated any consistent trends in relation to weed management. In one experiment weed removal increased the numbers of aphids (mixed population of blue alfalfa and pea aphids), but in another experiment weed removal decreased the aphid population. This apparent discrepancy may be related to the species of weeds present; this has not been resolved. Lygus bugs (probably Lygus hesperus Knight) were counted in one trial; presence of winter annual weeds caused an approximate 5-fold increase in these insects by the first cutting in comparison with weed free alfalfa. This has serious implications for regional IPM.

Computer modeling of the interaction between the EAW and alfalfa is being conducted. It is hoped to use such computer models for predicting the severity of attack by the EAW and to improve the ability to forecast economic losses. This should lead to more accurately defined thresholds for the insect in alfalfa. The current computer models do not include the influence of weeds, either on the alfalfa or on the EAW. It is thus feasible that the presence or absence of weeds in an alfalfa field may cause the EAW/alfalfa model to make incorrect predictions. According to IPM specialists involved in validation of the EAW/alfalfa model there have been errors in predictions of EAW larval populations; it can be speculated that such errors may have been caused by the amount of weeds present in the field. It now seems apparent that thresholds for the EAW may, in the future, have to incorporate a 'weediness' factor into the calculations.

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