

ALFALFA AS AN INSECTARY FOR BENEFICIAL INSECTS

Thomas F. Leigh¹

Abstract: Alfalfa hosts a wealth of insect and mite species that feed on the plant and that prey upon the plant feeding species. Several of the predatory species in alfalfa fields also populate a number of other crops where they greatly reduce the threat of pest damage. Parasitic insect species, which have narrower host ranges, will also move from alfalfa to other crops where their hosts occur and frequently provide excellent control. Alfalfa may be managed through strip harvesting and as an interplant in other crops such as cotton to reduce the threat of lygus bug outbreaks and to enhance the abundance of predators and parasites in those crops.

INTRODUCTION

An insectary is a place in which insects are reared. In a broad sense, some of us think of alfalfa as an insectary where lygus bugs and other pests are reared and thence infest cotton and many other crops. In recent decades, we have come to realize that alfalfa also serves as an insectary for beneficial insects which can disperse into other crops and help protect them from pests.

SIGNIFICANCE OF BENEFICIAL INSECTS

The occurrence of predatory and parasitic insects was recognized in ancient times. Their utilization in agriculture goes back many years, particularly for California citrus growers who have long used the vedalia beetle to combat cottony cushion scale. Significance of the parasite and predator complex associated with our crops was brought to full recognition more than four decades ago through outbreaks of secondary pests and resurgence of target insects following use of DDT and other synthetic organic insecticides. For many years the biological control impact was largely ignored since producers could conveniently treat their fields again or turn to another insecticide to meet the pest problems.

OUR NATURAL CONTROL CHALLENGE

Today the agricultural industry has lost most of the formerly useful products through pest resistance to insecticides and restrictions on when and where they can be used. This has resulted in increased consciousness of the role that biological control can have in suppression of insect and spider mite pests.

Growers and their crop management consultants are asking for information on biological control agents as they seek strategies for management of crop pests to replace the lost insecticides. They are asking which parasites and predators are important, when and where the parasites and predators occur, what factors influence their abundance and efficacy, and what can be done to enhance their impact on crop pests? We focus on alfalfa as a reservoir of natural enemies because it hosts an abundance of pest and beneficial insects, is widely grown in association with other crops, and occupies extensive acreage. Alfalfa serves as a year around preserve for both beneficial and pest insects and mites and the richness of this arthropod fauna helps make the biological control system function. In addition, management of alfalfa can be manipulated to enhance the potential of this crop as a preserve for biological control agents.

¹Corresponding Author: Thomas F. Leigh, Entomologist Emeritus, Department of Entomology, University of California-Davis, 17053 Shafter Avenue, Shafter, CA 93263

THE ALFALFA INSECTARY

Literally dozens of predacious and parasitic insects occur on California field crops. We recognize that all of these are important to maintaining the balance of nature. A relatively small number of these biological control agents appear to be the **work horses** in this balance of nature and are complemented by the many other less abundant species. These natural enemies are usually abundant in alfalfa fields. Perhaps more importantly they occur across a wide range of crops and weeds or other associated vegetation. Among the major predators on alfalfa are bigeyed bugs (*Geocoris pallens* and *G. punctipes*), damsel bugs (*Nabis americanoferus*), and minute pirate bugs (*Orius tristicolor*). They prey on a wide range of pests. Add to these thrips that are often considered by cotton growers to be pests, the western flower thrips (*Frankliniella occidentalis*), and lady beetles (*Hippodamia spp.*) which function to control aphids on many crops. A parasitic wasp, *Lysiphlebus testaceipes*, is also of great importance in aphid control on alfalfa, and several other parasitic wasps provide control of beet armyworms, western yellowstriped armyworms, and other lepidopterous pests of cotton, alfalfa and other field crops. Applications of insecticide to alfalfa frequently cause a prompt flair up of spider mites, beet armyworms, or cotton bollworms, pests that are otherwise seldom found in significant numbers in hay fields.

MANIPULATION OF THE ALFALFA INSECTARY

Alfalfa hay harvest, as practiced by most growers, converts fields into an ecological desert until considerable regrowth develops. As a result, most insects with wings leave the field to avoid hot dry conditions in the stubble field. Most of the immature stages of both pest or beneficial organisms are killed. Adult stages may move to nearby crops where they can survive. Plant feeding insects will be first to reinvade regrowth alfalfa and may reach devastating numbers before their predators or parasites can reestablish. Natural enemies may be greatly delayed in reestablishing until there is an abundance of the pests on which to feed.

How can we avoid the effect of the ecological upset caused by alfalfa harvest? Working with Drs. Vern Stern and Robert van den Bosch in the 1960s (1, 2)² in research directed at reducing lygus bug dispersal into cotton, we demonstrated that alfalfa harvest modification would prevent lygus bug movement into cotton fields. The practice which was known as strip harvesting, compared normal grower harvest of entire alfalfa fields with harvest of alternate alfalfa strips. This practice is illustrated diagrammatically in Fig. 1. In practice, one half of each field was harvested at about 14 to 16 day frequencies. In addition we observed a significant reduction in pest problems within alfalfa fields. Those studies which provided for alternate harvest of alfalfa strips at about 14 day frequencies supported preservation of a biological balance within the alfalfa and revealed that chemical control of alfalfa caterpillar, western yellowstriped armyworm and other alfalfa pests was no longer necessary.

This alfalfa management practice was then extended to plantings of alfalfa within cotton fields (3) as illustrated in Fig. 2. Cotton growers who utilized this interplant option realized a dramatic reduction in need for insecticides to control lygus bugs, bollworms and other pests. Dr. Andrew Corbett demonstrated in more recent studies (4) what we had previously observed, that bigeyed and minute pirate bugs will disperse from strips of alfalfa throughout nearby cotton fields (Fig. 3). Fortunately these predators are highly mobile and are key elements in suppression of lygus bugs, spider mites, and several lepidopterous pests on cotton and other field crops.

²Parenthetic numbers refer to references.

Similar trends were observed in relation to parasitic wasps which serve a major role in control of bollworms, beet and other armyworms and the alfalfa caterpillar. These pests existed at only very low numbers in strip cut alfalfa and in cotton fields interplanted with strip cut alfalfa.

HARVEST PRACTICE IMPACT ON PREDATORS

Recent studies have compared seasonal abundance of bigeyed, damsel and minute pirate bugs in alfalfa fields under three harvest management strategies. These included grower harvest of entire fields, strip cutting alfalfa at a 28 day frequency, and leaving alfalfa uncut. Season average numbers of bigeyed, damsel and minute pirate bugs are presented in Fig. 4. Abundance of bigeyed bugs was distinctly favored by the stripcut practice where large numbers of adult and immature stages were found to be present. Bigeyed bugs virtually disappeared from complete cut fields. Damsel bugs were favored most by the no cut practice, which resulted in high numbers of lygus bugs and spider mites, both prey of this insect. Damsel bugs were also present in large numbers in the strip cut fields, but only very low numbers were recovered in the grower practice complete cut field. Minute pirate bugs are recognized as major predators of thrips and spider mites. They were most abundant in the alfalfa strips that were not cut. We believe this abundance of minute pirate bugs related to observed large numbers of thrips and spider mites, both of which are preferred hosts of this predator.

CONCLUSIONS

- *Alfalfa hosts an abundant and diverse fauna of insects.
- * With its perennial and luxuriant growth, this crop serves as a major reservoir of natural biological control.
- *Alfalfa harvest can be manipulated to enhance natural enemy populations and hence has strong biological control value in agroecosystems with a diversity of crops.
- *Through strip harvest, need for insecticide use on alfalfa can be eliminated or greatly reduced.
- *Interplanting alfalfa within cotton (and presumably other crops) can enhance the presence and numbers of biological control agents at those sites.

REFERENCES

1. Stern, V.M., R. van den Bosch, T.F. Leigh, O.D. McCutcheon, W.R. Sallee, C.E. Houston, and M.J. Garber. 1967. Lygus bug control by strip cutting alfalfa. University of California Agricultural Extension Service AXT-241.
2. van den Bosch, R., and V.M. Stern. 1969. The effect of harvesting practices on insect populations in alfalfa. *In* Proceedings: Tall Timbers Conference on Ecological Animal Control by Habitat Management. 1: 47-54.
3. Stern, V.M. 1969. Interplanting alfalfa in cotton to control lygus bugs and other insect pests. *In* Proceedings: Tall Timbers Conference on Ecological Animal Control by Habitat Management. 1: 55-69.
4. Corbett, A. 1991. Doctoral dissertation on file at University of California-Davis.

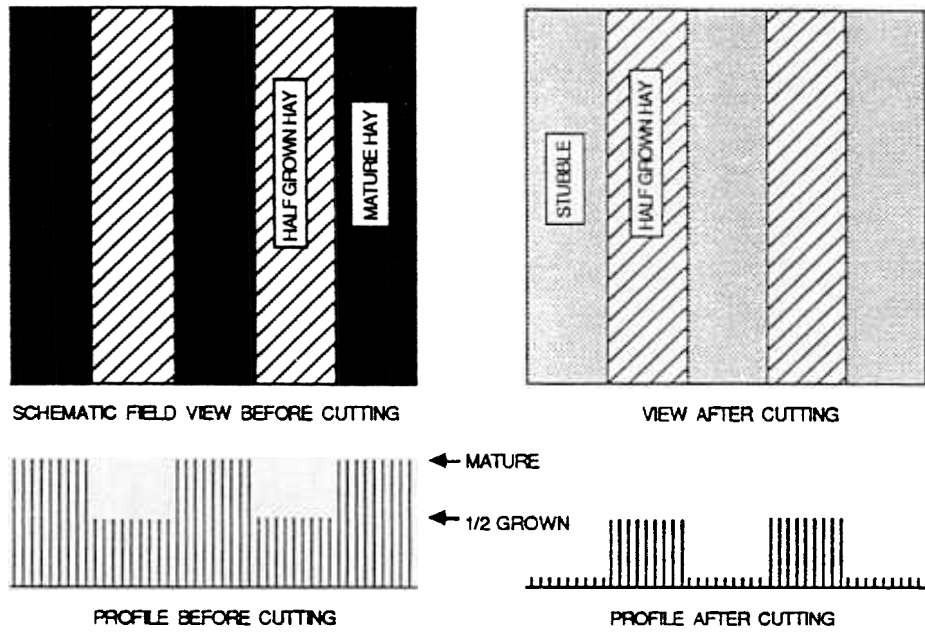


Figure 1. Schematic diagram of alfalfa strip cut plan for alfalfa hay harvest strategy to suppress lygus bug migration to cotton and enhance natural enemy abundance, and hay growth profile before and immediately after harvest. Individual strips may be from 200 to 500 ft. wide or more. (After van den Bosch and Stern 1969).

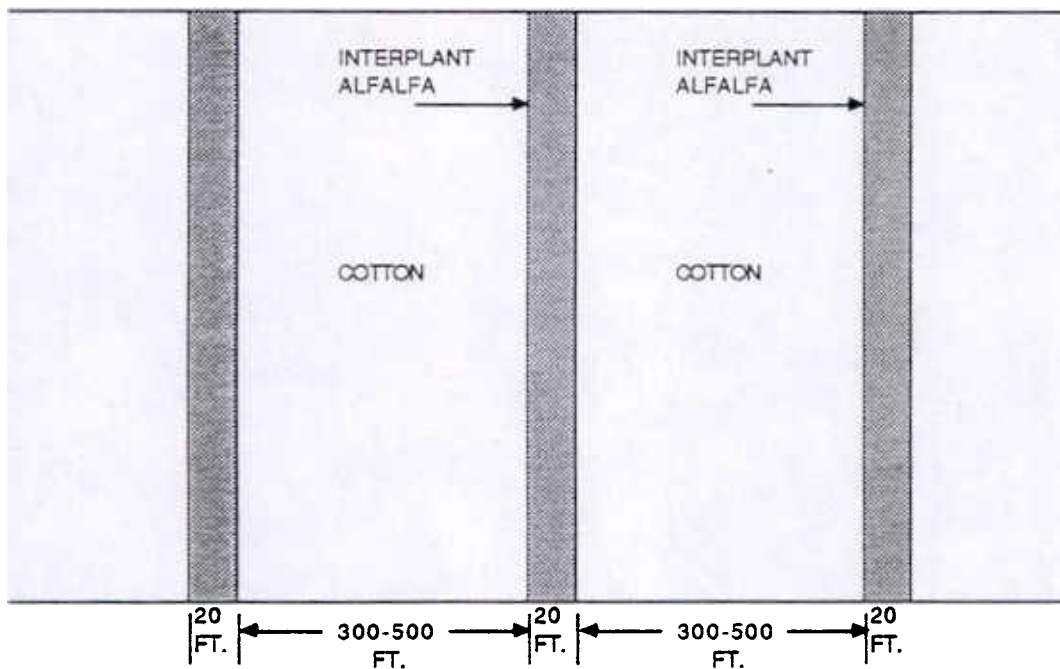


Figure 2. Schematic diagram of an alfalfa interplant plan to attract lygus bugs away from cotton and provide a source of beneficial insects to populate the cotton field. (After Stern 1969).

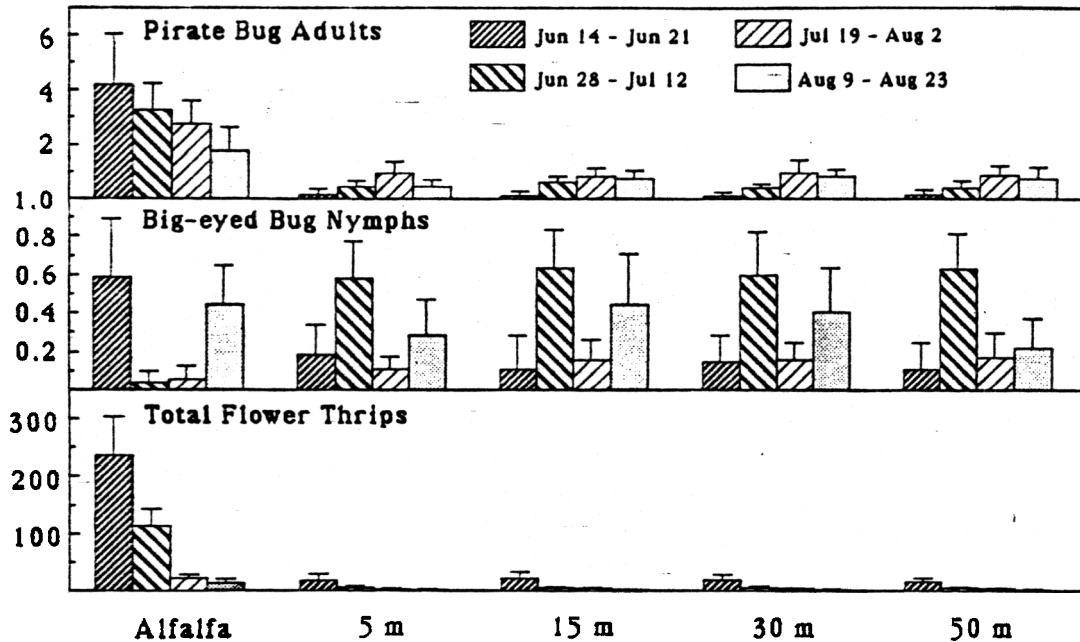


Figure 3. Comparative abundance of the predacious minute pirate and bigeyed bugs and of western flower thrips which prey on spider mites, on alfalfa and on nearby cotton at various distances from the alfalfa in fields which alfalfa was interplanted in cotton. UC West Side Field Station, 1989. (After Corbett 1991).

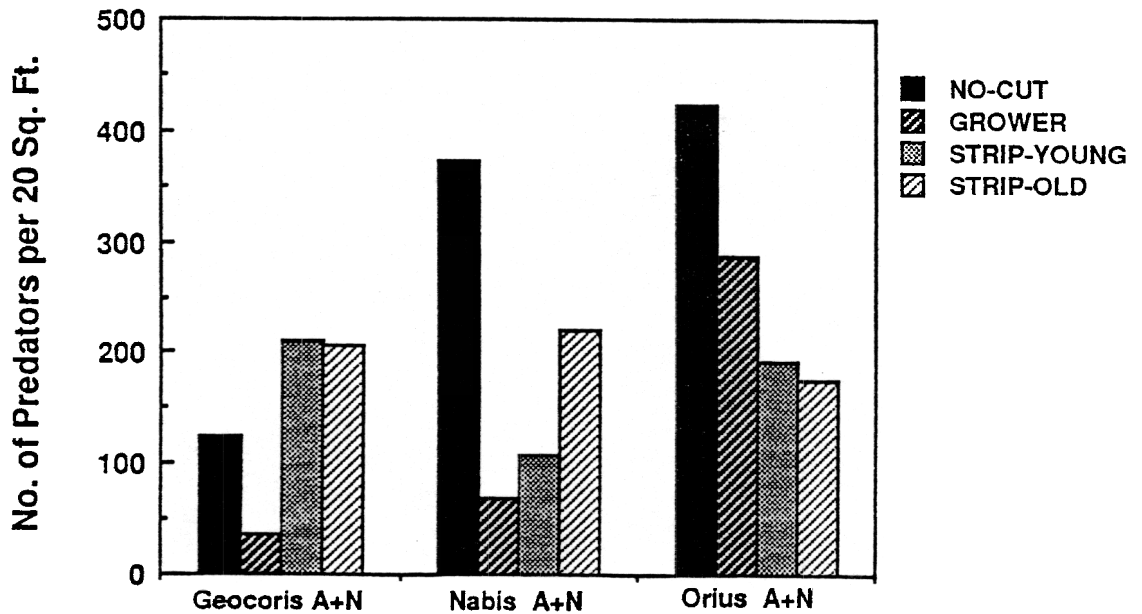


Figure 4. Seasonal average numbers of three predatory bugs (adult and immature stages) in alfalfa fields under three regimens of harvest: not cut, complete cut on 28 day cycle by grower practice, and newer versus older growth stage in 28 day harvest cycle strip cut fields. (The author, Shafter, 1990).