MANAGING WESTERN TARNISHED PLANT BUG (*LYGUS HESPERUS)* IN A REGIONAL CONTEXT

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Abstract

The increasing portion of cotton production costs dedicated to insecticides is forcing a re-evaluation of managing *Lygus hesperus* in cotton in the San Joaquin Valley through mitigation of insect movement. The idea of managing crops around cotton to prevent the movement of insects into cotton is becoming more acceptable. The management of alfalfa hay is key to limiting the movement of Lygus into cotton and was suggested as a cultural management tool over 30 years ago. Using on-farm demonstrations, we confirmed the validity of this approach. We were able to limit the migration from alfalfa into cotton by two approaches. First, alfalfa harvests were staggered between fields to provide sufficient amount of suitable habitat. Second, uncut strips were left in harvested fields to maintain habitat during the harvest period.

Background

Lygus bug, *Lygus hesperus*, is the key pest in San Joaquin Valley (SJV) insect cotton pest management. Between 1990 and 1998, it caused average losses estimated at 60,279 bales of cotton annually. The degree of Lygus control that is required will set the stage for insect pest management for the entire year. The use of broad-spectrum insecticides for Lygus control upsets the balance of other pests such as aphids, spider mites, and foliage feeding worms.

Lygus is not an annual problem and its severity is linked to rainfall patterns and host availability (Goodell, 1998). Lygus moves from other hosts including cultivated and uncultivated plants in a manner described as aseasonal migration (Nechols et al, 1999), that is when the host becomes unsuitable and the insects are forced to migrate. In the SJV of CA, crop diversity provides many suitable sources for Lygus development including tomatoes, garlic, sugar beets, safflower, alfalfa, seed alfalfa and cotton. While not all of these crops are good hosts, associated weeds provide protective habitat or nursery resources. For example, in one typical 34 square mile area of the westside of Fresno County, 10 different crops could be found (Figure 1) with cotton and processing tomato dominating the landscape.

The migratory nature of Lygus offers challenges to the cotton industry that seeks to increase is biological reliance in IPM. During the growing season, it is not difficult to find a cotton field initially under biological control that then experiences a migration event that causes population densities to rapidly shift from non-economic to economic levels within days. Dr. Vern Stern noted this problem over 30 years ago when he proposed managing the sources from which the Lygus originate in order to prevent cotton from becoming a sink for Lygus (Stern et al, 1967). The application of broad-spectrum insecticides is the only control option once a population density exceeds the action threshold. This has resulted in secondary pest outbreaks and increased the proportion of production costs required for insect control. Over three decades ago, UC pest management guidelines recommended managing Lygus through habitat manipulation. These suggestions included management of Lygus in safflower based on heat accumulations (Sevacherian et al, 1977), developing alfalfa strips within cotton fields (Stern et al, 1969) and managing alfalfa hay through retention of uncut strips (Stern et al, 1967).

In 1998 and 1999, we conducted demonstration trials with alfalfa to manage Lygus movement into cotton.

Procedures

Strip Cutting Alfalfa, Tulare County, 1999

Steve Wright, Cotton Farm Advisor in Tulare County, was called to a farm at which Lygus bugs were consistently a problem. The farm was located near the St. John's River and contained both alfalfa hay and cotton (NuCot 33B). Fields were ½ mile by ¼ mile and contained 80 acres. The grower's practice was to harvest the alfalfa fields within days of each other, completing removing all alfalfa habitats.

The demonstration trial consisted of three different cutting patterns in the alfalfa that was interspersed with cotton fields. During the June harvest, a variety of uncut strips about 15 ft wide were left in three alfalfa fields. One field retained only two outside strips, another retained two outside strips and one inside strip, and the third retained two outside strips and every irrigation "check". This corresponded roughly to 1.8, 2.8 and 8 acres of alfalfa. Lygus densities were estimated weekly with a standard 38" sweep net in the alfalfa and the adjacent cotton during July 1999.

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Staggered Cutting of Alfalfa, Fresno County, 1998 and 1999

To improve management of Lygus on a large West Side farm, alfalfa harvest on 160-acre fields was staggered. This cutting schedule removed roughly one third of 900 acres of alfalfa on a weekly basis. Thus, two-thirds of the alfalfa was still available for Lygus, either ready to cut or receiving and irrigation after harvest. The alfalfa was sprinkler irrigated and 2-foot strips on either side of the hand-moved pipe were left uncut.

Population densities of Lygus were estimated with a standard sweep on a weekly basis in both alfalfa and surrounding cotton by Agri-Consultants as part of the regular pest management inspection service.

Results

These demonstrations reinforced the earlier guidelines that managing alfalfa has value for managing Lygus in cotton. In the Tulare County trial, Lygus densities averaged 3 Lygus per 50 sweeps in cotton but were 108 Lygus per 50 sweeps in alfalfa (Figure 2) during July. The number of strips remaining (2, 3 or 9) did not appear to be important in retaining Lygus in the alfalfa fields.

In the West Side Fresno County demonstration, the uncut strips within field provided easy access to local alfalfa habitat for Lygus. More important, staggering the harvest of the 160-acre alfalfa fields created a mosaic of fields that provided ample habitat on the ranch to absorb Lygus movement from any field being harvested. This approach was successful during the two-year demonstration in preventing Lygus migration into cotton. In 1998, Lygus densities were higher in cotton fields located further away from alfalfa then in cotton located closer to alfalfa (Figure 3). Results were similar in 1999 (Figure 4), but Lygus densities overall were lower compared to 1998.

Discussion

As we move toward the 21st Century, IPM is being pushed to higher levels of system management. The goal should be to move farming systems toward increased biological reliance and away from reliance on chemical intervention, with the result being increased biological and economic stability. In cotton production, the options for accomplishing this are limited. Lygus is a key pest for which:

- there are no products that have a narrow spectrum against Lygus or reduced-risk to human health,
- there are no commercially available biological control strategies,
- no host plant resistance has been identified from either traditional breeding efforts or genetic engineering.

Increasing cotton's reliance on more biological approaches will require strategies to manage Lygus outside of the cotton fields. Pest management of Lygus in the SJV should focus on managing the sources to encourage Lygus residence or preventing it from taking wing. Prevention of Lygus problems in cotton is the key to decreasing our current reliance on chemical intervention. In cotton, moving toward more biological reliance will require the farmer, Pest Control Advisor, crop consultant, and Land Grant College to look well beyond the individual field and consider the surrounding landscape.

Alfalfa grown for forage should play a critical role in providing a continuous available habitat for Lygus population in a region. These field demonstrations reinforce the value of alfalfa in the cropping landscape proposed 30 years ago. Where possible, staggering cutting schedules of alfalfa in an area will do much to keep Lygus from moving into cotton, is easier to accomplish then strip cutting, and does not compromise the quality of the hay.

Scheduling alfalfa harvest in order to maintain habitat should be possible without directed coordination in areas that have a high proportion of land dedicated to alfalfa hay. However, cooperation is essential if the cotton grower who is the recipient of Lygus movements does not farm the alfalfa. Finally the critical ratio of cotton to alfalfa remains to be elucidated.

As alfalfa becomes less dominant in a local ecosystem, block cutting within a field or preservation of uncut strips becomes more important. In block cutting, the field is divided and harvested at different times. However, block cutting and creation of uncut strips is much more intrusive in the normal management of alfalfa. There are concerns about the loss of revenue from uncut strips due to reduced value of the older hay to the diary industry. However, this conflicts with earlier trials (Summers, 1976) that found uncut strips when blended with newly cut hay did not suffer a reduction in quality. This problem requires further study.

Alfalfa hay in the SJV provides our best hope of managing Lygus in a biologically intensive manner. In regions where alfalfa is found as a dominant plant cover, Lygus outbreaks are seen less frequently and with less severity. In areas with little or no alfalfa, cotton acts as a major sink due to the lack of other suitable hosts. In these cases, it s doubtful if alfalfa could be introduced into the region in sufficient quantity to affect movements.

SJV cotton is similar to other cotton growing regions in the US where criticism has been levied for its over-dependence on insecticides. With a migratory pest like Lygus, the most direct way to increase biological reliance is to manage the ecosystem and eliminate its need for movement. Alfalfa can play a key role by providing alternative habitat to cotton or in the future, acting as release site for biological control organisms against Lygus. Thus, the future strategy echoes the guidelines developed by an earlier generation of IPM entomologists, giving rise to the familiar refrain, *back to the future*.

Acknowledgments

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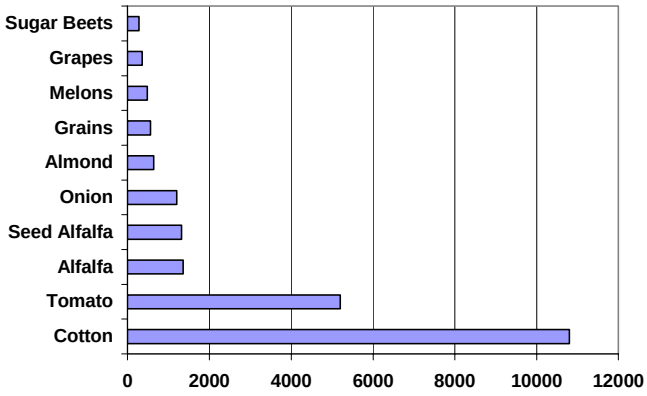

Figure 1. Crop diversity and proportional composition in the westside of Fresno County in 34.68 square miles.

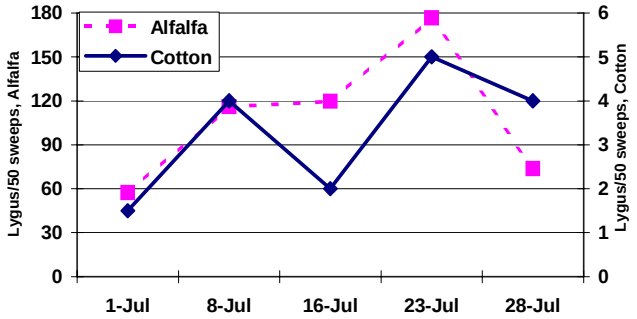

Figure 2. Lygus densities from adjacent alfalfa and cotton fields, Tulare Co. 1999

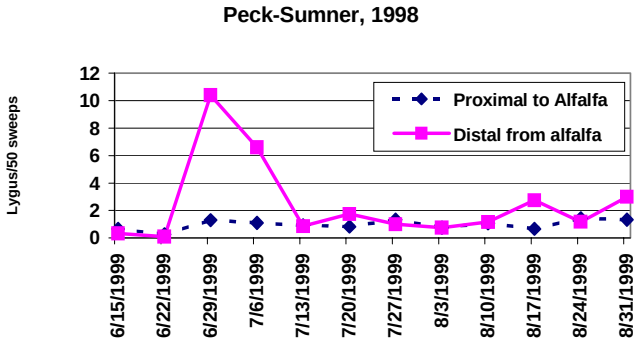

Figure 3. Lygus densities from cotton near alfalfa or distant from alfalfa, Fresno County 1998.

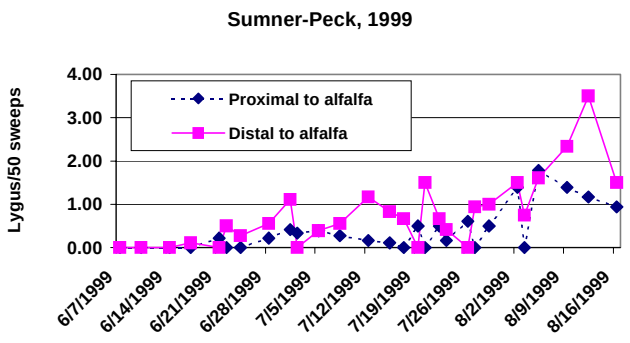

Figure 4. Lygus densities from cotton near alfalfa or distant from alfalfa, Fresno County 1998