

EFFECT OF LEAFHOPPER FEEDING ON ALFALFA QUALITY AND YIELD

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Abstract: Feeding effects by Empoasca leafhoppers on alfalfa was investigated. CUF101 alfalfa was hand cut in field and separated into 10 samples by percent of leaflets with hopperburn. Leafhoppers were collected from samples and have initially been determined as Empoasca canda. Percent crude protein was reduced by 26.1% and 24.8% in the 81-90% and 91-100% samples respectively by E. canda feeding. Some reduction in plant height and leaf numbers was noticed in the samples but not quantified in this study. Reduction in leaf numbers may be partly due to initial size of plant at time of leafhopper infestation.

Keywords: Alfalfa Crude Protein, Potato Leafhopper, Empoasca fabae, Empoasca canda, Empoasca mexara.

INTRODUCTION

Several species of leafhoppers are found feeding on alfalfa in the Colorado River valleys with the most important of these belonging to the genus Empoasca. The alfalfa attacking Empoasca complex is made up of several similar appearing leafhoppers, all greenish colored, wedge shaped and about 4 mm long. Some species are only able to be distinguished by examining the genitalia of the males following dissection.

In this area, the species of Empoasca known to occur on alfalfa include the southern garden leafhopper, E. solana; the western potato leafhopper, E. abrupta; and the potato leafhopper, E. fabae, and its related complex of species. This complex includes E. mexara, which has no common name but is thought to be a subspecies of E. canda, another leafhopper without a common name. (4)

These species do differ in the visible damage they cause. Feeding of the western potato leafhopper causes a coarse stippling on the upper side of the leaf (5), but that of the southern garden leafhopper is unknown. The potato leafhopper and other members of the E. fabae complex, such as E. mexara, cause a different type of injury. Potato leafhopper feeding damage is characterized by a yellow to reddish, diamond shaped discoloration of the terminal end of the alfalfa leaflet, and is known as hopperburn. This is caused by a toxin located in the saliva which is injected by the feeding leafhopper. The leaf later turns yellow, and with severe feeding the foliage exhibits a condition known as yellows.

The potato leafhopper occurs over the entire U.S. (Fig. 1) but its damage appears to be limited to east of the Rocky Mountains. Empoasca mexara, a Mexican native which was reported in the U.S. for the first time in 1954 from Arizona (5), has a much reduced area where it causes damage (Fig. 2) in comparison.

The effects of potato leafhopper feeding upon alfalfa quality and yield have been looked at by various researchers in the eastern and north central U.S. Although the potato leafhopper occurs in the western U.S. it is not considered to be economically important on alfalfa. The visual effects of leafhopper feeding, thought to be caused by E. mexara, have been noticed by the alfalfa producers along the Colorado River, but have not been fully investigated. This study was conducted to look more closely at the leafhoppers and the effects on their feeding upon alfalfa quality and yield in this area of the U.S.

METHODS AND MATERIALS

A leafhopper infested alfalfa field was located near Yuma, AZ. This field, which was nearing bloom, was of the CUF101 variety. Alfalfa plants exhibiting hopperburn were cut, placed into cardboard sacks, and shortly thereafter separated into groups of equal of per-

cents of hopperburn. Ten groups of samples (0-10%, 11-20%, etc.) were made to correspond closely with the 1 to 9 scale used for visually rating leafhopper yellowing (19th Alfalfa Improvement Conference, CR-54-56:63, 1964). Alfalfa with open bloom was discarded to eliminate fluctuations in protein levels due to factors other than leafhopper feeding. Leafhoppers on these samples were collected and sent to Dr. Paul W. Oman, Department of Entomology at Oregon State University, for determination.

The samples, after sorting was complete, were air dried and sent to Laboratory Consultants, 9213 South Hardy Drive, P.O. Box 27381, Tempe, AZ, for crude protein analysis.

RESULTS AND DISCUSSION

Leafhoppers collected from the alfalfa in this study have initially been determined as Empoasca canda. We are not aware of this species previously damaging alfalfa in the U.S., although E. mexara, which may be a subspecies of canda (4), does (1). The E. fabae complex has not yet been shown to be biologically different species at the present time and may be different forms of the same species. Much more work is needed to resolve this issue.

Feeding by E. canda leafhoppers caused a large reduction in the crude protein in this study (Fig. 3). Percent crude protein ranged from a high of 23.55 in the 0-10% samples to lows of 17.4 and 17.7 in the 81-90% and 91-100% samples respectively. When percent of protein is examined this represents a loss of 26.1% and 24.8% of the total crude protein respectively. The loss of protein due to E. canda feeding was curvilinear instead of a direct linear relationship. A better fit to the line would be expected if one looked at the total amount of tissue having hopperburn compared to the percent of leaves with hopperburn, as not all leaves had the same amount. The type of relationship and the amount of protein loss agree closely with studies conducted with the potato leafhopper on alfalfa by other researchers who found a maximum reduction of 29.5% (3) and a curvilinear relationship (2).

Alfalfa can also be severely stunted by Empoasca leafhopper feeding, depending upon numbers of leafhoppers and height of plant when attacked. One potato leafhopper/stem has been demonstrated to reduce plant height by 10.7% and 8 nymphs/plant reduce plant height by 53.6% (3). Alfalfa plants fed on by area leafhoppers also exhibit stunting. Empoasca mexara has been reported to severely stunt alfalfa in California fields with bloom occurring when plants are 6-9" tall (1). This may have resulted from heavy early field infestations just as regrowth was beginning and/or it may be that E. mexara has a stronger toxin than other Empoasca leafhoppers on alfalfa. Alfalfa fed upon by E. canda in this study was not as severely stunted as that reported for E. mexara, but the samples with more feeding (71-80, etc.) were shorter than the samples with lower feeding levels. Unfortunately, measurements of average plant height by sample were not taken in this study, and may not have been accurately correlated as initial time of attack may have been different.

More research needs to be done in the areas of leafhopper effects upon growth and yield. Producers pushing fields for increased tonnage may be economically hurting themselves because of the plant stunting and loss of crude protein as an effect of Empoasca leafhopper feeding.

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LITERATURE CITED

1. Ede, L. L. 1987. Leafhoppers stunt summer alfalfa. Univ of Cal., Riverside Co Coop. Ext Desert Ag Highlights. Aug.-Sept. p. 5.
- Hower, A. A., and R. A. Byers. 1977. The potato leafhopper reduced alfalfa quality. *Sci. Agric.* 24: 10-11.

3. Hower, A. A., and P. W. Flinn. 1986. Effects of feeding by potato leafhopper nymphs (Homoptera: Cicadellidae) on growth and quality of established stand alfalfa. *J. Econ Entomol.* 79: 779-784.
4. Ross, H. H., and T. E. Moore. 1957. New species in the Empoasca fabae complex (Homoptera, Cicadellidae). *Annals Entomol. Soc. Amer.* 50: 118-122.
Smith, F. F., and F. W. Poos. 1931. The feeding habits of some leafhoppers of the genus Empoasca. *J. Agric. Research.* 43: 267-285.
6. U.S.D.A. 1984. Standard tests to characterize pest resistance in alfalfa cultivars. Misc. pub. no. 1434. 38 pp.



Fig. 1. Distribution of the potato leafhopper, Empoasca fabae.



Fig. 2. Areas where the potato leafhopper, Empoasca fabae, and E. mexara cause economic damage (6).

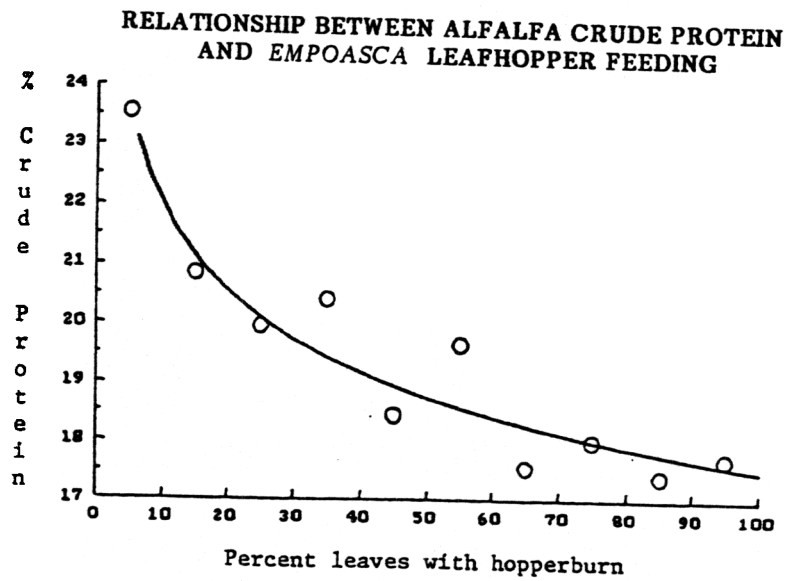


Fig. 3. The effect of Empoasca canda feeding upon crude protein in CUF101 alfalfa.