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# THE IMPACT OF OKRA-LEAF COTTON ON BENEFICIAL INSECT POPULATIONS

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## Abstract

The effects of okra-leaf cotton on beneficial arthropods were assessed by comparison of large field plots of acala okra-leaf (W 1218), and conventional (1517-99) cotton. Microclimatic differences were evaluated by comparing leaf area, relative humidity, and photosynthetically active radiation (PAR). Morphological differences including trichome density and plant height also were compared. Seasonal populations of beneficials were estimated using sweep-samples. Based on two years of data many of the predatory beneficials appeared to occur in greater numbers in the okra-leaf variety although, according to preliminary statistical analysis, there is no significant difference in the occurrence of beneficials in the two cotton varieties.

## Introduction

Upland acala, *Gossypium hirsutum*, and Pima, *G. barabadense*, cottons dominate cotton production under the dry, arid conditions of New Mexico. Varieties grown in the state are the result of complex parentages and breeding improvements that have made them more suitable for the southwestern environment. The search for improved varieties continues and due to the increased implementation of integrated pest management practices, reliance on traditional chemical pest control is decreasing and more environmentally conscious means of control are being sought.

Advances in breeding technology have allowed scientists to identify and manipulate morphological characteristics that are believed to be advantageous to the plant. Some of these morphological traits have been shown to impact resistance against pest feeding and damage. Okra-leaf cotton is currently of interest due to its potential impact on arthropod populations and has the potential to be a valuable tool for host-plant resistance without the selective pressures imposed by Bt. It provides an "open-canopy" cotton crop due to decreased leaf surface area. This feature may permit greater air circulation and light penetration to the inner, lower portions of the canopy than that of conventional cotton (Meredith 1984). Due to this increase in air movement and light penetration, temperature within the canopy is also affected and these characteristics may influence arthropods in and around the plant. The okra-leaf trait has been shown to have decreased numbers of silverleaf whitefly, *Bemisia argentifolii*, adults and nymphs than the normal leaf cotton varieties that also were tested (Natwick and Walker 2002) and to be less attractive to the sweet potato whitefly, *B. tabaci* (Chu et al. 2002). Okra-leaf cotton also has been shown to be resistant to cotton and pink bollworms, boll weevil, and mites (Burleigh 1975, Wilson 1986, Pieters and Bird 1977, Wilson 1994). Okra-leaf cotton

The okra-leaf trait may potentially impact beneficial populations as well. However, little information is available. Therefore, this study was initiated to examine the potential impact of the okra-leaf trait on populations of beneficial arthropods.

## Materials and Methods

### Experimental design

Large field plots (24 rows by 56 ft) of acala okra-leaf (W 1218) and conventional (1517-99) cotton were planted on the 2nd of May 2003 and the 7th of May in 2004 at the Leyendecker Plant Sciences Research Center near Las Cruces, NM. Plots were arranged in a randomized complete block design with four replications. Two rows from the center of each plot were machine harvested and weighed to estimate yield.

### Leaf microclimate

Temperature and humidity levels were monitored season-long each year using Hobo Pro-series data loggers. Loggers were placed both within the canopy and above for comparison. Leaf surface area was measured every 2 weeks in 2003 and once a month in 2004 by removing a leaf from the fifth node of 10 randomly selected plants per plot and utilizing a portable leaf area meter (LI-3000A). Relative humidity and photosynthetically-active radiation

(PAR) were taken once in 2003 and twice in 2004 using LiCor Steady State Porometer (LI-6400). Trichome density was measured in 2003 to determine if there was a difference between varieties.

**Beneficials**

Beneficial populations were estimated using a sweep net each season. Fifty-sweep samples were taken from one randomly-selected row in each plot each week beginning at bloom and continued until harvest. Samples were taken to the laboratory and frozen until they could be counted.

## Results

**Leaf microclimate**

Leaf area measurements showed that, as expected, okra-leaf cotton had the smaller leaf area of the two varieties examined (Fig. 1). Results of the other microclimate readings taken using the Licor measuring device show no significant difference for either PAR or relative humidity in both of the varieties examined. There also were no differences in trichome density between varieties.

**Beneficials**

Among the most common beneficials collected during this study were lady beetles, green lacewings, nabids, *Geocoris* and collops beetles. For the 2003 season preliminary examination of the data seems to show that all of the beneficial arthropods except green lacewings were numerically more abundant in the okra-leaf variety than in the conventional variety. However, preliminary statistical analysis shows no significant difference in beneficial occurrence in either the okra-leaf or conventional varieties (Fig. 2). For the 2004 season, again the preliminary examination of the data seems to indicate that beneficials with the exceptions of green lacewings and lady beetles were numerically more abundant in the okra-leaf variety than in the conventional variety. Due to heavy spraying implemented for the pink boll worm eradication program overall numbers for the 2004 season are very different from those seen in 2003(Fig. 3). Therefore, it is difficult to draw any strong conclusions from the data. However, preliminary comparisons of the two seasons seem to show that although the overall numbers are very different the relative proportions of each group of beneficials for each season seem to be similar.

**Yield**

There was no significant difference in the yield (seed cotton) for the okra-leaf and conventional varieties examined in this study (Fig. 4).

## Conclusions

Preliminary results indicate that several beneficial arthropod species were numerically more abundant in the okra-leaf variety than the conventional cotton. It is difficult to determine the specific reasons behind predator abundance in a crop. Possible reasons include presence of favorable microclimatic conditions influenced by such factors as PAR or humidity, a suitable food source, etc. However, preliminary analyses of our data indicate that there were no differences in PAR or humidity. Analysis of seasonal hobo data may provide a better indication of what is happening in the field. Although not included in this study, data were taken on populations of the most common pests in this system; this will be examined to see if there is a correlation between pest numbers and beneficial populations.

## Acknowledgments

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## References

Burleigh, J. G. 1975. Comparison of Heliothis spp. Larval Parasitism and Spicaria Infection in Closed and Open Canopy. Environ. Entomol. 4: 574-576.

Chu, C., E. T. Natwick, T.J. Henneberry. 2002. Normal Leaf and Okra-Leaf Upland Cultivars Susceptibility to Infestation by Silverleaf Whitefly. Journal of Economic Entomology. 95: 733-738.

Meredith, W. R. 1984. Influence of Leaf Morphology on Lint Yield of Cotton—Enhancement by the Sub Okra Trait. Crop Sci. 24:855-857.

Natwick, E. G. and G. P. Walker. 2002. Silverleaf whitefly resistance in the cotton relative, *Gossypium thurberi*. In Proceedings Beltwide Cotton Conferences, 2002. National Cotton Council, Memphis, TN.

Pieters, E. P., and L. S. Bird. 1977. Field Studies of Boll Weevil Resistant Cotton Lines Processing the Okra Leaf-Frego Bract Characteristics. Crop Science. 17: 431-433.

Wilson, F. D. 1986. Pink Bollworm Resistance, Lint Yield, and Lint Yield Components of Okra-leaf Cotton in Different Genetic Backgrounds. Crop Science. 26: 1164-1167.

Wilson, L. J. 1994. Resistance of Okra-Leaf Cotton Genotypes to Twospotted Spider Mites (Acari: Tetranychidae). Econ. Entomol. 87: 1726-1735.

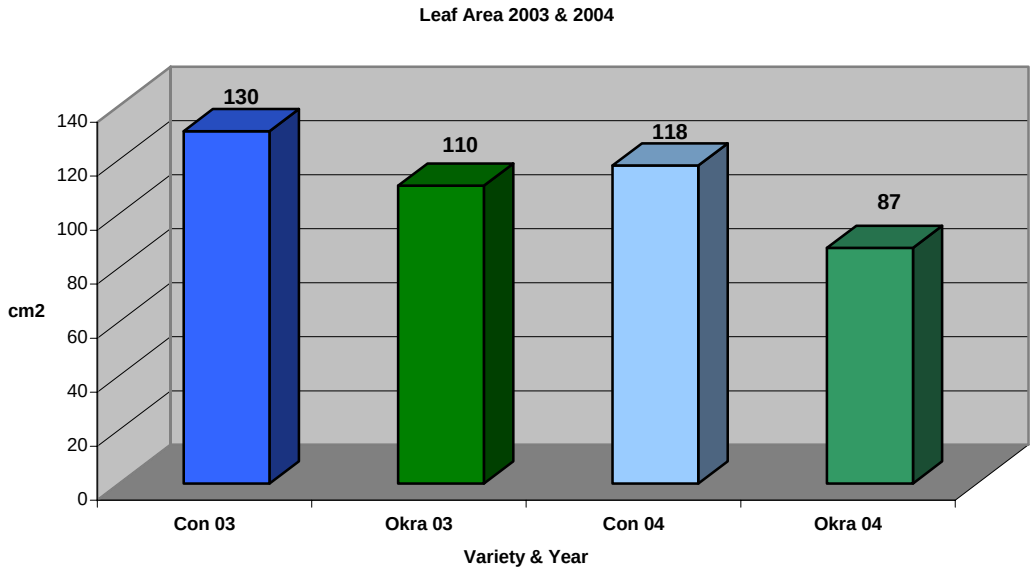


Figure 1. Average leaf area for cotton varieties at Leyendecker Farm, 2003 & 2004.

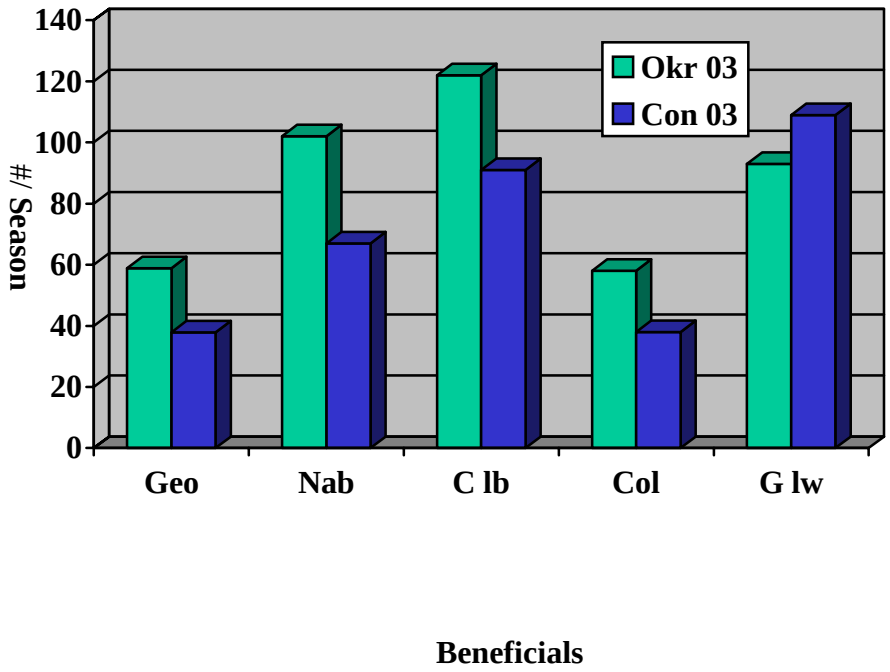


Figure 2. Total numbers for each beneficial by variety at Leyendecker Farm, 2003.

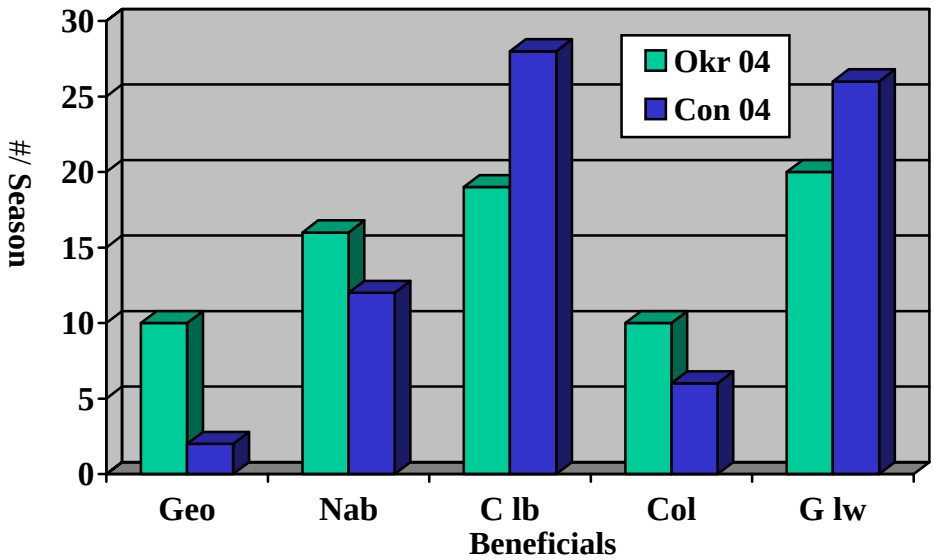


Figure 3. Total numbers for each beneficial by variety at Leyendecker Farm, 2004.

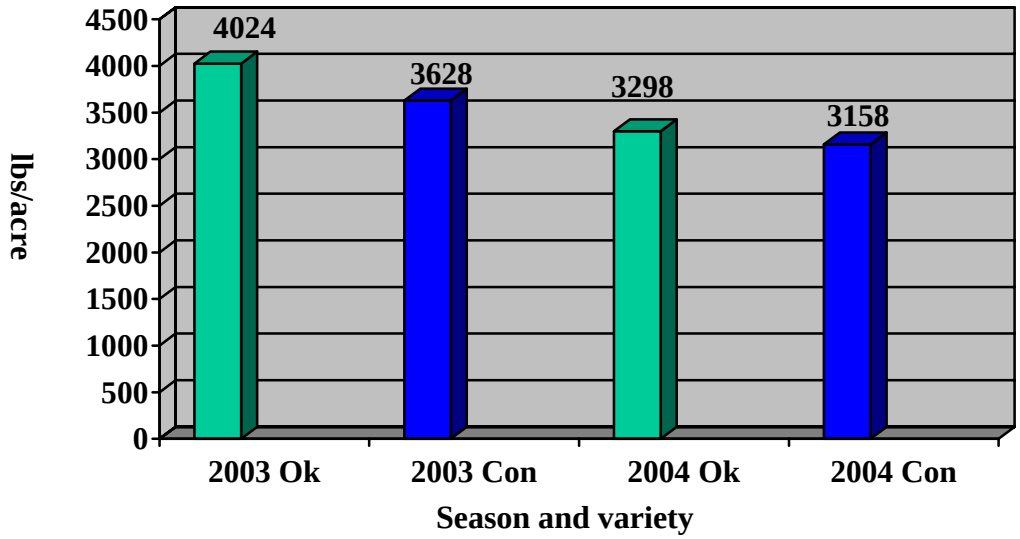


Figure 4. Yield in lbs/acre listed by season and variety from cotton plots at Leyendecker Farm, 2003 & 2004 .