

level, flight was heaviest up to 2.45 m. Flight occurred at 2.90 m indicating that some flight may take place above that level. Insects flying at these levels are likely to be carried long distances by the high winds that frequently accompany evening storms in the summer months.

A computer program (WATBUG) was developed with the Department of Agricultural Engineering, University of Arizona, that will determine the rate of development of the different stages of an insect in relation to fluctuating temperatures. Actual temperatures at one-hour intervals can be used as input or the program will estimate hourly temperatures from daily maximum and minimum temperatures. In addition, this program can model insect populations when such factors are known such as sex ratio, adult longevity, number of eggs laid per female, percent laying eggs, percent of life during which eggs are laid, reproductive diapause, various mortality factors, and other pertinent parameters. Specific mortality can be introduced to simulate the effect of insecticides, chemosterilants or parasites. The value of the program has been demonstrated with lygus bugs and cabbage loopers. Preliminary programs have also been run for pink bollworm, bollworm, and other insects.

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## BIOCLIMATOLOGY AND INSECT DEVELOPMENT

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### Objectives

To develop bodies of bioclimatological and biological data that may be used to predict the course of biological control of cotton insects.

### Summary of Progress

Temperatures in the various plant parts of cotton planted in one m rows and in two rows on a 0.52 m bed were monitored for 5-24 hour periods during the growing season. Future analysis will compare the temperatures within the canopies of the cotton in the standard row and the narrow-spaced cotton.

Leaf temperatures ( $\hat{y}$ ) on the upper side of cotton leaves may be estimated from air temperature ( $at$  in  $^{\circ}F$ ) with the regression equation:  $\hat{y} = 12.6 + 0.892(at)$ , and for the underside with the regression equation:  $\hat{y} = 3.7 + .916(at)$ . In the regression study introducing the height of the leaf in the plant as an additional independent variable had little effect upon the estimates by the regression equations. Though the modification of temperatures by the leaves is but a few degrees the leaves provide a sphere of activity where insects can function during periods of high temperatures.

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