

Source: Soybean Science [Ta tou k'o hsüeh ISSN:1000-9841, CN23-1227/S]

(1993) v.12(3) p.252-254.

Translated by Yujia Zhou, Edited by Mohan Ramaswamy, Kansas State University, 2003

EFFECTS OF APHID POPULATION ON THE MAJOR ECONOMIC PARAMETERS OF SOYBEAN

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Abstract- During the growing period of soybeans, aphids are harmful to several economic parameters of soybean. The aphid population density has a significant positive correlation with the rate of soybean shriveling and significant negative correlation with the 100-kernel weight and individual kernel weight of soybean.

Keywords- aphid population, economic parameters of soybean

The soybean aphid is a principal pest of soybean. Recently aphids, which are highly harmful, have infested over successive years many areas in Jining, Shandong Province due to drought, low rainfall and favorable temperatures during soybean growing seasons. Aphids injure the leaves, stems, pods, and affect the physiology of plants, leading to stunting, flower shedding and fruit dropping. Also, the honeydew secreted by aphids introduces large amounts of mildew, affecting the photosynthetic activity of plants, and ultimately leading to reduction in yield and quality. In order to define the harmful effects of aphid infestation, we investigated the relationship between aphid population and economic parameters of soybean from 1988 to 1990. Results are as follows:

I. RESEARCH APPROACH

Experiments were conducted in natural soybean fields in 1988 and 1989. In the seedling stages of soybean, experimental fields were chosen having homogeneous terrain, soil productivity, irrigation and soybean sprouting. The experimental fields were partitioned into blocks. Each individual plant within each block was identified by a recording card. The base number of aphids on each individual plant was recorded in the early flowering phase. Thereafter, the numbers of aphids were recorded every seven days. After soybean harvest, seeds of individual plants were examined. Plant height, pod yield, quantity of shriveled pods, quantity of seeds, 100-kernel weight and individual grain weight, etc. were recorded. The relationship between quantity of aphids and each economic parameter was statistically analyzed.

In 1990, the experiment was divided into six treatment levels of aphid population and replicated thrice. Each experimental block consisted of 1 square meter area with a 0.25-meter distance between individual plants. In the early flowering phase of soybean, the number of aphids introduced on individual plants in each treatment were 0, 65, 150, 600,

1250 and 1750, respectively. To release aphids, soybean stems with large numbers of aphids were plucked from an infested field and shaken on plants, letting aphids fall naturally. To control their number, any extra aphids were brushed off and crushed. After harvest, the same statistical analysis was performed.

II. RESEARCH RESULTS

A. Relationship between aphid population density and proportion of shriveled soybean pods

Quantity of pods per plant, quantity of viable pods, quantity and proportion of shriveled pods are major economic parameters of soybean, closely related to soybean yield. The results of experiments in 1989 and 1990 show that there is significant relationship between aphid population density during the soybean flowering phase and the proportion of shriveled soybean pods.

The regression relationship between aphid population density during soybean flowering phase and proportion of shriveled soybean pods in 1989 is:

$$y_1 = 5.4899 + 0.01816x_1 \quad (1)$$

$$n = 5, r = 0.9344 \quad (p < 0.05)$$

The regression relationship between aphid population density during soybean flowering phase and proportion of shriveled soybean pods in 1990 is:

$$y_2 = 2.5895 + 0.001755x_2 \quad (2)$$

$$n = 6, r = 0.8592 \quad (p < 0.05)$$

From (1) and (2), the aphid population density during soybean flowering phase demonstrates a significant positive correlation with proportion of shriveled soybean pods. More aphids lead to higher proportion of shriveled pods.

B. Relationship between aphid population density and soybean 100-kernel weight

The results of experiments from 1988 to 1990 show that there is a significant relationship between aphid population density and soybean 100-kernel weight.

The regression relationship between the aphid population density and soybean 100-kernel weight in 1988 is:

$$y_3 = 16.2406 - 0.011x_3 \quad (3)$$

$$n = 4, r = -0.9262 \quad (p < 0.05)$$

The regression relationship between the aphid population density and soybean 100-kernel weight in 1989 is:

$$y_4 = 20.5364 - 0.00168x_4 \quad (4)$$

$$n = 5, r = -0.95696 \quad (p < 0.01)$$

The regression relationship between the aphid population density and soybean 100-kernel weight in 1990 is:

$$y_5 = 14.1913 - 0.00123x_5 \quad (5)$$

$$n = 6, r = -0.8796 \quad (p < 0.05)$$

From (3), (4) and (5), the aphid population density has a significant negative correlation with soybean 100-kernel weight. Higher aphid population density leads to lower 100-kernel weight.

C. Relationship between aphid population density and soybean individual grain weight

In the 1990 experiment, aphid population density was artificially controlled. Investigations on the relationship between aphid population density and soybean individual kernel weight resulted in the regression relationship below:

$$y_6 = 21.6320 - 0.00233x_6 \quad (6)$$

$$n = 6, r = -0.9431 \quad (p < 0.01)$$

From (6), there is a significant negative correlation between aphid population density and soybean individual kernel weight. Higher aphid population density leads to lower individual kernel weight.

III. RESULTS AND CONCLUSION

The results of the above experiments showed that aphid population density during growth period of soybean significantly affected proportion of shriveled pods, 100-kernel weight and individual grain weight. The higher the density of aphid population, the higher the proportion of shriveled pods, the lower 100-kernel weight and individual kernel weight. In conclusion, by affecting major economic parameters of soybean, aphids cause soybean yield decrease.

IV. REFERENCES

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