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Studies on the Population Dynamics and Control Stage of Soybean Aphid in Jining, China

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Soybean aphids were widespread and caused serious harm in the Jining area in recent years. About 800 aphids were found on a single soybean plant at peak time in general and even over 3,000 were found on typical individual plants. From 1988 to 1990 the aphid population was systematically investigated in soybean fields for scientific and efficient control. The relationship between population dynamics of soybean aphid and meteorological information was analyzed.

Investigation Method

In 1988, a sampling survey was carried out to determine the spread and damage of soybean aphids during a peak emergence period in Jiexiang, Wenshang and Qufu Counties. In 1988-1990, the population of soybean aphids was systematically investigated in experimental fields of the Agricultural Institute of Jining on soybean variety Ludong No.2. Specimens were sampled from 10 fixed plants at each of 5 fixed sites. The numbers of pterygote and apterous aphids, the characteristics of occurrence and damage caused by aphids were recorded once every 3 days until they disappeared from the fields.

Result and Analysis

A. Characteristics of Occurrence and Damage Caused by Soybean Aphids

The result of the sampling survey from the above-mentioned 3 counties showed that 100% of the soybean plants were infested. Aphids occurred mainly on the back sides of leaves at the seedling stage and infested the leaves and stems on the middle part of soybean plants at the beginning of the flowering phase. At the full flowering stage, aphids mainly infested upper leaves, top sprouts and flower buds. Decreased differentiation, shrinkage and falling of flower buds, dwarfed plants and reduced weight of 100 grains occurred in with severely damaged soybean plants.

B. Population Dynamic of Soybean Aphid in Field

Aphids soon began to migrate into soybean fields after leaf emergence in early July. The aphid population increased slowly in the whole seedling stage until the end of the month. About 30 aphids occurred per plant on average. Sometimes the population even decreased because of wind and rain. From then on to early August, the reproduction of aphids increased up to the beginning of flowering. The aphid numbers continued to increase on a log scale for 15 days and reached a peak around the 15th of August at the

flowering and podding stage. From the last 10 days of August, aphid numbers decreased rapidly at late podding stage and disappeared in the maturing period. Apterous aphids completely dominated soybean fields and the population dynamic was the same as that of the total population. The numbers of pterygote aphids were much fewer but very significant for migrating and spreading.

C. Relationship of Meteorological Factors and Population Dynamics of Soybean Aphid

The population dynamic was influenced by temperature, moisture, wind, rain etc. Among these factors, temperature and rain were more significant. Appropriate temperatures are essential for survival and propagation of soybean aphids. From early July to middle August, the daily mean temperature was about 25° C, and 20° C was the lowest temperature at night. This was beneficial for aphids and population growth. After the end of August, the daily mean temperature dropped and the temperature difference between day and night increased, which was harmful for aphids, whose population decreased quickly. Rain is another major factor influencing the aphid population. In 1990, there were more rainy days than normal, and the population was kept at a low level until the end of July to the middle 10 days of August. Then the weather conditions were sufficient, so that average numbers of soybean aphid increased from tens to nearly one thousand on a single plant.

D. Discussion on the proper time for control

According to the observed population dynamics, soybean aphids need not be controlled at the seedling stage because of the small quantities of aphids and the growth of soybeans. From the end of July to the middle 10 days of August, the population was growing quickly to peak at the flowering and podding stages of soybean growth. The outbreak of aphids seriously affected the growth of soybean plants. Photosynthetic efficiency was reduced and some diseases were induced, since honeydew secreted by aphids covered the surface of the plants. Soybean aphids caused withering and release of flower buds, reduced number and weight of seeds, weakness and dwarfing of plants and decreases in flower bud differentiation, which led to yield reduction. Therefore, chemical control should be applied in the first days of the flowering age, approximately from the end of July to the beginning of August, which is the period of rapid increase in the aphid population. Over 95% control efficiency was obtained and validated for 7-10 days by spraying Omethoate, Dichlorvos and Deltamethrin routinely. Basically, just one spraying during this time could reduce the population of soybean aphids to a low level. Simultaneously, other injurious insects such as the mugwort looper and greenish yellow-brown hawk-moth were controlled.