Source: Soybean Bulletin [ISSN: 1009-2765, CN23-1337/S] (2000) v.8(1) p.5.
Translated by Dr. Zhishan Wu, edited by Dr. George Heimpel, University of Minnesota, 2003

Outbreak of Soybean Aphid in Suihua District in 1998 and its Control Strategies

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In 1998, the soybean aphid *Aphis glycines* Matsumura severely infested soybeans in previously unfested areas and unprecedented damage levels in Suihua District. Damage by soybean aphids caused huge losses. Yield losses in the district were up to 30% on average with a yield reduction of 112.5 million kilograms. The development characteristics, cause and control strategies of soybean aphids in 1998 are presented as follows.

1. Development and damage characteristics

1.1 Broader areas and wider distribution

The infested areas totaled 200,000 ha in the district in 1998, 3-5 times more than in normal years. Soybean aphid outbreaks developed in 10 cities and counties, and such an infestation was very rare in the district.

1.2 High density and severe infestation

Aphid density was over 1,000 per plant in the moderately infested soybean fields, while the density reached 3000 in heavily infested fields. Wangkui County was one of the most infested counties. About 6,000 ha out of total 40,000 ha produced nothing, and the rest had 10-30% yield decreases. The average yield loss was about 30% in this county.

1.3 Longer development and delayed damage

Soybean aphids usually infest soybeans from late June to late July, and then aphid populations decrease after early August. However, in 1998, the infestation continued until the end of August and peaked during mid-late August. Since soybeans began to grow pods and seeds in this stage, aphid infestations strongly affected the yield.

1.4 More injured plant parts

In normal years, aphid colonies concentrate on the tops of leaves, and young leaves and stems. In 1998, however, soybean aphids infested every part of the soybean plant.

2. Development cause analysis

2.1 Suitable climatic conditions

Two climatic stages affected the aphid population dynamics. First, the overwintered eggs hatched, nymphs survived and aphids reproduced from late April to mid May. In April-May 1998, sufficient rainfall benefited soybean growth and therefore the survival and reproduction of soybean aphids. Second, soybean aphid populations built from late June to early July. In this period, mean temperature per 10 days was 20-24ºC and mean relative humidity was below 78%. Aphid growth benefited from these climatic conditions. The development time of soybean aphid depends on temperature and nutrition. At 20-25ºC, 5-7 days were enough for soybean aphids to develop under suitable nutritious conditions, and aphids reproduced rapidly. Aphid populations peaked in mid August and continued until late August.

2.2 Decreased natural enemies

In the past, a number of natural enemies were reported, including the dominant ladybird beetles (*Harmonia axyridis*, *Propylaea japonica*, *Coccinella septempunctata*, *Hippodamia tredecimpunctata*), lacewings (*Chrysopa formosa*, *C. septempunctata*), syrphids, parasitoids, chamaemyiids and entomophagous fungi at the end of the season. Recently, however, unreasonable application of highly toxic pesticides in high volumes killed the natural enemies of soybean aphids and destroyed the ecological balance, resulting in high aphid density and heavy infestation.

2.3 Reduced variety resistance to aphid

In recent years, high yield soybean varieties were widely promoted and extended, but most of the varieties were insect-susceptible. For example, the Sui series of varieties (Suinong 10, 14 and 15) accounted for 60%, and Hefeng 25 and 35 accounted for about 20%. The extension of those varieties was one of the main factors leading to the aphid outbreak.

2.4 Untimely control

Soybean aphids migrate 4 times, including the two most threatening migrations in late June and mid July respectively. Effective control before these two migrations could suppress aphid populations and avoid severe damage. However, control was not applied at these critical times because of expectations of slight damage from soybean aphids based upon the fact that soybean aphids only infested soybeans minimally in the past several years. Thus, control was not effective, when soybean aphids developed rapidly in August and soybeans covered the spaces between the rows.

3. Control strategies

3.1 Control rules

General control rules include reasonable chemical application, protection of natural enemies, early application of chemicals (in sown stage, when aphids distribute sparsely, before second and third immigrations), and avoidance of aphid dispersal and wide infestation.

3.2 Monitoring and prediction

For mid- or long-term prediction, soybean aphid development in the current year can be predicted based on the comprehensive analysis of number of overwintered eggs and climatic conditions in late April – mid May and late June – early July. For short-term prediction, it is necessary to predict when aphids appear on 5% of plants with relatively high density around June 25th and high possibility of heavy infestation if accompanied with short-term climatic prediction and natural enemy analysis. If aphid populations do not decrease after late June, climatic conditions are suitable, natural enemy density is low and aphid infestations tend to be severe, control prediction needs to be conducted. In this period, once aphids develop on over 50% of plants, aphid density is up to 1,500 per 100 plants, the mean temperature for 10 consecutive days reaches 22ºC and the mean relative humidity for 10 consecutive days is below 78%, control methods need to be applied immediately.

3.3 Control in sown stage

Seed-coated pesticide can be used during sowing. The ratio of pesticide to soybean seeds is 1:75 by weight. Five percent Phorate can also be used for seed-coating. Twenty kg/ha of pesticide is applied with sown seeds and fertilizers to prevent soybean aphids in the seedling stage.

3.4 Field control

When soybean aphids appear sparsely and curled leaves develop on 5-10% of plants, or aphids appear on 50% of plants, aphid density is up to 1,500 per 100 plants, with few natural enemies and suitable temperature and humidity, control is required in the fields. The following pesticides can be used: 40% Dimethoate or Omethoate (1.5 kg in 300 kg water/ha, spraying) or 5% Sumi-alpha (150-300 ml in 450-600 ml water/ha, spraying).