

Damage and Control of Soybean Aphid

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The soybean aphid, *Aphis glycines*, is one of the major insect pests of seedling soybean. This aphid has become a serious problem in soybean production due to heavy infestation in recent years and lack of favorable varieties resistant to soybean aphids. To understand the damage by soybean aphids and evaluation of control effect, in 1989-1990, we investigated the population dynamics of soybean aphid in the fields and its effect on soybean growth, development and yield.

1. Survey methods

Experiments were conducted on a 15-mu (= 1 ha) experiment plot of the institute during 1989-1990. Soybean varieties Jilin 21 (1989) and 25 (1990) were tested under regular culture practice. Five sites of 50 m² each within the plot were kept untreated, while the rest of the field was sprayed with 10% Zengxiaoluyou when soybean aphids were found on June 26. From June 5th to July 30th, aphid density on twenty designed plants within each site was determined every 5 days. The number of aphids on trifoliolate leaves of the main stem, 3 top trifoliolate leaves, young stems and petioles were counted. Plant height and development stage were also recorded. During harvest, pod number (full pods only), weight of 100 seeds and total seed weight per plant were determined in a 2 m² area in untreated and adjacent treated sites respectively. Effects of aphid damage to soybean growth, development and yield were evaluated.

2. Results

2.1 Population dynamics of soybean aphid in the fields

In the untreated sites, aphids developed earlier and increased more rapidly in 1989. Aphid density went up to over 10,000 per 100 plants on June 15th and the peak period lasted 40 days. However, aphids developed slightly later with a shorter peak period in 1990.

Comparison between 1989 and 1990 was as follows. Aphids were first detected on June 5th and 10th respectively. The dates of aphid density reaching over and then dropping to below 10,000 per 100 plants were June 15th - July 30th (lasting 45 days) and June 25th - July 25th (lasting 30 days), respectively. Over 50% of plants had aphids on June 15th and 20th. All plants had aphids on June 25th and 30th, while aphid density decreased significantly on July 30th and 25th respectively.

2.2 Comparison of aphid density in the untreated and treated sites and effect of aphid density on soybean plant development

Aphid density was reduced in the treated sites after spraying. Comparisons of aphid densities and soybean development between untreated and treated sites are shown in Table 1.

Table 1 Effect of aphid damage on soybean development

Date	Aphid density per 100 plants		Plant height (cm)		Number of nodes per plant		Developmental stage		
	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	
1989.7	5	18,914	43,131	35.8	28.5	9.1	9.6	Beginning bloom	Early bloom
	20	1,460	42,481	66.7	49.1	13.6	11.4	Full bloom	Full bloom and beginning pod
	25	-	12,743	74.3	54.1	14.8	13.6	Full bloom and beginning pod	Beginning pod
	30	-	1,015	77.7	64.8	15.7	14.8	Beginning pod	Full pod
1990.7	5	873	85,640	46.3	43.1	10.0	9.7	Beginning bloom	Beginning bloom
	20	4,580	21,233	81.1	69.8	14.9	14.2	Full bloom	Full bloom and beginning pod
	25	1,288	4,348	88.6	77.4	18.0	17.0	Full bloom and beginning pod	Beginning pod
	30	1,346	2,331	90.5	79.1	18.5	18.2	Beginning pod	Beginning pod

2.3 Results of two-year experiments

2.3.1 Significantly decreased aphid density in the treated sites

On July 5th 1989, aphid density was 18,914 and 43,131 per 100 plants in the treated and untreated sites. Aphid density in the treated sites was only 44% of that in the untreated sites. On July 20th, aphid numbers were 1,460 and 42,481 respectively, while aphids in the treated sites were only 3% of those in the untreated sites. On July 5th and 20th 1990, aphid density in the treated sites was 1% and 22% of that in the untreated sites.

2.3.2 Significantly curled leaves and stunted stems in the untreated sites

Soybean plants in the treated sites were taller than those in the untreated sites. On July 5th 1989 and 1990, average plant height in the treated sites was 7 cm, which was 3 cm more than that in the untreated sites. On July 25th, aphid numbers decreased significantly, but plant height difference was the greatest. The difference was 20 cm and 11 cm in 1989 and 1990. Plant height in the untreated sites was 73% in 1989 and 87% in 1990 of that in the treated sites. After July 30th, development of untreated soybean plants was compensated gradually with a reduced difference of plant height and not significantly different number of nodes between treated and untreated sites.

2.3.3 Slightly earlier plant development in the untreated sites

On July 20th in both years, the development stage was full bloom and beginning pod in the untreated sites, and it was full bloom in the treated sites. On July 25th, untreated soybeans began to develop pods while treated soybeans were fully blooming and began to produce pods.

Damage by aphids led to curled leaves, shortened stems, stunted plants and earlier development.

2.4 Effect of aphid infestation on soybean yield

Survey results during soybean maturing stage are shown in Table 2.

Pod number, weight of 100 seeds and yields were higher in the treated sites. Yields in the untreated sites were reduced 28% and 16% in 1989 and 1990, equivalent to 726kg/km² and 550kg/km².

Table 2 Pod number, weight of 100 seeds and yield (? node weight) of soybeans

Year	Pods/plant		Weight/100 seeds (g)		Node weight (g/m ²)	
	Control plot	Untreated plot	Control plot	Untreated plot	Control plot	Untreated plot
1989	30.9	25.8	16.0	15.0	261.3	188.7
1990	49.3	44.0	22.7	22.0	340.5	285.5

Injury by soybean aphids had a significant effect on yield. Especially when aphid density was high in the early seedling stage and had a longer peak period, treatment would be able to save yield losses by 28%. Based on the saved yield of 726kg/ha and soybean price of 1.60 yuan/kg, it translated to a profit of 1,162 yuan/ha. If control (chemical) cost was 50 yuan, labor was 30 yuan, and utility cost was 20 yuan, total cost would be 100 yuan. Ratio of input to output was 1:12 and then profit increased over 1000 yuan/ha.

When aphid density per 100 plants is over 10,000 in seedling stage and there are aphids on over 90% of plants, timely control can produce favorable economic profit. In the middle areas of Jilin Province, suitable control date is around June 26th in the heavily infested year.