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Screening for Soybean Varieties Resistant to Soybean Aphid

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One of the basic measures to control insect pests uses insect resistance found in crop varieties. We carried out screening work on cultivars of soybeans resistant to soybean aphids (*Aphis glycines* Matsumura) in order to obtain resistant sources and study the mechanism of resistance. The objectives of screening are to identify soybean cultivars that are not only resistant to aphids, but also to virus diseases. We adopted simple and convenient screening methods due limitations of human resources and time.

During the peak of the soybean aphid occurrence in 1983, we selected 181 accessions of soybean materials from 902 grown in our institute's nursery of cultivar resources, after investigating the occurrence damage caused by aphids. After planting these 181 soybean accessions in plots in 1984 and carrying out two investigations on June 13 and September 5, 42 further accessions of soybean materials were selected. Of the 42 accessions, 19 accessions were selected after two investigations carried out July 2 and October 5. The 19 accessions were planted again in 1986 in plots, and two investigations were carried out June 27 and July 12, respectively.

Plot-setting methods: every cultivar was planted in one plot, and no replicates were made. Each plot was 2 meters long and 3 rows were planted.

Scoring standard in investigations: the scoring standard of resistance varies according to the different dates of investigation.

1. Scoring standard at the late stages of aphid occurrence:

Scale 0: no aphid infestation in the whole plot;

Scale 1: Less than 100 aphids on each plant in the whole plot;

Scale 2: Some of the new leaves on the top of just a few plants in the whole plot begin to curl, and there are about 1000 aphids on each plant;

Scale 3: Three adjacent plants in the whole plot show curling of new leaves on the top, and there are about 1000 aphids on each plant;

Scale 4: Many plants in the whole plot show curling of new leaves on the top, and there are more than 1000 aphids on each plant.

2. Scoring standard at the peak stage of aphid occurrence:

Scale 0: no aphid infestation in the whole plot;

Scale 1: Few aphids infested in the whole plot, less than 100 aphids on each plant.

Scale 2: Few plants in the whole plot show curling, and wrinkling of new leaves on the top of a plant; or although there are no stunted plants, there are many aphids distributed on the leaves and stems of each plant.

Scale 3: About 10 plants in the whole plot show curling, and wrinkling of the new leaves on the top of a plant; there are many aphids on each plant (more than 1000 aphids).

Scale 4: Many (about 20) plants in the whole plot shows curling, and wrinkling of the new leaves on the top of a plant; and the amount of aphids on each plant is quite large (more than 2000 aphids).

3. Scoring standard at about one week after the peak stage of aphid occurrence:

Scale 0: no aphid infestation in the whole plot;

Scale 1: No plants in the whole plot show curling, and wrinkling of the new leaves on the top of a plant;

Scale 2: Few plants in the whole plot show curling, and wrinkling of the new leaves on the top of a plant;

Scale 3: Only a fraction of plants in the whole plot shows curling, and wrinkling of the new leaves on the top of a plant; most plants are normal; or most plants show curling, and wrinkling of the new leaves on the top, but the plants are not stunted;

Scale 4: Most plants in the whole plot show curling, and wrinkling of the new leaves on the top of a plant.

For investigations carried out in the fall (autumn), observations should be focused on the maturation stage, the density of pod-bearing, and the situation of lodging of the soybean varieties, so as to obtain resistant varieties with high resistance and ideal traits of production after screening. At the same time, information could be provided for the exploration of the mechanisms of resistance in soybeans.

The results of investigations on the resistance of major varieties after screening for the past several years are summarized in the following table:

Table 1. The grades of resistance in released soybean varieties to soybean aphid

Variety	Grade of Resistance			Amount	Average Grade
	1984	1985	1986		
Xiaojinhuang	1—1	0	3—3	4.0	1.33
Silihuang	0—1	1	3—4	5.0	1.66
5621—1—6—2—4	1—1	1	2—3	4.5	1.56
Duludou	2—1	1	2—1.5	4.25	1.42
Dahuangdou	0—1	4	4—4	3.5	2.83
Jiti—1	2—1	1	4—3	6.0	2.00
Tiejiazhi	1—1	1	3—3	5.0	1.66
Qingpipingdingxing	1—1	0.5	2—1.5	3.25	1.08
Xiao-Jinyun	0—1	1	3—3	5.0	1.66
Liaodou—3	—	1	2—3	3.5	1.75
Fiefeng—18	2—1	1	3—3	5.5	1.83
Silihuang—2	0—1	1	4—4	5.5	1.83
Tie feng—8	0—1	0.5	2—3	4.5	1.50
Jiti—2	1—1	1	3—4	6.0	2.00
Jionang—6	1—1	1	2—3	5.0	1.66
Heiqi	0—1	1	3—3	5.0	1.66
Km—k	1—2	4	4—4	10.0	3.33
Huetiejia	2—1	3	4—4	8.5	2.83
Sili huang 3	1—1	3	3—4	8.0	2.67
Aphid quantity/100 plants/peak day	22100	54402	255800	—	—

The following conclusions can be made from the above table:

- (1) The variation is significant in the resistance of different varieties of soybeans, and those varieties with an average grade (of 3 years-resistance grades) of less than 2 are moderately resistant ones. From the resistance scale at the year of severe infestation of aphids, Qingpipingdingxing and Duludou should belong to highly resistant varieties.

- (2) The same variety showed higher resistance in the year of mild aphid infestation, and showed lower resistance in the year of severe infestation. The variation is significant in the resistance of different varieties of soybeans in either situation. Therefore, the identification of natural aphid resistance in soybeans in the field should be carried out over many years, especially year(s) with severe aphid, to obtain relatively accurate scoring of resistance levels in soybean varieties.
- (3) For some varieties, they were not quite resistant to aphids in the first year of investigation, getting low grades of resistance; but they showed comparative resistance to aphids in the second year. These varieties belong to damage-tolerant ones. Otherwise, they will not be damage-tolerant varieties.
- (4) To screen for resistant varieties, at least two investigations at different stages should be carried out. The first investigation should be at the peak stage (approaching the peak day) of aphid infestation, because the variation is significant in resistance of different soybean varieties at this stage; and it is easier to score different resistance grades. The second investigation should be at about one week after the peak stage, mainly for finding the damage-tolerant varieties. Only those varieties that are significantly recovering to the normal growth belong to the type of damage-tolerant varieties. If manpower is available, it would be better to carry out one more investigation at the late stage of aphid infestation, so that the performance of each variety could be observed at each stage of aphid infestation.