

EFFECT OF ARTIFICIAL DEFOLIATION ON LEAF SPOT DISEASES AND SEED YIELDS OF SUNFLOWER

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Abstract

The results of three year trials in the fields showed that artificial defoliation of 16 and 20 leaves from the lower part of sunflower plants decreased the disease indices by 21.98% and 31.60% and increased the seed yields by 44.82% and 43.32%, the upper leaf areas by 56.00% and 69.27% and the chlorophyll contents by 29.41% and 2.48%, respectively ,compared with that of the control.

Key-words: Sunflower , Artificial defoliation

Introduction

Sunflower is one of the important oil crops in China and the growing area of the crop in Jilin Province makes up 20% of the total area of the country. However, the growing area in the province was reduced by 54% during 1986-1990 because of economic and growing conditioned reasons. One of the reasons is the infection of leaf spots including the *Alternaria* spot and *Septoria* spot which make most of the leaves wilt and the plants die early in some years. Chemical control for the two diseases have been tried but the effectiveness was not good enough. Hybrids and varieties of sunflower have not been found to resist to either of the two diseases. Since the two diseases begin to infect the sunflower plants from the lower old leaves, defoliating the leaves would reduce the infection carrier of the diseases. The objective of the study was to prove the effect of the artificial defoliation on the leaf spot diseases and seeds yields.

Materials and methods

The trials were conducted in the experimental fields of Jilin Province Research Institute of Sunflower, at Baicheng City, Jilin Province, in which *Alternaria* spot and *Septoria* spot attack sunflower severely every year. The sunflower hybrid "Baikuizha 1" was used in the entire trials. Defoliating 0(CK), 4 , 8 , 12 , 16 , 20 and 24 leaves from the lower part of the plants served as 6 treatments , respectively. The field was divided into plots

consisting of 10 rows 0.75 m apart and 15 m long with 30 plants per row. The plots were arranged in a completely randomized block design with 3 replicates. Sowing took place at the beginning of May. The first defoliation started when the plants were 7-8 leaves old (early to middle of June), defoliating 4 leaves each time and doing in the same way every 10 days.

In each treatment, 5 plants with 3 replicates were checked for the disease index (DI) on a scale of 0-8, where 0=no leaves spotted; 1=1% leaf area spotted; 2=5% leaf area spotted; 3=10% leaf area spotted; 4=20% leaf area spotted; 5=30% leaf area spotted; 6=50% leaf area spotted; 7=70% leaf area spotted and 8=100% leaf area spotted. The DI was calculated using the formula: $DI = \frac{\sum(I \times j)}{n} \times 100 \times I$, where n =total number of plants; I =the highest severity class of the plants investigated; I =the severity class of each plant and j =number of plants in each class. The mean of the 3 replicates was used for comparing with that in the control.

By harvesting time, 50 heads were sampled in each treatment for testing the seed yields and the mean of the 3 replicates was used for comparison with that in the CK.

On the 20th of August, 10 plants in 1991 and 5 plants in 1992 were sampled from each treatment for calculating the approximate leaf areas (length x width) in square centimeter. The mean of the three replicates was used for comparison with the CK.

On the 20th of August, 5 leaves at upper part of one of the 10 plants were sampled from each treatment for testing the chlorophyll content with photoelectric colorimeter in 1992. The mean of the three replicates was used for the comparison with CK.

Results and discussion

The average results of the three years showed that the disease indexes in the treatments of defoliating 4-24 leaves were decreased by a range of 5.10-40.04% compared with that in CK and the most reductions of the disease indexes were obtained in the treatments of defoliating 16, 20 and 24 leaves by 21.98%, 31.61% and 40.04%, respectively (Table 1). Generally, the two leaf spot diseases begin to attack the lower part leaves of sunflower plants during the late of June to the early of July so that the disease indexes could be reduced by defoliating such leaves which are the carriers of the infection.

The defoliation of the sunflower plants significantly increased seed yields compared with CK (Table 2). The seed yields in the treatments of defoliating 4-24 leaves were higher by 6.80-44.82% than that in the control on the basis of the means of the three years. The treatments of defoliating 16 and 20 leaves produced the highest seed yield increase percentages by 44.82% and 43.32%, respectively.

Table 1. Effect of the artificial defoliation on the disease index of the leaf spot in sunflower

Years	Treatments						CK
	4	8	12	16	20	24	
1980	52.41 (14.47)*	46.71 (23.78)	39.30 (35.87)	33.05 (46.07)	30.31 (50.54)	24.51 (60.00)	61.28 -
1991	87.16 (2.61)	85.79 (4.15)	81.26 (9.21)	78.96 (11.78)	72.64 (18.84)	61.73 (31.03)	89.50 -
1992	95.53 (1.40)	91.45 (5.61)	82.19 (15.17)	81.22 (16.17)	66.44 (31.43)	62.25 (35.75)	82.56 -
Means	78.37 (5.10)	74.65 (9.60)	67.58 (18.14)	64.41 (21.98)	56.46 (31.61)	49.50 (40.04)	82.56 -

* The figures in the brackets are the decreased disease index percentage by comparing with the CK.

Table 2. Effect of the artificial defoliation on the seed yields in sunflower

Years	Treatments						CK
	4	8	12	16	20	24	
1980	2127.75 (10.99)*	2190.75 (14.28)	2043.75 (6.61)	2468.25 (28.76)	2731.50 (42.49)	2064.75 (7.71)	1917.00 -
1991	1833.90 (4.65)	1874.70 (6.98)	2236.05 (27.60)	2553.90 (45.80)	2445.15 (39.34)	1929.00 (10.08)	1752.45 -
1992	1669.50 (4.06)	2026.80 (26.34)	2444.10 (62.35)	2615.10 (63.01)	2381.55 (48.45)	2217.30 (36.210)	1604.25 -
Means	1877.05 (6.80)	2030.75 (15.52)	2241.30 (27.50)	2545.75 (44.82)	2519.40 (43.32)	2070.35 (17.77)	1757.90

* The figures in the brackets are the increased seed yield percentage by comparing with the CK.

Table 3. Effect of the artificial defoliation on the total leaf areas(square centimeter) and chlorophyll contents(mg/g) in sunflower

Items	Treatments						CK
	4	8	12	16	20	24	
Total leaf area per plant	8258.93 (1.00)*	9449.40 (15.55)	13774.08 (68.44)	12757.15 (36.00)	13842.35 (69.27)	6998.38 (-14.48)	8177.55 -
Chlorophyll content	12.27 (12.77)	14.58 (34.00)	12.56 (15.44)	14.08 (29.50)	11.15 (2.48)	13.92 (28.00)	10.88 -

* The figures in the brackets are the increased percentage by comparing with the CK.

The results showed that the approximate leaf areas per plant in the treatments of defoliating 4-20 leaves increased by 1.00-69.27% compared with the CK (Table 3). The higher approximate leaf area increases took place in the treatments of defoliating 12, 16 and 20 leaves by 68.44%, 56.00% and 69.27%, respectively.

The defoliation of the sunflower plants in all treatments increased chlorophyll contents by a range of 2.48-34.00% compared with the CK (Table 3).

In line with the results of the three year trials, it was concluded that the optimum defoliating figures were 16 and 20 leaves from the lower part of the sunflower plants, which could decrease the disease indexes of the plants infected by *Alternaria* and *Septoria* spots and increase the leaf areas, chlorophyll contents and seed yields.