INCIDENCE OF *ALTERNARIA* LEAF SPOT IN RELATION TO PLANT POPULATION AND FERTILIZATION VARIATION IN SUNFLOWER

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INTRODUCTION

The incidence of causal organisms in different crops is known to be greatly influenced by the agro-cultural practices like crop geometry, planting density, mineral nutrition, site drainage and time of sowing. But, such attemps are lacking in sunflower. Among various diseases *Alternaria* leaf spot had been reported to be the most widely distributed and harmful agent of sunflower (Ačimović, 1979) causing epiphytotics of brownish-black spots, premature withering of leaves and yield decreases by 10—12% (Ačimović, 1974). Garud et al. (1979) reported that the introduced Russian cultivars get severe infection covering more than 50% leaf area and the spots extend over the petioles, stem and floral parts. The disease has assumed epiphytotic proportions in India (Bhaskaran and Kandaswamy, 1978) and has been reported to occur in a severe form from various parts of the country. An attempt has therefore, been made to evaluate the incidence of *Alternaria* in relation to nitrogen nutrition, population density regulated by different spacings and the mineral micro-elements.

MATERIALS AND METHODS

The cultivars Armavirski during monsoon (August-November) and Peredovik during winter (December-March) 1979-80 were grown at the Agricultural Research Institute, Rajendranagar, Hyderabad on black soils of medium fertility. Six spacings corresponding to differential plant population ranging from 27,556 to 166,500 plants per hectare (Table 1) in whole plots and four levels of nitrogen (0, 40, 80 and 120 kg N/ha) in sub-plots were replicated thrice in a split plot design. Uniform dose of 60 kg P_2O_5 and 40 kg K_2O per hectare was applied at the time of sowing.

Simultaneously another experiment with six micro-nutrients and a control was run in a randomised block design with four replications. The crop received an uniform dose of 60 kg N, 60 kg P_2O_5 and 40 kg K_2O per hectare. The micro-elements copper (Cu SO_4), manganese (Mn SO_4), iron (Fe SO_4) and zinc (Zn SO_4) each at 10 kg per hectare while sodium (Na SO_4) and boron (Borax) each at 5 kg per hectare were all applied at the time of sowing. In both the experiments one-third nitrogen was applied at the time of sowing and the rest two-third top dressed at bud stage of the crop.

Observations on the disease severity were made from bottom five leaves on five plants from each plant, 70 days after sowing. The disease intensity was calculated by the number of leaves in the sample whether they were infected or not. The disease incidence was computed as the number of leaves infected and expressed as per cent per sample. Based on the type of lesions, severy of the infection was graded as follows :

1. Resistant — Very low infection with a few lesions of 1 mm diameter.
2. Moderately resistant — 2—5 developed concentric spots of 2—3 mm with a necrotic area in the centre.
3. Moderately susceptible — Spots further increase in size up to 3—6 mm and the leaf area get affected by marginal necrosis or by lesions.
4. Susceptible — Lesions further increase in size and number. The necrotic lesions crack and shed giving an irregular shape to the leaf. The leaves become buttle.

The data were subjected to angular transformation and statistically analysed.

RESULTS AND DISCUSSION

The organism was identified as *Alternaria helianthicola* as described by Narsimha Rao and Rajagopalan (1977). The disease appeared during later stages of crop growth. The first symptoms in the form of small, scattered brownish-black spots appeared at bud and flower opening stage (50 days) of the

Table 1

Mean intensity (%) and the incidence (%) of *Alternaria* leaf spot in sunflower crop in relation to population density and levels of nitrogen

Treatment	Percentage intensity						Percentage incidence	
	Armavirski					Peredovik		
	total intensity	type of lesions				total intensity	Armavirski	Peredovik
		resistant	moderately resistant	moderately susceptible	susceptible			
Spacing								
60 cm × 60 cm	10.45 (18.12)	0.09 (0.91)	0.99 (4.25)	3.23 (10.08)	6.05 (12.71)	40.47 (39.40)	68.00 (58.76)	87.33 (84.74)
60 cm × 45 cm	8.58 (16.83)	0.10 (1.21)	1.05 (5.79)	2.87 (9.51)	4.57 (11.47)	34.01 (34.49)	72.66 (58.88)	83.66 (73.82)
60 cm × 30 cm	8.28 (16.47)	0.16 (1.71)	0.86 (4.98)	2.77 (9.28)	4.49 (11.19)	20.92 (26.49)	63.66 (53.29)	87.33 (73.50)
60 cm × 20 cm	8.35 (15.50)	0.10 (1.41)	1.27 (6.08)	2.47 (8.85)	4.51 (11.27)	27.48 (30.63)	61.33 (52.12)	88.33 (76.24)
45 cm × 30 cm	7.83 (15.66)	0.31 (2.19)	0.92 (5.36)	2.33 (8.41)	4.25 (10.31)	24.56 (28.52)	54.33 (47.57)	83.00 (73.82)
30 cm × 20 cm	4.98 (12.38)	0.16 (1.93)	0.97 (5.42)	1.53 (6.68)	2.29 (6.88)	12.35 (19.06)	48.33 (43.68)	64.66 (55.62)
SEm ±	1.07	0.38	0.72	0.92	1.36	3.05	2.55	4.22
CD 5%	NS	NS	NS	NS	NS	8.77	7.33	13.27
N level (kg/ha)								
N_0	4.85 (12.46)	0.14 (1.81)	0.96 (5.38)	1.72 (7.16)	2.00 (7.02)	18.02 (23.20)	47.55 (43.33)	71.55 (61.45)
N_{40}	7.99 (24.06)	0.20 (1.82)	1.20 (5.96)	2.21 (8.33)	4.35 (10.59)	25.36 (29.03)	58.22 (50.42)	78.88 (68.20)
N_{80}	9.26 (26.17)	0.14 (1.31)	0.73 (4.65)	2.87 (9.57)	5.60 (12.56)	26.64 (30.20)	68.88 (57.33)	90.44 (78.61)
N_{120}	10.19 (27.06)	0.13 (1.29)	1.01 (5.20)	3.34 (10.14)	5.47 (12.38)	36.58 (36.63)	70.88 (58.46)	95.33 (83.12)
SEm ±	0.79	0.38	0.41	0.47	1.07	1.51	2.54	3.23
CD 5%	2.30	NS	NS	1.40	3.08	4.34	7.30	9.25
Interactions (S×N)	NS	NS	NS	NS	NS	NS	NS	NS

Figures in parantheses are Arcsine percentage transformed values.

crop. The infection was mild at flowering and pollination phase (60 days) of the crop. The spots increased in size and number and the severity was highly manifested at grain filling (70 days) stage of the crop. Similarly, Ačimović (1979) reported higher damage caused by premature withering of leaves due to *Alternaria* at the stage of seed filling.

EFFECT OF PLANT POPULATION

Percentage severity in terms of disease intensity and incidence of the fungus on the number of leaves in general decreased at higher levels of plant population and closer spacing (Table 1). The percentage intensity of the infection in Armavirski decreased from a maximum of 18.12% at wider spacing of 60 cm × 60 cm to a minimum of 12.38% at 30 cm × 20 cm. The percentage intensity of resistant and moderately resistant type of lesions increased from 0.91 to 1.93% and from 4.25 to 5.42%. Conversely, the moderately susceptible and susceptible types indicated a decline in the intensity from 10.08 to 6.68% and from 12.71 to 6.88% respectively with a population fluctuation in plant density from lowest to the highest. The vigorous plant growth at wider spacings might have conferred a congenial microclimate for the spread of the fungus.

The infection on Peredovik during winter was so severe that the type of lesions other than the susceptible ones could hardly be recorded. The susceptibility to the infection increased significantly at wider spacings. A minimum intensity of 19.06% at closer spacing of 30 cm × 20 cm increased with decrease in plant density to a maximum of 30.40% at wider spacing of 60 cm × 60 cm. The disease incidence increased significantly at lower population densities. It increased from 43.69 to 58.76% in Armawirski and from 55.62 to 89.74% in Peredovik with decrease in population density from maximum to minimum.

EFFECT OF NITROGEN

The induced luxuriant vegetative crop growth with increasing levels of nitrogen played a significant role and conferred a predisposing factor for the infection of *Alternaria*. The intensity increased with every increment of added nitrogen up to 120 kg N/ha in both the cultivars. An intensity of 24.06% in Armavirski and 29.03% in Peredovik at 40 kg N/ha was significantly more than in control.

The intensity of lesions in Armavirski indicated that the susceptibility increased significantly at higher levels of nitrogen. The intensity of moderately susceptible and susceptible lesions increased from 7.17 to 10.14% and from 7.02 to 12.38% with increase in the levels of nitrogen from 0 to 120 kg N/ha.

The incidence of infection on number of lesions in Armavirski increased significantly from 43.33% in no nitrogen treatment to 57.33% at 80 kg N/ha and remained on a par with that of 58.46% at 120 kg N/ha. Similarly, increasing levels of nitrogen in Peredovik increased the incidence of infection from 61.45% in control to 83.12% at 120 kg N/ha.

The interaction between nitrogen and plant population was not effective in altering the severity of leaf spot symptoms in sunflowers.

EFFECT OF MICRO-NUTRIENTS

The micro-nutrients studied did not exert pronounced influence in altering both the incidence and intensity of the *Alternaria* leaf spot (Table 2).

Table 2

Mean per cent intensity and incidence of *Alternaria* as influenced by micro-nutrients

Treatments	Intensity (%)	Incidence (%)
$CuSO_4$ 10 kg/ha	8.49 (16.90)	65.00 (71.83)
$MnSO_4$ 10 kg/ha	7.93 (16.04)	57.00 (65.52)
$FeSO_4$ 10 kg/ha	6.41 (14.54)	59.00 (67.04)
$ZnSO_4$ 10 kg/ha	8.98 (17.17)	52.00 (61.55)
NaMo 5 kg/ha	7.40 (16.25)	52.00 (61.49)
Borax 5 kg/ha	8.27 (16.67)	53.00 (62.56)
Control	8.61 (16.83)	63.00 (70.99)
S Em ±	1.51	5.02
CD 5%	NS	NS

Figures in parantheses are Arcsine transformed values.

CONCLUSIONS

Wider spacing and higher levels of nitrogen nutrition predispose sunflowers to the susceptibility of *Alternaria helianthicola* causing leaf spot disease, while, the micro-nutrients seem to have no influence in altering the disease severity.

REFERENCES

Ačimović M., 1974, Bolesti kao uzrok niskih prinosa suncokreta godine. Bilten za biljna ulja i masti. 34 : 3—8.

Ačimović M., 1979, Pathogenicity of *Alternaria helianthi* (Hansf) Tub and Nish in sunflowers and other plant species. Sunflower Newsletter. 1 (3) : 9—13.

Bhaskaran R., Kandaswamy T. K., 1978, *Mineral metabolism of sunflower leaves as influenced by Alternaria helianthi infection,* Madras Agric. J. 65 (11) : 755—757.

Garud T. B., Ganacharya N. M., Shinde D. D., 1979, *Leaf spot of sunflower caused by Alternaria in Marathwada,* Res. Bull., Marathwada Agric. Univ. 3 (6) : 75.

Narsimha Rao G., Rajagopalan K., 1977, *A new record of Alternaria causing a leaf spot of sunflower,* Curr. Sci. 46 (21) : 750.

L'INCIDENCE DES TACHES FOLIAIRES CAUSÉES PAR L'ALTERNARIOSE EN RAPPORT AVEC LA DENSITÉ DES PLANTES ET LA VARIATION DE LA FERTILISATION DU TOURNESOL

Résumé

Les études conduites en Inde à l'Institut de Recherches Agronomiques de Rajendranagar, Hyderabad, ont rendu possible l'évaluation de l'incidence de l'alternariose *(Alternaria helianthicola)* en fonction de la nutrition en azote et microéléments et de la densité des plantes réglée d'après les différents espaces de nutrition. Dans ces études on a utilisé les cultivars Peredovik et Armavirski.

Les grands espaces et les niveaux élevés de nutrition en azote prédisposent le tournesol aux attaques de *Alternaria helianthicola,* cependant qu'il semble que les microéléments n'ont aucune influence sur la sévérité de la maladie.

INCIDENCIA DEL MANCHADO DE LAS HOJAS PROVOCADA POR ALTERNARIOSIS, EN RELACIÓN CON LA DENSIDAD DE PLANTAS Y LA VARIACIÓN DE LA FERTILIZACIÓN DEL GIRASOL

Resúmen

Las investigaciones efectuadas en India en el Istituto de investigaciones agrícolas de Rajendranagar, Hyderabad, han permitido evaluar la incidencia de la alternariosis *(Alternaria helianthicola)* en función de la nutrición con nitrógeno y microelementos, así como de la densidad de las plantas reglada en base a los diferentes espacios de nutrición. En este estudio se emplearon los cultivares Peredovik y Armavirski.

Los espacios grandes y los niveles altos de nutrición con nitrógeno predisponen el girasol al ataque de *Alternaria helianthicola,* mientras que los microelementos parecen no tener influencia alguna sobre la gravedad de la enfermedad.