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Effect of different levels of nitrogen in field on Alternaria blight severity of mustard

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Field trial were carried out (2007-08 to 2008-09) to assess the role of five different levels of nitrogen (80, 100, 120, 140 and 160 kg ha^{-1})application on soil against Alternaria blight of mustard caused by *Alternaria brassicae*. Application of increasing level of nitrogen in soil revealed that there was a significant ($p < 0.05$) increase in disease parameters like per cent of leaf infection, disease severity (AUDPC), per cent of siliqua infection, number of spots per siliqua as well as increase the yield attributes like number of siliqua per plant and 1000 seed weight. The optimum N fertilization would be 120 kg ha^{-1} to reduce the Alternaria blight of mustard like per cent of leaf infection (14.24%), disease severity (AUDPC= 16.38), per cent of siliqua infection (20.38%), number of spots per siliqua (12.69) and increase the yield parameters like number of siliqua per plant (105.34) and 1000 seed weight (3.39 g) in Gangetic alluvial zones of West Bengal.

Key words: *Alternaria brassicae,* mustard, nitrogen fertilization, Leaf blight, disease parameters, yield parameters

INTRODUCTION

Among the oilseed crops, mustard plays an important role in agricultural economy in India. This crop is affected by number of diseases, limiting productivity of crop over a wide area. Among them Alternaria blight (*Alternaria brassicae* (Berk) Sacc.) is the most important, causes an average yield loss of 10-70% (Kolte *et al.,* 1987). In addition to direct loss of yield, it also affects the quality of seed, its germination by reducing seed size, seed colour and oil content (Kaushik *et al.,* 1984). Though the disease can be managed to some extent by the use of fungicides (Varma and Saharan, 1994) but environmental imbalance is the major problem in various regions due to injudicious and untimely application of fungicides as well as nitrogen fertilizers. Very few information are available regarding effect of inorganic fertilizer application on the severity of Alternaria blight severity and seed yield of mustard caused by *Alternaria brassicae* (Dasgupta *et al.*, 1991; Sharma and Kolte, 1994). In view of this scenario, a field experiment has been carried out to find out the effect of different levels of nitrogen on Alternaria blight severity and seed yield of mustard in West Bengal condition to optimise their input for reducing the disease and increase yield.

MATERIALS AND METHODS

A field trial was conducted at University Instructional Farm, Jaguli, West Bengal during two crop seasons at 2007-08 and 2008-09 which is situated

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at an average altitude of 9.75 m and latitude and longitude of 22°93′ N and 88°33′ E respectively. A mustard cultivar Binoy (B-9) susceptible to Alternaria blight was used with a plot size of 5x5 m^2. The crop was sown on 5th November in each year in a randomized block design with three replications and uniform plant population with 30 cm x 15 cm spacing was maintained. Five different doses of nitrogen (80, 100, 120, 140 and 160 kg ha^{-1}) were used as treatments for this experiment. A uniform dose of phosphorus and potassium (30 and 60 kg ha^{-1} respectively) was applied as basal, in the form of single super phosphate and muriate of potash respectively. Application of nitrogen (N) at their different doses was made in two equal split doses, the first as basal and second as top dressing at first irrigation 30 days after sowing. One check untreated control (N:P:K @ 0:30:60 kg ha^{-1}) was also maintained for comparison of treatments. The observation of per cent leaf infection, disease severity were taken from 40 DAS to 100 DAS at an interval of 10 days. The per cent of leaf infection, number of spots per siliqua and the data on yield parameters (1000 seed weight and number of siliqua per plant) were taken at harvest. The per cent of leaf infection was assessed as number of leaf infected/10 plants and disease severity was assessed as the average disease index on leaves. Per cent Alternaria blight severity was recorded on leaves at 10 days interval and pods at harvest following 0-5 disease rating scale of Sharma and Kolte (1994) , where,0= no visible symptoms,1= 1 – 10%,2= 11 – 25%,3=26 – 50%,4=51 – 75% and 5=>75% area of leaf infected. Evaluation was done on randomly selected plant in each replicated block for measuring the disease progress. The per cent diseases index (PDI) was calculated using the formula

$$\text{Per cent Disease Index (PDI)} = \frac{\text{Sum of all numerical ratings}}{\text{Total number of leaf observed x maximum rating}} \times 100$$

Disease severity calculated as per Wilcoxon *et al.*, (1975). The formula was used as follows:

$$AUDPC = " [(Y_{i+1} + y_i)/ 2 (X_{i+1} - X_i)]$$

Y_i = severity at 1st observation, X_i = Time (days) at first observation N = Total number of observation.

RESULTS AND DISCUSSION

The results showed that the disease and yield parameters showed different reactions on different years due to different environment in field. The leaf blight of mustard was more in 2008-09 than 2007-08. In the year 2007-08, with increasing in the N doses there was a significant increase in per cent leaf infection and zero (0) level of N showed minimum leaf infection in both the years (27.44% and 28.94% respectively). Among the N doses, minimum per cent of leaf infection was recorded at 80 Kgha^{-1} N (28.29%) followed by 100 Kgha^{-1} N (29.79%) and maximum in 160 Kgha^{-1} N (34.55%). It indicated that with increase nitrogen doses there was a significant increase in per cent in leaf infection (Table1).

Similar type of observation was noticed in 2008-09 and minimum percentage of leaf infection (30.31%) was noticed in 80 Kgha^{-1} N followed by 100 Kgha^{-1} N (33.53%) and maximum in 160 Kgha^{-1} N. The two years pooled mean also showed similar type of reactions that with increase in N doses there was a significant increase in per cent leaf infection and zero level of N showed least per cent of infection. Among the nitrogen doses minimum per cent of leaf infection was observed in 80 Kgha^{-1} N (29.30%) followed by 100 Kgha^{-1} N (31.66%) and maximum in 160 Kgha^{-1} N (37.09%) (Table1).

In case of disease severity (AUDPC), different N doses showed different severity. In each year with increase in N doses there was a significant increase in disease severity and least was noticed in zero level N application. In the year 2007-08, minimum disease severity (AUDPC) was noticed (14.21) in 80 Kgha^{-1} N applied plots significantly at par with 120 Kgha^{-1} N (14.24). Similarly zero level N and application of N 100 Kgha^{-1} N showed no significant difference with each other in respect to disease severity (14.93 and 15.00 respectively). In the year 2008-09, application of N at zero level (0), 100 Kgha^{-1} and 120 Kgha^{-1} N showed no significant difference among themselves (18.24, 18.48 and 18.52 respectively) in respect to disease severity, though maximum was noticed in 160 Kgha^{-1} N (21.23) applied plots. The two years pooled mean showed that minimum disease severity (16.38) was recorded in 120 Kgha^{-1} N applied plots significantly at par with zero (0) level N (16.58). No significant difference in disease severity was noticed in 80 Kgha^{-1} N and 100 Kgha^{-1} N applied plots (16.71 and 16.74 respectively), though maximum disease severity was noticed in 160 Kgha^{-1} N applied plots (20.29)(Table1).

Table 1: Effect of different levels of nitrogen on per cent of leaf infection and disease severity (AUDPC) due to ALB of mustard for two consecutive years

Nutrient			Per cent Leaf infection			AUDPC		
N	P	K	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
80	30	60	28.29(32.13)	30.31(33.41)	29.30 (32.77)	14.21	19.20	16.71
100	30	60	29.79(33.08)	33.53(35.39)	31.66 (34.24)	15.00	18.48	16.74
120	30	60	31.82(34.34)	36.21(37.00)	34.02 (35.67)	14.24	18.52	16.38
140	30	60	33.79(35.54)	38.64(38.43)	36.22 (36.99)	16.42	20.55	18.49
160	30	60	34.55(36.00)	39.62(39.01)	37.09 (37.51)	19.34	21.23	20.29
0	30	60	27.44(31.56)	28.94(32.52)	28.69 (32.01)	14.93	18.24	16.58
Sem(±)			0.20	0.12	0.16	0.08	0.18	0.08
CD (0.05%)			0.64	0.39	0.50	0.24	0.57	0.27

(Figure within the paranthesis are angular transform values)

The per cent of siliqua infection on different N doses showed different reaction in two different years. It was also noticed that with increasing N doses these was a significant increase in per cent of siliqua infection and least infection was recorded in zero level of N application. It was observed in both the years and also in pooled mean. In the year 2007-08, among the N doses minimum per cent of siliqua infection was recorded (16.76%) in 80 $Kgha^{-1}$ N applied plots followed by 100 $Kgha^{-1}$ N (17.81%) and maximum in 160 $Kgha^{-1}$ N (25.12%)applied plots.

In the year 2008-09, similar type of results were also observed and minimum per cent of siliqua infection was recorded in 80 $Kgha^{-1}$ N applied plots (18.76%) statistically at par with 100 $Kgha^{-1}$ N (19.39%) and maximum in 160 $Kgha^{-1}$ N (28.39%) applied plots though least infection was recorded in zero level of N (17.56%) (untreated control).

The two years pooled mean also showed minimum per cent of siliqua infection on 80 $Kgha^{-1}$ N applied plots (17.76%) followed by 100 $Kgha^{-1}$ N (18.60%) and maximum in 160 $Kgha^{-1}$ N applied plots (26.76%) though untreated control (zero level of N) produced minimum per cent of siliqua infection (16.43%) in comparison to others (Table 2).

The number of spots per siliqua was different in different nitrogen doses and their difference were statistically significant. It was also noticed that with increasing N doses there was significant increase in number of spots per siliqua and least was recorded in untreated control (zero level of N). It was observed in both the years and also in pooled mean. In the year 2007-08, among the N doses, minimum number of spots per siliqua was noticed in 80 $Kgha^{-1}$ N (9.25) followed by 100 $Kgha^{-1}$ N (10.96) and maximum in 160 $Kgha^{-1}$ N (16.16). In the year 2008-09, minimum number of spots per siliqua was also noticed in 80 $Kgha^{-1}$ N (10.48) followed by 100 $Kgha^{-1}$ N (12.06) and maximum in 160 $Kgha^{-1}$ N (16.66) applied plots. Though, least number of spots per siliqua was observed in untreated control for both the years (8.87 and 10.00 respectively). The two years pooled mean showed minimum number of spots per siliqua in 80 $Kgha^{-1}$

Table 2: Effect of different levels of nitrogen on per cent of siliqua infection and number of spots per siliqua due to ALB of mustard for two consecutive years

Nutrient			Per cent of Siliqua infection			Number of spots per siliqua		
N	P	K	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
80	30	60	16.76 (24.17)	18.76 (25.67)	17.76(24.92)	9.25	10.48	9.87
100	30	60	17.81(24.96)	19.39(26.12)	18.6 (25.54)	10.96	12.06	11.51
120	30	60	18.77 (25.67)	21.98(27.96)	20.38(26.82)	11.92	13.46	12.69
140	30	60	22.18 (28.09)	25.16(30.10)	23.67 (29.09)	14.33	15.58	14.96
160	30	60	25.12 (30.08)	28.39 (32.20)	26.76 (31.14)	16.16	16.66	16.41
0	30	60	15.30 (23.03)	17.56(24.73)	16.43 (23.88)	8.87	10.00	9.43
Sem(±)			0.13	0.24	0.13	0.19	0.18	0.14
CD (0.05%)			0.40	0.77	0.40	0.58	0.56	0.43

(Figure within the paranthesis are angular transform values)

N (9.87) followed by 100 Kgha^{-1} N (11.51) and maximum in 160 Kgha^{-1} N (16.41) and their differences were statistically significant ($p < 0.05$). Though untreated control (zero level N) showed least number of spots per siliqua (9.43) in mustard.

Different disease parameters on different N levels had ultimately reflected on yield parameters like number of siliqua per plant and 1000 seed weight of mustard. It was observed that with increasing level of N there was a significant increase in number of siliqua per plant in comparison to untreated control. This was observed in both the two years and also in pooled mean. In the year 2007-08, maximum number siliqua per plant was harvested on 120 Kgha^{-1} N (107.67) significantly at par with 140 Kgha^{-1} N (1107.67) followed by 160 Kgha^{-1} N (105.33) and minimum in 80 Kgha^{-1} N (88.57) applied plots. In the year 2008-09 maximum number of siliqua was harvested on 120 Kgha^{-1} N (103.00) applied plots followed by 140 Kgha^{-1} N (101.00) and minimum in 80 Kgha^{-1} N (78.83) applied plots.

The results were also reflected on two years pooled mean and it was noticed that maximum number of siliqua per plant was harvested on 120 Kgha^{-1} N (105.34) applied plots significantly at par with 140 Kgha^{-1} N (104.34) followed by 160 Kgha^{-1} N (102.67) and minumum in 80 Kgha^{-1} N (83.70) applied plots, though all the N levels increased the number of siliqua per plant in comparison to untreated control (zero level of N)(Table 3).

The 1000 seed weight of mustard was significantly different in different N levels and it was recorded in both the years and also in pooled mean.

In the year 2007-08, maximum 1000 seed weight was recorded from 120 Kgha^{-1} N (3.50 g) applied plots significantly at par with 160 Kgha^{-1} N (3.45 g). Minimum 1000 seed weight was noticed from 80 Kgha^{-1} N (3.24 g) applied plots significantly at par with 100 Kgha^{-1} N (3.32 g) and 140 Kgha^{-1} N (3.37g) applied plots, though least was recorded in untreated control (3.07 g). In the year 2008-09, maximum 1000 seed weight was recorded from

Table 3: Effect of different levels of nitrogen on number of siliqua per plant and 1000 seed weight (g.) due to ALB of mustard for two consecutive years

Nutrient			Number of siliqua per plant			1000 seed weight (g.)		
N	P	K	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
80	30	60	88.57	78.83	83.7	3.24	3.08	3.16
100	30	60	96.68	90.30	93.49	3.32	3.18	3.25
120	30	60	107.67	103.00	105.34	3.50	3.27	3.39
140	30	60	107.67	101.00	104.34	3.37	3.24	3.31
160	30	60	105.33	100.00	102.67	3.45	3.24	3.35
0	30	60	51.83	46.43	49.13	3.07	3.05	3.06
Sem(±)			0.63	0.59	0.48	0.04	0.04	0.03
CD (0.05%)			1.99	1.85	1.51	0.13	0.13	0.08

120 Kgha^{-1} N applied plots (3.27 g) and 160 Kgha^{-1} N (3.24 g) applied plots, though minimum in 80 Kgha^{-1} N (3.08 g) significantly at par with 100 Kgha^{-1} N (3.18 g). The two years pooled mean showed maximum 1000 seed weight on 120 Kgha^{-1} N (3.39 g) applied plots significantly at par with 160 Kgha^{-1} N (3.35 g). No significant difference in 1000 seed weight was noticed in 100 Kgha^{-1} N (3.25 g) and 140 Kgha^{-1} N applied plots, though minimum was noticed in 80 Kgha^{-1} N (3.16 g) applied plots. Though all the N levels increased the 1000 seed weight significantly in comparison to untreated control (zero level of N) (Table 3)

The result therefore indicated that increasing application of N in soil increased the Alternaria blight severity on mustard. The result agreed with the previuos study of Singh *et al.* (1992), that severity of white leaf spot of cabbage caused by *Alternaria brassicicola* increased with increased N application. It has been suggested by Stavely and Slana (1971) that high N creats a favourable environment on host for infection by the pathogen. Kiraly and Farkas (1962) observed on rust of wheat that increased N fertilization enhanced disease severity because of decrease in total phenol oxidation and thereby vulnarable for disease susceptibility of host. In other diseases like blast of rice it was observed by several workers that increased N application increaed accumulation of soluble N, total protein, lowering down the silicification of epidermal cell (Wakimoto amd Yashii, 1958) decreased hemicellulose and lignin content (Matsuyama, 1975) and decreased phenolic compound oxidases their substrate (Sridhar, 1972) which all increased tissue susceptibility in plant. The present experiment therefore concluded that application of N @120 Kgha^{-1} N would be suitable for reducing Alternaria blight severity and increasing yield parameters of mustard in alluvial region of West Bengal.

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