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EFFECT OF NPK ON THE INCIDENCE OF *ALTERNARIA* LEAF BLIGHT OF MUSTARD

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Abstract

A 2-year field study was carried out to find out the effect of three macro nutrients NPK on the severity of *Alternaria* leaf blight and yield of mustard. Nitrogen @ 80, 100, 120, 140, and 160, phosphorus @ 15, 30, and 45, and potassium @ 30, 60, and 90 kg/ha were applied. Among the nutrients, 120-30-60 kg NPK/ha was considered as recommended dose on the basis of soil test. Fertilizer dose 120-30-90 kg/ha appeared to be the best combination of N, P, and K in reducing the disease incidence and to increase seed yield of mustard. Higher dose of K (90 kg/ha) decreased the incidence of *Alternaria* leaf blight but higher dose of nitrogen (140 and 160 kg N/ha) increased the disease incidence. The highest seed yield of 1718 kg/ha was obtained with 120-30-90 kg of NPK/ha which was statistically similar to the doses of 120-30-60 and 120-45-60 kg of NPK/ha. Higher seed yield and lower disease severity was also observed under these three treatments as compared to other treatments.

Keywords: Mustard, *Alternaria* leaf blight, nutrient management.

Introduction

Mustard *(Brassica juncea, B.campestris* and *B.napus)* is one of the important oilseed crops in Bangladesh. The average yield of mustard in Bangladesh is 1001 kg/ha (BBS, 2008), which is low compared to many mustard growing countries of the world (Ahmed *et al.,* 1988). The crop suffers from 14 diseases in Bangladesh (Bakr *et al.,* 2007; Meah, 1986) where *Alternaria* blight is the most serious and widely distributed in the country (Kaul and Das, 1986). The disease causes blight of leaf, pod and stem (Ahmed and Ahmed, 1994) and seed abnormalities (Howlider *et al.,* 1991). The disease is caused by *A. brassicae and A. brassicicola.* It is endemic in Bangladesh and most of the cultivated varieties are susceptible to this disease. The disease causes yield losses of 40-70% in India (Vishwanath and Kolte, 1997) and 30-60% in Bangladesh (Ahmed and Ahmed, 1994). In addition to direct yield losses, the disease adversely affects the seed quality by reducing seed size, seed discolouration and reduction in oil contents (Howlider *et al.,* 1991). Application of N, P, and K alone or in combination increases seed yield and oil content of mustard

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(Singh, 2002). Application of balanced fertilizers is very important for the management of many diseases. Severity of *Alternaria* blight of many crops can be reduced by applying nutrients at suitable doses (Singh *et al.*, 1992). Jessore is one of the major mustard growing areas in Bangladesh, but the farmers usually grow local varieties with their own fertilizer management. So, the yield is very low. There is a good scope to introduce high yielding variety of mustard with optimum fertilizer management in that area which will help to minimize the yield and gap between existing production and potential yield of the crop. Therefore, the experiment was carried out to determine the optimum N, P, and K combination for the management of *Alternaria* blight of high yielding mustard variety BARI Sarisha-6.

Materials and Method

The experiment was conducted in the calcareous soil of Regional Agricultural Research Station (RARS), BARI, Jessore during the *rabi* season of 2004-05 and 2005-06. The land belongs to High Ganges River Floodplain agro-ecological zone and Gopalpur soil series having high pH value (8.1) with low organic matter (1.32%). Among the three macro elements, nitrogen (N) was applied at the rate of 80, 100, 120, 140, and 160 kg/ha, phosphorus (P) at 15, 30, and 45 kg/ha and potassium (K) at 30, 60, and 90 kg/ha. The nutrient elements were applied in 10 different treatments combination viz. T_1 = 80-30-60, T_2 = 100-30-60, T_3 = 120-30-60, T_4 = 140-30-60, T_5 = 160-30-60, T_6 = 120-15-60, T_7 = 120-45-60, T_8 = 120-30-30, T_9 = 120-30-90 kg/ha, and Tip (control). Urea, triple super phosphate, and muriate of potash were used as sources of N, P, and K. Among the treatments, T_3 was considered as standard check (BARC, 2005). The treatment T_{10} received no nutrient and used as control. Recommended doses of S, Zn, and B were applied at the rate of 30-2-1 kg/ha (BARC, 2005). The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 4m × 3m. This layout was kept undisturbed for the second year of the study. Each year, mustard variety BARI Sarisha-6 was sown on 1st week of November maintaining a spacing of 30 cm between the lines. Intercultural operation viz., weeding, irrigation, and insecticide spray were done as and when required. Data on percent infected leaf, leaf area diseased, infected siliqua, and number of spots/siliqua, yield and some yield contributing characters were recorded. The data were analyzed statistically for ANOVA and differences in means were evaluated for significance by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Percentage of infected leaf and leaf area diseased

Application of N-P-K at nine different combinations significantly reduced percent infected leaves over control in both the years except 120-30-30 in 2005-

06 kg/ha. The lowest percentage of infected leaves was obtained with 80-30-60 kg/ha followed by 100-30-60, 120-45-60, and 120-3060 kg/ha in both the years. Effectiveness of the four treatments was not significantly different. In 2004-05, significant reduction in percent leaf area diseased was obtained with N-P-K at 120-30-90, 120-30-60 and 80-30-60, kg/ha compared to control (0-0-0). The effectiveness of three doses was statistically similar. In 2005-06, only the 120-30-90 kg/ha of N-P-K gave significant reduction of the disease over control (Table 1).

Table 1. Effect of NPK leaf infection and siliqua infection of mustard.

Dose of NPK (kg/ha)	% Infected leaf		% Leaf area diseased		% Infected siliqua		Spots siliqua (no.)	
	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06
80-30-60	28.64d	30.64d	14.58c	17.48bc	16.89d	18.54f	9.104	10.13f
100-30-60	29.90cd	33.65cd	15.13bc	18.61abc	17.99cd	20.33ef	11.20c	12.00e
120-30-60	31.79bcd	36.24cd	14.54c	18.83abc	19.12c	22.01 cde	12.09c	13.13d
140-30-60	33.93b	38.80bc	16.73abc	20.77a	22.27b	25.13bc	14.30b	15.62bc
160-30-60	34.22b	39.34bc	19.83a	21.04a	25.49a	28.49a	16.02a	16.67ab
120-15-60	32.50bc	39.77bc	18.24ab	18.96abc	19.31c	23.04cde	11.79c	14.03cd
120-45-60	31.56bcd	35.72cd	15.19bc	17.40bc	18.89c	21.02def	11.2 1 c	13.78d
120-30-30	33.12bc	42.86ab	18.68a	20.53a	24.69a	27.39ab	16.89a	18.04a
120-30-90	29.75cd	37.53bc	14.42c	16.53c	18.89c	23.82cd	8.90d	10.32f
0-0-0	37.39a	48.29a	18.21 ab	19.03ab	25.13a	27.38ab	16.32a	18.34a

Means within a column followed by same letter(s) are not significantly different at 5% level of probability by DMRT.

Percentage of infected siliqua and spot number per siliqua

In both 2004-05 and 2005-06 crop seasons, the percentage of infected siliqua was significantly reduced due to application of N-P-K at all doses compared to control (0-0-0) except the two doses, 160-30-60 and 120-30-30 kg/ha. The lowest percentage of infected siliqua was achieved with the dose 80-30-60 kg/ha, which was statistically similar to 100-30-60 kg/ha. The third lowest percentage of infected siliqua was observed at 120-45-60 kg/ha, which was statistically similar to 120-30-60, 120-15-60, and 120-30-90 kg/ha. Like percentage of infected siliqua, except 160-30-60 and 120-30-30 kg/ha, all other doses of N-P-K caused significant reduction in spot number/siliqua compared to control. The lowest percentage of infected siliqua was achieved with the dose 80-30-60 kg/ha, which was statistically similar to 100-30-90 kg/ha. Differences in spot number recorded at 120-30-60, 120-15-60 and 120-45-60 kg/ha were significant (Table 1).

Plant growth and yield contributing parameters

In both the seasons of experiment, plant height, siliqua number/plant, seed number/siliqua, and 1000-seed weight increased remarkably due to application of N-P-K at different doses tested compared to control. The maximum plant height and number of siliqua/plant were achieved with 120-30-90 kg/ha. Its effect on this parameter was statistically Similar to 120-45-60, 160-30-30, 14030-60 and 120-30-60. The highest number of seeds/siliqua as well as 1000-seed weight was recorded from the dose 120-45-60 kg/ha, which was statically similar to 120-30-90, 160-30-60, 140-30-60 and 120-30-60 kg/ha (Table 2).

Table 2. Effect of NPK on the plant growth and some yield contributing characters of mustard.

Dose of NPK (kg/ha)	Plant height (cm)		Siliqua/plant (no.)		Seeds/siliqua (no.)		1000-seed wt (g)	
	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06
80-30-60	133.3b	124.5c	88.3de	79.3de	21.3cd	19.9f	3.09cd	3.03cd
100-30-60	141.8ab	133.3bc	96.7cd	89.4cd	22.6a-d	21.3de	3.21 a-d	3.13bcd
120-30-60	148.2a	141.7ab	109.0ab	103.6ab	23.9ab	22.9ab	3.37ab	3.26ab
140-30-60	149.0a	142.3ab	108.3ab	101.5ab	23.2ab	21.9bcd	3.3 5 ab	3.21ab
160-30-60	150.3a	142.9ab	106.0a6c	98.7abc	22.93abc	21.5cde	3.30abc	3.19abc
120-15-60	131.6b	122.9c	82.3e	74.3e	20.9de	19.8f	3.16bcd	3.02cd
120-45-60	147.9a	139.8ab	115.7a	109.3a	24.3a	23.2a	3.41a	3.33a
120-30-30	140.4ab	131.6bc	100.7bc	95.9bc	22.3bcd	20.9e	3.23abc	3.11 bcd
120-30-90	152.6a	147.7a	114.7a	107.8a	24.1a	22.7ab	3.36ab	3.23ab
0-0-0	89.2c	78.1d	52.0f	45.8f	19.60e	17.3g	3.00d	2.98d

Means within a column followed by same letter(s) are not significantly different at 5% level of probability by DMRT.

Seed yield

The highest seed yield was achieved with N-P-K at 120-30-90 kg/ha, followed by 120-45-60, 12030-60, and 140-30-60 kg/ha. The lowest yield increase' was observed at 80-30-60 kg/ha followed by 120-15-60, 100-30-60, 120-30-30, and 160-30-60 kg/ha. The seed yield was lower at 160 kg, N/ha compared to 120 kg N/ha. Higher dose of P (45 kg/ha) and K (90 kg/ha) showed no appreciable effect on seed yield. Again lower dose of P (15 kg/ha) and K (30 kg/ha) produced 1098 and 1315 kg seed yield/ha, respectively (Fig. 1). Such results indicate the positive influence of P and K on mustard yield when applied along with × blanket dose of 120-30-2-1 kg N-S-Zn-B/ha.

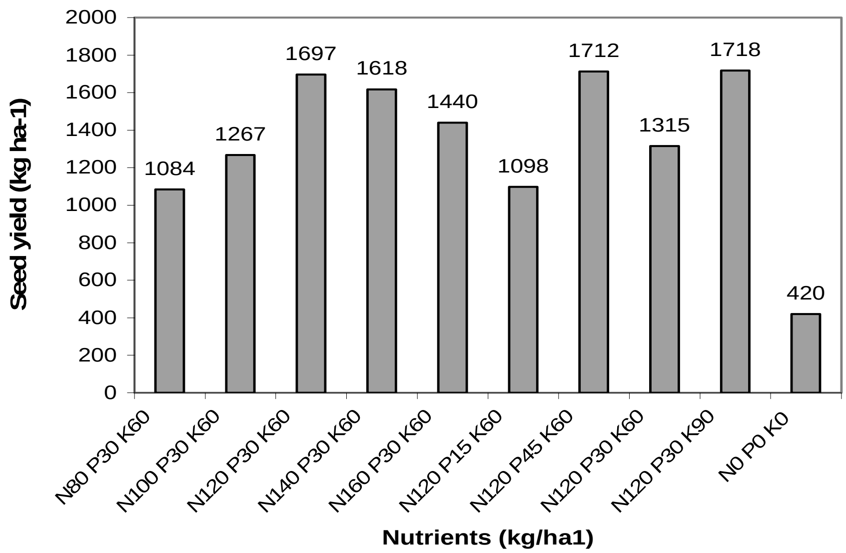

Fig 1. Effect of different doses of NPK on seed yield of mustard (mean of two years).

Results of the present investigation indicated that N fertilizer plays an important role on disease development and seed yield of mustard. At lower dose of N, disease incidence remained low but seed yield reduced drastically. With increase in level of N, the incidence of disease and seed yield was also increased up to 120 kg N/ha. It appeared that seed yield of mustard reduced and disease incidence increased at higher doses of N (140 and 160 kg/ha). This might be due to increase in proneness plants to the disease at higher dose of N. Successive increase of N at 20 kg/ha over optimum dose of 120 kg under constant level of P and K gave 79 kg (at 140 kg N/ha) and 257 kg/ha (at 160 kg N/ha) lower seed yield.

Potassium had depressive effect on diseases incidence. Higher dose of K (90 kg/ha) decreased the incidence of *Alternaria* leaf blight and increased seed yield of mustard but not significantly over the recommended dose (60 kg/ha). The best dose of N minimizing disease incidence and increased seed yield was 120 kg/ha. Higher dose of N (140 and 160 kg/ha) and lower dose of K (30 kg/ha) increased number of spots/siliqua compared to other treatments. The highest dose of P (45 kg/ha^{-1}) gave the highest number of seeds/siliqua and 1000-seed weight.

Several reports indicate that soil application of NPK decreased *Alternaria* leaf blight intensity to various levels and increased seed yield of mustard. Higher dose of N than a balanced rate enhanced the severity and incidence of various diseases caused by *Alternaria brassicicola, A. brassicae, A. porri, A. solani,* and *Alternaria* spp. (Ferdous, 1990; Dasgupta *et al.*, 1991). Singh *et al.* (1992) reported that P has no significant effect on severity of *Alternaria* but severity of leaf spot increased with the increase of N, while addition of K decreased disease severity. Singh (2002) also reported that 120 kg N/ha and 45 kg P/ha significantly increased the seed and yield attributes of mustard. Singh *et al.* (2003) observed that the N level higher than 120 kg/ha did not significantly increase the yield and yield attributes.

The plants take up the nutrient from fertilizers and utilize them in the plant metabolic system for strengthening the defence mechanism of plant through formation of different kinds of barriers (both mechanical and biochemical), which ultimately opposes the infection by plant pathogenic organisms (Bradford, 1975; Hossain and Mian, 2004). In the present study, the treatment T_3 having 120-30-60 kg NPK/ha with a blanket dose of 30-2-1 kg SZnB/ha was found to be the most effective nutrient combination to reduce *Alternaria* blight and increase seed yield of mustard.

Conclusion

Based on findings of the present investigation, it may be concluded that potassium decreases the incidence of *Alternaria* leaf blight and the seed yield increases with the increase in level of N upto 120 kg/ha. If the level of N is increased above 120 kg/ha it reduces the seed yield and increase disease incidence. The NPK dose of 120-30-60 kg/ha with a blanket dose of 30-2-1 kg SZnB/ha is the most effective to reduce *Alternaria* blight and increase seed yield of mustard.

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