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IMPACT OF NPK FERTILIZERS ON MUSTARD (*Brassica juncea* coss).

II. Yield components

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Abstract

Accumulation of dry matter and yield of mustard seeds have been observed from a NPK field trial experiment. Addition of nitrogen significantly increased the production of dry matter at 35 days of growth. Higher the rate of nitrogen supplied, higher was the dry matter yield. No such marked effect due to phosphorus addition was recorded. Accumulation of dry matter at harvest was significatly increased mostly by either N or P alone or by their combination. In constrast, potassium in both the stages of growth decreased the yield of dry matter. Nitrogen and phosphorus application stimulated yield of mustard seeds almost double. Potassium supply, on the contrary, reduced the yield remarkably.

Introduction

Oil an important source of energy for humanbeing is derived from either animal or vegetable resources. In this part of the world vegetable oil is the most common form used. Mustard, groundnut, till, castor, sunflower, soybean and lineseed are the major oil seed crops of which mustard ranks the top most position for its popularity for cooking purposes in Bangladesh. Mustard accounts for more than 62% of the total acreage under oil seed crops, yielding approximately 50% of the total production of oil seed.

Cultivation of the crop commonly practiced here is without fertilizers. Bangladesh Bureau of Statistics (1984) from a survey of last 10 year's data reported that the average yield of mustard in Bangladesh is very low accounting 542.0 lbs/acre. This is undoubtedly a very poor yield. The possible two ways to increase yield is either by increasing the acreage under mustard or by improving the yield per unit area. Since the scarcity of land is acute, the only effective measure may be the judecious application of NPK fertilizers to boost up mustard production. With this constraint in mind a field experiment was set up at Amla Experimental Station potentially very low in yield (434.6 lbs/acre, Bangladesh Bureau of Statistics 1984), Kustia to assess the effect of NPK fertilizers on the growth and yield of mustard.

Materials and Methods

Detailed of the experimental was described in series 1 (Elahi *et al.* 1984-85). Dry matter yield at two different stages of growth and grain yield at maturity were taken into consideration. To measure yield of dry matter and seed five plants from each plot was harvested following a random sampling pattern.

Results and Discussion

The dry weight of mustard plants measured at 35 days after sowing and at maturity as influenced by nitrogen, phosphorus and potassium fertilizers have been shown in Table 1.

The results impart that nitrogen was effective to increase the dry weight of mustard plants significantly at 1% level after 35 days of growth. Higher the doses of nitrogen applied, higher was the accumulation of dry material. Phosphorus did not have any effect in increasing the dry weight of the plant. On the other hand, potassium appeared to decrease the dry weight with increasing rates of potassium with nitrogen and phosphorus remaining constant. This trend was most effectively observed in treatments of N_2P_3, N_3P_1, N_3P_2 and N_2P_3 series. The interactions of NP, NK and PK were not significant in increasing dry weight at 35 days after sowing,

Dry matter yield at harvest was significantly changed by all the nutrients applied. The effects of nitrogen and potassium were significant at 1% level and that of phosphorus at 5% level. Interactions of NK and NP were significant at 1% level.

Nitrogen had the most dramatic effect on the dry matter yield of mustard plants. The visual effect was dramatic in the field with bushy, heavy plant growth in these plots. Dry weight increased with increasing doses of nitrogen (Table 1). Maples and Keogh (1969) also observed that supply of nitrogen and phosphorus produced more vegetative growth of oil yielding crop viz. soybean. Positive influence of NPK application on growth of groundnut was further recorded by Puntamkar and Bathmal (1967). The gradual increase from N_0 to N_1 and N_2 was sharpened at N_3 level. With phosphorus and potassium the change remained almost constant. The increase from N_2 to N_3 was much higher than at N_0 to N_1 or N_1 to N_2.

The effect of potassium was easily indentified as a negative one. With all combinations of nitrogen or phosphorus, potassium decreased the yield significantly. This was more pronounced at higher levels of nitrogen. Thus, at N_3P levels addition of the first dose of potassium decreased dry weight by about 200% supposing that potassium supply is detrimental in the ultimate dry matter production of mustard plant. Phosphorus at the same time had a significant effect in increasing the accumulation of dry matter. The increase was most significant where nitrogen applied in a higher doses of N_2 and N_3

NK interaction was significantly negatively correlated. Thus, the down trend from K_0 to K_3 at any particular nitrogen and phosphorus level can be visualized. Contrary to this, NP interaction was significantly positively correlated at 5% level. The increase by nitrogen was greatly enhanced by small adition of phosphorus where as a large addition of the nutrient (P_2 and P_3) did not effectively change the situation The effect of phosphorus in these cases was countermanded at higher levels of the interacted treatments.

Comparison of dry matter yield between 35 days and at harvest, showed a good correlation. The effects of fertilizer treatment are

Table 1. Dry matter yield of mustard shoot (g/plant) as influenced by NPK fertilizers.

Treatments	N_0		N_1		N_2		N_3	
	after 35 days	maturity	after 30 days	maturity	after 35 days	maturity	after 35 days	maturity
$P_0 K_0$	0.48	2.13	0.65	2.27	0.54	4.04	0.68	5.25
$P_0 K_1$	0.54	1.78	0.56	2.48	0.29	2.35	1.07	1.72
$P_0 K_2$	0.42	1.40	0.50	4.28	1.89	2.71	0.55	2.00
$P_0 K_3$	0.40	0.66	0.51	1.65	0.22	2.31	0.87	2.39
$P_1 K_0$	0.66	2.60	1.79	2.94	0.84	4.08	2.10	12.40
$P_1 K_1$	0.27	2.09	0.93	2.84	0.46	4.63	1.12	4.26
$P_1 K_2$	0.74	1.36	0.30	2.05	1.65	3.04	0.88	3.98
$P_1 K_3$	0.52	1.07	0.85	1.90	1.12	1.91	0.81	3.18
$P_2 K_0$	0.24	0.96	0.88	1.76	1.86	3.18	2.20	11.30
$P_2 K_1$	0.58	1.59	0.94	3.00	1.75	2.72	1.75	9.75
$P_2 K_2$	0.68	2.28	0.49	1.93	0.63	2.15	0.99	7.75
$P_2 K_3$	0.52	1.49	0.83	2.07	0.93	2.24	0.78	5.65
$P_3 K_0$	0.56	1.75	0.96	2.96	3.17	4.59	1.85	10.12
$P_3 K_1$	0.42	1.06	1.18	1.62	1.17	3.69	1.14	6.13
$P_3 K_2$	0.48	1.09	0.96	4.37	1.46	4.00	0.89	3.23
$P_3 K_3$	0.52	0.96	0.62	2.05	1.55	2.97	0.69	8.35

CD at 5% level, 1.18 and 2.32 after 35 days and at maturity respectively.
0, 1, 2. 3 represents 0, 35.6, 67.2, 134.4 kg/ha respecitively.

quite muted at the first stage. The treatments with higher yield of dry matter at 35 days have similar effects with greater magnitude at the next stage except in few cases. The effect of increased physiological activity initiated by nitrogen and phosphorus at an early stage is quite evident (Table 1) which gave a highly significant external performance at both collection dates

Data for yield have been shown in Table 2. Yield of mustard increased dramitically with increasing doses of nitrogen and phosphorus. Similar effect of NP fertilization on grain yield of sesame, sunflo wer, groundnut and winter rape was also reported by other investigators (Singh*et al.*, 1960; Sen and Lahiri, 1960 ; Galgoczi, 1966, 1967; Bahadur and Gupta, 1966; Mazzani *et al.*, 1968; Acuna and Carlostadio,

Table 2. Yield of mustard seeds (g/plot) as influenced by NPK fertilizers.

Treatments	N_0	N_1	N_2	N_3
$P_0 K_0$	166.7	286.2	372.5	561.4
$P_0 K_1$	154.2	295.9	236.1	171·9
$P_0 K_2$	99.4	267.2	338.6	226·2
$P_0 K_3$	260.7	150.4	253.0	256.3
$P_1 K_0$	192.7	332.2	395 1	825.2
$P_1 K_1$	200.4	335·9	487.5	419.0
$P_1 K_2$	152.1	243.9	369.1	498.7
$P_1 K_3$	186.0	252.1	342.8	775 1
$P_2 K_0$	132.0	334.1	569.2	718.0
$P_2 K_1$	177.6	295.0	500.6	603.9
$P_2 K_2$	219.7	217.1	393.0	614.7
$P_2 K_3$	171.8	217.1	413.8	601.0
$P_3 K_0$	171.0	255.3	594.0	711.0
$P_3 K_1$	222.2	409.7	484.1	287.1
$P_3 K_2$	124.8	455.6	446.7	606.7
$P_3 K_3$	258.4	278.0	346.5	805.7

CD at 5% level, 220.05
Symbol same as Table 1.

1969; Dembinski *et al.*, 1969). Highest yield of seeds was recorded in the treatment receiving highest amount of nitrogen. Added potassium showed a negative effect. In most of the treatments potassium supply decreased the yield remarkably.

Nitrogen at the rate of 33.6 kg/ha had no significant effect on yield. The effect of phosphorus and potassium exerted only significant effect in $N_1P_3K_1$ and $N_1P_3K_2$ treatments. This exception might be due to the cumutative effect of high dose of phosphorus alongwith nitrogen. This effect was reduced in the similar treatments with higher dose of potassium.

It has been seen that reduction in yield by potassium could be minimized to some extent by the addition of phosphorus. The cumulative effect of nitrogen and phosphorus produced maximum yield of mustard with no potassium applied. However, the increase in doses of phosphorus did not result in an increase in yield. The highest yield was obtained at $N_3P_1K_0$ (825.17 g).

The first order interactions of NK, PK and NP were significant at 1 to 5% level in this respect. The interactions at all stages were positive and effectively offset the negative effects of K; if any, resulting a gradual rise in grain yield with increasing amount of N, P, and K from the control.

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