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Short Communication

OPTIMIZATION OF FERTILIZER REQUIRMENT FOR BROCCOLI UNDER FIELD CONDITION

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Broccoli (*Brassica oleracia* var *italica* L.) is one of the winter vegetable cole crops, which is more nutritious than other coles, such as cabbage, cauliflower and kohlrabi (Thomson and Kelly, 1985). Soil and winter climate of Bangladesh are suitable for luxuriant growth of broccoli. However, the yield of broccoli in Bangladesh is very poor compared to that of other countries. The main reason for such poor yield may be due to poor fertility management. The requirement of fertilizer for any crop varies with the cultivars and soil types in agro-ecological zones (Mitra *et al.,* 1990). Judicious application of fertilizers has great impact on growth and yield of crop plants. In order to obtain satisfactory results, the nutrients should be applied in optimum dose. It was reported that the application of NPK markedly increased yield of broccoli (Anwar *et al*., 2000; Prodeep-Kumar *et al*., 2001). The application of molybdenum increased the yield of broccoli by reducing whiptail incidence from 30 to 40 percent in control to 0-8 percent in treated plot (Mitra *et al*., 1990). Research information regarding fertilizer management for the satisfactory production of broccoli is limited in Bangladesh. The present investigation was, therefore, undertaken to optimize the fertilizer need for maximizing yield of broccoli under irrigated condition in Grey terrace soil of Joydebpur.

The experiment was conducted at the research farm of Bangabandhu Sheikh mujibur Rahman Agricultural University (BSMRAU), Salna, Gazipur during the period from 18 November 1995 to 13 February 1996 using broccoli var. Premium (hybrid). The experimental soil was a terrace soil which is equivalent to Ochrapt suborder of USDA soil taxonomy and belongs to locally termed Salna Series of Shallow Red-Brown Terrace Soil (Saheed, 1984). The soil had the following characteristics: pH 5.7, organic carbon 0.65%, total N 0.053% available P 9.70 ppm, exchangeable K 0.33 meq/100g soil, available S 33.10 ppm, available B 33.10 ppm, and available Mo 33.10 ppm. There were 16 treatment combinations consisting of three levels of nitrogen (0, 60, and 120 kg N /ha from urea), four levels of phosphorous (0, 60, 120, and 180 kg P_2O_5 ha

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from TSP), three levels of potassium (0, 50, and 100 kg K_2O ha from MOP), two levels of sulphur (0 and 20 kg ha from gypsum), two levels of boron (0 and 1 kg/ha from solubar), four levels of molybdenum (0, 0.4, 0.8, and 1.2 kg/ha from sodium molybdate), two levels of cowdung (0 and 10 t/ha) and two levels of compost (0 and 0.5 t/ha). The entire amounts of cowdung, compost, phosphorous, sulphur, boron, and molybdenum were applied in rows at final land preparation. Urea and MOP were applied in two equal installments at 15 and 30 days after transplanting. The experiment was laid out in a randomized complete block design replicated three times. Seedlings of 25 days old were transplanted on 18 November 1995 at a spacing of 60 cm x 45 cm after seven days of fertilization. The crops were first harvested on 14 January 1996 and continued upto 26 January 1996. The unit plot size was 2.5 m x 2.0 m. Irrigation was done by boarder method. For proper seedling establishment, water was given for seven days after transplanting by water can. Other cultural practices were adopted as and when required. The data on plant height, number of leaves per plant, size of the biggest leaf were recorded from 10 plants of the plot and reported treatment wise. Eight harvestings of terminal head including secondary heads were taken and marketable head yield was recorded at each harvest per plot in grams and it was then converted into yield per hectare in tons. Data on head diameter and marketable head weight/plant (terminal head + lateral heads) were recorded from 10 plants per plant. The data were analyzed through MSTAT Programme and the treatment means were separated by DMRT at 5% level of probability.

Plant height was significantly influenced by different fertilizer treatments (Table 1). The maximum plant height (51.59 cm) was recorded in T_{12} treatment ($N_{120}P_{120}K_{100}S_{20}B_1Mo_{0.8}C_{500}$) and the lowest plant height (33.43 cm) in the absolute control treatment (T_1). Plant height increased with increasing rates of nitrogen. Nitrogen application at the rates of 60 and 120 kg/ha in prsence of other elements showed 16 and 48.7% higher plant height over nitrogen control treatment, respectively. Plant height was not significantly influenced by different levels of potassium, phosphorous, sulphur, boron, molybdenum, cowdung, and compost.

There was a significant difference in number of leaves per plant among fertilizer treatments (Table 1). The treatment T_{16} produced significantly the maximum number of leaves (16.47/plant) which was superior to all other treatments. The lowest number of leaves (12.20/plant) was found in control treatment (T_1). Different levels of N, P, and K did not significantly affect number of leaves. However, 60 and 120 kg N/ha led to increase the leaf number by more than 5.67% and 8.00% compared to control. In case of phosphorous, the maximum number of leaves was observed at 180 kg P_2O_5/ha, which was 8.95% higher over phosphorous control treatment. Number of leaves per plant was also not significantly affected by different levels of sulphur, boron, molybdenum, and cowdung. Application of compost significantly produced higher number of leaves per plant.

Table 1. Effect of N, P, K,S,B, Mo, cowdung and compost on the growth and yield of broccoli (cv. Premium).

Treatments	Nutrient added (kg/ha)						CD/C (t/ha)	Plant height (cm)	Leaves/ plant (no.)	Diameter of curd (cm)	Head yield (t/ha)
	N	P_2O_5	K_2O	S	B	Mo					
T_1	0	0	0	0	0	0	0	33.43e	12.20e	8.72g	3.41h
T_2	0	120	100	20	1	0.8	10 CD	35.63e	13.87cd	10.27f	7.21g
T_3	60	120	100	20	1	0.8	10 CD	41.33d	14.07bcd	11.29e	13.68def
T_4	120	120	100	20	1	0.8	10 CD	50.01 ab	14.67bc	12.09cde	14.04cde
T_5	120	0	100	20	1	0.8	10 CD	50.57ab	13.52d	11.58de	13.29ef
T_6	120	60	100	20	1	0.8	10 CD	50.34ab	14.00bcd	11.83cde	14.01cde
T_7	120	180	100	20	1	0.8	10 CD	50.36ab	14.73bc	11.76cde	15.45b
T_8	120	120	0	20	1	0.8	10 CD	45.23c	13.88cd	12.38cde	13.09cde
T_9	120	120	50	20	1	0.8	10 CD	49.09abc	13.73cd	12.23cde	14.58bcd
T_{10}	120	120	100	0	1	0.8	10 CD	49.65bc	14.40bcd	12.93bc	14.72bc
T_{11}	120	120	100	20	0	0.8	10 CD	47.93abc	14.80bc	13.68ab	14.72bc
T_{12}	120	120	100	20	1	0	10 CD	49.19abc	14.41bcd	11.67de	13.00f
T_{13}	120	120	100	20	1	0.4	10 CD	46.45bc	14.01bcd	12.67bcd	14.19cde
T_{14}	120	120	100	20	1	1.2	10 CD	47.41abc	15.07b	12.70bcd	14.21cde
T_{15}	120	120	100	20	1	0.8	0	48.41abc	14.42bcd	11.36ef	14.05cde
T_{16}	120	120	100	20	1	0.8	0.5 C	51.59a	16.47a	14.58a	16.57a

Means having same letters or without letter in a column are not significantly different at 5% level of probability by DMRT
CD = Cowdung, C = Compost

The diameter of head significantly varied with different fertilizer treatments (Table 1). The maximum head diameter recorded in T_{16} (14.58 cm) treatment was statistically identical to T_{11} treatment (13.68 cm) and significantly superior to all other treatments and the minimum head diameter (8.72 cm) was obtained from control treatment. Application of different combination of fertilizer treatments led to an increase in head diameter from 17.78% to 67.20% over control treatment. Head diameter significantly increased with the increase in N from 0 to 60 kg/ha beyond which it did not increase significantly (Table 1). This was corroborated by the results of Haque *et al*. (1996). The maximum diameter of the head was found at 120 kg P_2O_5/ha which was statistically identical with 60 and 180 kg P_2O_5/ha and minimum diameter (11.58 cm) was obtained from no phosphorous. Head diameter was not significantly influenced by different potassium, sulphur, molybdenum, and cowdung levels. Application of compost significantly increased head diameter.

A significant increase in marketable head yield of broccoli was observed in response to different fertilizer treatments (Table 1). The treatment T_{16} gave the highest significant head yield of 16.57 t/ha which was superior to all other treatments. The lowest yield (3.4 t/ha) was recorded in control treatment. The T_{16} treatment registered 385.92% higher yield over control. The yield was increased by increasing application of N upto 120 kg N/ha. Head yield per hectare was also significantly influenced by different levels of P. Significant increase in head yield was observed at 180 kg P_2O_5/ha. The highest yield (15.45 t/ha) was recorded in 180 kg P_2O_5/ha which was statistically different from all other treatments (Table 1). Yield was not significantly influenced by different levels of K, S, B, and cowdung. But it was significantly influenced by different molybdenum and compost levels. The maximum yield was observed in 1.2 kg Mo/ha which was statistically identical with all other treatments except Mo control treatment. Application of compost significantly increased yield of broccoli.

It can be, therefore, inferred that nitrogen, phosphorous, potassium, sulphur, and molybdenum application were more effective with compost which played a significant role in increasing the head yield of broccoli. Application of 100 kg N, 120 kg P_2O_5, 100 kg K_2O, 20 kg S, 0.8 kg Mo, and 500 kg compost/ha might be sufficient for maximum yield of broccoli in Grey Terrace soil of Gazipur.

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