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EFFECT OF NITROGEN, PHOSPHORUS, POTASSIUM, BORON AND MOLYBDENUM ON GROWTH OF CAULIFLOWER

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Abstract: The results of the experiments conducted on a high land belonging to Salna Series under Madhupur Tract (Shallow Red Brown Terrace Soil) with different rates of N, P, K, S, B and Mo with cow dung and organic compost evince that the application of $N_{120}\,P_{120}\,K_{100}\,S_{20}\,B_1\,Mo_{0\cdot20}OC_{0.5}$ (T_{16}) had the best effect on the growth and yield of cauliflower followed $N_{120}\,P_{180}\,K_{100}\,S_{20}\,B_1\,Mo_{0\,2}CD_{10}$ (T_7).

Key words: Shallow Red Brown Terrace Soil; Fertilizers; Cauliflower; Growth

Introduction

Cauliflower (Brassica oleracea var. Botrytis) is one of the commercially important vegetable crops in Bangladesh. One hundred gram of edible portion of cauliflower contains calories 31, protein 2.48, calcium 22 mg, vitamin A 40 I. U, thiamine 0.2 mg, ascorbic acid 70 mg, riboflavin 0.1 mg, and niacin 0.57 mg (Anonymous, 1989). Vegetable production in our country is about 2.80 million tones per year of which 83.90% is produced in winter and only 16.91% in summer season (BBS, 1993). The present consumption of vegetable is only 25 g/head/day. Daily per capita vegetable consumption is very low in Bangladesh compared with some other Asian countries like Thailand (164g), china (268g), Japan (348g), India (167g) and Myanmar (151g), (FAO, 1986). One adult should consume a minimum of 200 g vegetables. Production should be increased at least three times from its present production level of 2.80 million including potato and sweet potato. Cauliflower is a nutritious vegetable, which may meet up the nutrition shortage of our people.

Even though Bangladesh has a few local cauliflower varieties of her own, they do not have proper description and uniformity in any respect. The Institute of Post Graduate Studies in Agriculture (IPSA) has however developed an early growing cauliflower line. For higher yields, cauliflower needs a combination of N, P, K, S, B and Mo nutrients.

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The present investigation was therefore, designed to study the performance of different combinations of N, P. K, S, B and Mo in respect to growth characteristics of cauliflower.

Materials and Methods

The experiment was conducted on a high land belonging to Salna Series under Madhupur Tract, during the period from October to January. The soil samples representing 0-10 cm depth were collected from different spots of the experimental site and analyzed for their chemical characteristics (Table 1).

Table 1. Chemical and physico-chemical properties of the experimental soil.

Soil properties	Analytical data
Soil pH	5.87
NH_4-N (ppm)	38.0
Total N (%)	0.047
Organic carbon (%)	0.39
C:N ratio	8.10
Available p (ppm)	6.50
Exchangeable K (meq/100g soil)	0.31
CEC (meq/100g soil)	11.05
Available S (ppm)	30.0
Available Zn (ppm)	15.0

The size of each unit plot was 2.4X1.8 m accommodating 12 plants, at a row-to-row and plant-to-plant distance of 60 cm. The treatment combinations involving N, P, K, S, B, Mo, CD (cow dung) and OC (Organic compost) were as follows:

Treatment	Combination	Treatment	Combination
T_1	$N_0P_0K_0S_0B_0Mo_0CD_0$	T_9	$N_{120}P_{120}K_{50}S_{20}B_1Mo_{.2}CD_{10}$
T_2	$N_0P_{120}K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{10}	$N_{120}P_{120}K_{100}S_0B_1Mo_{.2}CD_{10}$
T_3	$N_{60}P_{120}K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{11}	$N_{120}P_{120}K_{100}S_{20}B_0Mo0_{.2}CD_{10}$
T_4	$N_{120}P_{120}K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{12}	$N_{120}P_{120}K_{100}S_{20}B_1Mo_0CD_{10}$
T_5	$N_{120}P_0K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{13}	$N_{120}P_{120}K_{100}S_{20}B_1Mo_{.1}CD_{10}$
T_6	$N_{120}P_{60}K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{14}	$N_{120}P_{120}K_{100}S_{20}B_1Mo_{.3}CD_{10}$
T_7	$N_{120}P_{180}K_{100}S_{20}B_1Mo_{.2}CD_{10}$	T_{15}	$N_{120}P_{120}K_{100}S_{20}B_1Mo_{.2}CD_0$
T_8	$N_{120}P_{120}K_0S_{20}B_1Mo_{.2}CD_{10}$	T_{16}	$N_{120}P_{120}K_{100}S_{20}B_1Mo0_{.2}OC_{.5}$

Where subscripts to N, P, K, S, Mo and B, indicate their dose in kg ha^{-1} and CD t/ha. The experiment was conducted in a randomized complete block design with There replications. The fertilizers (cow dung compost, TSP, gypsum, solubar and molybdate) were broadcast and incorporated with soils properly. Urea and MP were top dressed in two equal installments, at 15 and 30 days after transplanting. The 28 days old polybag seedlings of the cauliflower line were transplanted in the experimental plots. The transplanted seedlings were protected against strong sunshine by banana leaf sheath cuttings. Shading and irrigation were continued till the seedlings were considered to be settled. After seedling establishment, cultural and intercultural operations were done timely through out the growing period. Five plants were randomly collected from each

plot and plant height was measured from base of the plant up to tip of the leaf. Twelve leaves were collected from four plants of each plot and their size (length X breadth) was measured, number of leaves per plant and single leaf area (length X Breadth X 0.660) per plant was determined.

Four plants were collected randomly from each plot and over dried at 72°C for 72 hours. Dried samples were ground using a grinding machine. The plant sample of different treatments was analyzed for N, P, and K. Nitrogen content was estimated following colorimetric method (Yamakawa, 1993), phosphorus and potassium by vanadomolybdate method (Yamakawa, 1993).

Results and Discussion

Plant height, the number of leaves per plant, leaf size and leaf area were significantly influenced by different fertilizer treatments (Table 2). Nitrogen and phosphorus at the rate of 120 kg ha^{-1}, potassium at the rate of 100 kg ha^{-1}, sulfur at the rate of 20 kg ha^{-1}, boron at the rate of 1 kg ha^{-1}, molybdenum at the rate of 0.2 kg ha^{-1} and organic compost at the rate of 0.5 ton ha^{-1} (T_{16}) contributed maximum to the growth.

Table 2. Effect of different fertilizer treatments on physical character of cauliflower.

Treatment	Plant height (cm)	Number of leaves/plant	Size of leaf (m^2)	Area of leaf (m^2)
T_1	27.80	19.78	0.018	0.246
T_2	32.29	17.66	0.025	0.298
T_3	42.81	18.33	0.057	0.790
T_4	45.74	21.78	0.067	0.974
T_5	46.19	22.33	0.073	1.097
T_6	46.08	20.56	0.070	0.610
T_7	45.57	21.00	0.065	0.899
T_8	42.28	21.56	0.053	0.773
T_9	43.18	21.33	0.061	0.877
T_{10}	43.34	20.56	0.073	0.972
T_{11}	43.27	22.00	0.055	0.860
T_{12}	41.21	20.67	0.059	0.784
T_{13}	45.60	20.67	0.068	0.903
T_{14}	45.37	21.78	0.068	0.990
T_{15}	45.28	22.33	0.063	0.854
T_{16}	47.61	23.00	0.074	1.124
$LSD_{.05}$	6.02	2.79	0.015	0.223
CV%	8.43	7.99	14.64	16.23

Maximum plant height (47.61 cm) was observed in T_{16}, which did not differ from other treatments except T_1, T_2 and T_{12}. Plant height increased with increasing rates of nitrogen (Table 3). Nitrogen application at the rates of 60 and 120 kg/ha in presence of other elements showed 32.58 and 41.65% higher plant height than that of control (T_2) treatment, respectively. Balyan *et al.* (1988) who obtained maximum plant height in cauliflower with 120 kg N/ha when 160 kg N/ha was applied a reduction in plant height was noticed. Plant height was not influenced by the different levels of potassium (Table

3). Deshi et al., (1964) reported no significant difference in cauliflower with 112 kg k/ha. Plant height was not also influenced by the P and Mo applications (Table 3). The highest number of leaves was obtained in T_{16} treatment which was statistically identical to other treatments except T_1, T_2 and T_3. The results were in agreement with to those of Balyan *et al*. (1988). Number of leaves was not affected by the different levels of N, P, K, and Mo applications.

Table 3. Effect of nitrogen, phosphorus, potassium and molybdenum fertilizer treatments on physical character of cauliflower.

Nutrient levels	Plant height (cm)	Number of leaves/plant	Size of leaf (m^2)	Area of leaf (m^2)
Nitrogen levels (kg/ha)				
0	32.29	17.66	0.025	0.298
60	42.81	18.33	0.057	0.790
120	45.74	21.78	0.067	0.974
LSD $_{.05}$	8.44	NS	0.124	0.143
CV%	9.24	16.34	9.62	9.46
Phosphorus levels kg/ha				
0	46.19	22.23	0.073	1.097
60	46.08	20.56	0.070	0.610
120	45.74	21.78	0.067	`0.974
180	45.57	21.00	0.065	0.899
LSD $_{.05}$	NS	NS	NS	0.154
CV%	8.00	3.35	10.89	8.64
Potassium levels kg/ha				
0	42.28	21.56	0.053	0.773
50	43.18	21.33	0.061	0.877
100	45.74	21.78	0.067	0.974
LSD $_{.05}$	NS	NS	NS	NS
CV%	4.28	3.03	13.60	11.12
Molybdenum levels kg/ha				
0	41.21	20.67	0.059	0.784
0.1	45.60	20.67	0.068	0.903
0.2	45.74	21.78	0.067	0.974

Maximum leaf size (0.074 m^2) was obtained the in T_{16} followed by T_5 (0.073 m^2) and T_{10}. A significant increase in leaf size was observed when N was applied at the rate of 60 kg/ha. When 120 kg N/ha was applied, leaf size was increased only by 17% compared with 60 kg N/ha. Nitrogen application at rates of 60 and 120 kg/ha in presence of other nutrient elements age 128 to 168% higher leaf size over N control (T2) treatment respectively. Rajput and Singh (1975) obtained maximum leaf size with 120 kg N/ha. Leaf size was not significantly influenced by the different levels of P. Balyan *et al*. (1988) obtained no effect of P fertilizer on leaf size. Leaf size was also not influenced by the different levels of K and Mo applications.

Maximum leaf area (1.124 m^2) was observed in T_{16} treatment having no with T_5 (1.097 m^2), T_4 (0.974 m2), T_{10}, T_{13} and T_{14} treatment. Leaf area was significantly influenced by different levels of N and P fertilizer. Rajput and Singh (1975) obtained maximum leaf area in cauliflower with 120 kg N/ha. It was not influenced by the different levels of Mo

and K application. Deshi *et al*. (1964) reported no significant effect in cauliflower with 112 kg K/ha.

Nutrient Uptake: Nutrients uptake by cauliflower is presented in Table-4. Nitrogen, phosphorus and potassium uptake by plants were inconsistent to some extent with the treatments. The highest uptake of nitrogen (54.92 kg/ha), phosphorus (100.40 kg/ha) and potassium (280.15) was found in T_{16} treatment and lowest uptake in control (T_1) treatment.

Table 4. Nitrogen, phosphorus and potassium uptake by cauliflower as influenced by different fertilizer treatments.

Treatments	Nitrogen kg/ha	Phosphorus kg/ha	Potassium kg/ha
T_1	11.90	15.20	73.68
T_2	13.42	70.50	112.15
T_3	36.10	77.10	243.60
T_4	54.20	80.59	258.57
T_5	50.75	57.50	165.34
T_6	52.78	60.59	250.85
T_7	53.88	83.70	265.90
T_8	53.50	58.21	190.50
T_9	52.75	65.12	248.31
T_{10}	50.89	72.65	185.10
T_{11}	52.62	79.98	164.11
T_{12}	52.51	75.59	144.92
T_{13}	53.10	77.23	217.70
T_{14}	52.82	78.75	225.95
T_{15}	53.21	76.85	210.35
T_{16}	54.92	100.40	280.15

From the findings of this experiment it can be concluded that the application of $N_{120}P_{120}K_{100}S_{20}B_1Mo_{0.2}OC_{0.5}(T_{16})$ had the most favourable effect with respect to growth and yield of cauliflower followed by $N_{120}P_{180}K_{100}S_{20}B_1Mo_{0.2}CD_{10}(T_7)$. Therefore, it may be recommended that higher doses of nitrogen, phosphorous and potassium with appropriate doses of S, B, Mo fertilizers and organic compost is effective for optimum growth of cauliflower in Shallow Red Brown Terrace soils.

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