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Effect of different organic and inorganic fertilizers on growth and yield of mukhi kachu (*Colocasia esculenta*) cv. sali kachu

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Abstract: The experiment was carried out at the Field Laboratory of the Department of Environmental Science, Bangladesh Agricultural University, Mymensingh during February to October, 2009 to evaluate the effect of different organic and inorganic fertilizers on growth and yield of Mukhi kachu cv. *Sali kachu*. There were eight treatments consisting of T_0: control, T_1: Urea, TSP, MOP, T_2: Urea, TSP, MOP and Gypsum, T_3: Urea, TSP, MOP and $ZnSO_4$, T_4: Urea, TSP, MOP and Borax and, T_5: Urea, TSP, MOP and Compost were used in this investigation. Different organic fertilizers significantly influenced the growth and yield components of Mukhi Kachu cv. Sali Kachu. The plant height, number of leaves per main plant, number of suckers per hill, the length and breadth of leaf blade, number of cormel per hill, dry weight of corm and cormel after different days, yield of corm and cormel were the highest where compost and low dose of inorganic fertilizers were applied. All of the above parameters were lowest where no fertilizer was applied (control). The results of the experiment demonstrated that the highest yields of cormels was recorded under T_5 (Compost @15 t/ha) treatment (37.29 t/ha) followed by T_2 (34.21 t/ha).

Key words: Organic fertilizer, inorganic fertilizer, growth, yield, mukhi kachu.

Introduction

Mukhi kachu [*Colocasia esculenta* (L.) Schott.], member of the family Araceae is one of the important edible aroid in Bangladesh. Mukhi kachu is a rich source of carbohydrate and contain sufficient quantity of protein (Verma *et al.,* 1996). It is extensively grown in Bangladesh in Kharif season, and contributes considerable part in the total supply of bulky vegetables during the late summer when other vegetables are scarce in the market (Siddique *et al.,* 1988). One of the main reasons for such a low yield is poor fertilizer management and low fertility of soil. But it could be easily cultivated by applying organic manure and other crop residues alone or in combination with chemical fertilizer. Low organic matter content of the soil, imbalanced use of inorganic fertilizers, less use of organic manures and inadequate attention given for its improvement and maintenance made the situation difficult (Karim *et al.,* 1994). The use of inorganic fertilizer is expensive and also hazardous to the soil environment. Chemical fertilizers cause problems not only to the soil health but also to the human health and physical environment. To combat this problem, it is necessary to use organic fertilizers alone or with chemical fertilizers that will not only boost agricultural production but also save the environment. So it is necessary to find out an effective organic fertilizer for the cultivation of Mukhi kachu without polluting the soil and the environment. Considering the above facts, the present study was undertaken to observe the effect of different organic and inorganic fertilizers on growth and yield, and to study the yield performance under the application of S, Zn and B with NPK fertilizers in Mukhi Kachu cv. Sali Kachu.

Materials and Methods

The experiment was carried out at the department of Environmental Science Field Laboratory of Bangladesh Agricultural University, Mymensingh during the period from February to October, 2009. The experiment was conducted following the Randomized Complete Block Design (RCBD) with three replications. The experimental plot was divided into three blocks, each of which was then divided into 6 unit plots. The treatments were assigned randomly to the unit plots of each block. The size of a unit plot was 2.5m x 2m. Two adjacent unit plots and blocks were separated by 50cm and 1m spaces, respectively. The study consists of six treatments viz. T_0: control (No fertilizer and manures), T_1: Urea, TSP and MOP @ 62.5,62.5 and 50 kg/ha, T_2: Urea, TSP, MOP and Gypsum @ 125, 125, 100 30 kg/ha, T_3: Urea, TSP, MOP and $ZnSO_4$ @ 62.5,62.5, 50 and 25 kg/ha, T_4: Urea, TSP, MOP and Borax @ 62.5,62.5, 50 and 25 kg/ha, T_5: Urea, TSP and MOP @ 62.5, 62.5 and 50 kg/ha respectively, and Compost @ 15 t/ha. Intercultural operations such as irrigation, weeding, gap filling, drainage, earthing up and plant protection measures were done as and when necessary. The crop was harvested on 2 November 2009 after 253 days of planting when the leaves of all the main plants were dead. Data were collected on different yield contributing characters and yield of Mukhi Kachu. The plants of outer two rows and the extreme ends of the middle rows were excluded to avoid the border effect. Ten plants were selected from each plot to record data on plant height (cm), number of sucker per hill, length of leaf blade (cm), breadth of leaf blade (cm), weight of main corm (g), dry weight of main corm (g), yield of main corm (t/ha) , number of cormels per hill, weight of cormel (g), dry weight of cormels (g), Yield of cormels (t/ha). The mean differences among the treatments were tested with Duncan's Multiple Range Test.

Results and Discussion

Effects on vegetative growth

Plant height: At most of the DAP, the highest plant height was found in the T_5 treatment where compost and NPK fertilizers were used and the second highest plant height from T2 where sulfur and NPK fertilizers were used and lowest from the control (Table 1). It might be due to higher nitrogen content in compost and NPK fertilizers combined been used in T_5 and fertilizers were not applied in the control plot. Here plant height was increased up to 130 DAP. So, 130 DAP may be

considered as full vegetative stage of growth. Plant height tended to decrease after 130 DAP by this time all the early formed bigger leaves have started withering and drying leaving only the short, late formed leaves which results in reduction of plant height.

Table 1. Effects of manure and fertilizer on plant height of Mukhi kachu cv. Sali kachu at different days after planting

Treatments	Plant height (cm)					
	40 DAP	70 DAP	100 DAP	130 DAP	160 DAP	190 DAP
T_o	11.22	32.28d	59.69d	108.55b	82.36c	32.62c
T_1	11.55	41.36ab	62.15cd	120.32a	94.32b	34.94bc
T_2	11.42	38.79bc	69.92b	126.19a	96.28b	39.28b
T_3	11.38	36.18bcd	66.53bc	122.74a	95.79b	36.59bc
T_4	11.40	35.19cd	64.21cd	121.28a	94.78b	37.77bc
T_5	11.75	44.43a	78.76a	128.01a	102.05a	58.08a
CV	5.09	7.75	4.41	5.32	3.18	6.81

T_o: control, T_1: Urea, TSP and MOP @ 62.5, 62.5 and 50 Kg/ha Respectively, T_3: Urea, TSP, MOP and Zn @ 62.5, 62.5, 50 and 25 Kg/ha respectively, T_4: Urea, TSP, MOP and B @ 62.5, 62.5, 50 and 25 Kg/ha respectively, T_5: Urea, TSP and MOP @ 62.5, 62.5 and 50 Kg/ha respectively, and Compost @ 15 t/ha
In a column, the means having same letter(s) do not differ significantly significantly at $p<0.05$ as per DMRT

Table 2. Effects of manure and fertilizer on the number of suckers hill^{-1} of Mukhi kachu cv. Sali kachu at different days after planting

Treatment	Number of suckers per main plant				
	80 DAP	110 DAP	140 DAP	170 DAP	200 DAP
T_o	6.72d	8.12c	7.85c	5.12c	5.44b
T_1	7.05cd	8.30bc	8.48bc	6.55ab	6.17a
T_2	7.78b	8.72b	8.90ab	6.92ab	6.32a
T_3	7.12cd	8.42bc	8.65b	6.62ab	6.24a
T_4	7.16c	8.38bc	8.62b	6.69bc	6.21a
T_5	8.40a	9.82a	9.45a	7.26a	6.56a
CV(%)	2.87	3.41	4.07	10.92	4.98

In a column, the means having same letter(s) do not differ significantly whereas at $p<0.05$ as per DMRT

Table 3. Effects of manure and fertilizer on length and breadth (cm) of leaf blade of Mukhi kachu cv. Sali kachu at 140 days after planting

Treatment	Length(cm)	Breadth(cm)
T_o	23.3d	20.34d
T_1	26.4cd	23.49cd
T_2	31.5ab	31.25b
T_3	28.1bcd	28.56b
T_4	28.7bc	27.79bc
T_5	34.2a	36.21a
CV(%)	8.93	8.89

In a column, the means having same letter(s) do not differ significantly at $p<0.05$ as per DMRT

Number of suckers per hill: The number of suckers per hill was influenced by different treatments. In most cases the maximum number of suckers per hill was found in the T_5 treatment and the minimum was found in the control(Table 2). It might be due to higher nitrogen content in compost and NPK fertilizers and fertilizers were not applied in the control plot. Hossain and Rashid (1982) reported that highest dose of nitrogen (320 kg ha^{-1}) gave the maximum number of suckers hill^{-1} it might be due to increased photosynthetic activity and translocation of photosynthesis to the corms which might have helped in initiation of more cormels. Anand and Krishnapa (1988) noticed that this character was mainly dependent on the cultivar and physiological state of seed tuber of potato rather than the fertility of the soil. After 110 DAP number of sucker was gradually decreased.

Length and breadth of the leaf blade: The length and breadth of the leaf blade was significantly influenced by different treatments. Highest length of leaf blade (34.2cm) was obtained from the T_5 treatment and highest breadth of leaf blade (36.21cm) was also obtained from the same treatment at 140 DAP. The lowest length of leaf blade (23.3cm) and the lowest breadth of leaf blade (20.34cm) were obtained from the control (Table 3). It might be due to higher nitrogen content in compost and fertilizers were not applied in the control plot. Nitrogen enhances the protein synthesis, which allows plant to grow faster, and stimulates apical growth as well as increases leaf size i.e. increases leaf length and leaf breadth.

Table 4. Effects of manures and fertilizers on yield components and yields of Mukhi kachu cv. Sali kachu

Treatment	Number of Cormels/hill	Average wt. of each corm (g)	Average wt. of each cormel (g)	Yield of Corm (t/ha)	Yield of Cormel (t/ha)
T_0	14.49d	335.3d	24.36d	16.29c	18.25d
T_1	15.89cd	432.8c	27.19cd	18.16c	26.23c
T_2	20.98b	507.1b	33.24b	23.58b	34.21b
T_3	18.15c	498.3b	31.15bc	21.93b	32.17e
T_4	17.90c	486.7b	30.86bc	21.68b	31.98b
T_5	24.23a	620.7a	38.29a	26.18a	37.29a
LSD	2.708	39.52	4.305	2.486	4.836
CV(%)	8.00	4.52	7.67	6.41	8.85

In a column, the means having same letter(s) do not differ significantly at p<0.05 as per DMRT

Table 5. Effects of manures and fertilizers on the dry weight of corms and cormels of Mukhi kachu after different days sun drying(t/ha)

Treatments	Weight of sun dried corm			Weight of sun dried cormel		
	1st	2nd	3rd	1st	2nd	3rd
T_0	5.75c	15.35c	14.95b	17.83d	17.55d	17.25d
T_1	17.65c	17.25c	16.90b	25.52c	25.08c	24.68c
T_2	22.92ab	22.52ab	22.18a	33.02ab	32.53b	32.16b
T_3	21.46b	21.02b	21.70a	31.21b	30.72bc	30.33bc
T_4	21.05b	22.70ab	22.40a	30.92b	30.45bc	29.92bc
T_5	25.20a	24.85a	24.50a	36.15a	35.62a	35.10a
CV(%)	6.77	7.14	7.33	7.43	7.87	8.66

In a column, the means having same letter(s) do not differ significantly at p<0.05 as per DMRT

Effect on yield components and yield: The numbers of cormels per hill, weight of corm and cormel weight were the important yield components of Mukhi kachu. The color of the cormels was pinkish at young stage and at harvesting stage was somewhat black. The size of the corm was much larger than the cormels. Different manures and fertilizers significantly influenced the number of cormel per hill, weight of corms, weight of cormels, yield of corms and cormels yield. The maximum number of cormels per hill (24.23) was recorded from the T_5 treatment and minimum (14.49) from the control. The maximum weight of corm (620.7g) was obtained from the T_5 treatment and the minimum (335.3g) from control. The maximum weight of cormel (38.29g) was obtained from the T_5 treatment and minimum (24.36g) from the control. Similarly, the maximum yield of corms (26.18 t/ha) and cormels (37.29 t/ha) were obtained from the T_5 treatment and minimum yield of corms (16.29 t ha^{-1}) and cormels (18.25 t ha^{-1}) were obtained from the control (Table 4). It might be due to higher nitrogen encouraged. higher nitrogen uptake, vegetative growth, photosynthesis and then translocation of photosynthesis to the cormels. Potassium is known to be essential for the synthesis and translocation of carbohydrate, considered as one of the most important physiological activities of root crops. The beneficial effects of nitrogen and potassium in enhancing the cormel yield of taro were reported by Mohankumer *et al* (1991) and Hossain and Rashid (1982).

Dry weight of corms and cormels: Dry weight of corms and cormels was significantly influenced by different treatments (Table 5). The highest dry weight of corms of 1st, 2nd and 3rd days sun drying was 25.20, 24.85 and 24.50 t/ha respectively and cormels 36.15, 35.62 and 35.10 t/ha respectively was obtained from T5 where compost and NPK fertilizers were combined used and the lowest dry weight of corms 15.75, 15.35, 14.95 t ha-1 and cormels 17.83, 17.55, and 17.25 t ha^{-1} was obtained from To (control). The second highest dry weight of corms after 1st, 2nd and 3rd days sun drying was 22.92, 22.52, and 22.18 t/ha and cormels 33.02, 32.53 and 32.16 t/ha was obtained from T_2 where compost and NPK fertilizers were combined used.

The performance of compost and little amount of NPK fertilizers was the best in terms of yield and yield components of Sali kachu. The maximum yield of corms (26.18 t/h) and yield of cormels after 3 days sun drying (37.29 t/ha) were obtained from urea, TSP and MoP @ 62.5, 62.5 and 50 Kg/ha, respectively and compost @ 15 t/ha.

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