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GROWTH AND YIELD OF LETTUCE (*Lactuca sativa* L.) AS INFLUENCED BY POTASSIUM

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ABSTRACT

Two factorial Randomized Complete Block Design experiment was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka-1207, during the period from November 2006 to March 2007 to study the effect of different levels of potassium viz; no potassium (K_0), 120 kg K_2O/ha (K_1), 130 kg K_2O/ha (K_2) and 140 kg K_2O /ha (K_3) on the growth and yield of lettuce. The experiment was conducted with seven replications. Application of different doses of potassium showed significant differences among yield and different yield contributing characters. The highest plant height (21.08 cm), number of leaves (26.41), leaf length (23.29 cm), leaf breadth (22.04 cm), fresh weight of plant (325.82 g), dry matter content (12.32%) and yield (27.14 t/ha) were recorded from 130 kg K_2O/ha (K_2) and control treatment gave the lowest results.

Keywords: Potassium, growth, yield and lettuce

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is the most popular crop in the world. It belongs to the family compositae. It is a leafy herb with milky juice crop. It produces a short stem early in the season, a cluster of leaves varying considerably in shape, character and color in different varieties. Later in the season a seed stock is produced (Ryder, 1979). It is mainly a cold loving crop. The best temperature range for lettuce cultivation is 18°C to 25°C and the night temperature is 10°C to 15°C (Ryder, 1998).

Lettuce is popular for its delicate, crispy- texture and slightly bitter taste as fresh condition. The nutritive value of lettuce is very high but rests largely upon a good content of minerals and a moderate storage of vitamins to the humane diet plus substantial amount of fibre and that of water (Work, 1997).

It is usually used as salad with tomato, carrot, cucumber or other salad vegetables. It is often served alone of with dressing. Moreover, it is anodyne, sedative, diuretic and expectorant. Lettuce is a newly introduced crop in our country and getting popularity day by day. Its production package is not much known to Bangladeshi farmers. Among various factors responsible for higher yield, supply of nutrient and availability of moisture play vital role in the production, and quality of lettuce. Deficiency of nutrient is now considered as one of the major constrains to successful upland crop production in Bangladesh (Islam and Noor, 1982). The effect of potassium on the formation and translocation of carbohydrates, root development, growth and other agronomic characters are well recognized. Considering above facts on lettuce production the present study was under taken to determine the optimum dose of potassium for maximizing the growth of lettuce and to find out the suitable levels of potassium for ensuring the higher yield of lettuce.

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MATERIALS AND METHODS

The experiment was conducted in the field of Horticulture farm of Sher-e-Bangla Agricultural University during November 2006 to March 2007 followed Randomized Complete Block Design. The experiment was laid out with seven replications. The size of each plot was 2.1m ×1.2 m. The distance between blocks and between plots was kept respectively 1 and 0.5 m. The land which was selected to conduct the experiment was opened on 10 November, 2007 with the help of a power tiller and then it was kept open to sun for 7 days prior to further ploughing. The weeds and stubbles were removed after each laddering. Simultaneously, the clods were broken and the soil was made into good tilth. The following doses of manures and fertilizers were recommended for lettuce production by Rashid and Shakur (1986). Cowdung-10 t/ha, Urea- 180 kg/ha, TSP- 175 kg/ha and MP- 116 kg/ha. Entire cowdung and P_2O_5 (as TSP) were applied during the final land preparation. Nitrogen and K_2O (used as MP as per above mentioned treatments) were applied into three equal installments i.e., 10, 20 and 30 days after transplanting. The seeds of lettuce Green Wave, a Japanese variety, were used in the experiment. Well prepared seedbed was made 3m x 1m in size for raising seedlings. Thirty two days old seedlings were transplanted in the experimental field in the afternoon on 12 December 2007and light watering was done carefully around each seedling for their better established. The transplanted seedlings were protected from scorching sunlight providing by banana sheath. Gap filling, weeding, diseases and pest management were done as necessary. The crop was harvested on 15, 25, 35 and 45 days after transplanting (DAT). Harvesting of the crop was done plot wise. It was done carefully by uprooting the plants by hand. The soil adhering older leaves were removed and cleaned with fresh water. Data on the following parameters were recorded from the sample plants during the course of experiment. Five plants were sampled randomly from each unit plot for the collection of per plant data. The whole plot was harvested to record per plot data. The following observations were made regarding plant growth, yield and yield attributes as affected by different levels of potassium. Plant height, number of leaves per plant, length of leaf (cm), breadth of leaf (cm), petiole length (cm), fresh weight of leaves per plant (g) were recorded from five random selected plants at 15, 25, 35 and 45 DAT. For measuring of per cent dry matter of leaves (%) , an electric balance was used. The yield of lettuce per plot was recorded as the whole plant in every harvest within a plot (2.1 m x1.2 m) and was expressed in kilogram. Yield included weight of leaf with roots and total at different harvested time. The data collected from the experimental plots were statistically analyzed. The mean value for all the treatments was calculated and the analysis of variance for most of the characters was accomplished by F variance test. The significance of difference between pair of means was tested by the Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Plant height

The plant height was recorded at different stages of growth i.e. 15, 25, 35, and 45 days after transplanting (DAT). The plant height was also varied due to application of different levels of potassium at different stages of growth. The tallest (21.08 cm) plant height was found from 130 kg K_2O/ha (K_2) whereas, the shortest (18.63 cm) was recorded from control treatment at 45 DAT (Fig.1). Bastelaere and Van (1998), also found similar trend of results which supported the present study.

Number of leaves per plant

Application of different levels of potassium influenced the number of leaves per plant significantly at different days after transplanting (DAT). The number of leaves was increased with the increasing of certain level of potassium. However, at 45 DAT with 130 kg K_2O/ha (K_2) produced the highest (26.41) number of leaves and the control treatment gave the minimum (21.83) (Fig.2). It may be mentioned

here that, the number of leaves increased more rapidly during early period of crop growth. Bakker *et al.*, (1984), found with the increase of certain level of potassium fertilizer also increase the number of leaves which support the present study.

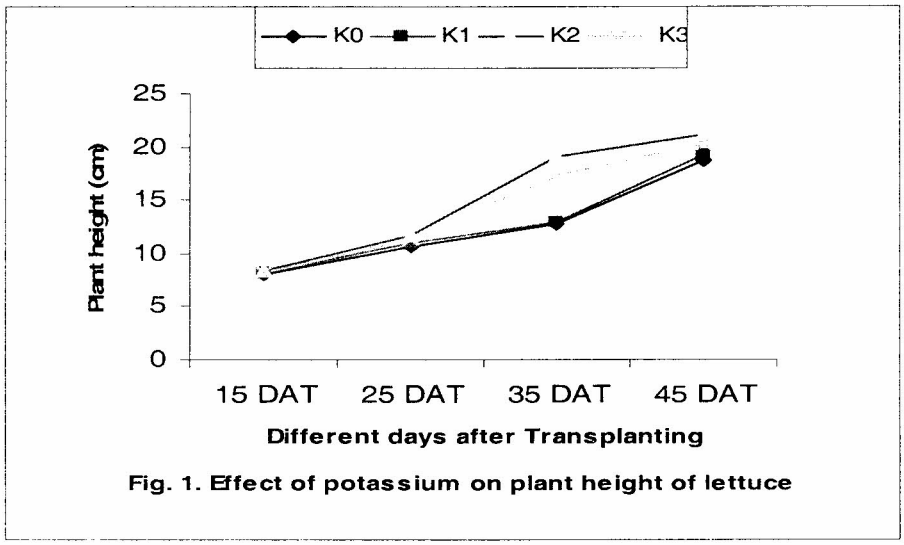

Fig. 1. Effect of potassium on plant height of lettuce

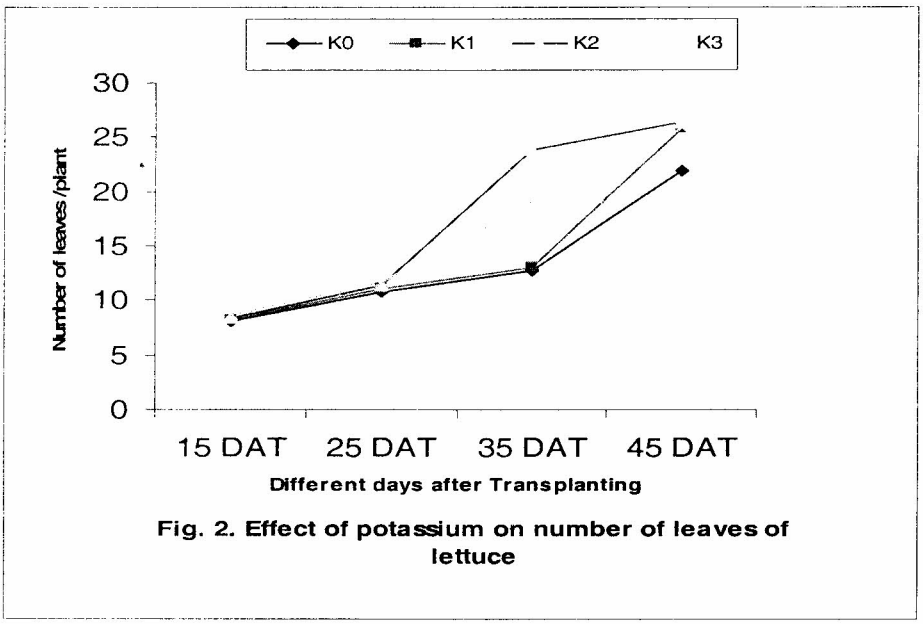

Fig. 2. Effect of potassium on number of leaves of lettuce

Leaf length: Due to application of different levels of potassium showed significant variation on leaf number at different days after transplanting (DAT). However, at 45 DAT, 130 kg K_2O/ha (K_2) produced the longest (23.29 cm) leaf length which was similar (22.01 cm) to K_3 and the shortest (20.02

cm) leaf length was found from control treatment (Table 1). Sajjan (1992) stated that with the increasing of potassium fertilizer up to a certain level, the number of leaves were increased.

Leaf breadth

There was no significant variation on leaf breadth due to application of different levels of potassium at different days after transplanting. The maximum (22.04cm) leaf breadth was recorded from 130 kg K_2O/ha (K_2) and the minimum (19.7 cm) was found from control treatment at 45 DAT (Table 1). Feller *et al.* (2003) found similar trend of results with their study.

Petiole length

Application of different levels of potassium did not show the significant difference on petiole length at different days after transplanting of lettuce. However, 130 kg K_2O/ha performed the maximum (4.89 cm) petiole length while the minimum (4.05 cm) was recorded from control condition (Table 1).

Jaenaksorn and Ikeda (2004), worked on leafy vegetables and they did not found significant differences on petiole length which agreed to the present study.

Table 1. Effect of different levels of potassium on leaf length and leaf breadth of lettuce at different days after transplanting

Treatment(s)	Leaf length (cm)				Leaf breadth (cm)			
Levels of potassium	15 DAT	25 DAT	35 DAT	45 DAT	15 DAT	25 DAT	35 DAT	45 DAT
K_0	5.32b	9.93c	10.88c	20.02c	4.5	8.92	9.02	19.7c
K_1	5.39b	10.24b	11.27b	21.97b	5.22	9.15	9.07	20.49b
K_2	6.09a	11.14a	12.93a	23.29a	5.43	9.4	9.94	22.04a
K_3	5.59b	11.06a	11.89b	22.01ab	5.26	9.26	9.41	21.24b
LSD (0.05)	0.490	0.300	0.380	1.291	0.953	0.539	0.931	0.783
Level of significant	**	**	*	*	NS	NS	NS	*
CV (%)	6.96	8.98	9.36	7.85	3.65	7.95	8.63	9.06

Table 2. Effect of different levels of potassium on petiole length and fresh weight per plant of lettuce at different days after transplanting

Treatment(s)	Petiole length (cm)				Fresh weight per plant (g)			
Levels of potassium	15 DAT	25 DAT	35 DAT	45 DAT	15 DAT	25 DAT	35 DAT	45 DAT
K_0	2.19	2.33	3.19	4.05	165.37c	180.06d	230.05d	235.07d
K_1	2.25	2.42	3.44	4.28	170.21ab	189.61c	237.81c	278.61c
K_2	2.29	2.49	3.69	4.89	173.00a	210.77a	250.43a	325.82a
K_3	2.26	2.48	3.58	4.53	171.01ab	197.37b	243.05b	317.05b
LSD (0.05)	0.175	0.185	0.576	0.552	3.489	8.456	6.357	7.895
Level of significant	NS	NS	NS	NS	**	**	**	**
CV (%)	6.94	8.66	6.65	5.87	7.35	6.81	7.04	9.65

Fresh weight of leaves per plant

A signification variation was observed on the fresh weight of leaves per plant due to different levels of potassium (Table 2). At 45 DAT, the plant contributed the maximum (325.82 g) fresh weight of leaves when received 130 kg K_2O/ha (K_2) and the minimum (235.07 g) was obtained from control treatment. Neuvel and Kanters (1999), conducted the such type of study and found similar trend of results which was support the present trial.

Percent dry matter of leaves

Application of different levels of potassium had significant effect on dry matter of leaves at different days after transplanting At 45 DAT, the maximum (12.32%) dry matter was recorded from 130 kg K_2O/ha (K_2) and the minimum (5.15%) showed in control condition (Table 3). Mitra and Bose (1990) agreed to the present study.

Table 3. Effect of different levels of potassium on per cent dry matter of leaves and yield per plot of lettuce at different days after transplanting

Treatment(s)	Dry matter (%) of leaves			
Levels of potassium	15 DAT	25 DAT	35 DAT	45 DAT
K_0	2.70b	5.15c	7.63d	9.63d
K_1	2.80b	6.02b	7.94c	10.07c
K_2	3.21a	7.91a	8.67a	12.32a
K_3	3.00ab	7.34ab	8.12b	11.44b
LSD (0.05)	0.223	0.602	0.173	0.312
Level of significant	**	**	**	**
CV (%)	7.63	6.86	5.97	7.19

Yield per hectare

The yield per hectare of lettuce found to be statistically significant due to the effect of different levels of potassium (Fig. 3).

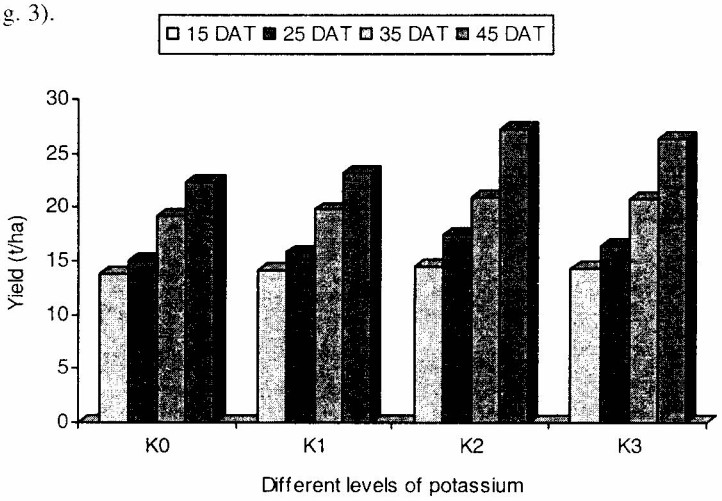

Fig. 3. Effect of different levels potassium on yield of lettuce

The highest (27.14 t/ha) yield was obtained from 130 kg K_2O/ha (K_2) while the minimum (22.33 t/ha) was recorded from control treatment at 45 DAT (Table 3). Sajjan *et al.* (1991) showed that, certain levels of potassium performed the higher yield and then after decline.

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