Effect of variety and NPKZnB fertilizers on growth and yield of Kohlrabi

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Abstract: The study was carried out to investigate the effect of variety and NPKZnB fertilizers on growth and yield of Kohlrabi using two varieties viz, Early 005 and, Quick Star, and five different levels on NPKZnB fertilizers viz, F_0: Control ($N_0P_0K_0Zn_0B_0$), F_1: 50 kg N ha^{-1} + 12.9 kg P ha^{-1} + 62.25 kg K ha^{-1} + 2 kg Zn ha^{-1} + 1 kg B ha^{-1}, F_2: 75 kg N ha^{-1} + 25.8 kg P ha^{-1} + 124.5 kg K ha^{-1} + 4 kg Zn ha^{-1} + 2 kg B ha^{-1}, F_3: 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} and F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}. The two-factor experiment was laid out in RCBD with three replications. Different variety and NPKZnB fertilizers showed highly significant influence on almost all the studied parameters. In case of variety, the taller plant height (28.47 cm), fresh weight of knob and root (407.33 and 3.32 g $plant^{-1}$), the highest gross (22.47 kg $plot^{-1}$) and marketable (19.55 kg $plot^{-1}$ or 67.89 t ha^{-1}) yield were obtained from Quick Star while the dwarf plant (24.60 cm), fresh weight of knob and root (378.67 and 2.51 g $plant^{-1}$), the lower gross (21.67 kg $plot^{-1}$) and marketable (18.18 kg $plot^{-1}$ or 63.04 t ha^{-1}) yield were found from Early 005. In case of NPKZnB fertilizers, the tallest plant (28.63 cm), fresh weight of knob and root (467.50 and 3.23 g $plant^{-1}$), the highest gross (25.34 kg $plot^{-1}$) and marketable (22.44 kg $plot^{-1}$ or 77.92 t ha^{-1}) yield were obtained from F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} while the dwarf plant (24.00 cm), fresh weight of knob and root (279.20 and 2.57 g $plant^{-1}$), the lowest gross (16.40 kg $plot^{-1}$) and marketable (13.40 kg $plot^{-1}$ or 46.36 t ha^{-1}) yield were found from F_0: control (no fertilizers). In case of combined effect, the tallest plant (31.20 cm), fresh weight of knob and root (478.30 and 3.80 g $plant^{-1}$), the highest gross (25.41 kg $plot^{-1}$) and marketable (22.96 kg $plot^{-1}$ or 79.72 t ha^{-1}) yield were obtained from Quick Star grown under 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}, whereas the dwarf plant (22.93 cm), fresh weight of knob and root 263.30 and 2.30 g $plant^{-1}$), the lowest gross (15.52 kg $plot^{-1}$) and marketable (12.64 kg $plot^{-1}$ or 43.55 t ha^{-1}) yield were found from variety Early 005 grown with F_0: control (no fertilizers). These findings concluded that variety Quick Star with 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} was the best successful combination for the highest production of Kohlrabi.
Key words: Kohlrabi, variety, NPKZnB fertilizers, yield.

Introduction

Kohlrabi (*Brassica oleracea* var. *gongylodes* L.) is non-traditional and short duration vegetable crop in Bangladesh belongs to Brassicaceae family. It is closely related to cabbage, broccoli, cauliflower and brussels sprouts (Saleh *et al*., 2013; Combs and Ernst, 2014). It is known as Knolkhol and Ol-kapi in Bangladesh (Rahman, 2008; Sultana *et al*., 2012). In Bangladesh, about 7.29 thousand hectares of land was used for Kohlrabi cultivation where 35 thousand tones were produced per year with an average yield of 4.80 t ha^{-1} in 2009-2010 (BBS, 2010). Kohlrabi is grown for its stem. It forms a round globe just above the soil line with leaves emerging in a spiral from the stem. Combs and Ernst (2014) reported that the Kohlrabi can be eaten raw or cooked. Rahman (2008) also reported that it has high nutritive value, contains substantial amount of moisture (92.70g), protein (1.10g), fat (0.20g), mineral (0.70g), vitamin A (38 IU) and vitamin C (85 mg/100g of edible portion). All types of soil are suitable for kohlrabi cultivation.

Judicious application of fertilizer and proper cultural management are related to get proper growth and high yield of kohlrabi. Adequate supply of N, P, K, S, B and Zn fertilizers favors the transformation of carbohydrates into proteins and promotes the good quality foliage (Rai, 1981). Ahmed *et al*. (2003) reported that the potassium is considered essential in photosynthesis, sugar translocation, nitrogen metabolism, enzyme activation, stomatal opening and growth of meristematic tissues, root booster, stalk strengthener, protein builder, breathing regulator and retard the diseases. Fisher (1997) applied varying amounts of N and K along with P, Fe, Mn and Zn and found significant response on growth and yield of Kohlrabi. The nutrients calcium, boron, manganese, molybdenum and iron are more important for cole crop development reported by Uddin *et al*. (2009). Considering the above facts, the study was undertaken to determine the suitable variety and proper doses of NPKZnB fertilizers in relation to growth and yield of Kohlrabi.

Materials and Methods

The study was conducted at Horticulture farm, PSTU, Patuakhali during October 2015 to February 2016. Two cultivars viz, Early 005 (V_1) and Quick Star (V_2) containing five different combinations of N, P, K, Zn and B fertilizers viz, F_0: control (no fertilizers) F_1: 50 kg N ha^{-1} + 12.9 kg P ha^{-1} + 62.25 kg K ha^{-1} + 2 kg Zn ha^{-1} + 1 kg B ha^{-1} F_2: 75 kg N ha^{-1} + 25.8 kg P ha^{-1} + 124.5 kg K ha^{-1} + 4 kg Zn ha^{-1} + 2 kg B ha^{-1} F_3: 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} and F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} were used. It was laid out in RCBD with three replications. The unit plot was 1.8 m × 1.6 m in size. Block to block and plot to plot distances were 1.0 m and 0.5 m while plant to plant and row to row was 20 cm and 30 cm wherein each plot contains 48 plants, thus 1440 plants were in whole experimental plots. The selected land was opened on 14 October, 2015 with a power tiller and the soil was treated by Diazinon 60 EC @ 650 ml ha^{-1} at final land preparation to protect the young plants from the attack of mole cricket and cutworm (Biswas, 2006). Fertilizers were also applied as per treatments where ⅓ of urea was applied at 10 days after transplanting of seedlings. The remaining doses of urea were top dressed at 25 and 40 days after transplanting. Rest of the fertilizer namely P, K, Zn and B were applied as basal dose in all the plots except control plots. Twenty four day-old healthy seedlings were transplanted on 23 November 2015 in the afternoon while watered and shading with banana leaf sheath were done after transplanting and continued for 7 days. Gap filling, weeding, earthling up, irrigation and pest management were done. Harvesting was done over a period from 25 January to 10 February 2016 and ten sample plants were randomly selected for recording data

on plant height, leaves plant^{-1}, days to 80% knob initiation, fresh weight of knob and roots, gross and marketable yield. The collected data were analyzed in MSTATc program while means were adjust by DMRT at 5% level of significant.

Results and Discussion

Plant height: Effect of variety, NPKZnB fertilizer and their combination had significant influenced on plant height where Quick Star (V_2) had taller (28.47 cm) than Early 005 (24.60 cm) (Table 1). Similarly, plant height had the tallest (28.63 cm) in F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} and the dwarf (24.00 cm) in without fertilizers (F_0) (Table 2). The tallest plant (31.20 cm) was found in Quick Star grown under 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (V_2F_4) while the shortest plant (22.93 cm) was produced from Early 005 grown under control condition (V_1F_0) (Table 3). The variation in plant height between the varieties might be due to the variation in genetical makeup of the varieties and the variation in adaptability with the regional conditions. Same observation was found by El–Bassiony *et al*. (2014). This result showed significantly increased plant height with increasing level of NPKZnB, might be due to the highest rates of fertilizers was appropriate for brings several chemical and biological changes in the soils, which are beneficial or helpful for improving crop growth and yields by stimulating the plant growth and various physiological processes including cell division and cell elongation of the plant. Similar observation was also reported by Saleh *et al*. (2013).

Table 1. Effect of varieties on growth and yield of Kohlrabi

Variety	Plant height (cm)	No. of leaves plant^{-1}	Days to 80% knob initiation	Fresh wt. of knob (g plant^{-1})	Dry wt. of knob (g plant^{-1})	Fresh wt. of roots (g plant^{-1})	Dry wt. of roots (g plant^{-1})	Gross yield (kg plot^{-1})	Marketable yield (kg plot^{-1})	Marketable yield (t ha^{-1})
Early 005	24.60 b	12.59 a	21.80 b	378.67 b	4.87b	2.51 b	0.54 b	21.67 b	18.18 b	63.04 b
Quick Star	28.47 a	11.47 b	33.00 a	407.33 a	5.34 a	3.32 a	0.90 a	22.47 a	19.55 a	67.89 a
$LSD_{0.05}$	0.62	0.22	0.36	10.04	1.00	0.09	0.03	0.55	0.49	1.60
CV (%)	3.07	2.43	1.76	3.33	2.55	4.34	5.52	3.28	3.40	3.18
Level of sign.	**	**	**	**	**	**	**	**	**	**

In a column, figures having similar and no letter(s) do not differ significantly at 5% level, whereas figures with dissimilar letter(s) differ significantly as per DMRT at same level; ** = Significant at 1% level of probability

Table 2. Effect of different rates of NPKZnB fertilizers on growth and yield of Kohlrabi

Fertilizer treatments	Plant height (cm)	No. of leaves plant^{-1}	Days to 80% knob initiation	Fresh wt. of knob (g plant^{-1})	Dry wt. of knob (g plant^{-1})	Fresh wt. of roots (g plant^{-1})	Dry wt. of roots (g plant^{-1})	Gross yield (kg plot^{-1})	Marketable yield (kg plot^{-1})	Marketable yield (t ha^{-1})
F_0	24.00 d	11.10 c	29.17 a	279.20 d	3.44 e	2.57 c	0.63 c	16.40 d	13.40 d	46.36 d
F_1	25.60 c	11.57 b	28.00 b	351.70 c	4.46 d	2.70 c	0.66 c	20.55 c	16.88 c	58.61 c
F_2	27.03 b	12.33 a	27.67 b	413.30 b	5.35 c	2.95 b	0.73 b	22.84 b	19.84 b	68.89 b
F_3	27.40 b	12.48 a	26.50 c	453.30 a	5.97 b	3.13 a	0.77 ab	25.22 a	21.76 a	75.56 a
F_4	28.63 a	12.50 a	25.67 d	467.50 a	6.33 a	3.23 a	0.82 a	25.34 a	22.44 a	77.92 a
$LSD_{0.05}$	0.98	0.35	0.58	15.87	0.15	0.15	0.05	0.87	0.77	2.53
CV (%)	3.07	2.43	1.76	3.33	2.55	4.34	5.52	3.28	3.40	3.18
Level of sign.	**	**	**	**	**	**	**	**	**	**

In a column, figures having similar and no letter(s) do not differ significantly at 5% level, whereas figures with dissimilar letter(s) differ significantly as per DMRT at same level; ** = Significant at 1% level of probability, F_0: Control (no fertilizers), F_1: 50 kg N ha^{-1} + 12.9 kg P ha^{-1} + 62.25 kg K ha^{-1} + 2 kg Zn ha^{-1} + 1 kg B ha^{-1}, F_2: 75 kg N ha^{-1} + 25.8 kg P ha^{-1} + 124.5 kg K ha^{-1} + 4 kg Zn ha^{-1} + 2 kg B ha^{-1}, F_3: 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1}, F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}.

Number of leaves plant^{-1}: Number of leaves plant^{-1} showed significantly variation due to the effect of varieties and NPKZnB fertilizers. The maximum number of leaves plant^{-1} (12.59) was produced in Early 005 as compared to Quick Star (11.47) (Table 1). Again, treatments F_4 (125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) produced more leaves plant^{-1} (12.59) while control treatment recorded the lowest number (11.47) (Table 2). In case of combined effect, number of leaves plant^{-1} (13.03) was the highest in V_1F_4 (Early 005 with 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) while the lowest (10.87) in V_1F_0 (Table 3). The mixed use of higher NPKZn and B levels were appropriate rate for the production of more leaves which might be due to those rates of NPNZnB fertilizer had highly accumulate the physical and chemical properties of the regional soil and supply the proper soil nutrients to the plant and confirmed the proper growth. It was more or less similar to Hossain *et al*. (2011); Saleh *et al*. (2013).

Days required for 80% knob initiation: Effect of varieties and NPKZnB fertilizers had also statistically significant effect on days to 80% knob initiation. Early 005 required the lowest time (21.80 days) compared to Quick Star (33.00 days) (Table 1). Again, without fertilizer needed the highest time (29.17 days) while F_4 (125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) required the lowest time for 80% knob initiation (Table 3). Required time for 80% knob initiation ranged from 20.33 to 34.67 days due to combined treatments where the highest time was required for the variety Quick Star grown under 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (V_2F_0) while the lowest time (20.33 days) was required for the variety Early 005 grown under both 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} and F_4: 125 kg N ha^{-}

^{1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (V_1F_3 and V_1F_4) (Table 3). The variations in days to 80% knob initiation in Kohlrabi were obtained between the varieties due to the variation in their genetical makeup. The higher rates of NPKZnB fertilizers reduced the time knob initiation. Naher *et al*. (2014) reported that the significant increase of inorganic fertilizer decreased the card initiation of cabbage by increased the macro and micronutrients to the soil.

Fresh and dry weight of knob (g plant^{-1}): Between the varieties, Quick Star produced significantly the highest weight of fresh and dry knob (407.33 and 5.34 g plant^{-1}) than Early 005 (378.67 and 4.87 g plant^{-1}) (Table 1). In case of fertilizers, the highest fresh weight of knob (467.50 and 6.33 g plant^{-1}) was recorded in F_4 (125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) while treatment F_3 (100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1}) produced statistically identical weight of fresh knob (453.30 and 3.44 g plant^{-1}). The treatment F_0 (without fertilizer) showed the lowest weight of fresh knob (279.20 g plant^{-1}) (Table 2). Similarly, combined effect showed significant response on fresh and dry weight of knob while they were the highest (478.30 and 6.49 g plant^{-1}) in V_2F_4 (Quick Star with 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) and the lowest (263.30 and 3.16 g plant^{-1}) in V_1F_0 (Early 005 and without fertilizer) (Table 3). Abou El–Magd (2013) agreed the present findings. Besides, the higher rates of NPKZn and B fertilizers had highly efficient for making the favourable growing condition by enhance the macro and micronutrients of the soil which ultimately produced the heaviest knob. This observation was fully supported by Saleh *et al*. (2013) for fresh weight and Bahadur *et al*. (2015) for dry weight of knob.

Table 3. Combined effect of varieties and different rates of NPKZnB fertilizers on growth and yield of Kohlrabi

Fertilizer treatments	Plant height (cm)	No. of leaves plant^{-1}	Days to 80% knob initiation	Fresh wt. of knob (g plant^{-1})	Dry wt. of knob (g plant^{-1})	Fresh wt. of roots (g plant^{-1})	Dry wt. of roots (g plant^{-1})	Gross yield (kg plot^{-1})	Marketable yield (kg plot^{-1})	Marketable yield (t ha^{-1})
V_1F_0	22.93 f	11.33de	23.67 e	263.30 f	3.16 h	2.30 f	0.47	15.52 e	12.64 f	43.55 f
V_1F_1	23.87 ef	12.23 b	22.33 f	346.70 d	4.32 f	2.47 ef	0.50	20.48 c	16.64 d	57.78 d
V_1F_2	25.03de	13.03 a	22.33 f	383.30 c	4.88 d	2.57 e	0.53	21.76 c	18.40 c	63.89 c
V_1F_3	25.10 de	13.07 a	20.33 g	443.30 b	5.83 c	2.57 e	0.58	25.31 a	21.28 b	73.89 b
V_1F_4	26.07 cd	13.27 a	20.33 g	456.70ab	6.17 b	2.67 de	0.63	25.28 a	21.92 ab	76.11 ab
V_2F_0	25.07 de	10.87 e	34.67 a	295.00 e	3.72 g	2.83 cd	0.79	17.28 d	14.16 e	49.17 e
V_2F_1	27.33 c	10.90 e	33.67 b	356.70 d	4.60 e	2.93 c	0.82	20.62 c	17.12 d	59.44 d
V_2F_2	29.03 b	11.63 cd	33.00 bc	443.30 b	5.82 c	3.33 b	0.93	23.92 b	21.28 b	73.89 b
V_2F_3	29.70 b	11.90 bc	32.67 c	463.30 ab	6.10 b	3.70 a	0.96	25.12 ab	22.24 ab	77.22 ab
V_2F_4	31.20 a	11.73 bcd	31.00 d	478.30 a	6.49 a	3.80 a	1.02	25.41 a	22.96 a	79.72 a
$LSD_{0.05}$	1.40	0.50	0.82	22.45	0.22	0.21	0.07	1.24	1.10	3.57
CV (%)	3.07	2.43	1.76	3.33	2.55	4.34	5.52	3.28	3.40	3.18
Level of sign.	*	*	*	*	**	**	NS	*	*	*

In a column, figures having similar and no letter(s) do not differ significantly at 5% level, whereas figures with dissimilar letter(s) differ significantly as per DMRT at same level; * & ** = Significant at 5 and 1% level of probability; NS = Not significant; V_1 = Early 005 and V_2 = Quick Star, F_0: Control (no fertilizers), F_1: 50 kg N ha^{-1} + 12.9 kg P ha^{-1} + 62.25 kg K ha^{-1} + 2 kg Zn ha^{-1} + 1 kg B ha^{-1}, F_2: 75 kg N ha^{-1} + 25.8 kg P ha^{-1} + 124.5 kg K ha^{-1} + 4 kg Zn ha^{-1} + 2 kg B ha^{-1}, F_3: 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1}, F_4: 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}.

Fresh and dry weight of roots plant^{-1}: Fresh and dry weight of roots had statistically significant due to the effect of variety where Quick Star showed better result (3.32 and 0.909 g plant^{-1}) than Early 005 (2.51 and 0.547 g plant^{-1}) (Table 1). Effect of NPKZn and B fertilizer had statistically significant on fresh and dry weight of roots. It was the highest (3.23 and 0.827 g plant^{-1}) in F_4 (125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) and both F_0 (control) and F_1 (50 kg N ha^{-1} + 12.9 kg P ha^{-1} + 62.25 kg K ha^{-1} + 2 kg Zn ha^{-1} + 1 kg B ha^{-1}) recorded statistically identical the lowest fresh (2.57 and 2.70 g plant^{-1}) and dry (0.635 or 0.667 g plant^{-1}) weight of roots (Table 2). Dry weight of roots plant^{-1} did not vary significant with the ranges of 0.473 (V_1F_0) to 1.02 (V_2F_4). In case of fresh weight, it was significantly varied from 2.30 to 3.80 where V_2F_0 (Quick Star with 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1}) showed the highest and V_1F_0 (Early 005 and without fertilizers) recorded the lowest weight of fresh roots plant^{-1} (Table 3). This result revealed that the higher rates of NPKZnB fertilizer enhanced the roots weight. Bahadur *et al*. (2015) reported that the higher rates of Urea-TSP-MoP-Gypsum-Borax-Zinc Sulphate @ 326–218–201–55.6–9.52–20 kg ha^{-1} produced the higher yield of roots in Kohlrabi.

Gross yield (kg plot^{-1}): The effect of varieties and NPKZnB fertilizers showed significant variation on gross yield. Quick Star produced the highest gross yield (22.47 kg plot^{-1}) than Early 005 (21.67 kg plot^{-1}) (Table 1). Again, gross yield varied significantly from 16.40 to 25.34 kg plot^{-1} due to NPKZn and B where 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (F_4) produced the highest and control (without fertilizers) showed the lowest gross yield of Kohlrabi. 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} (F_3) produced numerically identical the highest gross yield of Kohlrabi (25.22 kg plot^{-1}) (Table 2). In case of combined treatment, Quick Star grown under 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (V_2F_4) showed the highest gross yield and Early 005 grown under control condition (V_1F_0) showed the lowest gross yield. The plants of Early 005 treated by both same fertilizer treatments (V_1F_4) and 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} (V_1F_3) also gave the numerically identical the highest gross yield (23.51 and 23.25 kg plot^{-1}, respectively) (Table 3). Halim

et al. (1994) found significant variation for gross yield of cabbage due to the effect of different doses of NPK where gross yield plant^{-1} were the highest in 150 kg N_2+ 100 kg P_2O5 + 150 kg K_2O or 200 kg N_2+ 100 kg P_2O_5 + 150 kg K_2O.

Marketable yield (kg plot^{-1} and t ha^{-1}): Effect of varieties, NPKZnB fertilizer and their combination significantly affected the marketable yield of Kohlrabi. Between the varieties, Quick Star produced the highest (19.55 kg plot^{-1} or 67.89 t ha^{-1}) marketable yield than that of Early 005 (18.18 kg plot^{-1} or 63.04 t ha^{-1}) while both 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (F_4) and 100 kg N ha^{-1} + 38.7 kg P ha^{-1} + 186.75 kg K ha^{-1} + 6 kg Zn ha^{-1} + 3 kg B ha^{-1} (F_3) produced numerically identical the highest gross yield of Kohlrabi (22.44 kg plot^{-1} or 77.92 t ha^{-1} and 21.76 kg plot^{-1} or 75.56 t ha^{-1}, respectively). On the other hand, without NPKZnB fertilizer (F_0) showed the lowest marketable yield of Kohlrabi (13.40 kg plot^{-1} or 46.36 t ha^{-1}). In case of combined effect, the highest marketable yield (22.96 kg plot^{-1} or 79.72 t ha^{-1}) was found in Quick Star while it was grown under 125 kg N ha^{-1} + 51.6 kg P ha^{-1} + 249 kg K ha^{-1} + 8 kg Zn ha^{-1} + 4 kg B ha^{-1} (V_2F_4). Similarly, Early 005 grown under control soil showed the lowest (12.64 kg plot^{-1} or 43.55 t ha^{-1}) marketable yield (Table 3). This difference might be genetical makeup of the varieties varied the marketable yield. Besides, Quick Star showed the highest performance regarding growth and yield which was helpful for getting the greater production. Halim *et al*. (1994) found significant variation for marketable yield of cabbage due to the effect of different doses of NPK where marketable head weight plant^{-1} were highest in 150 kg N_2 + 100 kg P_2O5 + 150 kg K_2O or 200 kg N_2+ 100 kg P_2O_5 + 150 kg K_2O. Sultana *et al*. (2012) were found similar results. From the above facts, it may be concluded that application of 125 kg N + 51.6 kg P + 249 kg K + 8 kg Zn + 4 kg B per hectare with Quick star variety were the best combination of NPKZnB fertilizers and variety for the higher yield of Kohlrabi under the agroclimatic conditions of Patuakhali.

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