EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 12
204-207
Year: 2022

EFFECT OF DIFFERENT LEVELS OF NITROGEN, PHOSPHORUS AND POTASSIUM ON THE GROWTH AND YIELD OF CABBAGE (*BRASSICA OLERACEA* VAR. CAPITATA) CV. VARUN IN PITHORAGARH HILLS

***Abhishek Bahuguna and G. S. Bisht**

KVK, GBPUA&T, Pantnagar, Gaina Pithoragarh, Uttarakhand.

***Corresponding Author: Dr. Abhishek Bahuguna**
KVK, GBPUA&T, Pantnagar, Gaina Pithoragarh, Uttarakhand.

Article Received on 24/09/2022 **Article Revised on 14/10/2022** **Article Accepted on 03/11/2022**

ABSTRACT
A field experiment was conducted to "effect of different levels of nitrogen, phosphorus and potassium on the growth and yield of cabbage Cv. Varun in Pithoragarh Hills." All three nutrients (nitrogen, phosphorus and potash) were given in eleven different combinations with or without farmyard manure. An experiment was conducted with cabbage during October 2021 to February 2022 at the Krishi Vigyan Kendra, GBPUA&T, Gaina, Pithoragarh, Uttarakhand, India. Four levels of nitrogen (N) @ 0, 120, 190 & 260 kg per hectare, three levels of phosphorus (P_2O_5) @ 0, 85 & 115 kg per hectare, three levels of potassium (K_2O) @ 0, 60 & 100 kg per hectare and two levels of farmyard manure (FYM) @ 15 & 20 tons per hectare were applied in a Randomized Block Design with three replications. Nitrogen @ 120 kg ha^{-1}, phosphorus@ 85 kg ha^{-1}, potassium (K_2O) @ 60 kg ha^{-1} and farmyard manure 20 ton ha^{-1} was more effective and produced the highest fresh weight of head (1.883kg), marketable head yield (75.33 ton ha^{-1}). This treatment was also more profitable than the rest of the treatments. The present studies "effect of different levels of nitrogen, phosphorus and potassium on the growth and yield (Plant height, germination percent, head length, head diameter, weight of head, yield g $plot^{-1}$ and yield kg ha^{-1}) of cabbage (*Brassica oleracea* var. capitata) Cv. Varun in Pithoragarh Hills" found significant effect on T_7 treatment in all over 11 treatments with control. Among all treatment combinations, fertilizer dose of nitrogen, phoshphorus, potassium and farmyard manure 120:85:60 kg & 20 ton ha^{-1} (T_7 treatment) was found to be most and best of cabbage cultivation. The economics of fertilizers were also worked out on the basis of current market prices and it was found that use of fertilizer was profitable.

KEYWORD: Nitrogen, Phosphorus, Potassium, Growth, Yield, Cabbage, *Brassica oleracea.*

INTRODUCTION
Cabbage (*Brassica oleracea* L.) is an important leafy vegetable belonging to the family Cruciferae. It is herbaceous biennial and extensively grown in India during winter. It is a rich source of vitamins A and C and may be served in slaw, salads or cooked dishes (Andersen, 2000 and Tiwari *et al.*, 2003). Cabbage (*Brassica oleracea* var. capitatais) the most important leafy vegetable crop in India. Cabbage has high requirements for all nutrients, especially nitrogen, and cabbage demands for achieving high yields ranged from 130 to 310 kg nitrogen ha^{-1} (Lesic *et. al.* 2004, Sanderson and Ivany, 1999). Nitrogen over use in modern agriculture is of major importance with respect to both environmental concerns and the quality of plant products. Cabbage, as other cruciferous vegetables, has high nutritional value and contains specific sulphur compounds glucosinolates that increase its antioxidant activity.

Cabbage has good responsiveness on animal manure application in quantity of 40 t ha^{-1}. Organic fertilization enhances soil biological activity, improves nutrient mobilization and soil structure and increases soil water retention. Systems relying on organic fertilizers as plant nutrient sources have different dynamics of nutrient availability than those using mineral fertilizers. Sustainable crop production with integrated use of mineral and organic fertilizer has proved to be highly beneficial. Several studies have shown the positive effect of combined use of mineral and organic fertilizers in fields that continuously for a few years received only N, P and K, without any micronutrient or organic fertilizer (Chand *et al.* 2006; Kaur *et al.* 2005).

In the past, agricultural production was focused on maximizing the quantity of vegetables produced for commercial market (Pavla and Pokluda, 2008) while in the last few decades the organic management of crops has gained great popularity because of increased

consumers' awareness of the health problems that come from food grown under conventional and intensive farming. Differences between organic and conventional farming systems, especially in soil fertility management, may affect the nutritive composition of plants.

MATERIAL AND METHODS

Field experiment was established at Krishi Vigyan Kendra, Gaina, Pithoragarh on vegetable experimental field in winter season of 2021 year. The experiment was laid out in the randomized block design (RBD), consists of 11 treatments and 03 replications.

The treatments were T_1 (120kg Nitrogen per hectare), T_2 (190kg Nitrogen per hectare), T_3 (260kg Nitrogen per hectare), T_4 (Nitrogen: Phosphorus: Potash @ 110: 85: 60kg and FYM 15ton per hectare), T_5 (85kg Phosphorus and 15ton FYM per hectare), T_6 (20 ton FYM per hectare), T_7 (Nitrogen: Phosphorus: Potash @ 120: 85: 60kg and FYM 20t per hectare), T_8 (115kg Phosphorus per hectare), T_9 (60kg Potash per hectare), T_{10} (100kg Potash per hectare) and control without Nitrogen, Phosphorus, Potash and FYM (T_{11}).

Field trial was established as randomized block design with three repetitions and 30 plants per treatment per replication. Sowing was done on first week of October 2021. A seedling with substrate was planted in 5 row strips distance 50 cm row to row and 50 cm plant to plant. After planting, every plant was watered of tap water. Every plot was 7.50 m (3.00 x 2.50 m) and all measurements were conducted on 6 plants in the each row. During cabbage growing all standard procedures for crop maintenance were done (cultivation, irrigation, spraying) taking into consideration harvest time. Nitrogen was applied in the split doses, while phosphorus and potassium were applied in single doses well before transplantation. Ten pants were selected randomly in each plot.

Following vegetative parameters were measured during the experiment: plant height (from ground to the highest plant part), rosette diameter (mean of two measured diameters, one in row line, another vertically) and stem diameter (measured under plant head same as for rosette). Analysis for different parameters like total weight, weight of edible portion, both in grams, while girth and plant height were taken in cm. The attack of cabbage butterfly was notice, it lasts for two weeks. After the harvest, heads weight was noted and total yield calculated. Heads were cut on longer side and head length, width and stem length in head were measured. Stem part was divided from head and weighed to calculate stem portion in total head weight (head efficiency).

All data were analyzed statistically using the Standard Analysis of Variance. Means were compared using the least significant difference (LSD)

RESULTS AND DISCUSSION

(Vegetative, growth and yield parameters)

a. **Plant height:** The plant height (table and figure 1) indicated that it was not significantly affected by any of the treatment. It was however, observed that highest plants were seen in T_7, as 35.41 cm followed by T_4 as 34.51 cm. The minimum plant height in T_{11} (control) was found to be 31.05 cm. Plant heights were in the range from 31.05 cm to 35.41 cm (Table 1). Similar results were recorded by Bahuguna *et al.* (2021) who observed maximum plant height in French bean with maximum fertilizer inputs.

b. **Germination percent:** The germination percent (table and figure 1) indicated that there was found significant difference among all treatments. It was however, observed that maximum germinated seeds were seen in T_7 treatment as 94.33 percent followed by T_4 as 93.67 percent. The minimum germinated seeds in T_{11} (control) were found to be 73.33 percent. Germination percent were in the range from 75.33 to 94.33 (Table 1).

c. **Head length (cm):** The cabbage head length (table and figure 1) indicated that there was found significant difference among all treatments. It was however, observed that highest head length was seen in T_7 as 25.50 cm followed by T_4 as 23.77 cm. The minimum cabbage head length in T_{11} (control) was found to be 20.73 cm. Head length was in the range from 20.73 cm to 25.50 cm (Table 1).

d. **Head diameter (cm):** Data on the girth of cabbage head (table and figure 1) indicates that there was found significant difference among all treatments. Maximum girth was found in T_7 as 28.33 cm followed by T_4 as 27.63 cm. Head diameter was in the range from 18.80 cm to 28.33 cm (Table 1) and the minimum girth in T_1 was found to be 18.80 cm. Similar results were recorded by Khadir *et al.* (1991) who observed maximum head girth in cabbage with maximum fertilizer inputs.

e. **Weight of head (kg):** The results obtained on weight of head showed table and figure 1 that cabbage with maximum head weight was obtained in $_{T7}$ as 1.883 kg, followed by $_{T4}$ as 1.633 kg. The application of N2, P2O5 and K2O all three along with FYM increases the total marketable weight. Weight of head was in the range from 0.816 kg to 1.883 kg (Table 1). Kang *et al.* (1989) reported that by keeping the P and K fixed, increase in the amount of N from 15-30 kg ha^{-1} to 45 kg ha^{-1} results in increase of marketable yield.

f. **Yield kg $plot^{-1}$:** The results obtained on yield kg per plot showed table and figure 1 that cabbage with maximum yield kg $plot^{-1}$ was obtained in T_7 as 56.50 kg, followed by T_4 as 49.33 kg. Yield kg $plot^{-1}$ was in the range from 24.49 kg to 56.50 kg (Table 1). Kang *et al.* (1989)

reported that by keeping the P and K fixed, increase in the amount of N from 15-30 kg ha^{-1} to 45 kg ha^{-1} results in increase of marketable yield. Same response has been observed in this study.

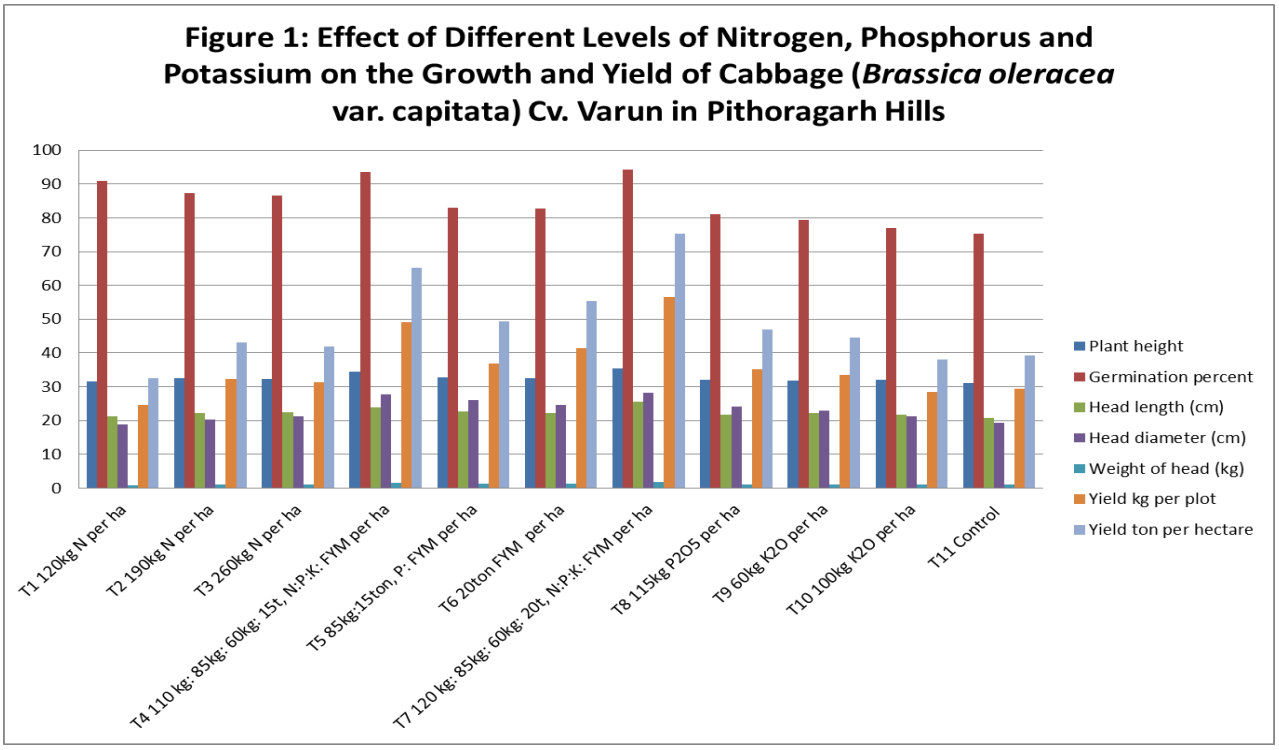
g. Yield ton ha^{-1}: The results obtained on yield ton per hectare showed table and figure 1 that cabbage with maximum yield ton per hectare was obtained in T_7 as 75.33 tons, followed by T_4 as 65.33 tons. Yield ton ha^{-1} was in the range from 32.65 ton to 75.33 ton (Table 1). Kang *et al.* (1989) reported that by keeping the P and K fixed, increase in the amount of N from 15-30 kg ha^{-1} to 45 kg ha^{-1} results in increase of marketable yield. Same response has been observed in this study.

Optimal doses of nitrogen, phosphorus and potash can contribute better and continuous supply of nutrients to the plant during growth and development. At lower level of nutrients were least available, resulted in low yield.

Table 1: Effect of Different Levels of Nitrogen, Phosphorus and Potassium on the Growth and Yield of Cabbage (*Brassica oleracea* var. capitata) Cv. Varun in Pithoragarh Hills.

Treatment	Plant height	Germination percent	Head length (cm)	Head diameter (cm)	Weight of head (kg)	Yield kg $plot^{-1}$	Yield ton ha^{-1}
T_1 120kg N ha^{-1}	31.66	91.00	21.33	18.80	0.816	24.49	32.65
T_2 190kg N ha^{-1}	32.45	87.33	22.10	20.27	1.076	32.27	43.03
T_3 260kg N ha^{-1}	32.21	86.67	22.33	21.23	1.048	31.45	41.93
T_4 110 kg: 85kg: 60kg: 15t, N:P:K: FYM ha^{-1}	34.51	93.67	23.77	27.63	1.633	49.00	65.33
T_5 85kg:15ton, P: FYM ha^{-1}	32.83	83.00	22.73	26.13	1.232	36.95	49.27
T_6 20ton FYM ha^{-1}	32.42	82.67	22.10	24.53	1.383	41.50	55.33
T_7 120 kg: 85kg: 60kg: 20t, N:P:K: FYM ha^{-1}	**35.41**	**94.33**	**25.50**	**28.33**	**1.883**	**56.50**	**75.33**
T_8 115kg P_2O_5 ha^{-1}	32.03	81.00	21.70	24.03	1.173	35.20	46.93
T_9 60kg K_2O ha^{-1}	31.77	79.33	22.23	23.03	1.115	33.45	44.60
T_{10} 100kg K_2O ha^{-1}	32.09	77.00	21.63	21.30	0.950	28.50	38.00
T_{11} Control	31.05	75.33	20.73	19.23	0.983	29.50	39.33
GM	**32.58**	**84.67**	**22.38**	**23.14**	**1.21**	**36.26**	**48.34**
Sem (±)	**0.64**	**0.59**	**0.74**	**0.45**	**0.06**	**1.99**	**2.66**
CD (0.05)	**1.88**	**1.73**	**2.17**	**1.34**	**0.19**	**5.89**	**7.86**
CV (%)	**3.39**	**1.19**	**5.69**	**3.39**	**9.15**	**9.05**	**9.53**

* N = Nitrogen, P or P_2O_5 = Phosphorus, K or K_2O = Potassium, FYM = Farmyard Manure



REFERENCES

1. Andersen CR 2000. Cabbage home gardening series, University of Arkansas.
2. Bahuguna A, Bhatt N, Bisht GS and Devrari N 2021. Effect of Optimum Levels of Organic and Inorganic Fertilizer on the Plant Growth and Pod's Yield of French Bean (Phaseolus vulgaris L.) Cv. Arka Sharath in Uttarakhand. *Frontiers in Crop Improvement*, 9: 2844-2847.
3. Chand S, Anwar M and Patra DD 2006. Influence of long-term application of organic and inorganic fertilizer to build up soil fertility and nutrient uptake in mint-mustard cropping sequence. *Communications in Soil Science and Plant Analysis*, 37: 63-76.
4. Kang CK, Oh EY, Yoon PS and Lee DW 1989. The effects of nitrogen levels potassium level and planting density on the growth and productivity of cabbage. *J. Korean Soc. Hort. Sci*, 29: 1-8.
5. Kaur K, Kapoor KK and Gupta AP 2005. Impact of organic manures with and without mineral fertilizers on soil chemical and biological properties under tropical conditions. *Journal Plant Nutrition and Soil Science*, 168: 117-122.
6. Khadir GA, Marzat SK and Sadoun SA 1991. Effect of different levels of urea fertilizer and plant spacing on the growth and yield of Cabbage. *Diasat*, 16: 88-105.
7. Lesic R, Borosic J, Buturac I, Herak-Custic M, Poljak M and Romic D 2004. Povrćarstvo. Zrinski d.d. Cakovec.
8. Pavla B and Pokluda R 2008. Influence of Alternative Organic Fertilizers on the Antioxidant Capacity in Head Cabbage and Cucumber. *Notulae Botanicae Horti Agrobotanici Cluj*, 36(1): 63-67.
9. Sanderson KR and Ivany JA 1999. Cole crop yield response to reduced nitrogen rates. Canadian *Journal of Plant Science*, 79: 149-151.
10. Tiwari KN, Singh PK and Mal PK 2003. Effect of drip irrigation on the yield of cabbage (*Brassica oleracea* L. var. *capitata)* under mulch and non-mulch conditions. *Agric. Water Manag*, 58: 19-28.