

Effect of Varieties and Nutrient Levels on Growth, Yield and Economics of Cabbage (*Brassica oleracea* var. *capitata* L.)

Pooja Mishra¹, Rohatash Singh Bhadauria², Sourav Gupta^{3*} and R.K. Sharma⁴

¹M.Sc. Scholar, College of Horticulture, Mandsaur (Madhya Pradesh), India.

²SMS, KVK, Ratlam (Madhya Pradesh), India.

³R.A., Krishi Vigyan Kendra, Khandwa (Madhya Pradesh), India.

⁴Assistant Professor, College of Horticulture, Mandsaur (Madhya Pradesh), India.

(Corresponding author: Sourav Gupta*)

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ABSTRACT: High yield of cabbage is related to judicious application of fertilizer, proper cultural management etc. Cabbage is well known to be an exhaustive crop and has the capacity to absorb higher amount of nutrient from soil. The supply of proper nutrient must be ensured during its cultivation, which is related to the judicious application of fertilizer. A field experiment was conducted at the Vegetable Research Field, College of Horticulture, Mandsaur, Madhya Pradesh during the *rabi* season of 2016-17 under the edaphic and climatic conditions of Mandsaur. The experiment consisted two varieties (V₁-Golden Acre and V₂-Pusa Drumhead) and six nutrient levels (N₁-75:50:60 kg NPK/ha, V₂-75:75:60 kg NPK/ha, V₃-100:50:60 kg NPK/ha, V₄-100:75:60 kg NPK/ha, V₅-125: 50:60 kg NPK/ha and V₆-125:75:60 kg NPK/ha) laid out in factorial randomized block design with three replications. Significantly superior values of growth parameters, yield attributes & yield and economics were observed in cabbage variety Pusa Drumhead compared to Golden Acre. Under nutrient levels; significantly superior values of above parameters were recorded due to application of nutrient level N₆ (NPK-125:75:60 kg/ha) followed by N₅, N₄, N₃ and N₂ and least in N₁ (NPK-75:50:60 kg/ha). Combination of treatments; highest values of gross income (Rs.325181.93/ha) and B:C ratio (5.18) was recorded in case of Pusa Drumhead x NPK-125:75:60 kg/ha, while lowest values (Rs.134443.10/ha and 1.65) was found under Golden Acre x NPK-75:50:60 kg/ha.

Keywords: Cabbage, Economics, Growth, Nutrient levels, Quality, Varieties and Yield.

INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata* L.) is a member of family cruciferae. It is one of the prominent leafy vegetable crops used for salad and cooking. Cabbage is more nutritious than cauliflower and knol-khol; which contains vitamin-A (2000 IU), thiamine (0.06 mg), riboflavin (0.03 mg) and vitamin-C (124 mg) per 100 g edible part. It is rich in minerals like potassium (114 mg), phosphorus (44 mg), calcium (39 mg), sodium (14.1 mg) and iron (0.8 mg) per 100 g edible part (Jood and Neelam, 2011). India ranks second in area and production of cabbage in the world after China. It is grown in 435.9 thousand hectare with production of 8573.3 thousand metric tonnes and productivity of 19.8 metric tons per hectare in India. The major cabbage growing states are Uttar Pradesh, Karnataka, Bihar, West Bengal, Odisha, Gujarat, Punjab, Himachal Pradesh, Haryana and Rajasthan. In Madhya Pradesh, it is grown in 25.1 thousand hectare with a production of 70.38 thousand metric tons and highest productivity of 28.1 metric tonnes per hectare (NHB, 2020). Cabbage needs nitrogen in optimum amount and excessive amount may cause loose head formation and internal decay; if nitrogen is not adequate amount it would not form heads (Verma and Nawange, 2015). Phosphorus is an important constituent of living

and enters in the composition of phospholipids, nucleic acids, nucleoprotein and coenzymes. Potassium involves in carbohydrates metabolism, enzyme activation, nitrogen uptakes, protein synthesis and translocation of accumulates and improve quality (Singh *et al.*, 2004). Potassium increased vigour and disease resistance in plant. It also regulates water loss from the plant by maintaining the balance between anabolism, respiration and transpiration. Thus, it reduces the tendency to wilt and help in better utilization of available water, which ultimately helps in the formation of protein and chlorophyll and improve the quality of cabbage head in relation to taste and keeping quality (Sharma, 2016 and Neethu *et al.*, 2015).

MATERIALS AND METHODS

Conducted a field experiment at the Vegetable Research Field, College of Horticulture, Mandsaur, Madhya Pradesh during the *rabi* season of 2016-17 under the edaphic and climatic conditions of Mandsaur. The topography of the field was uniform with proper drainage. The soil was light alluvial, light alkaline (pH 7.8), low available nitrogen (207.2 kg/ha), medium available phosphorus (19.75 kg/ha) and high available potassium (448 kg/ha). The experiment consisted two varieties (V₁-Golden Acre & V₂-Pusa Drumhead) and

six nutrient levels (N₁-75:50:60 kg NPK/ha, V₂-75:75:60 kg NPK/ha, V₃-100:50:60 kg NPK/ha, V₄-100:75:60 kg NPK/ha, V₅-125: 50:60 kg NPK/ha & V₆-125:75:60 kg NPK/ha) laid out in factorial randomized block design with three replications. A uniform dose of nutrient was applied through urea, DAP and muriate of potash. Half dose of nitrogen and full dose of phosphorus and potash were applied as basal dose; while the rest dose of nitrogen was given at 20 days after transplanting. Other intercultural operations and crop management practices were carried out in accordance with the recommended package of practices. The studied for selected attributes by using five plants in randomized manner. All data were statistically analyzed using the F-test procedure given by Panse and Sukhatme (1985). The difference between treatment means were compared with the critical differences (CD) at 5% level of probability (P=0.05).

RESULTS AND DISCUSSION

A. Growth Parameters

Varieties. Significantly maximum values of plant height (34.33 cm), number of leaves per plant (16.30), dry weight of plant (380.63 g) and days to 50% head maturity (87.68 days) were observed in cabbage variety Pusa Drumhead compared to Golden Acre (29.97 cm, 14.77, 165.18 g and 69.05 days; respectively) (Table 1). The observed differences in growth parameters of cultivars are mainly due to the nature of genotype. Similar findings have been also found by Yadav *et al.* (2013) in cauliflower, Gabhale *et al.* (2014) in cauliflower, Giri *et al.* (2013); Zaki *et al.* (2015) in broccoli, Haque (2015) in cabbage, EI- Bassiony *et al.* (2014); Chaudhari *et al.* (2015).

Nutrient levels. Significantly higher values of plant height (36.97 cm), number of leaves per plant (18.56), dry weight of plant (410.57 g) and days 50% head maturity (87.06 days) were recorded by the application of nutrient level N₆ (NPK-125:75:60 kg/ha) followed by N₅, N₄, N₃ & N₂ and least in N₁ (NPK-75:50:60 kg/ha) (28.63 cm, 13.18, 155.18 g and 72.33 days; respectively) (Table 1). The maximum growth under higher supply of nitrogen might be due to increasing the photosynthetic and assimilation rates; which lead to increase in the plant height of cabbage. These findings are in agreement with Kumari *et al.* (2015); Verma and Nawange (2015); Akand *et al.* (2015) in cabbage. The increased number of leaves per plant may be due to balanced fertilization of the crop. Similar results have been reported by Shree *et al.* (2014) in cauliflower, Mishra *et al.* (2014); Dadhich *et al.* (2015) in knolkhol. Delay in head initiation as a result of lower dose of fertility level might have increased the days to 50% head maturity. Similar results have also been reported by Mankar *et al.* (2015) in cabbage, Shree *et al.* (2014) in cauliflower.

B. Yield Parameters and Yield

Varieties. Maximum values of head length (15.11 cm), head breadth (25.94 cm) and total head yield (475.28 q/ha) were measured significantly under variety Pusa Drumhead over variety Golden Acre (13.28 cm, 14.49 cm and 321.03 q/ha; respectively) (Table 1 & 2). The

observed difference in head length of cultivars may be due to the genotypes. These results are also reported by Singh *et al.* (2015) in cauliflower.

Nutrient levels. Higher values of head length (17.34 cm), head breadth (23.94 cm) and total head yield (518.14 q/ha) were recorded with nutrient level N₆ (NPK-125:75:60 kg/ha) followed by N₅, N₄, N₃ and N₂; while minimum values (11.87 cm, 17.18 cm and 309.63 q/ha; respectively) were observed under nutrient level N₁ (NPK-75:50:60 kg/ha) (Table 1 & 2). The increased supply of nitrogen might have accelerated synthesis of chlorophyll and amino acids and effective utilization of carbohydrates and other organic factors might have resulted in enlargement of head. These findings are in agreement with Verma and Nawange (2015) in cabbage, Yanglem and Tumbare (2014) in cauliflower. It is a fact that the presence of all the three major elements in a suitable combination enhanced the vegetative growth of the plants. Similar results have been reported by Mankar *et al.* (2015) in cabbage, Singh *et al.* (2015) in broccoli. This might have been due to better availability of metabolic and auxin activities of plant and resulted in increased fresh weight of leaves and head and total head yield per plant and per hectare. These findings are in close conformity to Kumari *et al.* (2015); Mankar *et al.* (2015) in cabbage, Verma and Nawange (2015).

C. Quality Parameters

Variety. Maximum values of protein content (16.03%) and ascorbic acid content (25.44 mg/100 g) were determined with variety Pusa Drumhead; while minimum values (14.95% and 22.98 mg/100 g) were noted in variety Golden Acre (Table 2). It could be attributed to the genetic makeup of varieties. These results have parity with Zaki *et al.* (2015) in broccoli.

Nutrient levels. Higher values of protein content (18.01%) and ascorbic acid content (28.39 mg/100 g) were recorded with nutrient level N₆ (NPK-125:75:60 kg/ha) followed by N₅, N₄, N₃ and N₂; while minimum values (13.56% and 21.18 mg/100 g; respectively) were observed under N₁ (NPK-75:50:60 kg/ha) (Table 2). These findings are in agreement with those of Verma and Nawange (2015) in cabbage, Kumari *et al.* (2015) and Mankar *et al.* (2015) in cabbage.

D. Economics

Higher value of gross income (Rs.237639.74/ha) and B:C ratio (3.59) were found with Pusa Drumhead; which was significantly superior over variety Golden Acre (Table 2). Maximum values of gross income (Rs. 259071.48/ha) and B:C ratio (3.92) were found with nutrient level N₆ (NPK-125:75:60 kg/ha); while minimum values (Rs. 154813.35/ha and 2.05) were recorded under N₁ (NPK-75:50:60 kg/ha) (Table 2).

Under combination of treatments; highest values of gross income (Rs. 325181.93/ha) and B:C ratio (5.18) were observed in Pusa Drumhead × NPK-125:75:60 kg/ha, while lowest values (Rs. 134443.10/ha and 1.65) were registered under Golden Acre × NPK-75:50:60 kg/ha treatment combination. Similar results were also reported by Haque *et al.* (2015) in cabbage.

Table 1: Effect of varieties, nutrient levels and their interaction on growth parameters and yield attributes of cabbage.

Treatment	Plant height (cm)	No. of leaves per plant	Dry weight of plant (g)	Days to 50% head maturity	Head length (cm)	Head breadth (cm)
Varieties (V)						
V ₁ (Golden Acre)	29.97	14.77	165.18	69.05	13.28	14.49
V ₂ (Pusa Drumhead)	34.33	16.30	380.63	87.68	15.11	25.94
S.Em±	0.55	0.36	9.17	1.31	0.38	0.34
CD at 5%	1.60	1.05	26.91	3.85	2.74	1.00
Nutrient levels (N)						
N ₁	28.63	13.18	155.18	72.33	11.87	17.18
N ₂	29.17	14.07	198.28	74.69	12.62	18.53
N ₃	30.44	15.00	239.55	76.96	13.50	18.92
N ₄	33.12	15.66	274.28	78.85	14.49	20.85
N ₅	34.56	16.73	359.55	80.28	15.37	21.85
N ₆	36.97	18.56	410.57	87.06	17.34	23.94
S.Em±	0.95	0.62	15.89	2.27	0.66	0.59
CD at 5%	2.78	1.82	46.61	6.67	1.94	1.73
Interaction (V × N)	NS	NS	NS	NS	NS	NS

Table 2: Effect of varieties, nutrient levels and their interaction on yield, quality parameters and economics of cabbage.

Treatment	Head yield (q/ha)	Protein (%)	Ascorbic acid content (mg/100g)	Gross income Rs./ha	B:C Ratio
Varieties (V)					
V ₁ (Golden Acre)	321.03	14.95	22.98	160516.91	2.10
V ₂ (Pusa Drumhead)	475.28	16.03	25.43	237639.74	3.59
S.Em±	12.33	0.34	0.59	6169.68	0.12
CD at 5%	36.19	1.00	1.72	18095.05	0.35
Nutrient levels (N)					
N ₁	309.63	13.56	21.18	154813.35	2.05
N ₂	338.52	14.54	22.07	169257.65	2.26
N ₃	383.40	14.91	23.51	191701.95	2.75
N ₄	396.29	15.72	24.45	198146.25	2.79
N ₅	442.96	16.19	25.66	221479.27	3.29
N ₆	518.14	18.01	28.39	259071.48	3.92
S.Em±	21.37	0.59	1.02	10686.20	0.21
CD at 5%	62.68	1.74	2.99	31341.55	0.61
Interaction (V × N)	NS	NS	NS	NS	NS

CONCLUSION

Under Mandsaur conditions; the performance of Pusa Drumhead is better than Golden Acre cv. of cabbage with respect to plant growth, yield, quality and profitability. Hence cultivation of Pusa Drumhead cultivar of cabbage should be performed better over Golden Acre. The cabbage should be supplemented with 125 kg/ha nitrogen, 75 kg/ha phosphorus and 60 kg/ha potassium for optimum growth, yield, quality and profitability.

FUTURE SCOPE

1. The investigation should be repeated for confirmation of the results.
2. Integration of organic manures and bio-fertilizers may be tested along with chemical fertilizers.
3. In the future studies nutrient levels along with more varieties may be tested.

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Conflict of Interest. None.

REFERENCES

- Akand, M. H., Khairul Mazed, H. E. M. and Ashraful, M. (2015). Influence of different dose of nitrogen on the growth and yield of cabbage (*Brassica oleracea* var. *capitata* L.). *Int. J. Multidisciplinary Res. and Dev.*, 2(2): 11-14.
- Chaudhari, A. H., Vadodaria, J. R., Patel, H. T. and Patel, G. S. (2015). Performance of different varieties and planting date on growth of knolkhol (*Brassica oleracea* var. *gongylodes*). *IJRANSS*, 3(8): 39-42.
- Dadhich, S., Meena, A. K., Paliwal, R., Meena, K. K. and Singh, S. P. (2015). Influence of levels of nitrogen and zinc on yield attributes and economics of knol-khol (*Brassica oleracea* var. *caulorapa*) in Loamy sand soil of Jobner. *Indian Res. J. Genet. & Biotech.*, 7(3): 334-336.
- El-Bassiony, A. M., Fawzy, Z. F., El-Nemr, M. A. and Li, Y. (2014). Improvement of growth, yield and quality of two varieties of kohlrabi plants as affected by application of some bio stimulants. *J. Agric. Res.*, 3(3): 491-498.
- Gabhale, L. K., Bharad, S. G. and Chaudhari, G. V. (2014). Effect of varieties and planting dates on growth and yield of cauliflower. *Bionfolet*, 11(3A): 806-808.

- Giri, R. K., Sharma, M. D., Shakya, S. M. and Kandel, T. P. (2013). Growth and yield responses of broccoli cultivars to different rates of nitrogen in Western Chitwan, Nepal. *Agril. Sci.*, 4(7A): 8-12.
- Haque, F. A., Islam, N., Islam, M. N., Ullah, A. and Sarkar, M. D. (2015). Growth, yield and Profitability of cabbage (*Brassica oleracea* L.) as influenced by applied nitrogen and plant spacing. *The agriculturist*, 13(1): 35-45.
- Jood, S. and Neelam, K. (2011). Importance of vegetables in human nutrition and health. In: Rana, M.K. (ed.) *Fundamentals of Vegetable Production*, New Indian Publishing Agency, New Delhi. p 70.
- Kumari, C., Mankar, A., Karuna, K., Solanki, S.S. and Singh, V. K. (2015). Effect of different levels of nitrogen and microbial inoculants on yield and quality of cabbage. *Indian J. Agri. Sci.*, 85(4): 515-8.
- Mankar, A., Kumari, C. and Karuna, K. (2015). Effect of nitrogen levels and microbial inoculants on growth, yield and quality of cabbage. *Prog. Hort*, 47(2): 296-299.
- Mishra, P. P.; Das, A. K. and Mishra, N. (2014). Effect of integrated nutrient management on yield, quality and economics of knolkhol (*Brassica oleracea* L.cv. *gongyloides*). *Asian J. Hort.*, 9(2): 382-385.
- Neethu, M. T, Tripathi, S. M., Narwad, A. V. and Sreeganesh, S. (2015). Effect of N and P levels on growth and yield parameters of broccoli (*Brassica oleracea* var. *Italic*) under South Gujarat soil conditions. *Int. J. Trop. Agric.*, 33(2): 913-917.
- NHB (2020). National Horticulture Database – 2015. National Horticulture Board Government of India, Gurgaon, India.
- Pansee, V. G. and Sukhatme, P. V. (1985). *Statistical Methods for Agricultural Workers*. Fourth edition. ICAR Publication, New Delhi.
- Patel, K. K., Patel, B. A., Jadav, N. J., Patel, J. C. and Panchal, D. B. (2011). Influence of integrated nutrient management on curd yield, quality and nutrient uptake and economics of cauliflower (*Brassica oleracea* var. *botrytis* L.) under middle Gujarat. *Adv. Res. J. Crop Improv.*, 2(2): 193-196.
- Shree, S., Singh, V. K. and Kumar R. (2014). Effect of integrated nutrient management on yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.). *The Bioscan*, 9(3): 1053-1058.
- Sharma, V. (2016). Effect of nutrient management on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis*) inside low cost polyhouse. *Himachal J. Agric. Res.*, 42(1): 88-92.
- Singh, K. P., Sohane, R. K. and Das, A. K. (2015). Performance of early cauliflower variety sabour agrim vis a vis different dates of transplanting in Arwal district of Bihar. *J. Krishi Vigyan*, 4(1): 84-87.
- Singh, S. K., Singh, T., Singh, B. N. and Verma, R. B. (2004). Response of fertility levels and plant density on growth, yield and quality of hybrid cabbage. *Veg. Sci.*, 31(1): 69-72.
- Verma, H. and Nawange, D. D. (2015). Effect of different levels of nitrogen and sulphur on the growth, Yield and quality of cabbage (*Brassica oleracea* L. var. *capitata*). *Agric. Sci. Digest.*, 35(2): 152-154.
- Yadav, M., Parsad, V. M. and Ahirwar, C. S. (2013). Varietal evaluation of cauliflower (*Brassica oleracea* var. *botrytis* L.) In Allahabad Agro – climatic condition. *The Bioscan*, 6(1): 99-100.
- Yanglem, S. D. and Tumbare, A. D. (2014). Influence of irrigation regimes and fertigation levels on yield and physiological parameters in cauliflower. *The Bioscan*, 9(2): 589-594.
- Zaki, M. F., Saleh, S. A., Tantawy, A. S. and El-Dewiny, C. Y. (2015). Effect of different rates of potassium fertilizer on the growth, productivity and quality of some broccoli cultivars under new reclaimed soil conditions. *Int. J. Chem. Tech. Res.*, 8(12): 28-39.

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