Biological Forum – An International Journal 14(3): 58-61(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Impact of Organic, Inorganic and Biofertilizers on Growth and Yield Attributes of cabbage (*Brassica oleracea* var. capitata L.) in Bastar, Chhattisgarh

Mukta Rajput[1], Beena Singh[2] and Nisha Jangre[3]*
[1]*Research Scholar (Horticulture), Indira Gandhi Krishi Vishwavidayalaya, Raipur (Chhattisgarh), India.*
[2]*Scientist (Horticulture), SGCARS, Indira Gandhi Krishi Vishwavidayalaya, Raipur (Chhattisgarh), India.*
[3]*Scientist (Horticulture), Indira Gandhi Krishi Vishwavidayalaya, Raipur (Chhattisgarh), India.*

(Corresponding author: Mukta Rajput)*
(Received 03 May 2022, Accepted 23 June, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present experiment was conducted during the *Rabi* season of the year 2021-22 at the Instructional cum Research Farm at S.G. College of Agriculture and Research Station, Jagdalpur (C.G.) to study the impact of organic, inorganic and biofertilizers on growth and yield attributes of cabbage (*Brassica oleracea* var. capitata L.). The results revealed that the application of 50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter* + PSB recorded the maximum plant height (27.13 cm), leaf width (18.97 cm), stem diameter (22.87 cm), head diameter (45.17 cm), number of non-wrapper leaves (20.73) and yield ha^{-1} (384.91 q) in cabbage and also for the maximum nitrogen (299.81 kg ha^{-1}), phosphorus (21.25 kg ha^{-1}) and potassium (367.15 kg ha^{-1}) content in soil after harvest of crop. However, the application of 50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB recorded the minimum number of days for head maturity (77.03) and leaf length (21.60 cm).

Keywords: Cabbage, Vermicompost, *Azospirillum, Azotobacter,* PSB, FYM.

INTRODUCTION

Cabbage (*Brassica oleracea* var. capitata L.) is an important member of the 'Cruciferous' family and belongs to the genus "*Brassica*" and has chromosome number 2n=2x=18. The word "crucifer" comes from the *Latin* word for "cross" and alludes to the fact that this plant family has four petals that are all the same size and form. The prefix "*Brassica*" is also taken from the *Latin* word meaning "cabbage."

Several authors have noted the significance of organic and inorganic fertilizer on the productivity and nutritional values of cabbage. Furthermore, according to Obi and Ofonduro (1997); Moyin-Jesu (2007), issues with ongoing usage of chemical fertilizers include nutritional imbalance, increasing soil acidity, deterioration of the physical qualities of the soil and loss of organic matter. However, organic manure can be applied or used in conjunction with inorganic fertiliser to satisfy the nutrients that plants need. The control of organic and inorganic nutrients has a significant impact on the growth and yield of these vegetable crops.

The presence of organic matter in a given soil determines its fertility; consequently, organic matter needs to be restored in the soil, either by feeding nutrients from organic sources or through residue management. The response of crops to organic manures is initially slow even though they contain all the necessary plant nutrients. This is because it takes time for them to transform the inaccessible nutrients into available forms following application. However, the application of organic manures has to be encouraged because of the lasting and positive impacts on soil characteristics. Combining the use of organic and inorganic fertilisers can improve yields and protect the environment (Hsieh *et al*., 1995; Moyin-Jesu, 2007).

MATERIAL AND METHODS

The present study was laid out in randomized block design with fifteen treatments which were replicated thrice during the *Rabi* Season of 2021-22 at Instructional cum Research Farm at S.G. College of Agriculture and Research Station, Jagdalpur (C.G.).The region has a sub-tropical monsoon climate with three distinct seasons i.e. summer, monsoon and winter. Rainfall is the major source of ground water recharge in the area and receives maximum (85%) rainfall during the southwest monsoon season. The winter rainfall is meagre (10-15%).

The land of the experimental site was irrigated prior to sowing for optimum moisture level. Seedlings were transplanted at a spacing of 60 x 45 cm. The recommended package and practice methods were followed during the experiment to maintain a healthy population of crop. The results of various observations recorded during the experiment were statistically analyzed in order to find out the significance of different treatments. The treatments consisted *viz.,* T1- 50% NPK ha^{-1} + FYM, T2- 50% NPK ha^{-1} + FYM + *Azospirillum*, T3- 50% NPK ha^{-1} + FYM + *Azotobacter*, T4-50% NPK ha^{-1} + FYM + PSB, T5- 50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB, T6- 50% NPK ha^{-1} + Vermicompost, T7- 50% NPK ha^{-1} + Vermicompost + *Azospirillum,* T8-50%

NPK ha^{-1} + Vermicompost +*Azotobacter,* T9-50% NPK ha^{-1} + Vermicompost + PSB, T10-50% NPK ha^{-1} + Vermicompost + *Azospirillum* + PSB, T11-50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter*+ PSB, T12-Organic manures (FYM + Vermicompost), T13-Biofertilizers (*Azospirillum* + *Azotobacter* + PSB), T14- Inorganic fertilizers (recommended dose of NPK @160:75:80 kg ha^{-1}) and T15-Control.

RESULTS

The perusal of data revealed that the fertilizers (organic and inorganic) along with biofertilizers alone or in combination were found to have significant effect on the growth and yield of cabbage as compared to the control (Table 1).

Table 1: Effect of various treatments on growth and yield of cabbage.

Treatment	Plant height (cm)				Leaf length (cm)	Leaf width(cm)	Days taken to head maturity	Diameter of head (cm)	No of non-wrapper leaves	Yield (ha^{-1} q)
	30 DAT	45 DAT	60 DAT	At harvest						
T1 (50% NPK ha^{-1} + FYM)	20.63	20.70	23.30	25.07	19.80	17.03	80.80	34.89	18.73	25.30
T2 (50% NPK ha^{-1} + FYM + *Azospirillum)*	20.14	21.17	23.10	25.87	20.20	16.50	78.49	38.93	18.23	24.97
T3 (50% NPK ha^{-1} + FYM + *Azotobacter)*	19.10	21.63	23.37	25.87	20.70	16.83	79.67	38.80	18.00	24.73
T4 (50% NPK ha^{-1} + FYM + PSB)	20.07	21.10	22.80	24.70	19.80	16.87	78.93	35.70	17.80	24.37
T5 (50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB)	18.97	23.23	24.63	26.73	21.60	17.67	77.03	38.88	19.57	26.53
T6 (50% NPK ha^{-1} + Vermicompost)	18.43	21.97	22.70	24.27	20.10	16.40	83.07	43.53	19.27	24.93
T7 (50% NPK ha^{-1} + Vermicompost + *Azospirillum)*	21.17	22.30	23.47	25.60	19.47	17.07	81.03	39.63	19.27	25.57
T8 (50% NPK ha^{-1} + Vermicompost +*Azotobacter)*	18.63	22.10	22.90	25.80	20.63	16.97	78.80	38.20	18.70	25.50
T9 (50% NPK ha^{-1} + Vermicompost + PSB)	20.03	21.57	22.60	24.57	20.17	17.07	84.53	38.27	17.90	24.37
T10 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + PSB)	18.63	22.87	24.43	26.07	20.50	17.67	82.00	43.10	19.83	26.17
T11 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter* + PSB)	22.05	24.33	24.97	27.13	21.50	18.97	79.03	45.17	20.73	27.10
T12 (Organic manures -FYM+ Vermicompost)	19.17	21.60	22.67	25.03	19.90	16.70	82.23	41.83	17.90	24.43
T13 (Biofertilizers -*Azospirillum* + *Azotobacter* + PSB)	19.73	20.53	21.90	23.83	18.50	17.07	81.23	40.10	18.33	23.97
T14 (Recommended dose of Inorganic fertilizers @160:75:80 NPK ha^{-1})	18.80	21.60	22.23	24.00	19.77	16.37	81.93	37.23	19.23	24.90
T15 (Control)	18.30	17.80	21.23	23.20	18.70	15.67	79.17	32.23	16.40	23.43
S.Em$\pm$	NS	2.48	1.09	1.15	0.56	0.38	0.99	1.32	18.66	0.43
C.D. (P=0.05)	1.14	0.85	0.37	0.40	1.63	1.10	2.89	3.85	0.42	1.25

The plant height of cabbage was recorded at 30, 45 and 60 days after transplanting and at harvest. The maximum plant height (27.13 cm) of cabbage at harvest was recoded in treatment T11 which was statistically at par with T5 and T10 (26.73 and 26.07 cm respectively). According to Negi *et al*. (2017); Jaiswal *et al*. (2020), plants have the ability to photosynthesize more efficiently and produce more auxin when fertility levels are higher. NPK may induce plants to grow more quickly, which could boost the absorption of carbohydrates (Powar and Barkule 2017).

The leaf width was recorded to be the highest in T11 (18.97 cm) at harvest which was at par with the treatments T5, T10 and T7 (17.67, 17.67 and 17.07 cm respectively). It was observed that the leaf length of cabbage significantly increased by the different doses of N, P, K and biofertilizers and was the maximum in treatment T5 (21.60 cm) which was closely followed by the treatment T11 (21.50 cm) and T10 (20.50 cm). However; the minimum leaf length at all the growth stages was observed in T15 (11.63, 13.70, 16.30 and 18.70 cm respectively). According to Powar and Barkule (2017) higher vegetative growth of plants may be associated to greater growth and elongation of leaves.

The varieties having the minimum days to head maturity are mostly preferred by the farmers and growers as early yields may provide huge profits. The application of 50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB recorded the minimum number of days for head maturity in cabbage (77.03) whereas T9 and T6 took the maximum days for head maturity (84.53 and 83.07 respectively). This may be attributed to the fact that nutrients like nitrogen, phosphate and potassium are more readily available and biofertilizers work by contributing significantly to the production of protein and chlorophyll, which promotes early head development. Negi *et al*. (2017); Sharma and Arya (2001) observed quite similar results from their study.

The maximum head diameter in cabbage was recorded in the treatment T11 (45.17 cm) which was at par with the treatment T6, T10 and T12 (43.53, 43.10 and 41.83 cm respectively) and was closely followed by the treatment T13 (40.10 cm). The combination of N, P, K, and biofertilizers provides greater nutrients and improved growth characteristics to the plants which lead to a larger head diameter. According to Singh *et al*. (2018); Narayan *et al*. (2018) both 50 percent NPK and biofertilizer application had a substantial impact on cabbage growth and yield contributing features. With regard to the non-wrapper leaves in cabbage T11 (20.73) recorded the maximum value at harvest and was at par with the treatment T10 and T5 (19.83 and 19.57 respectively). The solubilizing effect of organic acids created by the decomposition of organic manures, which improves soil phosphorus availability, may be responsible for the rise in phosphorus concentration. The results are in agreement with the results of Choudhary *et al*. (2018); Mohapatra *et al*. (2013); Sharma and Arya (2001) who reported that integrated approach was found to be superior in comparison to any individual treatment.

The maximum yield plot^{-1} was recorded in the treatment T11 (27.10 kg) followed by T5 and T10 with (26.53 and 26.17 kg respectively). This could be attributed to higher nitrogen and biofertilizer application yields, as well as higher nitrogen availability from direct addition and soil nutrient solubility. Differently rising nitrogen levels favours large nutrient uptake and efficient nutrient utilisation for increased carbohydrate metabolism and synthesis, greater vegetative growth, and subsequent partitioning and translocation from the leaf (source) to the head (sink). As per the results of Kumar *et al*. (2017); Narayan *et al*. (2018) the nutrients also encourages the release of energy-rich organic compounds by biofertilizers, which may have been caused by increased auxin activities, growth and activity of microbial saprophytes and phosphates activity which ultimately influenced the yield and yield attributes.

Table 2 shows the data regarding the effect of various treatments on N, P and K residual content in the soil after crop harvest. The available N, P and K in soil were recorded after crop harvest and results indicate that the available nitrogen was recorded to be the maximum in the treatment T11 (299.81 kg ha^{-1}) which was statistically at par with the treatments T14, T5, and T8 (293.73, 290.46 and 290.04 kg ha^{-1} respectively). Nitrogen availability and absorption by the plants as a chemical fertilizer is comparatively higher and quick in most of the plants. With respect to the phosphorus content, T11 (21.25 kg ha^{-1}) recorded the maximum value followed by T4, T10 and T13 by (20.36, 19.75 and 19.39 kg ha^{-1} respectively). According to the solubilizing impact of organic acids may have enhanced soil phosphorus availability, which could account for the rise in phosphorus levels. With regard to potassium, T11 (367.15 kg ha^{-1}) recorded the maximum content in soil which was at par with the treatments T5 and T14 (353.62 and 353.39 kg ha^{-1} respectively). Jha *et al.* (2017) reported that the availability of K in plants and soil is caused by the synthesis of organic acids and other chemicals that promote plant growth and mineral uptake.

Table 2: Effect of various treatments on N, P and K residues in soil after crop harvest.

In soil (kg ha^{-1})			
Treatment	**N**	**P**	**K**
T1 (50% NPK ha^{-1} + FYM)	242.13	16.56	332.99
T2 (50% NPK ha^{-1} + FYM + *Azospirillum)*	242.03	16.28	341.33
T3 (50% NPK ha^{-1} + FYM + *Azotobacter)*	250.72	19.38	341.31
T4 (50% NPK ha^{-1} + FYM + PSB)	264.31	20.36	341.66
T5 (50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB)	290.46	18.25	353.62
T6 (50% NPK ha^{-1} + Vermicompost)	258.72	16.33	320.95
T7 (50% NPK ha^{-1} + Vermicompost + *Azospirillum)*	277.69	17.74	335.54
T8 (50% NPK ha^{-1} + Vermicompost + *Azotobacter)*	290.04	18.55	341.23
T9 (50% NPK ha^{-1} + Vermicompost + PSB)	258.14	19.98	345.42
T10 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + PSB)	267.35	19.75	334.22
T11 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter*+ PSB)	299.81	21.25	367.15
T12 (Organic manures –FYM + Vermicompost)	283.21	17.66	332.47
T13 (Biofertilizers -*Azospirillum* + *Azotobacter* + PSB)	285.19	19.39	341.45
T14 (Recommended dose of Inorganic fertilizers @160:75:80 NPK ha^{-1})	293.73	16.82	353.39
T15 (Control)	238.11	16.17	310.95
S.Em±	269.44	18.30	339.58
C.D. (P=0.05)	3.30	0.51	6.84

CONCLUSIONS

In light of the experimental findings summarized above, it may be concluded that the application of N, P, K and biofertilizers enhanced the growth, yield and quality attributes in cabbage. The comparison of various treatments taken for study revealed that the application of T11 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter*+ PSB) showed better response with respect to the plant height, leaf length, leaf width, number of non-wrapper leaves, diameter of cabbage head and yield plot^{-1} which are closely followed by the treatment T5(50% NPK ha^{-1} + FYM + *Azospirillum* + *Azotobacter* + PSB) and T10 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + PSB). T11 recorded the maximum nitrogen, phosphorus and potassium content in soil after crop harvest. Likewise, the B: C ratio was the highest in the treatment combination T11 (50% NPK ha^{-1} + Vermicompost + *Azospirillum* + *Azotobacter* + PSB).

FUTURE SCOPE

For research purposes, additional biofertilizers or organic manures may be used for quantifying the data with regard to the fertilizer application in cabbage. In order to analyse the impact of biofertilizers, nutrient uptake observations must be taken into consideration for increasing its scope in different localities.

Acknowledgement. I extend my sincere thanks to the Dean, Dr. R.S. Netam and advisory committee of my research work for giving me proper guidance throughout the course of study.

Conflict of Interest. None.

REFERENCES

Choudhary, S. K., Yadav, S. K., Mahto, D. K., Sharma, R. P. and Kumar, M. (2018). Response of Growth, Yield Attributes and Yield of Cabbage (*Brassica oleracea* var. capitata) to different organic and inorganic sources of nutriets in Maghdha Plain of Bihar. *International Journal of Current Microbiological Applied Science, 7*: 4748-4756.

Hsieh, C. F., Fang, H.C., Nan, K. and Hsu, K. N. (1995). Effect of continuous use of organic manures on the growth and yield of vegetable soybean and cabbage. *Bulletin of Taichung District. Agriculture. Improvement Station, Japan, 46*: 1-10.

Jaiswal, R. K., Ali, S. A., Niwariya, J., and Psumae, S. (2020). Effect of organic manures and biofertilizers on growth, yield and quality of cabbage (*Brassica oleracea* L. var. capitata). *International Archive of Applied Science and Technology, 11*(4): 55-60.

Jha, M. K., Jha, B., and Sahu, M. R. and U. (2017). Effect of organic, inorganic and biofertilizers on quality attributes of cabbage (*Brassica oleracea* var. capitata L.). *J. of Pharmocognosy and Phytochemistry, 6*: 502-504

Kumar, P., Kumar, C., Meena, R. K., Kumar, R., and Rawat, R. (2017). Efficacy of biofertilizers on growth and yield of sprouting broccoli (*Brassica oleracea* var. italica L. plenk), cv. Pusa broccoli KTS-1. *Plant Archives, 17*: 1647-1650.

Mohapatra, S. K., Munsi, P. S. and Mohapatra, P. N. (2013). Effect of Integrated Nutrient Management on growth, yield and economics of broccoli (*Brassica oleracea* L. var. italica L. plenck). *Vegetable Science, 40*(1): 69-72.

Moyin- Jesu EI (2007). Use of plant residues for improving soil fertility, pod nutrients, root growth and pod weight of Okra (*Abelmoshchus esculentum* L.) *Bioresour Technology, 98*: 2057-2064.

Narayan, S., Ibrahim, A., Khan, F. A., Hussain, K., Malik, A., Mir, S. A., and Narayan, R. (2018). Organic nutrient management for improved plant growth and head yield of Chinese cabbage (*Brassica rapa* var pekinensis L.). *International Journal of Current Microbiological Applied Science, 7*: 3049-3059.

Negi, E., Shailaja, P., Pant, S. C., Kumar, S., Bahuguna, P., Bengia, M. (2017). Effect of organic manures and biofertilizers on growth, yield, quality and economics of broccoli (*Brassica oleracea* var. *italica* L. plenk) cv. Green head under high hill conditions of Uttarakhand. *International Journal of Adv. Bio. Res., 7*: 96-100.

Obi, M. E., and Ofonduro, C. O. (1997). The effects of soil ammendments on soil physical properties of a severly degraded sandy loam soil in south eastern Nigeria. Usman Danfodio University, Sokoto, 30-35.

Powar and Barkule (2017). Study on effect of integrated nutrient management on growth and yield of cauliflower (*Brassica oleracea* var. botrytis). *Journal of Applied and Natural Science, 9*(1): 520-525.

Sharma, K. C., and Arya, P. S. (2001). Effect of nitrogen and FYM on cabbage in dry temperature hill zones of Himachal Pradesh. *Indian Journal of Agriculture Sciences, 71*(1): 60-61.

Singh, H., Barliya, P. K., Singh, J. and Kumar, P. (2018). Effect of integrated nutrient management on growth and yield of cabbage (*Brassica oleracea* var. capitata L.) and soil fertility. *Journal of Pharmocognosy and Phytochemistry, 7*: 1767-69.

How to cite this article: Mukta Rajput, Beena Singh and Nisha Jangre (2022). Impact of Organic, Inorganic and Biofertilizers on Growth and Yield Attributes of cabbage (*Brassica oleracea* var. capitata L.) in Bastar, Chhattisgarh. *Biological Forum – An International Journal*, *14*(3): 58-61.