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Effect of organic manure, inorganic manure and biofertilizer on growth, yield and quality of cabbage (*Brassica oleracea* var. *capitata*)

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Abstract

The experiment was carried out at Research Field of Horticulture Research Farm, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India, during October 2023-2024 to investigate the "Effect of organic manure, inorganic manure and biofertilizer on growth, yield and quality of cabbage (*Brassica oleracea* var. *capitata*).” nine treatments combination and replicated thrice in a Randomized Block Design. In cabbage use the application of bio fertilizer and bio compost hasten early harvesting by increasing the growth, yield and quality of cabbage. The results revealed bio fertilizer and bio compost maximized plant height (39.84 cm), number of leaves per plant (33.10), Plant spread (86.50 cm), Days taken to head maturity (19.13), Equatorial diameter (26.74 cm), Polar diameter (16.03 cm), head weight (1240.88 g), Plot yield (53.71 kg), Yield per hectare (515.44 q/ha), total soluble solids (8.84), Vitamin C (52.98 mg/100 g) at the harvest of cabbage crop. From the above experimental finding it may concluded that, the production of Cabbage by the bio fertilizer and bio compost of T₈ (80% RDN Through chemical fertilizer +20% through Vermicompost+ phosphate solublizing bacteria + Azospirillum) was found to best in terms of growth, yield and quality. In the investigation improves vegetative growth of flowering and improve yield by the help of bio fertilizer and bio compost such. The highest net return was also found in the T₈ and highest B:C ratio was found in the same with 3.19.

Keywords: Cabbage, bio fertilizer and bio compost, vermicompost, phosphate solublizing bacteria, Azospirillum

1. Introduction

Cabbage (*Brassica oleracea* var. *capitata*, the varietal epithet *capitata* is derived from the Latin word for "having a head". *B. oleracea* and its derivatives have hundreds of common names throughout the world. "Cabbage" was originally used to refer to multiple forms of *B. oleracea*, including those with loose or non-existent heads. A related species, *Brassica Rapa*, is commonly named Chinese, napa or celery cabbage, and has many of the same uses. It is also a part of common names for several unrelated species. These include cabbage bark or cabbage tree (A member of the genus *Andira*) and cabbage palms. Leaves are low in calories (27 per cent), fat (0.1 per cent) and carbohydrates (4.6 per cent). It is good sources of protein (1.3 per cent) which contains all essential amino acids, particularly sulphur containing amino acids. Cabbage is an excellent source of minerals such as calcium (39 mg), iron (0.8 mg), magnesium (10 mg), sodium (14.1 mg), potassium (114 mg) and phosphorus (44 mg). The major cabbage producing states are Uttar Pradesh, Odisha, Bihar, West Bengal, Assam, Maharashtra and Karnataka. Cabbage (*Brassica oleracea* var. *capitata* L.) is one of the most important members of genus *Brassica*. The word "Cabbage" is derived from the French word "coboche" means head. It has been reported that 100 g of green edible portion of cabbage contain 92% water, 18 mg Sodium, 170 mg Potassium, 1.28 g Protein, 5.8 g Carbohydrate, 4% Calcium and 2% mg Iron. The application of FYM and urea shows significant result on the plant height, number of leaves, length of plant, head diameter and biomass yield. The maximum head diameter was observed in treatment 50% FYM +50% UREA. The highest total yield and highest economic yield as obtained from treatment 50% UREA +50% FYM which was similar with recommend rate of fertilizer for cabbage.

The highest soil pH (6.40), soil moisture content, the lowest bulk density was obtained from FYM application. The highest organic matter content was also observed from FYM application. The most of the soil properties were enhanced by application of FYM and UREA NPK at the rate of 120-90-60 kg ha⁻¹ increases cabbage yield and growth. Application of NPK at the rate of 70, 100 and 70 kg ha⁻¹ per hectare respectively increased the number of leaves per plant, size and weight of cabbage head significantly as compared with control treatment. That's why the combination of 70 kg ha⁻¹ N, 90 kg ha⁻¹ P₂O₅ and 60 kg ha⁻¹ K₂O showed best results.

Vermicomposting is a process in which earthworms are used to convert organic materials into humus-like material known as vermicompost.

Phosphate-solubilizing bacteria (PSB) can promote the dissolution of insoluble phosphorus (P) in soil, enhancing the availability of soluble P. Thus, their application can reduce the consumption of fertilizer and aid in sustainable agricultural development

It is a biofertilizer that contains Azospirillum bacteria which has the ability to colonize the plant roots and fixing atmospheric Nitrogen. It synthesizes phytohormones, in particular, indole-3-acetic acid, and is supposed to increase abiotic and biotic stress tolerance capacity thereby assisting in plant growth.

2. Material and Methods

2.1 Location of Experimental site

The experiment was conducting at Vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad (UP) during 2023-2024. All the facilities necessary for cultivation, including labor will be made available in the department.

2.2 Experimental Design

The experiment was conducted in Factorial Randomized Block Design consisting of 9 treatment combinations of 3 levels of phosphorus and 3 levels of sulphur with 3 replications and the treatments were allocated randomly in each replication.

3. Result and Discussion

Effect of organic manure, inorganic manure and biofertilizer on growth, yield and quality of cabbage [*Brassica oleracea* var. *Capitata*]

3.1 Plant height (cm)

At 20 DAT, significantly maximum plant height was observed with application of (T₈) 20.49 cm, and followed which were statistically at par with (T₇) 19.51 cm during the analysis. Minimum plant height observed was the treatment T₀ (16.13 cm).

Scrutiny of data at 40 DAT revealed that during analysis, application of organic fertilizer, inorganic and bio fertilizer (T₈) recorded significantly higher plant height (25.38 cm) followed by (T₇) (24.36 cm) and (T₆) (22.82 cm) they were statistically at par with each other than other levels. At harvesting stage, minimum plant height observed was the treatment T₀ which was 18.59 cm.

Significantly higher plant height (33.73 cm) was observed with application of (T₈) followed by (T₇), (29.66 cm) and

both were statistically at par other treatment and least growth of the plant height was observed was the treatment T₀ (21.50 cm).

At harvesting stage, significantly higher plant height (39.84 cm) was observed with application of (T₈) followed by (T₇) (38.06 cm) and both were statistically at par. At harvesting stage, significantly higher value of plant height (39.84 cm) was observed with treatment and least growth of the plant height was observed was the treatment T₁ (26.04 cm).

3.2 Number of leaves

At 20 DAT, significantly maximum number of leaves was observed with application of (T₈) 11.52, and followed which were statistically at par with (T₇) 10.89, during the analysis. Minimum number of leaves observed was the treatment T₀ (8.67).

Scrutiny of data at 40 DAT revealed that during analysis, application of organic fertilizer, inorganic and bio fertilizer (T₈) recorded significantly higher number of leaves (19.91) followed by (T₇) (19.22) and (T₆) (18.51) they were statistically at par with each other than other levels. At harvesting stage, minimum number of leaves observed was the treatment T₀ which was 14.39.

At 60 DAT stage, significantly higher number of leaves (28.52) was observed with application of (T₈) followed by (T₇) (27.85) and both were statistically at par other treatment and least growth of the number of leaves was observed was the treatment T₀ (20.54).

Significantly higher number of leaves (33.10) was observed with application of (T₈) followed by (T₇), (32.89) and both were statistically at par. At harvesting stage, significantly higher value of number of leaves (33.10) was observed with treatment and least growth of the number of leaves was observed was the treatment T₁ (22.50).

3.3 plant spread

At 30 DAP, the maximum plant spread (54.62 cm) was recorded under the treatment T₈ followed by T₇ with (53.84 cm) and the minimum plant spread (45.63 cm) was observed under the treatment (T₀).

At 60 DAP, the maximum plant spread (77.78 cm) was recorded by organic fertilizer, inorganic and bio fertilizer the treatment T₈ followed by T₇ with (75.82 cm) which was found at par with T₆ & T₅ having plant spread of 71.56 and 71.06 cm respectively recorded statistically at par with each other and the minimum plant spread (66.16 cm) was observed under the treatment (T₀).

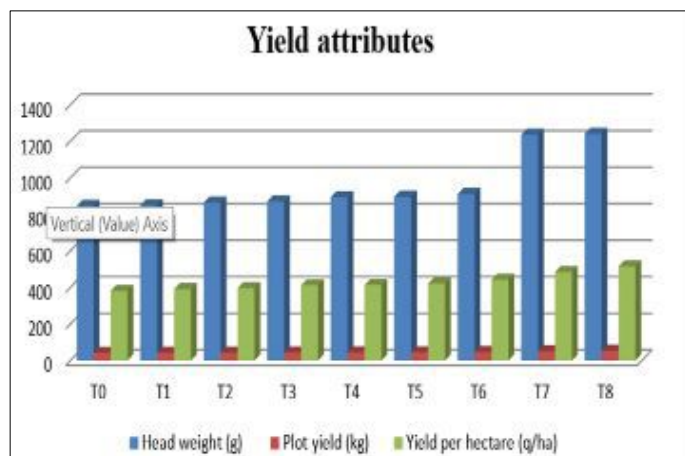
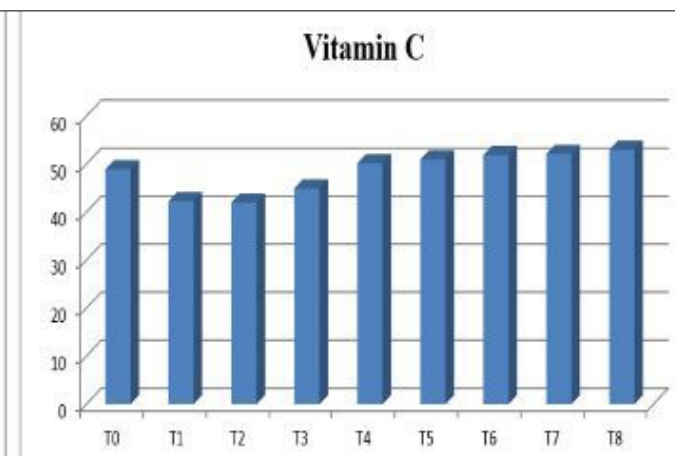
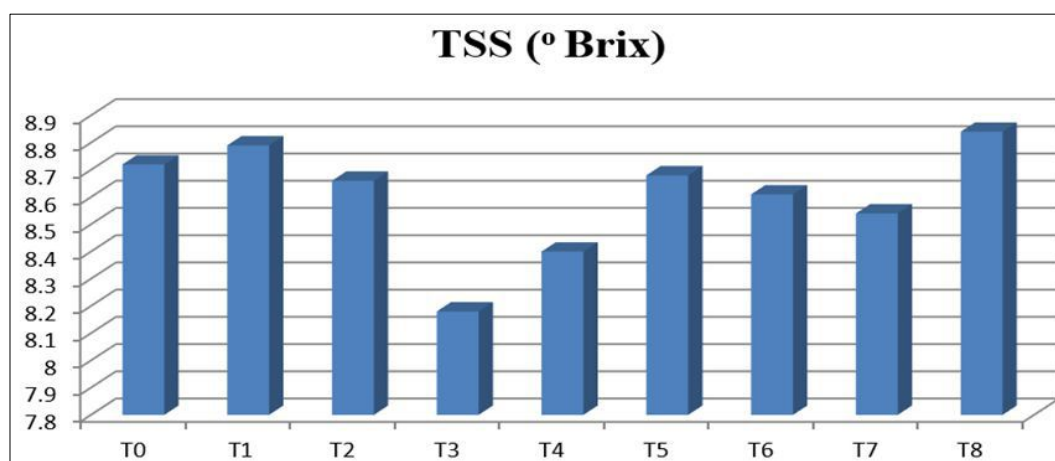
At harvest, the maximum plant spread (86.50 cm) was recorded by using organic fertilizer, inorganic and bio fertilizer the treatment T₈ which was found at par with T₇ having the plant spread 86.11 cm. However, the lowest plant spread (71.78 cm) was confirmed under the treatment T₀.

3.4 Days to taken head maturity

At maturity of crop, application of organic fertilizer, inorganic and bio fertilizer (T₀) recorded similar trend in respect of days to taken head maturity. Significantly higher days to taken head maturity (23.39) was observed with application of (T₀) followed by (T₇) (23.38) and both were statistically at par other treatment and least growth of the days to taken head maturity was observed was the treatment T₈ (19.13).

Table 1: Effect of different treatments on plant height, number of leaves, plant spread, and days to head maturity in cabbage

Treatment	Plant height	No. of leaves	Plant spread	Days to taken head maturity
T ₀	26.4	22.50	71.48	23.39
T ₁	26.72	26.13	72.32	23.38
T ₂	27.63	26.40	74.3	23.14
T ₃	31.96	26.71	75.06	23.09
T ₄	33.23	27.69	76.96	21.68
T ₅	34.03	29.03	80.32	21.12
T ₆	37.8	30.52	80.94	20.11
T ₇	38.06	32.89	86.11	20.07
T ₈	39.84	33.10	86.5	19.13
F test	S	S	S	S
Sem	1.70	1.15	1.86	0.55
C.D at 5%	0.77	0.52	0.84	0.25
C.V	15.57	12.13	7.14	7.93

**Fig 1:** Effect of different treatments on plant height (cm) at various stages (20 DAT, 40 DAT, 60 DAT, and harvesting stage)**Fig 2:** Effect of different treatments on the number of leaves per plant at various stages (20 DAT, 40 DAT, 60 DAT, and harvesting stage)**Fig 3:** Effect of different treatments on plant spread (cm) at various stages (30 DAP, 60 DAP, and harvesting stage).

4. Polar diameter (cm)

During the analysis, maximum polar diameter of cabbage (16.03 cm) was observed with application of organic fertilizer, inorganic and bio fertilizer (T₈) which was registered significantly superior to rest of the treatments followed by (T₇), (15.92 cm). The treatment (T₀) control recorded least polar diameter of cabbage (13.96 cm). However, minimum number of polar diameter of cabbage was found in the treatment (T₀) control i.e. without fertilizer.

5. Equatorial diameter (cm)

During the analysis, maximum head diameter of cabbage (26.74 cm) were observed with application of organic

fertilizer, inorganic and bio fertilizer (T₈) which was registered significantly superior to rest of the treatments followed by (T₇), (25.59 cm). The treatment (T₀) control recorded least Equatorial diameter of cabbage (21.89 cm). However, minimum number of Equatorial diameter of cabbage was found in the treatment (T₀) control i.e. without fertilizer.

6. Conclusion

From the above experimental finding it may concluded that, the application of T₈ (80% RDN Through chemical fertilizer + 20% through vermicompost+ phosphate solubilizing bacteria +Azospirillum) was found to best in terms of

growth, yield and quality. In the investigation improves vegetative growth and improve yield by the help of hybrid seeds. The highest net return was found in the T₈ (80% RDN Through chemical fertilizer +20% through vermicompost+ phosphate solubilizing bacteria +Azospirillum) and highest B:C ratio was found in the same with 3.19.

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