**Effect of Organic Manures and Biofertilizers on Growth and Yield of Cabbage in Humid Climatic Zone Rajasthan**

# Abstract

A field experiment was conducted at Research Farm, Mewar University Gangrar, Chittorgarh (Rajasthan) during rabi season 2024 to check of organic manures and biofertilizers on growth and yield of cabbage variety “Golden Acre‟ was used in this study. The result revealed that the maximum growth parameters like plant height (21.95 : 19.93 and 29.97 : 28.57 cm at 30 and 60 DAS), stalk length (7.66 and 7.10 cm), number of non-wrapper leaves per plant (15.96 and 15.03) and yield parameters like head diameter (18.62 and 17.17 cm), head size (17.19 and 15.74 cm), net head weight (853.17 and 776.25 g) and head yield (270.70 and q/ha) was recorded with O3B3 (Poultry manure @ 5 t/ha + PSB + VAM). Therefore, it was concluded that treatment combination O3-Poultry manure @ 5 t/ha + B3-PSB + VAM was found superior in growth and yield as compare to other treatments. So, it was concluded that the treatment O3B3 (Poultry manure @ 5 t/ha + PSB + VAM) are better among all the treatments combination for higher productivity.

**Key words: - Manures Yield, Cabbage, Biofertilizers**

**1. Introduction**

Cabbage (*Brassica oleracea* var. *capitata* L.) is a Cole crop and belongs to the family Cruciferae or Brassicaceae having chromosome number 2n=2x=18. It is believed to have originated from Western Europe and Mediterranean region. Cabbage is a popular vegetable in temperate, subtropical and tropical regions and now grown almost throughout the year. In India, Orissa, West Bengal, Karnataka, Maharashtra, Gujarat and Punjab are the major cabbage growing states (Mhaske *et al.* 2011). Organic manures are derived from decayed plant/ animal matters and are free from harmful chemicals. Bio fertilizers like Rhizobium, *Azotobacter*, *Azospirillum* and blue green algae (BGA) are extremely cost effective than the chemical fertilizers and increases crop yield by 20-30%, replaces chemical nitrogen and phosphorus by 25% and stimulate plant growth, provide protection against drought and soil-borne diseases. Phosphatic (Phosphatic biofertilizer) solubilize fixed phosphorus already in the soil and make it available to the plants. Organic manures feed the soil and maintain sustainability in the agro-ecosystem. The organic manures not only provide nutrients to plants but also improve the soil texture by binding effect to soil aggregates. Organic manure increases CEC, water holding capacity and phosphate availability of the soil, besides improving the fertilizer use efficiency and microbial population of soil; it reduces nitrogen loss due to slow release of nutrients. FYM not only supplies a lot of macro and micro nutrients to the soil, but also improve the soil physical, chemical and biological properties. Conventional FYM contains about 0.73 per cent N, 0.18 per cent P and 0.71 per cent K (Tolessa and Friesen 2001). Vermicompost increases the surface area provides strong absorbability and retention of, nutrients as well and retains more nutrients for a longer period of time. Vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs. Biofertilizers are the biologically active products containing active strains of specific microorganisms like bacteria, fungi, algae or combinations which may help in increasing crop productivity by the way of biological nitrogen fixation, solubilization of insoluble nutrients and by stimulating plant growth or decomposition of plant residue. Phosphorus Solubilizing Bacteria (PSB) are the biofertilizers which nourish the crops and soil by liberating the growth promoting substances and vitamins. PSB solubilises insoluble fixed phosphates present in the soils (Devi *et al*. 2017).

# 2. Materials and Methods

A field experiment was conducted during Rabi season of 2024-25 at research farm, Department of Agriculture (Horticulture), Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam in texture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient in available zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in factorial randomized block design with three replications, Level-I:- Control (No application of organic manure), FYM @ 12 t/ha, Vermicompost @ 7.5 t/ha, Poultry manure @ 5 t/ha and Level-II:- Control (No application of biofertilizer, PS, VAM, PSB + VAM. There are total 16 treatment combinations and total 48 plots in research.

**3. Results and Discussion**

The purpose of this study was to determine the extent of performance for growth and yield parameters.

# 3.1 Growth parameters

The perusal of data further revealed that plant height at 30 and 60 days after transplanting was also significantly affected by organic manures. The maximum plant height at 30 and 60 DAT was recorded with treatment O3-Poultry manure @ 5 t/ha (21.95 and 29.97 cm), closely followed by O2-Vermicompost @ 7.5 t/ha (20.22 and 28.67 cm). The minimum plant height was recorded with O0-Control (No application of organic manure) (16.30 and 26.12 cm). The perusal of data further revealed that plant height at 30 and 60 days after transplanting was also significantly affected by biofertilizers. The maximum plant height at 30 and 60 DAT was recorded with treatment B3-PSB + VAM (19.93 and 28.57 cm), it was found at par with B2-VAM (19.52 and 28.27 cm) and B1-PSB (19.18 and 27.95 cm). The minimum plant height was recorded with B0-Control (No application of biofertilizer) (18.31 and 27.51 cm), respectively. The perusal of data further revealed that stalk length at 60 days after transplanting was also significantly affected by organic manures. The maximum stalk length was recorded with treatment O3-Poultry manure @ 5 t/ha (7.66 cm), closely followed by O2-Vermicompost @ 7.5 t/ha (7.14 cm). The minimum stalk length was recorded with O0-Control (No application of organic manure) (6.06 cm). The perusal of data further revealed that stalk length at 60 days after transplanting was also significantly affected by biofertilizers. The maximum stalk length was recorded with treatment B3-PSB + VAM (7.10 cm), it was found at par B2-VAM and B1-PSB (6.96 and 6.79 cm). The minimum stalk length was recorded with B0-Control (No application of biofertilizer) (6.66 cm), respectively. The perusal of data further revealed that number of non-wrappers leaves per plant at 60 days after transplanting was also significantly affected by organic manures. The maximum number of non-wrappers leaves per plant was recorded with treatment O3-Poultry manure @ 5 t/ha (15.96), closely followed by O2-Vermicompost @ 7.5 t/ha (15.13). The minimum number of non-wrappers leaves per plant was recorded with O0-Control (No application of organic manure) (6.06). The perusal of data further revealed that number of non-wrappers leaves per plant at 60 days after transplanting was also significantly affected by biofertilizers. The maximum number of non-wrappers leaves per plant was recorded with treatment B3-PSB + VAM (15.03), it was found at par B2-VAM and B1-PSB (14.80 and 14.58). The minimum number of non-wrappers leaves per plant was recorded with B0-Control (No application of biofertilizer) (14.12), respectively. Similar results also reported by Meena *et al.* (2017), Barman *et al*. (2017), Neupane *et al.* (2020), Dlamini *et al*. (2020), Ujjwal *et al.* (2022), Prathyusha *et al.* (2023), Ghimirey *et al.* (2024) and Aryal *et al*. (2024).

* 1. **Yield parameters**

The perusal of data further revealed that head diameter was also significantly affected by organic manures. The maximum head diameter was recorded with treatment O3-Poultry manure @ 5 t/ha (18.62 cm), closely followed by O2-Vermicompost @ 7.5 t/ha (17.16 cm). The minimum head diameter was recorded with O0-Control (No application of organic manure) (14.70 cm). The perusal of data further revealed that head diameter was also significantly affected by biofertilizers. The maximum head diameter was recorded with treatment B3-PSB + VAM (17.17 cm), it was found at par B2-VAM and B1-PSB (16.90 and 16.57 cm). The minimum head diameter was recorded with B0-Control (No application of biofertilizer) (15.98 cm), respectively. The perusal of data further revealed that head size was also significantly affected by organic manures. The maximum head size was recorded with treatment O3-Poultry manure @ 5 t/ha (17.19 cm), closely followed by O2-Vermicompost @ 7.5 t/ha (15.80 cm). The minimum head size was recorded with O0-Control (No application of organic manure) (13.29 cm). The perusal of data further revealed that head size was also significantly affected by biofertilizers. The maximum head size was recorded with treatment B3-PSB + VAM (15.74 cm), it was found at par B2-VAM and B1-PSB (15.49 and 15.15 cm). The minimum head size was recorded with B0-Control (No application of biofertilizer) (14.62 cm), respectively. The perusal of data further revealed that net head weight was also significantly affected by organic manures. The maximum net head weight was recorded with treatment O3-Poultry manure @ 5 t/ha (853.17 g), closely followed by O2-Vermicompost @ 7.5 t/ha (786.25 g). The minimum net head weight was recorded with O0-Control (No application of organic manure) (651.25 g). The perusal of data further revealed that net head weight was also significantly affected by biofertilizers. The maximum net head weight was recorded with treatment B3-PSB + VAM (776.25 g), it was found at par B2-VAM and B1-PSB (759.50 and 745.42 g). The minimum net head weight was recorded with B0-Control (No application of biofertilizer) (725 g), respectively. The perusal of data further revealed that head yield was also significantly affected by organic manures. The maximum head yield was recorded with treatment O3-Poultry manure @ 5 t/ha (301.35 q/ha), closely followed by O2-Vermicompost @ 7.5 t/ha (274.50 q/ha). The minimum head yield was recorded with O0-Control (No application of organic manure) (220.50 q/ha). The perusal of data further revealed that head yield was also significantly affected by biofertilizers. The maximum head yield was recorded with treatment B3-PSB + VAM (270.70 q/ha), it was found at par B2-VAM (263.55 q/ha). The minimum head yield was recorded with B0-Control (No application of biofertilizer) (250 q/ha), respectively. Similar findings also supported by Atal *et al*. (2019), Palia *et al.* (2021), Katti *et al.* (2022), Thakur *et al.* (2023), Naznin *et al*. (2024), Mukhi *et al.* (2024), Chaudhary *et al.* (2024) and Hasan *et al.* (2024).

# Conclusion

On the basis of one year experimentation, it was concluded that treatment combination O3-Poultry manure @ 5 t/ha + B3-PSB + VAM was found superior in growth and yield as compare to other treatments. So, it was concluded that the treatment O3B3 (Poultry manure @ 5 t/ha + PSB + VAM) are better among all the treatments combination for higher productivity.

**Table 1 Effect of organic manures and biofertilizers on growth parameters of cabbage**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Plant height (cm)** | **Stalk length (cm) at 60 DAT** | **Number of non-wrappers leaves per plant at 60 DAT** |
| **30 DAT** | **60 DAT** |  |  |
| **Factor-I (Organic manures)** |  |  |  |
| O0-Control (No application of organic manure) | 16.30 | 26.12 | 6.06 | 13.12 |
| O1-FYM @ 12 t/ha | 18.46 | 27.54 | 6.64 | 14.32 |
| O2-Vermicompost @ 7.5 t/ha | 20.22 | 28.67 | 7.14 | 15.13 |
| O3-Poultry manure @ 5 t/ha | 21.95 | 29.97 | 7.66 | 15.96 |
| S. Em. ± | 0.38 | 0.26 | 0.11 | 0.19 |
| CD% | 1.10 | 0.74 | 0.33 | 0.56 |
| **Factor-II (Biofertilizer)** |  |  |
| B0-Control (No application of biofertilizer) | 18.31 | 27.51 | 6.66 | 14.12 |
| B1-PSB  | 19.18 | 27.95 | 6.79 | 14.58 |
| B2-VAM | 19.52 | 28.27 | 6.96 | 14.80 |
| B3-PSB + VAM | 19.93 | 28.57 | 7.10 | 15.03 |
| S. Em. ± | 0.38 | 0.26 | 0.11 | 0.19 |
| CD% | 1.10 | 0.74 | 0.33 | 0.56 |

**Table 2 Effect of organic manures and biofertilizers on yield parameters of cabbage**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Head diameter (cm)** | **Head size (cm)** | **Net head weight (g)** | **Head yield (q/ha)** |
| **Factor-I (Organic manures)** |
| O0-Control (No application of organic manure) | 14.70 | 13.29 | 651.25 | 220.50 |
| O1-FYM @ 12 t/ha | 16.15 | 14.72 | 716.00 | 246.40 |
| O2-Vermicompost @ 7.5 t/ha | 17.16 | 15.80 | 786.25 | 274.50 |
| O3-Poultry manure @ 5 t/ha | 18.62 | 17.19 | 853.17 | 301.35 |
| S. Em. ± | 0.25 | 0.22 | 11.11 | 3.98 |
| CD% | 0.73 | 0.65 | 32.08 | 11.50 |
| **Factor-II (Biofertilizer)** |
| B0-Control (No application of biofertilizer) | 15.98 | 14.62 | 725.00 | 250.00 |
| B1-PSB  | 16.57 | 15.15 | 745.42 | 258.50 |
| B2-VAM | 16.90 | 15.49 | 759.50 | 263.55 |
| B3-PSB + VAM | 17.17 | 15.74 | 776.75 | 270.70 |
| S. Em. ± | 0.25 | 0.22 | 11.11 | 3.98 |
| CD% | 0.73 | 0.65 | 32.08 | 11.50 |

**References**

Aryal, D., Tamang, A., & Magar, R. G. (2024). Evaluation of different organic and inorganic fertilizer combinations on the growth and yield of cabbage. *Journal of Agriculture and Applied Biology*, **5**(1), 63-74.

Atal MK, Dwivedi DH, Narolia SL, Bharty N and Kumari R. (2019). Influence of bio-fertilizer (*Rhizobium radiobacter*) in association with organic manures on growth and yield of broccoli (*Brassica oleracea* L. var. *italica* Plenck) cv. Palam Samridhi under Lucknow conditions. *Journal of Pharmacognosy and Phytochemistry* pp*.* 604-08.

Barman, K.S., Collis, J.P., Muralidharan, B. and Prasad, V.M. (2017). Effect of integrated nutrient management of plant brinjal (*Solanum melongena*). *International Journal Agritculture Science and Research*, **7**(1): 179-182.

Chaudhary, S. K., Singh, S. K., Sinha, N., & Kumar, V. (2024). Response of Inorganic, Integrated and Organic Sources of Nutrients on Growth and Yield of Cabbage. *International Journal of Plant & Soil Science*, **36**(8), 476-485.

Devi S, Choudhary M, Jat PK, Singh SP and Rolaniya MK. (2017). Influence of organic and biofertilizers on yield and quality of cabbage (*Brassica oleracea* var. *capitata* L.). *International Journal of Chemical Studies* 5:818-20.

Dlamini VC, Nxumalo K, Wahome PK and Masarirambi MT. (2020). Effects of cattle manure on the growth, yield, quality and shelf life of Beetroot (*Beta vulgaris* L. cv. Detroit Dark Red). *Journal of Experimental Agriculture International,* **42:**93-04.

Ghimirey, Vivek and chaurasia, Jay and Dhungana, Roshni (2024) Impact of Organic Fertilizers on Soil Characteristics, Growth and Yield of Cauliflower (*Brassica Oleraceae* VAR. Botrytis) in Chitwan Nepal. Available at SSRN: from the https://ssrn.com/abstract=5066629 or http://dx.doi.org/10.2139/ssrn.5066629.

Hasan, M. J., Khatun, K., Mostarin, T., Karishma, K. C., Nadim, M. K. A., & Chowdhury, S. M. A. (2024). Influence of Vermicompost and Biofertilizer on growth, head yield and quality of Broccoli (*Brassica oleracea* L. var. italica). *Agricultural Science &* Technology (1313-8820), **16**(1).

Katti, A., Rudresh, D.L., Jawadagi, R.S., Evoor, S. and Reddi, S.G., (2022) Plant growth promoting microbial consortia for enhancing growth and yield attributes of Brinjal (*Solanum melongena* L.). International Journal of Horticulture and Food Science, **4**(1): 176-180.

Meena Kusum, Ram R.B., Meena M. L., MeenaJ.K. and Meena D. C. (2017). Effect of Organic Manures and Bio-Fertilizers on Growth, Yield and Quality of Broccoli (*Brassica oleracea var. italica* Plenck.) cv. KTS-1. *Chem Sci Rev Lett*, **6**(24), 2153-2158.

Mhaske, M. G., Ziauddin, S., Kalalbandi, B. M., & Saitwal, Y. S. (2011). Effect of organic and inorganic sources of nitrogen and biofertilizers on growth and yield of cabbage (*Brassica oleraceae* var. capitata). *Int. J. Agric. Sci*, 7, 133-135.

Mukhi, S. K., Sardar, S. S., Mishra, P. J., Bar, N., & Mishra, D. (2024). Effect of Integrated Nutrient Management on Growth, Yield Attributes, Yield and Economics of Off-season Cauliflower (*Brassica oleracea* var. Botrytis L.) Grown under North Eastern Ghat Zone of Odisha. *International Journal of Bio-Resource & Stress Management*, **15**(11).

Naznin, M., Akter, S., Mia, M. H., Santa, S. S., & Khan, M. H. R. (2024). Growth and Yield Performance of Tomato (Solanum Lycopersicum L.) Swayed by Mulching and Organic Fertilizers. *Dhaka University Journal of Biological Sciences*, *33*(2), 53-65.

Neupane B, Aryal K, Chhetri L B and Regmi S. 2020. Effects of integrated nutrient management in early season cauliflower production and its residual effects on soil properties. *Journal of Agriculture and Natural Resources* 3:353-365.

Palia, M., Saravanan, S., Prasad, V. M., Upadhyay, R. G., & Kasera, S. (2021). Effect of different levels of organic and inorganic fertilizers on growth, yield and quality of brinjal (Solanum melongena L.). *Agricultural Science Digest-A Research Journal*, *41*(spl), 203-206.

Prathyusha, S., Kerketta, A., Bahadur, V., & Topno, S. E. (2023). Effect of INM and Biofertilizers on Growth, Yield and Quality of Eggplant (*Solanum melogena*). *International Journal of Environment and Climate Change*, **13**(9), 423-435.

Thakur, S., Sharma, A. K., Thakur, K., Sharma, S., Gudeta, K., Hashem, A., ... & Abd\_Allah, E. F. (2023). Differential responses to integrated nutrient management of cabbage–capsicum–radish cropping sequence with fertilizers and plant-growth-promoting rhizobacteria. *Agronomy*, **13**(7), 1789.

Ujjwal, V., Dev, P., Kumar, S., Malik, A., & Kumar, R. (2022). Effect of Organic Manures and Bio-fertilizers on Vegetative and Yield Parameters of Brinjal (Solanum melongena) cv. Pant Rituraj. *Flora and Fauna*, *28*(1), 27-30.