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Impact of Organic Manures and Biofertilizers on Growth, Yield and Quality of Cabbage

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ABSTRACT

A field experiment was conducted at Horticulture Research Farm, Tilak Dhari Post Graduate College, Jaunpur, Jaunpur Pradesh during 2021 to investigate the effects of organic manures and bio-fertilizers on the growth, yield, and quality of cabbage (*Brassica oleracea* L. var. capitata). The experiment was laid out in Randomized Block Design (RBD) having ten treatments and three replications. The treatments were farmyard manure (T_1), vermicompost (T_2), poultry manure (T_3), neem cake (T_4), *Azotobacter* (T_5), PSB (T_6), FYM + *Azotobacter* + PSB (T_7), vermicompost + *Azotobacter* + PSB (T_8), poultry manure + *Azotobacter* + PSB (T_9), and neem cake + *Azotobacter* + PSB (T_{10}). It was observed that with the application of Vermicompost + *Azotobacter* + PSB (T_8) plant exhibited all round increased growth viz. plant height of (41.77cm), speared of plant (76.83 cm), stem girth (8.43 cm), and head girth (24.55 cm). This treatment (T_8) was also effectively superior for to others in terms of producing maximum net weight of head (1527.86 g), head yield per plot (13.74 kg), head yield per ha. (687.16 q), staying of heads (10.94 days), shelf life (12.83 days), total soluble solid (6.91 ^{0}Brix) and days taken to head initiation. While in T_3 treatment where poultry manure was applied showed lowquality characteristic and least plant growth. According to the results above, T_8 (Vermicompost + *Azotobacter* + PSB) was the most effective treatment in Jaunpur regions for the cultivar in study.

Keywords: Neem cake, cabbage, farmyard manure, vermicompost, organic manures, and biofertilizers.

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INTRODUCTION

Cabbage (*Brassica oleracea* L. var. capitata) is one of the most important Cole crops grown as vegetables, under the Cruciferae family with chromosome number 2n = 18. It is said to have originated in the Mediterranean and Western European regions. The leaves of cabbage are modified into edible part technically known as head. It is highly cross-pollinated vegetable and best suitable for tropical and subtropical regions with a wide range of soil types, climates, and temperatures. Every 100 g of edible cabbage contains 92.1% moisture,1.7%protein, 0.2 g fat, 5.3 g carbohydrates, 0.9 g fiber, 64 mg calcium, 26 mg phosphorous, 0.9 mg iron, 8 mg sodium, 209 mg potassium, 0.05 mg thiamine, 0.05 mg riboflavin, 0.3 mg niacin, 62 mg ascorbic acid, 750 IU vitamin A. It is also among the greatest suppliers of amino acids that contain Sulphur as well.

One of the classic types of manure, FYM is the one that farmers can find the easiest. Through biological breakdown, it provides N, P, and K to plants in forms that are useful to them. Long-term manure experiments carried out across numerous locations have shown that integrated nutrient supply systems are superior to chemical fertilizer alone in sustaining crop output. It enhances the physical, chemical, and biological qualities of soil. Vermicompost has 3% N, 1% P, and 1.5% K, while neem cake contains 2.0 to 5.0% N, 0.5 to 1.0% P, and 1.0 to 2.0% K. Major source of nutrients is poultry manure, an effective organic manure with an average nutrient content of 3.03% N, 2.63% P_2O_5, and 1.4% K_20. The yields of pastures and crops, particularly vegetable crops, have regularly been observed to increase when poultry manure is used.

Biofertilizers, *Azotobacter* and PSB enrich the soil and crops by releasing nutrients and vitamins that promote growth. In the plant's root zone, *Azotobacter* fixes nitrogen from the atmosphere. It is an aerobic nitrogen fixing bacteria that is free to live and can replace some inorganic fertilizer. *Azotobacter* inoculation reduces the need for nitrogenous fertilizers by 10–20%. When inoculated, Phosphorous Solubilizing Bacteria (PSB) solubilizes the previously inaccessible insoluble soil phosphorus by dissolving the fixed, insoluble phosphates that are present in the soil. The PSB inoculation increases crop production by 10% to 30%.

Intensive application of chemical fertilizers and pesticides during and post-green revolution, Indian farming evolved into a chemical agriculture. This has caused a significant shift in the microbial population, and made the rhizosphere polluted. Some other disadvantages of chemical agriculture include nutrient imbalance, rapid depletion of soil fertility, and continuous deterioration of soil physical properties are being encountered. Now in the 21st century it is realized to incorporate organic matter and biofertilizers to ensure nutritional balance for betterment of the soil health. The study was carried out to find out the best combination of organic manures and biofertilizers having improved result on growth, yield and quality of cabbage in eastern Uttar Pradesh condition.

MATERIALS AND METHODS

The current study was conducted in Rabi season of 2021 at the Experimental Unit, Department of Horticulture, Tilak Dhari

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Post Graduate College, Jaunpur, Uttar Pradesh, India. The variety Golden Acre on which experiment was conducted was brought from the Indian Institute of Vegetable Research (IIVR), in Varanasi, Uttar Pradesh. District Jaunpur of Uttar Pradesh has a sub-tropical climate with three distinct seasons winter, summer, and rainy. Winter temperatures (December–January) can drop as low as 5°C, while summer temperatures (May–June) can rise as high as 45°C. Occasionally, during the winter, there may be precipitation and frost. The period from mid-July to the end of September has the heaviest rainfall, after which it becomes less intense. Average rainfall may range 850 to 1100 mm each year.

Last week in November, the cabbage seedlings were transplanted onto the field. At the time of field preparation for the concerned plots, farmyard manure, vermicompost, chicken manure, neem cake, and bio-fertilizers were administered according to the study plan. Other cultural techniques like managing insect pests and diseases, hoeing, watering, and weeding were carried out as needed. The observations made throughout cropping period to determine how organic manures and bio-fertilizers affect the quality, yield, and growth of the cabbage. The statistical programme was used to examine the observed data using analysis of variance (ANOVA), and the significance of mean differences was checked against the threshold at a 5% probability level.

RESULTS AND DISCUSSION

Growth parameters

The results showed that the approach of organic manures and bio-fertilizers had a substantial impact on growth parameters such as plant height (cm), spread (cm), stem girth (cm), head initiation (days), head maturity (days), and head girth (cm) of cabbage. The data in Table 1 revealed that T_8 (Vermicompost + *Azotobacter* + PSB) recorded the shortest time to head initiation (38.74 days) and head maturity (67.14 days), as well as the maximum height of the plant (41.77 cm), spread of the plant (76.83 cm), stem girth (8.43 cm), and head girth (24.55 cm). The treatments T_{10}, T_7, and T_2 came right after this one. The inoculation of more chlorophyll in the leaves as a result of the inoculation of nitrogen fixers may be the cause of the rise in vegetative growth and other metrics. Increased parameters may have been brought about by improved root system development, which may have been facilitated by the synthesis of plant growth hormones such IAA, GA, and cytokinin and the direct influence of biofertilizers. The findings of Chatterjee (2010); Sharma *et al.* (2013) and Meena *et al.* (2017) supported the findings under study.

Table 1: Impact of organic manures and biofertilizers on growth parameters of cabbage

Treatments		Height of plant (cm)	Spread of plant (cm)	Stem girth of plant (cm)	Head initiation (days)	Head maturity (days)	Head girth (cm)
T_1	Farm Yard Manure	38.07	73.25	6.88	41.21	72.39	17.39
T_2	Vermicompost	40.30	75.38	7.82	40.09	70.17	21.49
T_3	Poultry Manure	37.08	71.26	6.37	41.88	73.04	15.17
T_4	Neem Cake	39.23	74.46	7.41	40.44	71.16	19.10
T_5	*Azotobacter*	38.66	73.56	7.18	40.88	71.37	18.63
T_6	PSB (phosphorus solubilizing bacteria)	37.36	72.13	6.65	41.51	72.73	16.53
T_7	FYM + *Azotobacter* + PSB	40.76	75.66	8.04	39.77	69.53	22.44
T_8	Vermicompost + *Azotobacter* + PSB	41.77	76.83	8.43	38.74	67.14	24.55
T_9	Poultry manure + *Azotobacter* + PSB	39.54	74.74	7.59	40.25	70.60	20.31
T_{10}	Neem Cake + *Azotobacter* + PSB	41.41	76.45	8.18	39.42	68.47	23.38
	CD at 5%	**0.136**	**0.045**	**0.050**	**0.041**	**0.184**	**0.189**
	SE (m) ±	**0.045**	**0.015**	**0.017**	**0.014**	**0.061**	**0.063**

Yield parameters

The findings of this study showed that the effect strategy of organic manures and bio-fertilizer treatments had a significant impact on yield parameters of cabbage, including net weight of head (1527.86g), head yield per plot (13.74kg), and head yield per ha (687.16q) of cabbage (Table 2). T_8 (Vermicompost + *Azotobacter* + PSB) yielded more cabbage than T_{10} in terms of net weight of head, head yield per plot, and head yield per hectare. Given that the crop under these treatments had relatively stronger *Azotobacter* + PSB for root growth and development and nitrogen fixation, the cause for higher values of the yield parameter can be considered. As a result of the increased availability of nutrients, which helped to draw more water and nutrients from a wider area and deeper layers, more phosphorus was synthesized, and its distribution to various plant parts led to an increase in vegetative growth, including the development of reproductive structures. In terms of statistics, this treatment was comparable to T_8 (Vermicompost + *Azotobacter* + PSB). While in chicken manure, the minimum net weight of a head (g), head yield per plot (kg), and head yield per hectare (q) were noted. The findings of Kumar and Singh (2009); Devi *et al.* (2017); Singh *et al.* (2018) and Mishra *et al.* (2021) supported these results.

Quality parameters

The findings showed that organic manures and biofertilizers had a significanteffect on quality indicators such as cabbage's

total soluble solid (^{0}Brix), shelf life, and head staying time (days). The data in Table 3 revealed that T_8 (Vermicompost + *Azotobacter* + PSB) had the highest head retention (10.94 days), shelf life (12.83days), and total soluble solid (6.91^{0}Brix) however, minimum quality parameters were found in T_3(Poultry manure). These findings support the conclusion made by Meena *et al.* (2017).

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

Treatments		Net weight of head (g)	Head yield per plot (kg)	Head yield per ha (q)
T_1	Farm Yard Manure	829.24	7.46	373.00
T_2	Vermicompost	1248.00	11.22	560.33
T_3	Poultry Manure	643.75	5.79	289.50
T_4	Neem Cake	1064.85	9.58	475.66
T_5	*Azotobacter*	950.66	8.55	427.40
T_6	PSB (phosphorus solubilizing bacteria)	735.58	6.61	330.83
T_7	FYM + *Azotobacter* + PSB	1362.42	12.25	612.83
T_8	Vermicompost + *Azotobacter* + PSB	1527.86	13.74	687.16
T_9	Poultry manure + *Azotobacter* + PSB	1143.54	10.29	514.50
T_{10}	Neem Cake + *Azotobacter* + PSB	1465.33	13.18	659.16
	CD at 5%	**32.298**	**0.289**	**66.196**
	SE (m) ±	**10.787**	**0.097**	**22.108**

Table 3: Impact of organic manures and biofertilizers on quality parameters of cabbage

Treatments		Staying of head (days)	Shelf life (days)	Total soluble solid (^{0}Brix)
T_1	Farm Yard Manure	9.13	7.46	373.00
T_2	Vermicompost	10.46	11.22	560.33
T_3	Poultry Manure	8.61	5.79	289.50
T_4	Neem Cake	9.54	9.58	475.66
T_5	*Azotobacter*	9.34	8.55	427.40
T_6	PSB (phosphorus solubilizing bacteria)	8.83	6.61	330.83
T_7	FYM + *Azotobacter* + PSB	10.64	12.25	612.83
T_8	Vermicompost + *Azotobacter* + PSB	10.94	13.74	687.16
T_9	Poultry manure + *Azotobacter* + PSB	9.74	10.29	514.50
T_{10}	Neem Cake + *Azotobacter* + PSB	10.83	13.18	659.16
10.83	**CD at 5%**	**0.049**	**0.159**	**0.082**
0.049	**SE (m) ±**	**0.017**	**0.053**	**0.027**
0.017				

Conclusion

It was concluded from present study that the application of Vermicompost + *Azotobacter* + PSB found superior than other tested treatments under Jaunpur conditions.

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