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Response of different nutrient management practices on growth and yield of cabbage (*Brassica oleracea* L. var. *capitata*) under open field conditions

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Abstract

The field experiment was carried out at the Campus for Research and Advanced Studies, G.S.S.D.G.S. Khalsa College, Patiala during the *rabi* season of 2021-2022. The experiment was laid out in randomized block design with comprising of eleven treatment and three replications. The results revealed that different inorganic and organic manures recorded significantly superior in growth and yield characters. All the growth parameters like plant height (27.11 cm), leaf length (25.11 cm), leaf width (19.02 cm), plant spread (34.13 cm) and no of leaves plant⁻¹ (21.24) at harvest were significantly maximum in treatment T₁₁ (75% RDF + FYM 7 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Poultry manure 2 t ha⁻¹) and yield parameters like head height (16.11 cm), head diameter (16.03 cm), head weight (677.05 g), head yield plot⁻¹ (17.57 kg) and total yield (241.01 q ha⁻¹) were maximum in T₁₁ (75% RDF + FYM 7 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Poultry manure 2 t ha⁻¹).

Keywords: Cabbage, vermicompost, poultry manure, FYM

Introduction

Cabbage (*Brassica oleracea* L. var. *capitata*) is a cool season crop of family Cruciferae commonly known as “Bandgobhi”. Cabbage has its domestication from Coastal area of Mediterranean Sea. Chromosomes number of cabbage is 2n=18. Cabbage is derived from French word ‘Caboche’ means “Head.” In India, it is the second most important crop of cole family. In India, the cultivated area under cabbage crop is 403 thousand hectares and production is 9396 million tonnes with average productivity 23.31 tonnes ha⁻¹ (NHB 2020) [6]. In Punjab, total area under cabbage cultivation is 6.89 lac hectares and production is 127.48 lac tonnes and the average productivity of crop is 18.51 tonnes ha⁻¹ during 2019-20 (Anonymous 2020) [1]. Optimum temperature for seed germination of cabbage is 20-25 °C and for growth and head formation requires 15-20 °C temperature. It thrives well on drained loamy and fertile soil with good water holding capacity and rich in organic matter having pH 5.5-6.5. The seedlings are ready for transplanting in 30-40 days. Cabbage contains 91% Moisture, 1.8 g Protein, 0.1 g Fat 100⁻¹ g. Vitamin includes 1200 mg beta-carotene, 0.06 mg Thiamine, 0.09 mg Riboflavin, 124 mg Vitamin C 100⁻¹g. It has 39 mg Calcium and 0.8 mg Iron per 100g. Total carbohydrates are 4.6 K Cal. (Dhaliwal 2008) [3]. Organic and inorganic manures helps in improving quality and quantity of the cabbage crop. Organic manure is applied in the field before sowing of crop. It improves the soil fertility, soil texture and water holding capacity. When manures are applied at accurate time and amount it gives better result in their growth, yield and quality of the crop. Application of organic manures have enhanced the availability of native and applied micro and macro nutrients in the soil as significantly increase the net weight of heads (Yadav *et al.* 2001) [8].

Material and Methods

The experiment was performed during winter season of 2021-2022 at the Campus for Research and Advanced Studies, G.S.S.D.G.S. Khalsa College, Patiala (Punjab). The soil of field experiment was clayey soil having pH 7.7, organic carbon 0.74%, available N, P₂O₅ and K₂O with medium nitrogen and phosphorus and low potash availability. The treatments consists of eleven different nutrient management which was laid out in randomized block design with three replications. Germination of seeds takes place within a week after sowing. The cabbage nursery was one month old and these seedlings were transplanted on 12 November, 2021 with recommended spacing of 45 × 45 cm.

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The application of organic manures such as farmyard manure, vermicompost and poultry manure were applied during field preparation in all treatment plots before 2-3 days transplanting. Recommended dose of fertilizers such as half dose of nitrogen, phosphorus and potash were applied at basal dose in all treatment plots in the form of urea, single super phosphate and muriate of potash and second half quantity of nitrogen was given at 30 days after transplanting. For tagging five plants are randomly selected from each plot after they attained a reasonable results. The tagged plants were recording for various parameters were used to measure plant height, no of leaves plant⁻¹, leaf length, leaf width, plant spread as well as head height, head diameter and head weight, yield plot⁻¹ and total yield.

Table 1: Details of layout

Experimental design	Randomised block Design (RBD)
No of replications	3
No of treatments	11
Total number of plots	33
Seed rate	500 g ha ⁻¹
Spacing	45 × 45 cm
Gross plot size	2.9 × 2.9 m ²
Net plot size	2.7 × 2.7 m ²
Variety	Golden Acre

Table 2: Treatments details

T ₁	Control
T ₂	100% RDF
T ₃	FYM 10 t ha ⁻¹
T ₄	Vermicompost 3 t ha ⁻¹
T ₅	Poultry Manure 4 t ha ⁻¹
T ₆	FYM 7 t ha ⁻¹ + Vermicompost 2 t ha ⁻¹
T ₇	FYM 7 t ha ⁻¹ + Poultry Manure 2 t ha ⁻¹
T ₈	75% RDF + FYM 7 t ha ⁻¹
T ₉	75% RDF + Vermicompost 2 t ha ⁻¹
T ₁₀	75% RDF + Poultry Manure 2 t ha ⁻¹
T ₁₁	75% RDF + FYM 7 t ha ⁻¹ + Vermicompost 2 t ha ⁻¹ + Poultry Manure 2 t ha ⁻¹

Result and Discussions

Growth parameters

The data on growth parameters, (Table 3) revealed that the growth parameters of the crop were significantly best among different nutrient management i.e. T₁₁ (75% RDF + Farmyard manure 7 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Poultry manure 2 t ha⁻¹) recorded higher values of plant height (27.11 cm), no. of leaves plant⁻¹ (21.24), leaf length (25.11cm), leaf width (19.02cm) and plant spread (34.13 cm) which was at par with treatment T₉ (75% RDF + Vermicompost 2 t ha⁻¹) and treatment T₁₀ (75% RDF + Poultry manure 2 t ha⁻¹). The treatment T₁ (Control) significantly shows lower results in the growth parameters of cabbage. The appropriate effect of chemical fertilizers along with farmyard manure, vermicompost and poultry manure are raised in several micro and macro nutrients which acts as slow releasing of nutrients and have provide nutrients for crop period, it attributes to solubilisation of plant nutrients and leads to subsequent uptake of NPK, to enhance soil fertility, improve the moisture retention capacity of soil and better absorption of water and nutrients for vegetative growth of plant. (Chaudhary *et al.* 2015, Gupta *et al.* 2018 and Singh *et al.* 2018 in cabbage) [2, 4, 7].

Table 3: Effect of different nutrient management practices on growth parameters of cabbage.

Treatment	Plant Height (cm)	No. of Leaves plant ⁻¹	Leaf Length (cm)	Leaf Width (cm)	Plant Spread (cm)
T ₁	18.79	13.76	15.75	12.13	23.34
T ₂	25.73	19.77	23.99	17.16	32.59
T ₃	21.55	16.72	18.73	13.91	25.86
T ₄	23.83	17.80	20.37	14.36	27.22
T ₅	22.24	16.96	19.81	14.84	26.98
T ₆	24.85	18.97	22.03	16.21	30.08
T ₇	24.08	18.30	21.66	15.56	29.60
T ₈	25.16	19.13	23.43	17.70	31.83
T ₉	26.44	20.67	24.56	18.48	33.64
T ₁₀	26.01	20.12	24.23	18.11	33.04
T ₁₁	27.11	21.24	25.11	19.02	34.13
S.E(m) ±	0.52	0.54	0.42	0.44	0.53
CD (5%)	1.10	1.12	0.89	0.92	1.10

Yield parameters

The data on yield parameters, (Table 4) revealed that the yield parameters of the crop were significantly best by different nutrient management i.e. T₁₁ (75% RDF + Farmyard manure 7 t ha⁻¹ + Vermicompost 2 t ha⁻¹ + Poultry manure 2 t ha⁻¹) recorded higher values of head height (16.11 cm), head diameter (16.03 cm), weight of head (677.05 g), yield plot⁻¹ (17.57 kg) and total yield (241.01 q ha⁻¹) which was at par with treatment T₉ (75% RDF + Vermicompost 2 t ha⁻¹) and treatment T₁₀ (75% RDF + Poultry manure 2 t ha⁻¹). The treatment T₁ (Control) significantly shows lower results in the yield parameters of cabbage. The manures help in increasing yield attributes due to the early release of available nitrogen and phosphorus at the time of head development, which stimulates the organic matter in the soil, improves soil fertility, and also maintains physical properties of soil, which inhibits the elongation of stem cells and improves crop productivity, resulting an increase in the yield parameters of cabbage. (Chaudhary *et al.* 2015, Gupta *et al.* 2018 and Singh *et al.* 2018 and Kaur 2020 in cabbage) [2, 4, 7, 5s].

Table 4: Effect of different nutrient management practices on yield parameters of cabbage

Treatment	Head Height (cm)	Head Diameter (cm)	Head Weight (g)	Yield Plot ⁻¹ (kg)	Total Yield (q)
T ₁	10.33	9.16	343.69	7.62	104.52
T ₂	14.49	14.21	628.92	12.85	176.26
T ₃	11.86	10.98	493.91	9.84	134.97
T ₄	12.89	11.88	525.09	11.71	160.63
T ₅	12.35	11.54	502.47	10.19	149.65
T ₆	13.71	12.89	581.05	12.40	170.09
T ₇	13.17	12.35	558.30	12.08	165.70
T ₈	14.09	13.88	657.81	13.21	181.20
T ₉	15.81	15.68	674.80	16.02	219.75
T ₁₀	15.34	15.04	672.26	15.12	207.40
T ₁₁	16.11	16.03	677.05	17.57	241.01
S.E(m) ±	0.37	0.48	2.32	1.21	16.10
CD (5%)	0.77	1.01	4.85	2.52	33.59

Conclusion

On the basis of present inspection it is concluded that the treatment T₁₁ (75% RDF + FYM 7 t ha⁻¹ + vermicompost 2 t ha⁻¹ + poultry manure 2 t ha⁻¹) was found to be the best treatment combination in growth and yield parameters.

Manures are rich in organic matter which plays important role in production and maintain the health of soil. Manures act as natural fertilizer which does not causes any harmful effect to plant and environment and also helps to stronger root system thereby encourages plant growth.

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