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Effect of integrated nutrient management, yield and quality of cabbage (*Brassica oleracea* L. var. *capitata*)

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Abstract
In the diversified farming system, integrated nutrient management under different crop geometry along with growth regulators is the most appropriate approach to solve various issues related to productivity, quality as well as sustainability in efficient and economical way. Cabbage is well known for its nutritive and health benefits. A field experiments were conducted to study the effect of vermicompost, inorganic fertilizers and growth retardant (cycocel) with different spacing on cabbage carried out in factorial randomized block design at Agriculture Farm and Department of Horticulture, Mansarovar Global University Sehore (Madhya Pradesh) India during the two year 2023-24. Results indicated that yield and yield contributing components of cabbage the highest plant height (75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 45 CM spacing 48.64 cm), highest plant spread was observed in 75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 45 CM spacing 76.26 cm, highest number of open leaves 100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 45 X 45 CM spacing 20.93, highest leaf area 50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 45 X 45 CM spacing 1724.45, maximum thickness of main stem 75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 45 CM spacing 45.43, highest days taken to head initiation with F_2S_1 72.82, The highest days taken to head maturity 16.45, highest head diameter 37.80, highest head size 15.52, highest gross head weight (kg/head) 3.51, highest net head weight (kg/head) 3.31, highest yield (kg/plant) 3.17.

Keywords: Cabbage, vermicompost, fertilizer, cycocel, spacing, yield

Introduction
Vegetables are foods that provide protection. In addition to minerals like potassium, fiber, and folate, they are abundant in vitamins A, B, C, D, and E. Red blood cell formation is aided by folate. Consuming foods high in folate, such as spinach, tomatoes, and bell peppers, is crucial for women of reproductive age in order to avoid neural tube abnormalities in their unborn children. Additionally, vegetables help to maintain the body's alkalinity balance. The three most essential base elements required to neutralize the acid created by the body are calcium, magnesium, and potassium with addition to aiding with apatite satisfaction, the spongy moss produced by the majority of the fibrous structure of vegetable leaves, stems, bulbs, tubers, and roots also helps push food down the digestive canal, so avoiding constipation. Mineral salts, moderate acid juices and chemicals further aid the digestive function with their laxative effects. Vegetables are therefore crucial to human nutrition as preventive foods. It is also crucial for maintaining the expanded population's nutritional security. Compared to grains, vegetable crops yield four to ten times as much. Because they are the least expensive natural food source and may effectively complement the nation's staple cereals, veggies are therefore essential to the food chain.

Dietitians advised us to consume 300 g of vegetables per day. According to the Indian Council of Medical Research, for optimal growth and development, one should take 125 g of leafy vegetables, 75 g of root vegetables, and 100 g of other vegetables daily. As a result, we must produce more vegetables than we present.

India has a diverse variety of agroclimatic conditions that make it possible to cultivate a number of vegetable crops. With an area of 10099.82 thousand ha under vegetable cultivation, production of 185883.22 thousand MT and productivity of 18.40 t/ha, India is now the world's second-largest producer of vegetables, after China, and accounts for 11% of global production (National Horticulture Database 2018-19).

In Madhya Pradesh, on the other hand, there are 1256.27 thousand ha, production of 27703.82 thousand MT and productivity of 22.05 t/ha.

India's natural environment offers us a wide variety of vegetable crops that may be grown throughout the year. Vegetables come in a variety of forms that can be eaten as leaves, stems, flowers, fruits, or seeds. Given the seasonality and soil requirements, farmers can grow vegetables all year round to generate a consistent flow of income to cover daily costs. Vegetable crops of the short duration kind can be cultivated as intercrops or as the main crop in horticulture or agronomy. As a result, a farmer can choose from a wide variety of crops to modify his cropping pattern under the circumstances.

The Romans and Greeks utilized cabbage (*Brassica oleracea*e L. var *capitata*), one of the earliest Cole crops, as a vegetable. One of the most widely grown cole crops in India, it produces 9095 thousand MT of cabbage overall from an area of 399 thousand hectares (National Horticulture Database 2018-19). In Madhya Pradesh, however, a total of 302.97 thousand MT of cabbage is produced from an area of 9.06 thousand hectares, with a productivity of 33.44 t/ha (National Horticulture Database, 2017-18). As a cole crop, cabbage is descended from wild cliff cabbage, or colewort's, from whence the word "cole" comes. With chromosomal number 2n = 2x = 18, it is a member of the Brassicaceae or Crucifereae family. It is said to have come from the Mediterranean area and Western Europe. The original form does not have a header. Much later, in the 16th century or more, the head cabbage was mentioned.

Farmers in Madhya Pradesh have adopted cabbage as a significant crop because they prefer to grow known crops using traditional ways. The current study was conducted in Madhya Pradesh to investigate the many aspects of cabbage growth, yield, and quality. It aimed to hypothesis the impact of fertilizers, Vermicompost, and growth regulator concentrations at varying spacings on cabbage as Farmers in the Bhopal region do not, however, have complete access to specific information on the appropriate dosage of Vermicompost, cycocel, and spacing.

Therefore, the investigation was conducted with the following objectives.

- Evaluation of Integrated Nutrient Management
- Interaction of Integrated Nutrient Management and crop geometry
- Evaluation of quality parameter with different treatments
- Evaluation of yield parameter with different treatments

Materials and Methods

The present investigation entitled "Effect of integrated nutrient management, yield and quality of cabbage (*Brassica oleracea* L. var. *capitata*)" was carried out at Agriculture Farm and Department of Horticulture, Mansarovar Global University Sehore (Madhya Pradesh) India during the two year (2023-24 to 2024-25). The literature available with respect to present study has been reviewed as under:

Site of Experiment

The present investigation was carried out in the Agriculture Farm and Department of Horticulture, Mansarovar Global University Sehore (Madhya Pradesh) India during the year 2023-24. Geographically, the research farm of the university is located at 25.45°N latitude and 78.61°E longitude at an altitude of 285 m from mean sea level having a sub-tropical climate. Different parameter related to vegetative growth and yield parameters were measured at the research farm.

Soil Condition

The soils of experimental field of the university are comes under the order of Entisols. The soil of experimental plot red parwa soil proper drainage and optimum water holding capacity.

Design and layout experiment

The experiment was conducted in open field condition at Agriculture Farm and Department of Horticulture, Mansarovar Global University Sehore (Madhya Pradesh). The experiment was laid out in a factorial randomized block design with 36 treatment combinations with three replications. The experimental details are given below:

Experimental details

Variety to be selected	:	Pusa Drum Head
Design of Experiment	:	Factorial RBD
Treatment combinations	:	12
Replications	:	3
Total number of plots	:	36
Gross plot size	:	3.20x2.80 m^2
Net plot size	:	2.70×1.8 m^2
Plant distance	:	30x30cm, 30x45cm and 45×45cm

Treatment details

Integrated Nutrients Management

F_1-100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha)

F_2-75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost)

F_3-50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost)

F_4-25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost)

Spacing

S_1-30x30 cm

S_2-45x30 cm

S_3-45x45 cm

Results and Discussion

The present investigation on "Effect of Integrated Nutrient Management, Yield and Quality of Cabbage (*Brassica oleracea* L. var. *capitata*)" was carried out with a view to find out each character have been presented, discussed and possible interpretations have been drawn in this chapter and various experiments during 2023-24 result obtained from this investigation are presented as follows.

The integrated nutrient management, crop geometry and cycocel at 60 DAT (days after transplanting) the maximum plant height was recorded in treatment F_2S_3 (48.64 cm) with were most effective significantly superior followed by second significantly F_1S_3 (47.97 cm) the minimum plant height was recorded in treatment F_1S_1 (40.44 cm) Sharma *et al.* (2009) [11] and Kumar and Dhar, (2010) [8].

The integrated nutrient management, crop geometry and cycocel at 60 DAT (days after transplanting) the maximum plant spread (cm^2) was recorded in treatment F_2S_3 (76.26) with were most effective significantly superior followed by

second significantly F_3S_3 (75.84) Sharma and Chandra (2002) [12].

The interactive effect of fertilizer and cycocel shows on 60 days that the spacing on number of open leaves were found highest in treatments F_2S_3 (20.30 cm) in the year whereas, lowest number of open leaves found in treatments F_2S_1 (17.99 cm) Meena and Paliwal (2003) [10].

The interactive effect of fertilizer and cycocel shows on 60 days that the numbers ofinteraction of effect INM and spacing on Leaf area $(cm)^2$ of open leaves were found highest in treatments F_3S_3 (1724.45 cm) in the year whereas, lowest Leaf area $(cm)^2$ of open leaves found in treatments F_1S_1 (1328.60 cm) during 2023-24 Sharma and Arya (2001) [13].

The interactive effect of fertilizer and cycocel shows on 60 days that the numbers ofinteraction of effect INM and spacing on thickness of main stem (mm) were found highest in treatments F_2S_3 (45.43 mm) in the year whereas, lowest thickness of main stem (mm) found in treatments F_1S_2 (37.13 mm) during 2023-24.

The interactive effect of fertilizer and spacing showed table and figure 4.6 and 4.6 that the days taken to head initiation were found maximum in treatment F_2S_1 (72.82 days) in 2023-24, respectively whereas, minimum days taken to head initiation were observed in treatment F_3S_3 (67.44 days) in respective Kumar *et al.* (2008) [7].

The interactive effect of fertilizer and spacing showed that the days taken to head maturity were found maximum in treatment F_2S_1 (16.45 days) during the year whereas, minimum days taken to head maturity were observed in treatment F_3S_2 (11.20 days) during 2023-24. The results are in conformity with the findings of Shelke *et al.* (1999) [14] in brinjal, Shizou *et al*. (1999) [15] in capsicum.

The interactive effect of fertilizer and spacing appeared that the head diameter were found maximum in treatment F_4S_3 (37.80 cm) in their respective year whereas, minimum head diameter were observed in treatment F_2S_2 (31.88 cm) during 2023-24 Krishna *et al.* (2018) [6].

The interactive effect of fertilizer and spacing showed that the head size were found maximum in treatment F_3S_3 (15.52 cm) during the year whereas, minimum head size was observed in treatment F_2S_1 (13.38 cm) in their respective year. These results were in the line of findings reported by Gholampour *et al.* (2012) [4] in cabbage.

The interactive effect of fertilizer and spacing appeared that the net head weight (3.31 kg) were found maximum in treatment F_3S_3 in their respective year whereas, minimum net head weight (0.90 kg) were observed in treatment F_1S_1 the year. The similar findings were also reported by Emden and Cockshull (1967) [2] in cabbage.

The interactive effect of fertilizer and spacing exhibited that the gross head weight were found highest in treatment F_3S_3 (3.51kg) during the year whereas, lowest gross head weight were observed in treatment F_1S_1 (1.43 kg) in there respectively Cockshull (1967) [2] in cabbage.

The interactive effect of fertilizer and spacing exhibited that the yield q/ha (3.17) were found highest in treatments F_3S_3 during their respective year while the yield were observed lowest in treatment F_1S_1 (0.92 q/ha) in 2023-24. These results were supported with the findings of Hangarge (1997) [5] and Chaudhary *et al.* (2018) [1].

Application of 300 ppm CCC along with INM involving50% RDF through Inorganic Fertilizer and 50% Organic (Vermicompost) using 45x45 cm spacing maybe recommended for producing higher cabbage yield (head weight, head diameter, headsize), better quality (ascorbic acid, phosphorus, calcium, magnesium, total chlorophyll) and maximum returns in Mansarovar region.

Table 1: Effect of varying inorganic and organic fertilizer combinations and spacing on plant growth and development parameters of cabbage during 2023–24.

Treatment	Treatment combinations	Plant High	Plant spread (cm^2)	Number of open leaves	Leaf area (cm^2) of open leaves	Thickness of main stem (mm)	Days taken to head initiation
		2023-24	2023-24	2023-24	2023-24	2023-24	2023-24
F1S1	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 30 X30 CM spacing	40.44	67.83	18.97	1328.60	42.30	71.27
F1S2	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 45 X 30 CM spacing	46.57	68.49	19.81	1352.75	37.13	67.85
$F1S_3$	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 45 X 45 CM spacing	47.97	69.00	20.93	1366.05	37.74	68.99
F2S1	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 30 X30 CM spacing	41.84	72.72	17.99	1458.80	43.49	72.82
F2S2	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 30 CM spacing	45.83	74.37	20.02	1450.75	43.82	72.05
F2S3	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 45 CM spacing	48.64	76.26	20.30	1502.55	45.43	72.22
F3S1	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 30 X30 CM spacing	41.59	71.39	19.04	1551.90	43.81	68.28
F3S2	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 45 X 30 CM spacing	46.65	74.05	19.46	1596.70	43.79	68.04
F3S3	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 45 X 45 CM spacing	47.11	75.84	20.09	1724.45	45.36	67.44
F4S1	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 30 X30 CM spacing	42.97	71.53	18.55	1478.05	43.50	68.85
F4S2	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 45 X 30 CM spacing	42.68	73.57	18.62	1528.10	43.35	68.30
F4S3	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 45 X 45 CM spacing	42.91	75.33	19.25	1544.90	45.37	69.02
S Em±		0.44	2.05	0.29	19.91	1.19	0.46
CD at 5%		0.17	1.32	0.23	56.52	1.25	0.22

Treatment	Treatment combinations	Head diameter (cm)	Head size (cm)	Net head weight (kg)	Gross head weight (g)	Yield (q/ha)	Days taken to head maturity
		2023-24	2023-24	2023-24	2023-24	2023-24	2023-24
F1S1	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 30 X30 CM spacing	35.03	14.09	0.90	1.43	0.92	14.70
F1S2	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 45 X 30 CM spacing	35.74	14.49	1.88	2.40	1.73	12.25
F1s3	100% RDF Inorganic Fertilizer (120:80:60 NPK kg/ha) with 45 X 45 CM spacing	35.98	14.65	2.36	2.89	2.70	12.25
F2S1	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 30 X30 CM spacing	36.51	13.38	1.05	1.59	1.06	16.45
F2S2	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 30 CM spacing	31.88	13.76	1.38	1.90	1.35	15.75
F2S3	75% RDF Inorganic Fertilizer + 25% Organic (Vermicompost) with 45 X 45 CM spacing	32.07	13.82	1.93	2.47	2.01	15.40
F3S1	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 30 X30 CM spacing	36.13	15.17	1.13	1.66	1.11	12.25
F3S2	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 45 X 30 CM spacing	37.32	15.40	2.30	2.82	1.95	11.20
F3S3	50% RDF Inorganic Fertilizer + 50% Organic (Vermicompost) with 45 X 45 CM spacing	37.41	15.52	3.31	3.51	3.17	11.55
F4S1	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 30 X30 CM spacing	36.77	14.85	0.96	1.49	1.06	12.25
F4S2	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 45 X 30 CM spacing	37.63	15.29	2.01	2.53	1.84	11.90
F4S3	25% RDF Inorganic Fertilizer + 75% Organic (Vermicompost) with 45 X 45 CM spacing	37.80	15.19	2.48	3.00	2.87	13.30
S Em±		0.26	0.07	0.09	0.11	0.04	0.43
CD at 5%		0.76	0.26	0.28	0.28	0.11	1.21

Conclusion

The present study revealed that integrated nutrient management (INM), crop geometry, and cycocel application significantly influenced growth, yield, and quality attributes of cabbage during 2023–24. The combination of 50% RDF through inorganic fertilizer and 50% organic source (vermicompost) with 45 × 45 cm spacing (F3S3) showed superior performance in terms of plant height, spread, number of open leaves, leaf area, stem thickness, and reduced days to head initiation. It also recorded the highest head diameter, head size, net and gross head weight, and overall yield. Thus, the application of 300 ppm cycocel with INM (F3S3) can be recommended for maximizing cabbage productivity and quality under the Mansarovar region conditions.

Reference

1. Chaudhary MM, Bhanvadia AS, Parmar PN. Effect of integrated nutrient management on growth, yield attributes and yield of cabbage (*Brassica oleracea* L. var. *capitata*). Trends in Biosciences. 2018;8(8):2164-2168.
2. Emden HFV, Cockshull E. The effect of soil application of (2-Chloroethyl)-trimethyl ammonium chloride on leaf area and dry matter production by the Brussels sprout plant. Journal of Experimental Botany. 1967;18(57):707-715.
3. Gaur AC, Mukharjee D. Recycling of organic matter through mulch in relation to chemical and microbiological properties of soil. Journal of Plant and Soil. 1976;56(3):273-281.
4. Gholampur A, Hashemabadi D, Sedaghathour SH, Kaviani B. Controlling ornamental cabbage and kale (*Brassica oleracea* L.) growth via cycocel. Journal of Ornamental Plants. 2012;2(2):103-112.
5. Hangarge DS. Studies on relative efficiency of vermicompost along with other organics on various soil properties and yield of crops under chilli-spinach cropping system [M.Sc. thesis]. Prabhani: MAU; 1997.
6. Krishna P, Neema M, Arora A, Naveen KP, Singh MC. Effect of gibberellic acid on plant growth and flowering of chrysanthemum cv. Thai-Chen-Queen under short day conditions. International Journal of Agriculture Sciences. 2018;10(11):6274-6278.
7. Kumar D, Singh IP, Singh B, Pal MK. Effect of integrated nutrient management on growth attributing parameters in cabbage (*Brassica oleracea* var. *capitata*). Progressive Agriculture. 2008;8(2):243-246.
8. Kumar A, Dhar S. Evaluation of organic and inorganic sources of nutrients in maize (*Zea mays*) and their residual effect on wheat (*Triticum aestivum*) under different fertility levels. Indian Journal of Agricultural Sciences. 2010;80(4):364-371.
9. Laczi E, Apahidean A, Luca E, Dumitras A, Boanca P. Headed Chinese cabbage growth and yield influenced by different manure types in organic farming system. Horticultural Science. 2016;43:42-49.
10. Meena KK, Paliwal R. Growth and yield of cabbage (*Brassica oleracea* L. var. *capitata*) as affected by different nitrogen levels. Annals of Agricultural Research. 2003;24(4):961-963.
11. Sharma A, Kumar P, Parmar DK, Singh Y, Sharma KC. Bio-inoculants amendments substitute synthetic fertilizers in cauliflower (*Brassica oleracea* L. var. *botrytis*) and influence growth, yield, nutrient uptake and residual soil fertility. Vegetable Science. 2009;36(1):22-26.
12. Sharma A, Chandra A. Economic evaluation and different treatment combinations of plant spacing and nitrogen in cabbage and cauliflower. Current Agriculture. 2002;26(1-2):103-105.

13. Sharma KC, Arya PS. Effect of nitrogen and farmyard manure on cabbage (*Brassica oleracea* L. var. *capitata*) in dry temperate zone of Himachal Pradesh. Indian Journal of Agricultural Sciences. 2001;71(1):60-61.
14. Shelke SR, Adsule RN, Amrutsagar VM. Nitrogen management through organics and inorganics in brinjal. Journal of Maharashtra Agricultural Universities. 1999;24(3):297-298.
15. Shizou H, Duanwel ZH, Zhu DW. Effect of new types of mixed organic manures on yield quality and enzyme activity of chilli and tomato. Journal of Huazhong Agricultural University. 1999;18(2):139-142.