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Effect of integrated nutrient management on growth and yield of red cabbage (*Brassica oleracea var. Capitata*) under Punjab conditions

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Abstract

The current study named “Effect of Integrated Nutrient Management on Growth and Yield of Red Cabbage (*Brassica oleracea var. Capitata*)” was carried out at vegetable research farm, Lovely Professional University, Phagwara, Punjab during Rabi 2021-2022. The experiment was conducted in Randomised Block Design with three replications and consists of Ten treatment in combinations viz. 100% RDF, 75% RDF + 25% FYM, 50% RDF + 50% FYM, 75% RDF + 25% Vermicompost, 50% RDF + 50% Vermicompost, 75% RDF + 25% Cowdung cake, 50% RDF + 50% Cowdung cake, 75% RDF + 25% Poultry manure, 50% RDF + 50% Poultry manure, Control 100%RDF. The experiment reveals that among the various treatments, the growth characters like plant height (36.63 cm), number of leaves (22.92), plant spread (72.65 cm), stalk length (10.82 cm), diameter of head (13.74 cm) was recorded higher at harvest, minimum days taken for head initiation (35.58 DAT) and the yield characters like average head weight (845.33 g), head yield (37.18 t/ha) was recorded higher in the treatment T5 receiving 50% RDF + 50% Vermicompost. Thus, the influence of Integrated Nutrient Management has enhanced the production of Red Cabbage under Punjab conditions.

Keywords: Red cabbage, INM, vermicompost, poultry manure, cowdung, RDF

Introduction

Red cabbage is among the most well-known vegetables in India and other places around the world. Cabbage belongs to member of cole family of vegetables, which descended from a single wild progenitor known as wild cabbage (*Brassica oleraceae var. Capitata*). It belongs to the Brassicaceae family and the genus *Brassica*. It was Originated in Southern Europe. Chromosome number of Cabbage is $2n=18$. Cabbage, including red cabbage, is grown on 400 thousand hectares in India, yielding 9127 MT (NHB 2018-19). In Andhra Pradesh, crops are grown on 5.43 million hectares, yielding 81.45 million tonnes. Red Cabbage output together with cabbage reached 69.4 million tonnes worldwide, China is the leading producer, providing 48% of overall output. India, South Korea, and Russia were the other main producers of the world’s production (NHB 2018). In India major growing states of Cabbage are Andhra Pradesh, U.P, Orissa, Bihar, Assam, West Bengal, Maharashtra, and Karnataka. Red Cabbage also grown in kitchen gardens, commercial fields, like greenhouses and poly house.

Red cabbage is a delicious and healthy vegetable. It contains abundant nutrients such as Ca, Mn Mg, Fe, K, vitamin A, E K, and Ascorbic acid as well as dietary fibre. Cabbage may be cooked and eaten in several ways. The easiest alternatives are to consume the vegetable raw or steam it, but cabbage is also pickled, stewed, sautéed, or braise in various cuisines. Pickling cabbage is a conventional way of preserving it and used to produce meals like sauerkraut and kimchi. However, Chinese cabbage is commonly used in kimchi (*B. rapa subsp. Pekinensis*). Cabbages which having smooth-leaves are utilized for both processing and marketing. Commonly Savoy cabbages are used mostly for salads. Raw cabbage consists of 92 percent water, 6% carbs, 1% protein, and very low amount of fat. Raw cabbage contains 44 percent of Ascorbic acid and 77 percent of Vitamin K in a required quantity used daily in a 100gram reference quantity. Red Cabbage also contains a considerable amount of vitamin B6 and folate (10–19 percent DV), but no additional nutrients are present in substantial amounts per 100-gram intake.

Red Cabbage growth, yield, and quality are all influenced by a variety of interconnected factors. INM is the most significant and fundamental element among them. Integrated Nutrient Management, which includes organic, inorganic, and microorganism components, is extremely

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advantageous for long-term crop production because it improves soil habitat, ensures sufficient nutrient levels, and creates favourable conditions for high yields of desired quality. The use of organic and inorganic nutrient supplies not only increases crop production, but also serves as a storehouse of nutrients for subsequent crops, as well as enhancing soil physical condition. Bio-organic nutrition also increases the product quality. Organic manures enhance the physical and chemical qualities of soil while also balancing the nutrient supply. Nitrogen is a vital nutrient that is a component of protein and increases the plant's photosynthetic ability and yield as a result. Phosphorus is the most important factor of energy transfer since it is a component of nucleic acid, phospholipids, and coenzymes.

Materials and Methods

The present study entitled "Effect of Integrated Nutrient Management on Growth and Yield of Red Cabbage (*Brassica oleracea var. Capitata*)" was conducted during the year 2021-2022. The experiment was carried out during November 2021 to January 2022 at the teaching and research farm of Lovely Professional University, Phagwara (Punjab). The details of materials used and methodologies adopted are described below. The farm is situated at 31022'31.81" North latitude and 75023'03.02" East longitude with 252m average

elevation above mean sea level. It is at 350 km distance from capital of India Delhi in Punjab fall under sub-tropical region in central plane of state Argo climatic zone. The experiment was conducted in Randomised Block Design with three replications and consists of Ten treatment in combinations viz. 100% RDF, 75% RDF + 25% FYM, 50% RDF + 50% FYM, 75% RDF + 25% Vermicompost, 50% RDF + 50% Vermicompost, 75% RDF + 25% Cowdung cake, 50% RDF + 50% Cowdung cake, 75% RDF + 25% Poultry manure, 50% RDF + 50% Poultry manure, Control 100%RDF. The experimental field was ploughed twice and harrowed to a depth of 30 cm. The field was laid out with a gross plot size of 5 metres by 3.5 metres and a net plot size of 4 metres by 2 metres. Standard management and cultural practices were implemented. five plants are tagged in each plot, observations were made on several growth and yield parameters like plant height (cm) at (45 DAT, 60DAT, at Harvest), number of leaves at (45 DAT, 60 DAT, at Harvest), plant spread (cm) at (45 DAT, 60DAT, at Harvest), stalk length (cm) at harvest, diameter of head (cm) at harvest, minimum days taken for head initiation (DAT), average head weight (gm), head yield (t/ha), are among the observations. An analysis of variance was performed on the data collected (ANOVA). At 0.05 percent probability, the test of significance (t-test) and crucial difference were determined.

Table 1: Effect of Integrated Nutrient Management on Growth, Yield and Quality Characters.

Treatments	Plant height (cm)	Number of leaves	Plant Spread (cm)	Stalk length (cm)	Minimum days taken for head initiation	Average Head Weight (gm)	Head diameter (cm)	Yield (t/ha)	Ascorbic Acid (%)
100% RDF	31.90	16.59	56.91	8.69	38.55	620.00	12.63	27.28	30.82
75% RDF + 25% FYM	32.65	17.59	62.70	8.16	39.91	615.00	12.67	28.02	32.46
50% RDF + 50% FYM	34.23	17.39	60.50	8.54	39.80	730.00	11.87	27.38	32.36
75% RDF + 25% Vermicompost	33.25	18.41	69.42	8.95	39.43	845.33	12.94	32.11	33.41
50% RDF + 50% Vermicompost	36.63	22.92	72.65	10.82	35.68	606.00	13.74	37.28	32.07
75% RDF + 25% Cowdung cake	32.15	16.44	65.90	8.91	37.90	723.00	12.51	31.81	32.91
50% RDF + 50% Cowdung cake	32.54	18.22	62.50	8.71	38.68	659.10	11.86	29.01	33.31
75% RDF + 25% Poultry manure	33.83	16.55	62.58	8.39	36.26	791.00	13.04	34.80	35.31
50% RDF + 50% Poultry manure	35.63	17.40	69.72	9.31	39.72	550.00	12.35	28.60	32.98
Control	29.50	15.78	55.34	7.65	40.15	26.77	10.03	24.20	31.17
CD at 5%	1.35	1.02	3.33	0.40	2.14	26.77	0.69	1.31	1.47
SE(m)	0.45	0.34	1.11	0.13	0.71	8.90	0.29	0.44	0.56
SE(d)	0.40	0.58	1.67	0.28	1.01	12.60	0.38	0.62	0.65

Result and Discussion

The results of the field experiment conducted at teaching and research farm, Lovely Professional University, Phagwara on "Effect of Integrated Nutrient Management on Growth and Yield of Red Cabbage (*Brassica oleracea var. Capitata*) Under Punjab Conditions"

Growth and yield characters

Plant height, number of leaves, plant spread, and stalk length were all significantly different between treatments. The treatment receiving combination (50% RDF + 50% Vermicompost), at T₅ was significantly superior. The highest plant height recorded is (36.63 cm), Number of leaves (22.92 per plant), plant spread (72.65 cm), and stalk length is (10.82 cm) at harvest.

The increase in growth parameters is due to application of required fertilizers in combination with vermicompost. This vermicompost helps in increasing the fertility of the soil and water holding capacity. By providing vermicompost in the experimental plot the physical properties of soil increases,

which in-turn increases the availability of nutrients to the plant which further enhances the plant growth. Besides this vermicompost also helps in supply of nitrogen in a larger amount aided in increased chlorophyll content, which leads to increase in rate of photosynthesis and carbohydrate supply to the plant. Because nitrogen is a component of protein and chlorophyll, it is essential to the photosynthesis process. This boosted the accumulation of food components, which raised growth and yield characteristics, and eventually production of cabbage. Similar, results were found in (M.M Choudhary *et al.*, (2015) ^[2], (Budha Rabindra *et al.*, (2021), (Prashant Tiwari *et al.*, (2021) ^[5], (Abhilash Singh *et al.*, (2020) ^[4]. Whereas, the lower values of plant height (16.25 cm), Number of leaves per plant (15.78 cm), plant spread (55.34 cm) and stalk length is (7.65 cm) which was observed in control plot. Minimum days taken for Head formation is (35.68 DAT) observed in treatment T₅ receiving 50% RDF + 50% Vermicompost. Whereas, the maximum days taken for Head formation was observed in control (40.15 DAT). Which is treatment T₁₀. However, treatment T₅ which is receiving

(50% RDF + 50% Vermicompost) has recorded the highest head yield (37.28 t/ha) and the lowest head yield was observed in Control plot of T10 (24.20 t/ha). The maximum head weight (845.33 gm), head diameter (13.74 cm), was recorded in treatment T₅ receiving (50% RDF + 50% Vermicompost). The weight of the cabbage head has increased due to better root proliferation and rhizosphere growth. This was due to prolonged availability of nutrients from the plot which is treated with vermicompost, increased in nutrient availability and water intake, as well as increased leaf area development, resulting in a higher rate of photosynthetic activity. This leads to increase in the volume of head, which further increases weight of head, due to increase in supply of nitrogen the meristematic growth of the plant increases, this induces greenness in plant leaves by increasing chlorophyll synthesis. Besides this the head diameter increases which in-turn helps to increase head volume. The nutritional richness of vermicompost above farm yard manure was attributable to its fast mineralization and increased availability of nitrogen and other plant nutrients that encouraged root development and produced changes in root shape, affecting nutrient uptake. Similar, results were found in (M.M Choudhary *et al.*, (2015)^[2], (J. Khatkar *et al.*, (2018)^[3], (Jeelani Zargar *et al.* (2022)^[6],

Conclusion

The perusal from this study can be concluded as follows; in terms of growth and yield parameters, it can be found that treatment T₅ i.e., (50% RDF + 50% Vermicompost) have produced best results in almost all parameters *viz.*, plant height, Number of leaves, Plant spread, Stalk length, Head diameter, Head weight, yield per ha. Thus, it is clearly seen that Integrated Nutrient Management has a greater effect in the overall growth and production of red Cabbage under Punjab conditions.

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