The Pharma Innovation Journal 2022; 11(3): 2046-2048

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 2046-2048

www.thepharmajournal.com
Received: 02-12-2021
Accepted: 06-02-2022

Shivani Sadanand
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj, Uttar Pradesh, India

Urfi Fatmi
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj, Uttar Pradesh, India

Corresponding Author:
Shivani Sadanand
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj, Uttar Pradesh, India

Effect of organic and inorganic fertilizers on growth, quality and yield of red cabbage (*Brassica oleracea* var. *capitata* f. Rubra) cv. Red Jewel

Shivani Sadanand and Urfi Fatmi

Abstract
The experiment on the effects of different combinations of organic and inorganic fertilizers on growth, quality and yield of red cabbage (*Brassica oleracea* var. capitata f. *rubra*) was carried out in the research farm of Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India. The experiment was carried out during *Rabi* season of 2019- 2020 in Randomized Block Design with three replications. The variety used was Red Jewel. The results shown that the highest growth parameters were obtained by application of nitrogen through inorganic fertilizer at plant height 33.6 cm, number of leaves 36 and plant spread 55.7 cm, whereas treatment T5 (50% Nutrient through inorganic fertilizer + 50% through Vermi-compost) was found best in respect to yield and quality parameters via, {maximum head diameter (26.32 cm), head size (32.86 cm), gross head weight (1470.2 g), net head weight (988.7 g), highest head yield/plot (6.72 kg/ha), highest head yield (25.1 kg t/ha), highest Vitamin C (58.8 mg/100g) and TSS (5.49 ºBrix)} followed by treatment T4 (50% Nitrogen through inorganic fertilizer + 50% through FYM). Treatment T4 also gave best net return (₹ 3, 03,779/ha) with B: C ratio (4.07:2). The study revealed that, treatment T5 and T4 provides high benefits in respect to yield and quality parameters to the farmers through easy cultivation. Therefore, T5 and T4 could be good option farmers for the cultivation in Prayagraj agro-climatic condition.

Keywords: Red cabbage, effect, organic and inorganic fertilizer, growth, quality, yield

Introduction
Red cabbage (*Brassica oleracea* var. capitata f. *rubra*) is a native crop in the Mediterranean region of Europe. It belongs to the family *Brassicacea* and now grown all over the world as a fresh market vegetable. Red cabbage is a small, round headed type with dark red leaves. Red cabbage synthesized and accumulated anthocyanins at all the developmental stages of vegetative growth (Yuan *et al.* 2009) [8]. The health benefit of red cabbage includes prevention from cancer, premature aging, diabetes, ulcer and Alzheimer's diseases. It helps in weight loss, boosting the immune system, improving the skin and eye and detoxification of body. It is an excellent source of Vitamin C. In addition to containing some B vitamins, cabbage supplies some potassium and calcium to the diet. Other benefits of growing red cabbage are that the cost of cultivation is inexpensive, the crop yields quickly, and harvesting and storage operations can be performed easily. Like animals' plants growth depends on the nutrition. Plants need nutrition to germinate, grow, fights off diseases and pests. There are plant nutrients which are essential for plant growth. The three which are taken from atmosphere are carbon, hydrogen and oxygen and other elements are taken from soil. The major nutrients are nitrogen, phosphorus, potassium, Sulphur, magnesium and calcium. The minor nutrients, also called as trace elements are molybdenum, copper, boron, manganese, iron, nickel, zinc and chlorine. The deficiency of these elements reduces plant growth and vigor. The application of organic manure increases soil organic matter content and this leads to improved water infiltration and water holding capacity as well as an increased action - exchange capacity. Application of excess amounts of chemical fertilizers has led to environmental hazards, such as nitrate contamination in ground water, the surface runoff of phosphorus and eutrophication of aquatic ecosystems. In recent years, the pursuit of quality, fresh, non-toxic and safe products have become a trend in global agricultural production. One promising method to reduce the negative environmental effects caused by agricultural chemicals is the application of photosynthetic. Organic manure is an important input for maintaining and enhancing soil fertility. Manure contains the three major plant nutrients, nitrogen, phosphorus and potassium (NPK), as well as many essential nutrients such as Ca,

Mg, S, Zn, B, Cu, Mn etc. That, in addition to supplying plant nutrients, manure generally improves soil fertility, aeration, and water holding capacity of the soil and promotes growth of beneficial soil organisms.

Materials and Methods

The experiment was conducted at Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, and Prayagraj (UP) during 2019-2020. All the facilities necessary for cultivation, including labor were made available in the department. The details of the materials to be used and the methods to be adopted for this study are presented in this chapter. Prayagraj is situated at an elevation of 98 meters above sea level at 25.87º North latitude and 81.15º E longitudes. This region has a sub- tropical climate prevailing in the South-East part of U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 2-5 ºC in December – January and very hot summer with temperature reaching up to 46 ºC in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The average rainfall is around 850-1100mm with maximum concentration during July to September months with occasional showers in winters. The experiment was carried out in Randomized Block Design (RBD). The experiment was consisted of ten treatments which were consisted of three replications. Details of treatments presented in table 1.

Table 1: Details of the Treatments

Treatment	Treatment Combination
T0	Control (100% Nitrogen through inorganic)
T1	25% Nitrogen through inorganic fertilizer + 75% nitrogen through FYM
T2	25% Nitrogen through inorganic fertilizer + 75% nitrogen through Vermi-compost
T3	25% Nitrogen through inorganic fertilizer + 75% nitrogen through poultry manure
T4	50% Nitrogen through inorganic fertilizer + 50% nitrogen through FYM
T5	50% Nitrogen through inorganic fertilizer + 50% nitrogen through Vermi-compost
T6	50% Nitrogen through inorganic fertilizer + 50% nitrogen through poultry manure
T7	75% Nitrogen through inorganic fertilizer + 25% nitrogen through FYM
T8	75% Nitrogen through inorganic fertilizer + 25% nitrogen through Vermi-compost
T9	75% Nitrogen through inorganic fertilizer + 25% nitrogen through poultry manure

Thirty days old healthy seedlings having two pairs of leaves with a height of 10 to 15 cm were selected from the nursery and transplanted according to the spacing (60x45cm) and irrigated immediately thereafter.

Results

Plant height (cm)

At 20 DAS results varied non-significantly during growth period as supply of nutrient was rapid which showed no variation during starting days. Whereas, 40, 60 and 80 DAT results indicated that the plant height varied significantly. The highest plant height was recorded in T0 (33.75cm) followed by T5 (35.3cm) and the lowest was recorded in T9 (28.0cm). Chaudhary *et al*., (2020) [4] reported a similar finding in Rabi onion.

Number of leaves

The highest number of leaves was recorded in T0 and T5 (37 leaves). Similar findings were reported in rabi onion Chaudhary *et al.*, (2020) [4] where highest number of leaves was found in T1 (100% from inorganic fertilizers).

Plant spread (cm)

The maximum plant spread (55.7cm) was recorded in T0 and the lowest plant spread was recorded in T9 (38.0 cm).

Head diameter (cm)

The maximum head diameter of red cabbage was recorded in T5 (26.38 cm) followed by T4. The treatment T9 (17.36 cm) recorded the minimum head diameter. Similar findings were also reported by Dalal *et al*. (2010) [5], Ghosh *et al*. (2009) [6] and Choudhary *et al*., (2012) [3] in broccoli. Subhan (1988) [13] observed that application of organic manure increased head diameter.

Head size (cm)

The maximum head size of red cabbage 32.86 cm was recorded in followed by T4. The treatment T9 recorded the minimum head size 20.8 cm. Similar findings were also reported by Dalal *et al*. (2010) [5], application of nitrogen through various sources significantly influenced the size of the head.

Gross head weight (g)

The maximum gross head weight of red cabbage was recorded in T5 (1470.2 g) followed by treatment T4. The treatment T9 (890.9 g) recorded the minimum gross head weight. Similar findings were reported by Ghuge *et al*. (2007) [7], where they observed that combination of inorganic fertilizers and vermi-compost gave maximum gross head weight in cabbage.

Net head weight (g)

The highest net head weight of red cabbage 988.7g was recorded in T5 followed by treatment T4. The treatment T9 (637.2 g) recorded the minimum net head weight. Organic manure and inorganic fertilizer combined provide nutrients to plant that influenced the increased gross and net weight of cabbage. Similar findings were reported by Ghuge *et al*. (2007) [7], where application of nitrogen through various sources significantly influenced the gross weight of the head.

Head yield/plot (kg/ha)

The highest head yield of red cabbage 6.72 kg was recorded in was recorded in treatment T5 followed by treatment T4. The treatment T9 recorded the minimum net head weight 3.33kg. Sajib *et al*. (2015) also found the same results in an experiment, where the head yield/plot was significantly influenced by application of different organic manures and inorganic fertilizers.

Head yield (t/ha)

The highest head yield of red cabbage 25.1kg was recorded in T5. The treatment T4 was found statistically at par with T5 and treatment T3 recorded the minimum net head weight 17.4kg. The findings were found similar with Ghuge *et al*. (2007) [7]. They observed that maximum estimated yield per hectare was noticed in soil treated with vermicompost and inorganic fertilizers.

Ascorbic acid/Vitamin C (mg/100g)

The maximum Vitamin C content of red cabbage 58.8 mg/100g

was recorded in T5, followed by T4 (57.7 mg/100g) and minimum in T0 (43.8 mg/100g). Similar findings were reported by Dalal *et al.* (2010) [5], maximum vitamin C content (36.12 mg/100g) was recorded with the application of nitrogen 50% through urea + 50% through Vermi-compost.

Total Soluble Solids (ºBrix)

The maximum total soluble solid of red cabbage (5.49 ºBrix) was recorded in T5, followed by T2 (5.42 ºBrix). The treatment T0 recorded the minimum total soluble solids at 3.29 ºBrix. Similar findings were reported by Rai *et al.* (2013) [6]. The result revealed that application of Vermi-compost in combination with inorganic NPK fertilizers increased the total soluble solids in cabbage.

Discussion

Maximum growth parameters in red cabbage *i.e.*, plant height, number of leaves and plant spread through inorganic fertilizer be due to mainly quick and timely supply of plant nutrient, that resulted proper vegetative growth. The yield parameters *i.e.*, head size (cm) and head diameter (cm) in T5 might be due better availability of nutrients (macro and micro) through judicious application of inorganic fertilizers and vermicompost along with growth enhancing substances found in vermicompost which enhance plant growth, higher translocation of carbohydrates from the synthesis site (leaves) to sink tissue (head), thereby resulting in bigger head size and diameter. The maximum gross and net head weight (g), might be due to mainly greater size of head and more accumulation of water, enhanced deposition of soluble solids, increased photosynthetic rate and carbohydrate accumulation as a result increased availability of plant nutrients responsible for better plant growth, increased number of leaves and increased weight of head. Increased number of healthy folded leaves and compactness of head resulted maximum gross and net weight of red cabbage. The maximum rate of vitamin C content in treatment T5 might be due to better availability of potassium and phosphorus present in vermin-compost. They might have an improved effect on ascorbic acid and sugar content (Muthukumar *et al*., 2019) [10]. K plays an important role in many metabolic processes and enzyme activation and P is essential for nutrient absorption, photosynthetic, energy transfer and is cofactors of many antioxidant metabolisms (Meng *et al*., 2021) [9]. Their role and adequate nutrition might have increased soluble solids and ascorbic acid concentration in red cabbage (Wien, 1997) [15]. Ascorbic acid also tends to increase as the plant yield is increased by fertilizer application. Maximum TSS resulted in T5 might be due to increased macro and micro nutrients through vermicompost which accelerated the physiological process like carbohydrate synthesis, enhanced accumulation of carbohydrates in the head, which ultimately increased TSS in red cabbage (Antipchuk *et al*., 1982) [1]. The addition of synthetic fertilizers and lack of nutrient supply may have resulted in unsatisfactory production of TSS and ascorbic acid in the control.

Conclusion

On the basis of the present investigation it is concluded that the treatment T5 (50% Nitrogen through inorganic+ 50% nitrogen through vermi-compost) was found best in respect to yield and quality parameters *via*, {highest head diameter (26.32 cm), head size (32.86 cm), gross head weight (1470.2g), net head weight (988.7g), head yield/plot (6.72 kg/ha), highest head yield (25.1 t/ha), highest Vitamin C/Ascorbic acid (58.8 mg/100g) and TSS (5.49 ºBrix)} followed by treatment T4 (50% Nitrogen through inorganic+ 50% through FYM) which was also found best in net return (₹ 3, 03,779/ha) with B: C ratio (4.07:2) of red cabbage. While application of nitrogen through inorganic fertilizers was found best in respect to growth parameters *via,* highest plant height (22.21 cm), highest number of leaves (14.25) and highest plant spread 29.85 cm. Therefore, it is concluded that application of inorganic NPK fertilizers in combination with vermi-compost and FYM increased the productivity and quality of red cabbage. Quantitative and qualitative characters of red cabbage could be improved with the application of vermi-compost, and T5 and T4 could be good option farmers for the cultivation in Prayagraj agro-climatic conditions.

References

1. Antipchuk AF, Tanstrika EV, Manstseyaluk RM. Effect of bacteris on tomato yield and quantity. Technologia Pr-va-i-Effectivenost. Primeneniya-Bacterialnykh-Udobreni. 1982;98-193.
2. Banik P, Sharma RC. Effect of organic and inorganic sources of nutrients on the winter crops- rice based cropping system in sub-humid tropics of India. Archive of Agronomy and Soil Science. 2009;55:285-294.
3. Choudhary S, Soni AK, Jat NK. Effect of organic and inorganic sources of nutrients on growth, yield and quality of sprouting broccoli cv. CBH-1. Indian Journal of Horticulture. 2012;69(4):550-554.
4. Chaudhary SK, Yadav SK, Mahto DK, Singh SK, Singh BB and Sinha N. Effect of Different Organic and Inorganic Sources of Nutrients on Growth and Yield of Rabi Onion (Allium cepa L.) Bihar. International Journal of Current Microbiology and Applied Sciences. 2020;9(10):2851-2858.
5. Dalal VV, Bharadiya PS, Aghav VD. Effect of organic and inorganic fertilizer sources of nitrogen on growth and yield of cabbage (Brassica oleracea L. var. capitata). Asian Journal of Horticulture. 2010;5(2):291-293.
6. Ghosh C, Mandai J, Chattopadhyay NG. Effect of vermi-compost on growth and yield of cabbage (Brassica oleracea L. Var. Capitata). International Conference on Horticulture, 2009.
7. Ghuge TD, Gore AK and Jadav SB. Effect of organic and inorganic nutrient sources on growth, yield and quality of cabbage (Brassica oleracea var. capitata). Journal Soils and Crops. 2007;17(1):89-92.
8. Hasan MR, Solaiman AHM. Efficacy of organic and organic fertilizers on the growth of Brassica oleracea L. (cabbage). International Journal of Agriculture and Crop Sciences. 2012;4(3): 128-138.
9. Meng X, Chen WW, Huang ZR, Ye X. Chen LS. Effects of Phosphorus deficiency on the absorption of mineral nutrients, photosynthetic system performance and antioxidant metabolism in Citrus grandis. PLos ONE. 2021;16(2):e0246944
10. Muthukumar M, Jeyakumar P, Sritharan N, Somasundaram E, Ganesan K. Effect of Organic and Inorganic Fertilizers on Postharvest Physiological Characters of Tomato. International Journal of Pure Applied Biosciences. 2019;7(3):454-460.
11. Rai R, Thapa U, Mandal AR, Roy B. Growth, yield and quality of cabbage (*Brassica oleracea* var. *capitata* L.) as influenced by Vermi-compost. Environment and Ecology. 2013;3(1):314-317.
12. Sajib K, Kumar DP, Adhikary B, Mannan AM. Yield Performance of Cabbage under Different Combinations of Manures and Fertilizers. World Journal of Agricultural Sciences. 2015;11(6):411-422.
13. Subhan. Effect of organic materials on growth and production of cabbage (Brassica oleracea L.). Bulletin of Peletitian Horticulture. 1998;16(4): 37-11.
14. Yuan Y, Chiu L, Li L. Transcriptional regulation of anthocyanins biosynthesis in red cabbage. Planta. 2009;230:1141-1153.
15. Wien HC. The physiology of Vegetable crops. CAB INTERNATIONAL. 1997.