



Effect of NPK and Organic Manures on Growth, Yield and Quality of Pak Choi (*Brassica rapa sp. chinensis*) cv. Pusa Pak Choi-1

Surbhi Kumari ^{a+++*}, Vijay Bahadur ^{b#} and Samir E. Topno ^{b†}

^a Vegetable Science, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj-211007 (UP), India.

^b Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj-211007 (UP), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i163143

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/101753>

Original Research Article

Received: 12/04/2023

Accepted: 14/06/2023

Published: 23/06/2023

ABSTRACT

A field experiment was done on non-heading type of Chinese cabbage i.e. Pak choi (*Brassica rapa sp. chinensis*) on the topic the "Effect of NPK and Organic Manures on growth, yield and quality of Pak choi (*Brassica rapa sp. chinensis*) cv. Pusa pak choi-1 was undertaken at vegetable research farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP) in December 2021. The experiment was laid out in Randomized Block Design with 9 treatments and 3 replications. The treatments were T₀(control), T₁ (FYM @20t/ha), T₂ (poultry manure@15t/ha) T₃ (VC@10t/ha) T₄ (FYM+PM+VC@4t/ha+2t/ha+1t/ha) T₅ (75%NPK+25%FYM) T₆ (75%NPK+25%VC) T₇

⁺⁺ Research Student;

[#] Associate Professor;

[†] Assistant Professor;

*Corresponding author: E-mail: surbhisingh6464@gmail.com;

(75%NPK+25%PM) T₈ (25%NPK+25%FYM+25%VC+25%PM). Seed were sown at the spacing of 30 cm×45 cm. Result of this experiment revealed as T₂ (PM@15t/ha) was found best among all treatments with respect to plant height (17.84 cm), number of leaves (11.40), T.S.S (3.69⁰Brix), Ascorbic acid (2.28mg/100g), fibre content (.74g), yield (77.18q/ha). Similarly, Gross return (Rs.154400) recorded maximum in T₂. But net return (Rs.79560) and benefit cost ratio were recorded maximum in T₅ (75%FYM+25%NPK).

Keywords: Pak choi; Bok choy; organic manure; vermicompost (VC); farmyard manure (FYM); poultry manure (PM); growth parameter; quality parameter; yield parameter.

1. INTRODUCTION

Vegetables are rich sources of minerals and vitamins and are required in daily diet in approx.300g /day and green leafy vegetables in 125g on basis of daily requirement because it is the main source of minerals and rich in dietary fibres [1-3]. There are many under-exploited crops which are very essential for human health. Pak choi (*Brassica rapa sp. chinensis*) is a leafy vegetable belongs to the family Brassicaceae, with diploid chromosome number 20.

All the above part of this vegetable is edible. Raw vegetable contains 95% water, 2% carbohydrates, 1% protein and less than 1% fat. Pak choi provides 54 kilojoules of food energy and is a rich source of vitamin A, vitamin C and vitamin K while providing folate, vitamin B6 and calcium in moderate amounts [4-6].

Chinensis varieties of Chinese cabbage is non heading type. It does not form heads and has green leaf blades with higher bulbous bottom instead, forming a cluster reminiscent of mustard greens. It has a flavour between spinach and water chestnut but highly sweeter with mildly peppery undertone. A green leaf of Pak choi have a stronger flavour than white petiole [7-9].

It is a cool season leafy crop but it requires large amount of water during whole plant growth especially in Aug-sept. Required amount of water depends on stage of plant growth, soil type, and weather conditions [10,11].

Now a days because of continuous use of Inorganic/chemical fertilizer led environmental hazards such as nitrate contamination of ground water which cause blue baby syndrome, surface runoff water, eutrophication of aquatic system and also reduces soil fertility. To enhances the soil structure and to make it more fertile organic manure is very helpful. Organic fertilizer like

vermicompost, poultry manure, farmyard manure etc [12-14].

Organic manure is an ideal soil amendment. When it is applied to the agricultural fields it acts as a field residue. Farmers can sell the manure to people who need to improve their soil fertility [15-17]. Thus, it can bring income to farmers. They add to the overall soil ability and sustainability. Manure increases the water holding capacity of the soil.

2. MATERIALS AND METHODS

The experiment was designed to study the effect of NPK and organic manures on growth, yield and quality of Pak choi (*Brassica rapa sp. Chinensis*) cv. Pusa pak choi-1 carried out at Research field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). During Dec 2021-Feb 2022.

The experiment was laid out in Randomized Block Design (RBD) with nine treatments and three replications. Whole experimental area was 54m², which was divided into 27 plots and total no. of plants was 327 with spacing 30 cm x 45 cm.

Organic manures and NPK was applied as per the recommendations. Seed was sown at the depth of 1cm in ridges of raised beds. Other cultural practices like irrigation, weeding, and plant protection were carried out as and when required. Five representative individual plants were selected for observation of different parameters at regular intervals. Harvesting of plant was done at 45 DAS.

Statistical analysis by done by using method of analysis of variance (ANOVA) for randomized block design (RBD) by Fisher and Yates. whenever, F- Test was found significant for comparing the means of two treatments, critical difference (C.D. @ 5%) was worked.

Table 1. List of treatments combination

S. no.	Treatment no.	Treatment description
1	T ₀	RDF (N:P: K) chemicals
2	T ₁	FYM@20t/ha
3	T ₂	Poultry manure (PM) @15t/ha
4	T ₃	Vermicompost (VC) @10t/ha
5	T ₄	FYM+PM+VC@4t/ha+2t/ha+1t/ha
6	T ₅	75%NPK+25%FYM
7	T ₆	75%NPK+25%PM
8	T ₇	75%NPK+25%PM
9	T ₈	25%NPK+25%FYM+25%VC+25%PM

3. RESULTS AND DISCUSSION

3.1 Growth Parameter

The plant height was found to be significant among the treatments. The maximum plant height was recorded in treatment T2 (PM@15t/ha) (17.84cm), followed by T6 75% NPK+25%VC) (16.86cm), whereas the minimum plant height was found in treatment T0 (14.52 cm).

The highest no. of leaves (11.40) recorded in treatment T2 (PM@15t/ha) followed by T8(25%NPK+25%PM+25%FYM+25%VC) (9.93), whereas the minimum number of leaves found in T0(8.67).

The growth parameters of Pak choi was improved due to improvement in soil increase organic matter and nutrient retainment, better water holding capacity. The plant showed better performance in treatment with poultry manure as compare to control.

Poultry manure improve the soil fertility as it contains highest nitrogen, phosphorus and potassium among all the organic manures. It was found that T2 (poultry manure @ 15 tonnes/ha) showed best result among all the treatments.

3.2 Quality Parameters

As per the data in table and figure it is clearly shows that different treatments significantly influenced the TSS of Pak choi. The highest TSS observed in treatment T2(poultry manure @15t/ha) (3.69⁰brix) followed by T3(vermicompost@10t/ha) (3.59⁰brix) whereas the minimum TSS was found in T0 (3.05⁰brix).

As per the data in table it is clearly shows that different treatments significantly influenced the ascorbic acid content of Pak choi. The highest ascorbic acid content was observed in treatment T2 (poultry manure @15t/ha) (2.28 mg/100g) followed by T3 (vermicompost@10t/ha) (2.01mg/100g) whereas the minimum ascorbic acid content was found in T0 (1.63mg/100g).

As per the data in table it is clearly shows that different treatments significantly influenced the fiber content of Pak choi. The highest fiber content was recorded in treatment T2 (poultry manure@15t/ha)(.74g) followed by T5(@75%NPK+25%FYM) (.71g) whereas the minimum fiber content was found in T0(.56g).

3.3 Yield Parameter

As per the data in table and figure it is clearly shows that different treatments significantly influenced the weight of Pak choi. The highest petiole weight observed in treatment T2(poultry manure @15t/ha) (1.74kg)) followed by T3(vermicompost@10t/ha) (1.60kg) whereas the minimum weight was found in T0 (control) (1.18 kg).

As per the data in table and figure it is clearly shows that different treatments significantly influenced the weight of Pak choi. The highest petiole weight observed in treatment T2(poultry manure @15t/ha) (77.18q)) followed by T3(vermicompost@10t/ha) (71.30q) whereas the minimum petiole weight was found in T0 (control) (52.52q).

Poultry manure improve the soil fertility as it contains highest nitrogen, phosphorus and potassium among all the organic manures. It was found that T2 (poultry manure @ 15 tonnes/ha) showed best result among all the treatments.

Table 2. Effect of NPK and Organic manures on growth parameter, yield parameter and quality parameter

Treatments	Plant height (cm)	No. of leaves	TSS (^o Brix)	Ascorbic acid (mg/100g)	Fiber content (g)	Yield per Hectare (wt. in qt.)
T ₀ -RDF (N:P: K) Chemicals	14.52	8.67	3.05	1.63	0.56	52.50
T ₁ -FYM@20t/ha	15.53	9.67	3.27	1.81	0.59	56.43
T ₂ -Poultry manure@15t/ha	17.84	11.40	3.69	2.28	0.74	77.17
T ₃ -Vermicompost@10t/ha	15.40	9.17	3.59	2.01	0.67	71.30
T ₄ - FYM + Poultry manure Vermicompost + @ 4t/ha + 2t/ha + 1t/ha	15.69	9.37	3.12	1.99	0.68	59.73
T ₅ -75%NPK + 25%FYM	15.23	9.67	3.15	1.91	0.71	59.10
T ₆ -75%NPK + 25%Vermicompost	16.86	9.13	3.47	1.75	0.70	60.07
T ₇ -75%NPK + 25%poultry manure	15.71	9.40	3.16	1.99	0.67	57.00
T ₈ -25%NPK + 25%PM + 25%FYM + 25%VC	15.97	9.93	3.17	1.88	0.61	57.57
F-test	S	S	S	S	S	S
S.E.(m)	0.45	0.33	0.13	0.11	0.012	6.49
C.D.(P=0.05)	1.36	0.99	0.39	0.33	0.035	13.76
C.V.	14.52	5.95	6.83	9.77	3.06	12.99

4. CONCLUSION

From the present investigation concluded that the treatment T2 (poultry manure @15t/ha) performed best among all the treatments in terms of growth, yield and quality parameters.

In terms of economics, T5 (75%NPK+25%FYM) gave the highest benefit: cost ratio.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Naguib Abd El-Moniem M, Farouk K. El-Baz, Salama Zeinab A, H. Abd El Baky Hanna Hanaa F. Ali, Alaa A. Gaafar. Enhancement of phenolics, flavonoids and glucosinolates of Broccoli (*Brassica oleracea*, var. Italica) as antioxidants in response to organic and bio-organic fertilizers Journal of the Saudi Society of Agricultural Sciences. 2012;135-142.
- Moyin-Jesu Emmanuel Ibukunoluwa. Use of different organic fertilizers on soil fertility improvement, growth and

head yield parameters of cabbage (*Brassica oleracea* L) Int. J. Recycl. Org Waste. Agricult. 2015;4:291–298.

- Jigme, Jayamangkala Nipon, Sutigoolabud Pathipan, Jirapon Inthasan, Siriwat Sakhonwasee. studied on the effect of organic fertilizers on growth and yield of broccoli (*Brassica oleracea* L. var. italica Planck cv. Top Green). Journal of Organic Systems. 2015;10(1).
- Srichandan S, Mangaraj AK, Behera KK, Panda D, Das AK, Rout M. Growth and Economics of Broccoli (*Brassica oleracea* var. *Italica*) as Influenced by Organic and Inorganic Nutrients. International Journal of Agriculture, Environment and Biotechnology. 2015; 965-970.
- Reza MS, Islam AKMS, Rahman MA, Miah MY, Akhter S, Rahman MM. Impact of organic fertilizers on yield and nutrient uptake of cabbage (*Brassica oleracea* var. *capitata*). Journal of Science, Technology and Environment Informatics. 2016; 03(02):231-244.
- Dunsin O, Aboyeji CM, Adekiya AO, Aduloju MO, Agbaje GO, Anjorin, Oluwa Seun. Effect of biochar and NPK fertilizer on growth, biomass yield and nutritional quality of kale (*Brassica oleracea*) in a

- derived agro-ecological zone of Nigeria. Patnsuk Journal; 2017.
7. Altaf Muhammad Ahsan, Shahid Rabia, Altaf Muhammad Asad, Ren Ming-Xun, Tan Ke, Xiang Wen-Qian, Qadir Abdul, Shakoor Awais, Altaf Muhammad Mohsin. Effect of NPK, organic manure and their combination on growth, yield and nutrient uptake of chilli (*Capsicum annum* L.) Horticult Int J. 2019;3(5):217–222.
 8. Islam, Md. Anichhul, Kabir, Md. Yamin, Shuvra, Nubayra Tasnim, Islam, Md. Amirul and Hera, Md. Hasibur Rahaman. Effect of different organic manures and fertilizers on growth and yield of knol-khol (*Brassica oleracea* var. *gongylodes* L.). Malaysian Journal of Halal Research. 2020;3(2):56-62.
 9. Al-Bayati Hussien JM, et al. Effect of the combined application of organic and mineral fertilizers on the growth and yield of broccoli (*Brassica oleracea* var. *italica*). IOP Conf. Ser.: Earth Environ. Sci. 2021; 910 012115.
 10. Singh Amit Kumar, Singh Dharmender, Tiwari NK, Singh Diwakar, Singh Lal Vijay. Effect of NPK, vermicompost and spacing on growth, yield and quality of broccoli (*Brassica oleracea* L. var. *italica*). Journal of Pharmacognosy and Phytochemistry. 2018;7(6):2254-2258.
 11. Singh Jajveer, Gandhi Navdeep, Singh Karampal, Tinna Diksha, Singh Sukhdeep. Effect of the organic manure, inorganic fertilizers and their combination on growth, yield and quality of radish (*Raphanus sativus* L.) cv. R33. J Pharmacogn Phytochem. 2019;8(4S):57-59.
 12. Singh Gyanendra, Prasad Vipin Masih, Bahadur Vijay, Singh Nikhil Vikram, Yadav Netra Pal. Influence of different organic manures and inorganic fertilizers on vegetative growth of turnip (*Brassica rapa* L.) cv Purple Top White Globe. International Journal of Environment and Climate Change. 2022;12(12):718-725. ISSN: 2581-8627.
 13. Kiran M. Impact of different organic manures and NPK application on the growth and yield of turnip (*Brassica rapa* L.). Pakistan Journal of Science. 2023; 69(2).
 14. Shilan HS, Shara JH. Effect of NPK and organic fertilizers on yield and seed oil content of rapeseed (*Brassica napus* L.). Iraqi Journal of Agricultural Sciences. 2023;4:878- 889.
 15. Upadhyay Sushil Kumar and Prasad Rajendra. Studies on effect of organic manures and biofertilizers on growth and yield of radish var. Kashi Shweta. The Pharma Innovation Journal. 2021;10(8): 1211-1213.
 16. Sotayo FO, Donli PO. A comparative study of the effects of chemical fertilizer (NPK) and Organic Manure (Cow Dung) on the Growth of Bambara Groundnut in Borno State, Nigeria. Dutse Journal of Pure and Applied Sciences. 2021;7(2b):182-189.
 17. Kaur Amanpreet, Dr. Harpreet Kaur. Effect of different levels of NPK and manures on growth, yield and quality of cauliflower (*Brassica oleracea* L. var. *botrytis*) under open field conditions. The Pharma Innovation Journal. 2022;11(9):634-637.

© 2023 Kumari et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/101753>