



# Combined Effect of Vermicompost and Bonemeal on Growth and Yield of Radish (*Raphanus sativus* var. Hill Queen)

Vidyasagar Yashvardhan <sup>a\*</sup>, Abhishek Gautam <sup>b</sup>  
and Abhishek Yadav <sup>c</sup>

<sup>a</sup> Vegetable Science Department, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India.

<sup>b</sup> Vegetable Science Department, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Uttar Pradesh, India.

<sup>c</sup> Entomology Department, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Uttar Pradesh, 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/v35i143048

## 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/100091>

Original Research Article

Received: 22/03/2023

Accepted: 25/05/2023

Published: 06/06/2023

## ABSTRACT

The enquiry was done during rabi season from 21 November, 2022 to 26 January, 2023 at the research station of Chandra Shekhar Azad University of Agriculture And Technology, Kalyanpur Kanpur, India .The cultivar was Hill Queen of radish (*Raphanus sativus*) which is one of the important variety of North Indian Plain of Indian Subcontinent. The organic fertilizer vermicompost and bonemeal as a combined effect was recorded on different aspect of growth and yield of the respected variety.

The experiment was conducted in Randomized Block Design on the total area of 150m<sup>2</sup>.This area was divided in two halves ,of which one half area was under Hill Queen variety with combined organic fertilizer application and the other area was allotted with no fertilizer application.

\*Corresponding author: E-mail: v.s.yashvardhan17@gmail.com;

Considerable positive effect was recorded under the combined organic fertilizer on parameters like Diameter of the green foliage, Length of the roots, Diameter of the roots, Number of leaves, Total mass of the plant and Number of root hair development which is crucial for the later period of seed production. All the major parameters included had shown considerable increase and they have shown in the percentage from the counterpart of the experiment.

**Keywords:** Bonemeal; vegetative parameter; test cultivar; hill queen; vermicompost; radish.

## 1. INTRODUCTION

Organic farming is still in its infancy in India. As of March 2019, over 2.30 million hectares of cropland were under organic agriculture. This equates to 2% of the country's 140.1 million hectares net sown area. A large portion of organic farming is concentrated in a few states, a few states have taken the lead in boosting coverage. Madhya Pradesh leads the list with 0.76 million hectares of organic farming area, accounting for more than 27% of India's total organic cultivation area. Source (<https://ncof.dacnet.nic.in/StatusOrganicFarming>).

Organic farming practises rely on the recycling of crop leftovers, animal manure, farm organic residues and wastes, and so on [1]. Nitrogen (N) influences plant function at various levels, from metabolism to resource allocation, growth, and development [2,3].

Radish (*Raphanus sativus* L.) belongs Brassicaceae family, is an edible root vegetable. It is a tropical and temperate area crop. It is a biennial or annual plant that grows quickly. The colour of its edible roots ranges from white to scarlet. Organic radish is a popular salad vegetable that is cultivated all over the world. Its green leaves are high in vitamin A and may be eaten as a green leaf vegetable.

According to current research, several illnesses and livestock are reported as a result of the use of toxic pesticides during the standard farming method. Organic farming, which is derived from organic waste, has gained great importance in this area, adding more benefits and improving human immune systems. This organic gardening produced vegetables with 50% more vitamins and minerals than previous approaches. It primarily protects the environment by retaining soil fertility and preventing soil erosion. As a result, it is in great demand in the market, and farmers prefer it as the best growing method over traditional farming methods. Vermicomposting is a technology that employs earthworms to convert any sort of organic waste into extremely valuable organic fertiliser [4-6]. It is regarded

commercially feasible, socially acceptable, and environmentally benign.

## 2. MATERIALS AND METHODS

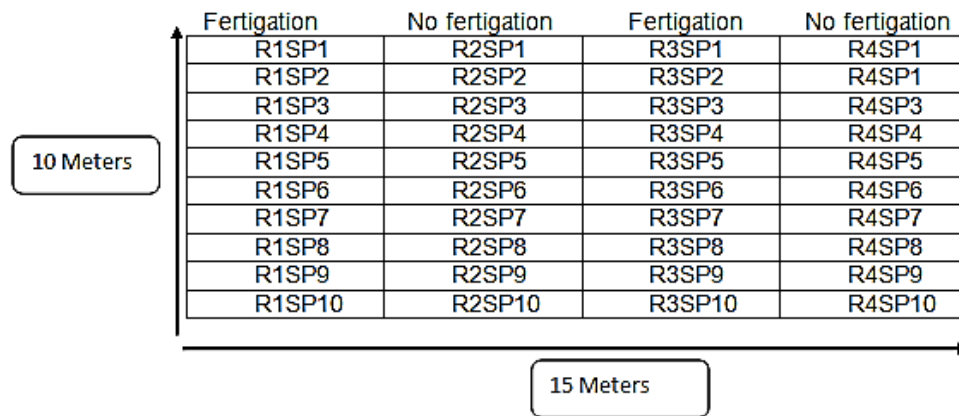
Present experiment was conducted from the sowing on well prepared field on 21 November, 2022 and harvesting on 26 January, 2023 with the intermediate operation of 1<sup>st</sup> fertigation on same date of sowing of seeds on 21 November, weeding on 24<sup>th</sup> December, 2<sup>nd</sup> fertigation on 24 December and final harvesting on 26<sup>th</sup> of January of 2023. The whole research was under Randomized Block Design with two replication at a spacing between plants of about 45x8cm. The area of block was 15m x 10m taken into consideration, with the number of plants equals to 4166 and half of block was under combined fertilizer effect of Vermicompost + Bonemeal and half area (75m<sup>2</sup>) was under no fertilizer supplement and only weeding and normal irrigation was carried out in this area. Total four plots was undertaken and alternatively treatment was given to each plots, The number of plants per plot was 1041.5.

On 21 November 1<sup>st</sup> fertigation was conducted with vermicompost + bonemeal (in equal amount) total weighing 52.075 Kg mixed in required water was applied and on 22 December same mixer of 72.9Kg was applied in required amount of irrigation water, applied in Replication 1 and Replication 3. In Replication 2 and Replication 4, no fertigation was carried out. Each replication (Plot) was divided into 10 sub plots (SP) containing 104.15 plants and data were recorded on taking average choosing randomly 7 plants from each subplots.

### 2.1 Vermicompost

Ancient civilizations such as Greece and Egypt recognised the importance of earthworms in soil. Cleopatra, the Egyptian Pharaoh, declared, "Earthworms are sacred." She recognised the worms' importance in fertilising the Nile Valley croplands following regular floods. Charles Darwin was fascinated with worms and spent 39 years studying them. "It may be questioned whether there are many other animals in the

**Table 1. Study protocol**



R Stands for Replication; SP stands for subplot

world that have played such an important part in the history of the world," Darwin stated of earthworms. The earthworm is a natural fertility and life resource. Earthworms are soil organisms that feed on decomposing organic matter. After digestion, the undigested food passes through the earthworm's alimentary canal, where a small film of oil is formed on the castings. This layer erodes during two-month period. So, while plant nutrients are readily available, they are gradually released in soil. The African earthworms (*Eudrillusengenia*), red worms (*Eiseniafoetida*), and composting worms (*Peronyxexcavatus*) are promising vermicompost producers. For vermicompost production, all three worms can be blended together. The African worm (*Eudrillusengenia*) is favoured over the other two species because it generates more vermicompost in a shorter amount of time and has more young ones during the composting process. Source: [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_vermicompost.html](https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html)

Organic carbon	:	9.5 – 17.98%
Nitrogen	:	0.5 – 1.50%
Phosphorous	:	0.1 – 0.30%
Potassium	:	0.15 – 0.56%
Sodium	:	0.06 – 0.30%
Calcium and Magnesium	:	22.67 to 47.60 meq/100g
Copper	:	2 – 9.50 mg kg-1
Iron	:	2 – 9.30 mg kg-1
Zinc	:	5.70 –11.50 mg kg-1
Sulphur	:	128 – 548 mg kg-1

**2.2 Bonemeal**

Steamed animal bones are crushed into a fine powder or granules for use on plants or crops to make bone meal fertiliser. Bones contain

nutrients and minerals that assist your plants, making them healthier and stronger. Phosphorus is abundant in rock phosphate and bone meal, with 25.2 and 20%, respectively [7,8].

Bonemeal is a product made from the waste left behind after meat processors butcher animals, particularly beef cattle. It is a white powder that is prepared by crushing raw or heated animal bones. Plants receive phosphorus and calcium from bone meal, as well as a little quantity of nitrogen. The N-P-K rating of bone meal is normally 3-15-0, The NPK contained can range from 1-13-0 to 3-22-0 with a calcium concentration of roughly 12% (18% CaO equiv.), depending on the source.

**2.3 Cultivar Hill Queen**

Sowing season is from May through November. Root colour is pure white and smooth, with little hair on the root surface. Roots mature to be 12-15 inches long, tapering and semicircular at the bottom, and sweet in flavour. Maturity After 50-55 days.

**3. RESULTS AND DISCUSSION**

In the following table significant increment in percentage of different vegetative parameters of radish (*R. sativus*) cv. Hill Queen.

The data expressed in Table 2, is shown in the graphical representation (Fig. 1) with the black bar showing significant increment in the major parameters in series 1 and series 2 representing fertilizer application and non- fertilizer applied values respectively. The highest increase observed was of 80.00% in the green mass

content of the fertigated plants than non-fertigated plants (Table 2), and increase in the total mass of plant (root plus green foliage) part which was in fertigated plant 75.13% more than non fertigated plant. Root part and the green part weight was taken separately after finely chopping off the head. Mass of the separate root part was recorded of each R1 and R3 subplots on average 60.86% increase was recorded as this was the most important economical part, which is the main edible portion of the whole plant. Green foliage is more like by product for the cattle feed.

Green foliage canopy increased significantly after the use of the fertilizer combination particularly leaves length and broadness escalated by 28.02% and 41.36% respectively. Most important edible part having economical value is radish roots. Scientist, breeder and researcher predominantly focus on the roots length, width, colour, pungency etc. The combined effect of vermicompost and bonemeal had shown more than quarter increment in the respective

parameters of the root. Increase in the length of the root by 27.58%, width (Diameter) of the root by 26.15% as the resultant increase in circumference by 25.93%.

Green canopy area (diameter of the foliage) was increased by 29.05 % as the leaves length and broadness increased but the number of leaves and the number of root hairs didn't show that much rise as 14.81% and 5.74% only was observed.

The main contribution of the combined positive effect of the both organic fertilizer was predominantly on the physiological growth but not observed in pronounced way on the chemical content of the crop. Very minute or fractional change was recorded of Ph, Acidity, TSS(°Brix) and Vitamin C concentration of both fertigated and non fertigated plants. The organic manures had statistically significant variation ( $p < 0.05$ ) in all the growth and yield parameters including vitamin-C in quality parameter but no significant difference was found in TSS content [9,10].

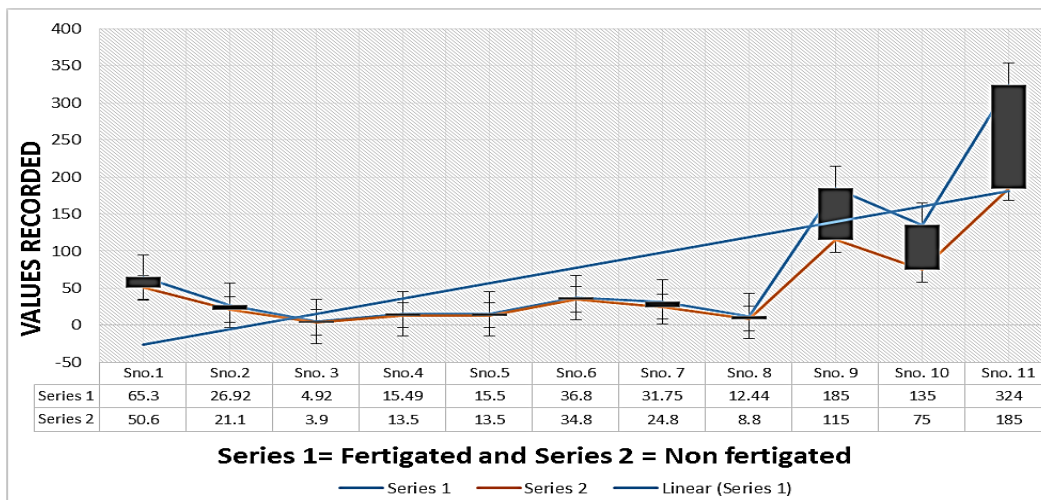


Fig. 1. Fertigated and Non-fertigated effect on radish cv. Hill queen



Fig. 2. Photos of the control (non fertigated) plant

**Table 2. Significant increment in percentage of different parameters**

S No.	Parameters recorded (Average)	Fertigation	No fertigation	Increased %
1.	Diameter of the foliage	65.30 cm	50.60 cm	29.05 %
2.	Length of the root	26.92 cm	21.10 cm	27.58%
3.	Diameter of the root	4.92 cm	3.9 cm	26.15%
4.	Circumference of the root	15.49 cm	12.3 cm	25.93%
5.	Number of leaves at harvesting	15.5	13.5	14.81%
6.	Number of root hair	36.8	34.8	5.74%
7.	Length of leaves	31.75 cm	24.80 cm	28.02%
8.	Leaves broadness	12.44 cm	8.8 cm	41.36%
9.	Root mass	185 g	115 g	60.86%
10.	Green mass	135 g	75 g	80.00%
11.	Total mass	324 g	185 g	75.13%
12.	Ph	6	6	0%
13.	TSS (°Brix)	5.82	5.81	Very minute
14.	Acidity (mg/100g)	0.09	0.09	0%
15.	Vitamin C (mg/100g)	18.19	18.18	Very minute



**Fig. 3. Photos of fertigated (vermicompost + bonemeal) plant**

#### 4. CONCLUSION

The current study found that combination of fertilizers had a substantial impact on the growth, production, and quality features of radish in the Kalyanpur region of North Indian plain, Kanpur, Uttar Pradesh. Potassium and phosphorus are important nutrient for the root crop and our organic fertilizer combination showed significant impact.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Stockdale EA, Lampkin NH, Hovi M, Keatinge R, Lemnartsson FKM, Maconald DW, Padel S, Tattersali FH, Walfe MS, Watson CA. Agronomic and environmental implications of organic farming systems. *Adv. Agro.* 2001;70:260-306.
2. Crawford NM. Nitrate: nutrient and signal for plant growth. *Plant Cell.* 1995;12:2383–2349.
3. Stitt M, Krapp A. The molecular physiological basis for the interaction between elevated carbon dioxide and nutrients. *Plant Cell and Environment.* 1999;22:583–622.
4. Singh CK, Kumar A. Vermicomposting of terrestrial weeds *Lantana camara* L. and *Parthenium hysterophorus* L.: Agriculture solid waste. *Ecol Quest.* 2017;28:63–69. Available:https://doi.org/10.12775/eq.2017.040
5. Yuvaraj A, Karmegam N, Ravindran B, Chang SW, Awasthi MK, Kannan S, Thangaraj R. Recycling of leather industrial sludge through vermitechology for a cleaner environment—A review. *Indus Crop Prod.* 2020;155:112791. Available:https://doi.org/10.1016/j.indcrop.2020.112791
6. Ali Yatoo, Zarka Zaheen, Md. Niamat Ali, Zahoor Ahmad Baba, Sartaj Ahmad Bha

- Yattoo AM, Ali MN, Baba ZA, Hassan B. Sustainable management of diseases and pests in crops by vermicompost and vermicompost tea. A review. *Agron Sustain Develop.* 2021;41:1–26.
7. Akande MO, Oluwatoyinbo FI, Kayode CO, Olowokere FA. Response of Maize (*Zea mays*) and Okra (*Abelmoschus esculentus*) Intercrop Relayed with Cowpea (*Vigna unguiculata*) to Different Levels of Cow Dung Amended Phosphate Rock. *World Journal of Agricultural Sciences.* 2006;2(1):119-122.
  8. Andrews N, Sullivan DM, Julian JW, Pool KE. Development and use of the Osu organic fertilizer and Cover Crop Calculator. *Proceedings of the Western nutrient Management conference Volume.* 2011;9:61-66.
  9. Gyewali B, Maharjan B, Rana G, Pandey R, Pathak R, Poudel PR. Effect of different organic manures on growth, yield, and quality of radish. Available:<https://doi.org/10.3329/sja.v18i2.51112>
  10. Akande MO, Oluwatoyinbo FI, Makinde EA, Adepoju AS, Adepoju IS. Response of Okra to Organic and Inorganic Fertilization. *Nature and Science.* 2010;8(11): 261-266.

© 2023 Yashvardhan 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/100091>