

Assessment of the Growth and Yield of Radish (*Raphanus sativus*) under the Influence Varying Levels of Vermicast

Medina, Melissa R ¹

¹Faculty, College of Agriculture, Nueva Ecija University of Science and Technology, Gabaldon Campus, Gabaldon, Nueva Ecija, Philippines 3131

*Corresponding author's email: engrmelissamedina@gmail.com ;

¹<https://orcid.org/0000-0001-8701-4832>

Abstract. The study was to determine the influence of different volumes of Vermicast on the growth performance of radish. The treatments comprised different quantities of Vermicast – IF, Vermi–2t, Vermi–4t, Vermi–6t, and Vermi–0t. This study implemented a Randomized Complete Block Design (RCBD) comprising three (3) blocks and five (5) treatments. The research was conducted at the Gabaldon Campus of Nueva Ecija University of Science and Technology, located in Gabaldon, Nueva Ecija.

In terms of growth, Vermi–4t has the longest length of leaves and the highest number of leaves, while Vermi–2t has the shortest number of days to maturity. In terms of yield performance of radish, the result showed that Vermi–2t produces the longest length of tuberous root, while Vermi–6t results in the largest diameter of the tuberous root, the highest weight of marketable, and the highest average yield per hectare. Furthermore, Vermi–0 obtained the highest weight of non–marketable tuberous root. On the other hand, the simple costs and return analysis showed that Vermi–6T obtained the highest net income of Php 232,725.47/ha.

Utilizing vermiculture as an additional organic fertilizer enhances the weight of tuberous roots but does not greatly improve the length of leaves and roots. Application of Vermi–6t of vermicast along with inorganic fertilizer results in the best net revenue.

Keywords: Vermicast, Income, Yield, Radish, Farming,

1. Introduction

Radish (*Raphanus sativus*) is one of the most popular root vegetable crops grown in tropical and temperate regions (Kumar et al., 2014). It can be eaten cooked or raw as a salad. Huge farms in Nueva Ecija allow farmers to grow lowland vegetables like radish in addition to high-value commodities. However, according to Llorito (2020), small farmers find it difficult to access inputs and markets for their produce, while buyers like agribusiness enterprises and wholesalers find it challenging to get the quantity and quality of products they need for processing on a timely basis.

In agriculture, synthetic chemicals like fertilizers and pesticides are widely utilized to improve soil fertility and shield against disease. Numerous investigations have revealed the damaging effect of these chemicals on the soil's ecosystem. Adhikary (2015) asserts that using organic fertilizers, including vermicast, has improved radish output metrics. Earthworm excrement, known as vermicompost, has the potential to improve a good soil additive, soil health, and nutrient status in compost that has been digested. As such, Gudeta (2022) asserts that vermicompost has both insecticidal and antifungal effects due to the coelomic fluid (CF) of earthworms and other bioactive chemicals, making it equally efficient at reducing disease and controlling pests because mucus has antibacterial qualities. According to Dulal et al. (2021), the use of vermicompost in the production of radishes had a significant impact on the growth and yield performance of the crop. The production cost is affected if the application is excessive. This study thus explores a lower production cost while maintaining growth and yield performance.

2. Methodology

2.1. Materials, and Description of the Experimental Area

The study was conducted at the NEUST–Palayaman experimental area, which consists of a total of 104 square meters of land. The white radish (East West Speedy Brand) was the seed used as the experimental plant. Prior to land preparation, soil sampling was done by digging ten (10) randomly selected sites in zigzag at about 25cm deep. A one-inch-thick column of soil was taken from each site, mixed thoroughly, and divided into equal portions. One kilogram of

soil samples was obtained from the first half. The soil sample was air-dried and analyzed using the Soil Test Kit (STK) for chemical analysis. The result was 80–50–30 kg NPK/ha. Land preparation was done using a rotavator machine that was plowed and harrowed to cultivate and pulverize the soil. Every plow was laid out with a size of 2.0x2.0 meters, and every plot had a 50-cm pathway on all sides.

2.2. Research Design and Data Analysis

The experimental area was laid out following the Randomized Complete Block Design (RCBD) comprised of five (5) treatments with three (3) replications; each treatment was randomly distributed in the field plot. The plot was 2.0 meters in length and 2.0 meters wide, with a planting distance of 15cm between rows and 15cm between plants, with a total of 121 plants per plot. Ten (10) sample plants are randomly chosen in the inner row per experimental unit. The treatments used were IF, Vermi-2T, Vermi-4T, Vermi-6T, and Vermi-0T as shown in Figure 1.

Statistical techniques were applied to all observations pertaining to growth and yield parameters. The treatment means for growth and yield characteristics were obtained from the collected raw data. The study employed the Statistical Tool for Agricultural Research (STAR). The data set underwent statistical analysis using.

Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) in order to assess the statistical significance of the treatments. The Least Significant Difference (LSD) Test was employed at a significance level of 0.05 to determine statistically significant differences among the means.

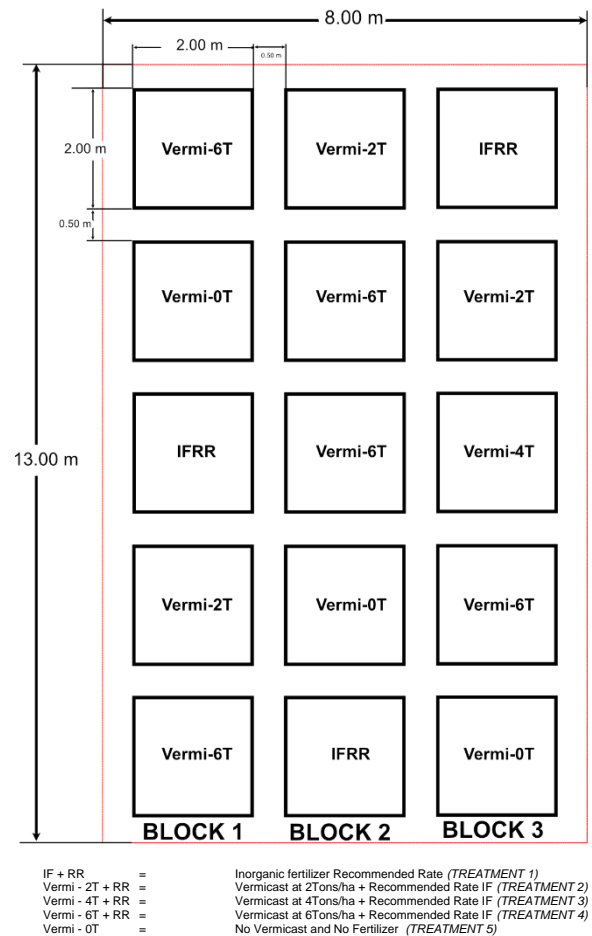


Figure 1. Experimental Layout of the study

2.3 Cultural Management

2.3.1. Seed Sowing and Seedling Management

The seeds were sown in the seedling tray singly with a mixture of garden soil, compost, and cocopeat in a 1:1:1 ratio. First, the seeds were checked to determine if they were free from damage and could be planted in the seedling tray. Next, the seedling trays must be filled with a combination of a 1:1:1 ratio of garden soil, compost, and cocopeat. Afterward, place the seeds inside healthy seedlings and place them in places where they can get enough sunlight, if they are ready for transplanting. Seeds start sprouting within 3–5 days, and the seedlings are ready to transplant if they have 2–3 true leaves.

2.3.2. Application of Vermicast and Transplanting

The vermicast was applied before transplanting within the plot of each designated treatment: Vermi–2T applied 800g, Vermi–4T applied 1,600g, and Vermi–6T applied 2,400g per plot of vermicast, respectively. On the other hand, the seedling was transplanted ten (10) days after sowing. Radish seedlings were planted along the row, with a planting distance of 15cm between rows and 15cm between plants. There are 11 plants per row and 11 rows per plot, for a total of 121 plants per plot.

2.3.3 Water, Fertilizer, Weed, Pest and Disease Management

Seedlings were watered twice daily, depending on weather conditions, and soil moisture was analyzed using the feel method to determine if additional irrigation was needed.

The fertilizer was based on the results obtained in the STK analysis, which showed that the recommended rate is 80–50–30 kg NPK/ha. The fertilizers used were complete fertilizer (14–14–14), ammonium phosphate (16–20–0), and urea (46–0–0). These fertilizers were applied based on the fertilizer recommendation per plot. For the first application, complete fertilizer was applied ten (10) days after transplanting (DAT) with 86g per plot. For the second application, ammonium phosphate was applied 20 days after transplanting (DAT) with 40g

per plot. Then, the last application was urea, which was applied 30 days after transplanting (DAT) with 37g per plot of urea.

The recommended fertilizer rate is 80-50-30 kg NPK/ha, using complete fertilizer, ammonium phosphate, and urea. Fertilizers were applied per plot, with complete fertilizer applied ten (10) days (86g of 14-14-14) after transplanting. While 20DAT (40 g of 16-20-0) and lastly on 30DAT (37g of 64-0-0).

Manual hand weeding was employed to remove the weeds from the area. Weeding was done regularly during seedling and vegetative stages. Insecticide was applied if there was a pest infestation during the study. Insect pests were controlled by applying insecticides (Prevathon) every seven (7) days in the amount of 5 mL per 8 liters of water to eliminate the Crucifer Flea Beetle. The application was early in the morning or late in the afternoon.

2.3.4 Harvesting

The radish was harvested when 75% of the radish's roots matured from 1.27 to 2.54cm in diameter, as size is one of the determining factors in harvesting the radish. When harvesting radishes, the whole plant was pulled from the soil. Ten (10) sample plants were harvested first and labeled with corresponding treatments and blocks.

2.4 Data Collection

In the data collection, for the growth parameters of radish, the following parameters were collected – length of leaves, number of leaves, number of days to mature. Additionally, the data in yield performance were as follows – length of tuberous roots, diameter of tuberous roots, weight of marketable and non-marketable and yield per hectare.

3. Results and Discussion

3.1 Growth Performance of Radish Applied with Varying Ratio of Vermicast

In terms of growth parameters, Table 1 shows that Vermi-4T resulted in the longest average length of leaves with 28.60cm ($p \leq 0.05$), while Vermi-6T had the most number of leaves with 17.27.60cm ($p \leq 0.05$). While Vermi-0T registered the

longest days to mature with 45 days ($p \geq 0.05$) among other treatments. Plants grown with vermicast have more leaves and flowers, a larger total leaf area, greater plant biomass, and a higher leaf chlorophyll content (Karmegam & Daniel, 2016).

Table 1 Growth Parameters Applied with Varying Ratio of Vermicast

Treatments	Ave. Length of Leaves (cm)	Ave. No. of Number of Leaves	Ave. Days to Maturity
IF	27.03	15.43	44.33 ^{ab}
Vermi - 2T	27.27	15.67	42.33 ^b
Vermi - 4T	28.60	16.33	42.67 ^b
Vermi - 6T	26.70	17.27	43.00 ^{ab}
Vermi - 0	25.50	15.20	45.00

Means with the same letter are not significantly different at 0.05 level, LSD

3.2 Yield Performance of Radish Applied with Varying Ratio Vermicast

Table 2 shows that the Vermi-2T resulted in the longest average tuberous root with 15.03cm ($p \leq 0.05$). While Vermi-6T shows the largest average diameter of tuberous root with 38.52mm ($p \leq 0.05$) and registered the highest marketable weight of the tuberous root with 2.73kg. Furthermore, the yield parameters indicate that Vermi-6T exhibits the highest average yield of 9,716.60kg ($p \leq 0.05$) and Vermi-0 registered the lowest average yield per hectare with a mean of 5,545.78kg ($p \leq 0.05$). These results are supported by the study of Gupta et al. (2015), which stated that better yields were observed in plots applied with vermicompost than other organic manures in radish crops.

Table 2 Yield Parameters Applied with Varying FCB

Treatments	Ave. Length of Tuberous Root (cm)	Average Diameter of Tuberous Root (mm)	Average Weight of Marketable (kg)	Average Weight of Non-Marketable Tuberous roots (kg)	Average Yield per Year (kg/ha)
IF	14.73	33.32	1.86 ^{ab}	1.10	7,433.96
Vermi - 2T	15.03	32.58	2.22 ^a	1.10	8,304.40
Vermi - 4T	14.07	32.45	2.32 ^a	1.17	8,739.23
Vermi - 6T	14.47	38.52	2.73 ^a	1.15	9,716.60
Vermi - 0	13.53	30.75	1.17 ^a	1.04	5,545.78

Means with the same letter are not significantly different at 0.05 level, LSD

3.3 Simple Cost and Return Analysis of using varying Vermicast

According to Table 3, the cost and return analysis of radish reveals that Vermi-6T achieved the highest gross sales of PHP 273,619.67 and net income of PHP 232,725.47. The Vermi-6T resulted the highest volume of marketable tuberos thus resulting to the higher revenue.

Table 3 Simple Cost and Return Analysis

Treatments	Marketable(kg)	Production Costs	Gross Sales	Net-income
IF	4,662.51	25,894.20	186,500.33	160,606.13
Vermi - 2T	5,553.43	30,894.20	222,137.00	191,242.80
Vermi - 4T	5,800.33	35,894.20	232,013.33	196,119.13
Vermi - 6T	6,840.49	40,894.20	273,619.67	232,725.47
Vermi - 0	2,942.46	22,358.65	117,698.33	95,339.68

4. Conclusions

The use of vermicast as an organic fertilizer does not result in a significant improvement in the length of leaves and tuberous roots. Utilizing vermiculture as an organic fertilizer can augment the mean mass of commercially viable tuberous roots. The utilization of Vermi-6T in conjunction with the suggested fertilizer resulted in the highest net income of PHP 232,725.47 per hectare, as determined by cost return analysis.

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