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Yield Performance of Pechay (*Brassica napus L.*) as Affected By Different Levels of Vermicast

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ABSTRACT

This study was conducted to evaluate the yield performance of pechay applied with different levels of vermicast and was determined in terms of the following parameters; average number of leaves, average plant height, average plant weight, and total plant weight per plot. The experiment was laid out in Randomized Completely Block Design (RCBD) with the following four treatments; 30g (T_1), 40g (T_2), 50g (T_3) and 60g (T_4) and was replicated four times. In the result of the Analysis of Variance (ANOVA) showed significant differences on the yield of pechay in terms of average plant height, average plant weight, and total plant weight per plot. Based on the Turkey HSD test, it showed that out of the 4 different levels T_3 (50g/hill) was significantly differed among other treatments. T_3 also gave a higher production and higher profit. Thus, based on the result of the study T_3 with the amount of 50g of vermicast/hill is recommended for it is found effective in pechay production. The application of vermicast not only helps in cost-saving but also promotes sustainable farming practices by minimizing excessive synthetic fertilizer use and considering its potential benefits in reducing environmental impact and promoting soil health.

Keywords : yield performance, pechay, different levels, vermicast

1 INTRODUCTION

Scholars [4], [8], [6] stated that green revolution agriculture has been a stunning technological achievement. It claims that green-revolution methods—involving high-yielding plant and animal varieties, mechanized tillage, synthetic fertilizers and bio-pesticides, and now transgenic crops are essential in order to produce adequate food for the growing human population [10]. Other scholars [12], [14], [19], [18] pinpointed that the environmental price of green-revolution agriculture includes increased soil erosion, surface and groundwater contamination, release of greenhouse gases, increased pest resistance, and loss of biodiversity [10]. The use of agrochemicals increases food productivity, but at the cost of environment and society. Over the years it has worked like a 'slow poison' for the farm soil and the society. To resolve the various problems related to 'human food safety, nutritional quality and environmental security' a global movement is going on to scientifically revive the traditional 'Organic Farming' systems [9].

Recent researcher [15] stated that organic farming produces nutrient-rich fertile soil, which nourishes the plants, keeping chemicals off the land, protects water quality and wildlife. It does also rejuvenate depleted soils and sustains fertility levels. Crops respond more to the addition of organic fertilizers than to chemicals [2]. It emphasizes cultivating the garden that sustains in enriching soil, plants and beneficial insects. This is achieved by avoiding the use of synthetic fertilizers and pesticides [13]. The use of organic fertilizer has advantage of being cheap, improves soil structure, texture and aeration thus increasing the soil water retention and stimulates healthy root development. The high efficiency of organic fertilizers can increase crop yield without depleting soil quality which supports both long-term food security and environmental production [5]. One of the organic fertilizers is vermicast.

Vermicast is an organic by product of composting activities of earthworm, where it enriches the soil and helps the plants in receiving all the nutrients they need to grow successfully. It is also considered as a soil conditioner and is often used as a natural fertilizer to enhance coarse soil [11]. And it is the best fertilizer to be used in

pechay as an organic fertilizer shown by the study of [16] where organic inputs (vermicompost) were preferred due to its chemical-free and environment friendly attributes. In fact, in the study of [17] vermicompost can enhance soil fertility physically, chemically and biologically. Physically, vermicompost-treated soil has better aeration, porosity, bulk density and water retention. Chemical properties such as pH, electrical conductivity and organic matter content are also improved for better crop yield. It contains plant nutrient like N, P, K, Ca, Mg, Fe, Mn and Zn which has a positive effect on the plant growth, yield, soil fertility and soil microbes. Vermicomposting has been getting attention due to its environmental friendly approach.

Resource-pechay farmers can utilize vermicast to reduce the need for chemical fertilizers and pesticides, while recycling farm waste to minimize environmental pollution. With less farm cost and less hazards to human health, the incomes and well-being of small farmers are enhanced [7]. In the study of [3], the use of organic fertilizer (in this case vermicast) on pechay production gained topped sales due to lower production cost, thus, very viable alternative to have higher and more profitable production.

Pechay (Brassica napus L. var. Black Behi) is major vegetable crop rich in vitamin C and contains significant amounts of nitrogen compounds known as indoles, as well as fiber—both of which appear to lower the risk of various forms of cancer. It has been selectively cultivated to produce a plant that has an exceptionally short life cycle of 30-45 days [1].

Pechay is important in supplying the food and nutritional needs of the people. They are capable of producing more than five times the quantities of food per unit area compared to cereal crops. With such high yield potential, pechay production may help solve the food problems of the nation's deficiency in food supply. Thus, it is necessary to intensify the production of pechay crops to meet the supply requirements of the fast-growing population of the country [20]. Moreover, different rates of vermicast may affect the nutrient content supplied which in turn greatly determines the effect of vermicast to soil and the crop planted. Thus, there is a need to determine the yield performance of pechay applied with different levels of vermicast. And, to find out if there is a significant difference among the yield performance of pechay applied with different levels of vermicast. Lastly, to evaluate which of the different levels of vermicast gave the highest yield performance of pechay.

2 Methodology

2.1 Materials

The following equipment used in the study were the following: carabao drawn plow, spade, hand trowel, sprayer, standard ruler, tape measure, meter stick, plastic bags, baskets, placards, calculator and weighing scale. Black behi variety was the pechay variety used in the study. The seeds are adapted to both low and highland conditions. It matures at 40 days after planting. The organic fertilizer applied in the study was vermicast. The study used Parapest a synthetic pesticide used to control insects' infestation.

2.2 Research Design

The total area of 246.5m^2 was laid out using Randomized Complete Block Design (RCBD) with four (4) blocks. Each block was divided into 4 plots. Each plot was measured six (6) meters in length and one and half (1.5) meters in width. One (1) meter space was provided between blocks and 0.5 meters between experimental plots. In addition, there were four (4) treatments which were replicated 4 times resulting to 16 plots. The treatments were the following: **T_1** – 30g/hill, **T_2** – 40 g/hill, **T_3** – 50 g/hill, and; **T_4** – 60 g/hill. Random numbers generated from the calculator were ranked from lowest to highest for the distribution of the treatments to every plot.

2.3 Cultural Practices and Management

A land area of 246.5m^2 was thoroughly prepared by cutting all the weeds and putting them away from the experimental area. After clearing the area, it was plowed and harrowed twice at one week interval to pulverize larger soil aggregates. Then, the area was fence to prevent the entry of stray animals and drainage was constructed to facilitate excess water flow. The seed box was prepared for seedling preparation. It measured 4m in length, 1m in width and 6 inches in height. The garden soil mixed with vermicast was then put in the seed box. Then the pechay seeds were sown in the box and was watered using sprinkler with fine droplets to provide adequate moisture for seed germination and promote growth for newly sprouted seedlings. Transplanting was done 14 days after sowing. One (1) seedling was transplanted at a distance of 30cm between rows and 30cm between hills with a total of 100 seedlings transplanted per plot. Transplanting was done late in the afternoon.

The seedlings were watered immediately after transplanting. And daily, it was watered during early in the morning in the absence of rain. Missing hills were replaced immediately upon noticed. Weeding was done weekly around the plants using hand trowel and the soil was cultivated to enhance soil aeration. Hilling-up was done to cover the roots with soil for anchorage and better absorption of the water and nutrients. Fertilization of vermicast was applied twice. The first application was done basally with the amount of 30g for T_1, 40 grams for T_2, 50g for T_3, and 60g for T_4. The second application was drilled 15days after transplanting (DAT) at the base of the plant and covered with a thin layer of soil about 5cm deep. The insect pests observed during the conduct of the study were the Diamond back moth and cutworm. It was controlled by handpicking. Moreover, at the increase of insect population, Parapest was used 30 DAT to control the insect pest with the rate of 20ml per knapsack sprayer. So far, no disease was observed during the conduct of the study.

The plants were harvested 40 DAT. It was done in the morning. The plants were washed, the old leaves were trimmed, and the roots were removed using a sharp knife. The harvested pechay was packed separately to avoid misinterpretation of data in a labeled basket container with holes at the sides to allow aeration. The baskets were lined with paper to maintain turgidity of the plant until reaches to the market. There were 20 sample plants out from 100 plant population per plot.

The data gathered and been recorded were the following: (1) Average number of leaves per plot. (2) Average plant height in cm per plot. (3) Average plant weight in gram per plot. (4) Total plant weight in kilogram per plot. (5) Cost and Return Analysis which was computed using the formula below.

$$\text{Return of Investment (ROI)} = \frac{\textit{Net Income}}{\textit{Cost of Production}} \text{ x } 100\%$$

2.4 Statistical Analysis

Analysis of Variance (ANOVA) for one way classification was used in the study to determine if there was a significant difference in the yield performance of pechay applied with different levels of vermicast. Tukey HSD Test was also used in order to determine which among the different levels of vermicast gave maximum yield.

3 Result and Discussion

Table 1. Summary of Means of the Different Treatments under Different Parameters

Treatments	Parameters			
	Average number of leaves	Average plant height (cm)	Average plant weight (g)	Total plant weight (kg)
T_1 (30g/hill)	8.56	19.79^c	47.93^d	3.98^c
T_2 (40g/hill)	9.11	21.43^b	85.85^c	6.28^b
T_3 (50g/hill)	10.39	22.20^a	125.66^a	9.28^a
T_4 (60g/hill)	9.21	21.55^b	100.88^b	7.27^b
ANOVA	ns	*	**	**

*Legend: ns – not significant; * - significant ** - highly significant*

Mean with the same letter/s are not significantly different based from Tukey's Honestly Significant Difference Test.

Table 1 result for average number of leaves revealed that T_3 obtained the highest average number of leaves (10.39) and lowest was obtained by T_1 with an average number of 8.56. In addition, the results revealed that longest average plant height (22.20) was still obtained by T_3 and lowest was still obtained by T_1 with an average number of 19.79. Subsequently, for average plant height in gram per plot results revealed that the heaviest average plant weight (125.66) was observed in T_3 and lowest was observed in T_1 with an average number of 47.93. Furthermore, for total plant weight in kg per plot results revealed that the heaviest total plant weight (9.28) was still observed in T_3 and lowest was still observed in T_1 with an average number of 3.98. Thus, T_3 with the amount of 50g of vermicast had the highest values than the other treatments. It got a greater number of leaves, tallest plant height, heaviest and higher yield (*see Appendix*).

As observe in table 1, the differences between the treatments on different parameters is very noticeable. Based on the result of the Analysis of Variance, to examine the significant difference in the yield performance of pechay applied with different levels of vermicast, there was a significant difference on the yield performance of pechay as applied with different levels of vermicast in terms of average plant height, average plant weight and total plant weight. It means that all different levels of vermicast have statistically different effect on the growth performance of pechay. Based on Tukey's HSD Test, T_3 (50g/hill) was significantly differed among other treaments thus recommended. Result of the study revealed that application of 50g of vermicast/hill is found effective and practical in pechay production. This finding is similar with the study shared by [17] in which it was said that the growth of pechay increases by incorporating 5 to 50 percent by volume of vermicast in soil mixtures and a higher rate of 60 percent causes negative effect.

Table 2. Return of Investment (ROI)

Treatment	Production Cost	Net Income	Return of Investment (%)
T_1	1,102.5	797.5	72.33
T_2	1,112.5	1,256.5	112.94
T_3	1,122.5	1,857.5	165.47
T_4	1,132.5	1,455	128.47

Table 2 showed the return of investment of the different rates of vermicast. Treatment 3 got the highest return of investment of 165.47% followed by the treatment 4 (1.284), then treatment 2 (1.129). Lastly, the treatment 1 (0.7233) which has the lowest return of investment.

4 Conclusion

Based on the result of the study, there was a significant difference among the yield performance of pechay. There was a significant effect on the average plant height, average plant weight, and total plant weight as affected by different rates of vermicast. Thus, application of different levels of vermicast gives significant different effects on the yield performance of pechay. Application of 50 grams of vermicast give the best result on the average plant height, average plant weight, and total plant weight of pechay in comparison to 30 grams, 40 grams, and 60 grams of vermicast. Thus, 50g/hill (T_3) of vermicast can be applied as nutrient source in pechay production which can give higher production and higher profit among all other treatments.

By utilizing vermicast in appropriate quantities, farmers can reduce their overall synthetic fertilizer consumption while still achieving maximum pechay production. This approach not only helps in cost-saving but also promotes sustainable farming practices by minimizing excessive synthetic fertilizer use. The study results suggest that the efficacy of vermicast as organic fertilizer may not be solely dependent on the quantity applied, but rather on the quality and nutrient content of the vermicast. Thus, farmers can optimize the use of vermicast by adjusting the application rate based on their specific farming conditions and crop requirements. This flexible approach allows farmers to adjust their fertilizer usage to maximize efficiency and productivity in pechay production.

5 Recommendation

Based on the result of the study, T_3 application with the amount of 50g of vermicast is recommended in pechay production. It recommended for it can give higher production and higher profit. It is also recommended to monitor pechay plant response to vermicast fertilizer application over multiple growing seasons to evaluate consistency in yield performance and adapt fertilizer practices accordingly.

For new researchers, conduct further studies to explore the specific mechanisms through which vermicast interacts with pechay to understand its impact on crop growth and yield more comprehensively. For agricultural practitioners, integrate vermicast into crop management practices as a sustainable alternative to synthetic ferti-

lizers, considering its potential benefits in reducing environmental impact and promoting soil health. For future research, explore the potential synergistic effects of combining vermicast fertilizer with other organic inputs or bio-stimulants to enhance crop vigor, nutrient uptake, and overall yield performance of pechay.

6 Appendix

Table 2. Average Number of Leaves per Plot.

Replication	Treatments			
	T_1	T_2	T_3	T_4
I	8.20	9.00	9.25	8.40
II	9.30	8.75	12.55	9.00
III	8.40	8.90	10.05	10.10
IV	8.35	9.80	9.70	9.35
Total	34.25	36.45	41.55	36.85
Mean	8.56	9.11	10.39	9.21

Table 3. Average Plant Height in Centimeter per Plot.

Replication	Treatments			
	T_1	T_2	T_3	T_4
I	18.50	20.15	22.05	19.80
II	20.30	20.60	21.75	21.90
III	19.50	22.50	23.60	22.20
IV	20.85	22.50	21.40	22.30
Total	79.15	85.75	88.80	86.20
Mean	19.79	21.43	22.20	21.55

Table 4. Average Plant Weight in Gram per Plot.

Replication	Treatments			
	T_1	T_2	T_3	T_4
I	37.32	85.46	147.97	85.78
II	51.70	95.23	139.10	97.18
III	37.42	76.67	125.86	115.75
IV	65.26	86.04	89.70	104.82
Total	191.70	343.40	502.63	403.53
Mean	47.93	85.85	125.66	100.88

Table 5. Total Plant Weight in Kilogram per Plot.

Replication	Treatments			
	T_1	T_2	T_3	T_4
I	2.80	5.00	9.45	5.20
II	3.95	7.30	11.75	7.95
III	4.60	6.53	11.65	8.20
IV	4.60	6.30	4.30	7.75
Total	15.95	25.13	37.15	29.1
Mean	3.98	6.28	9.28	7.27

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