International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

PRODUCTIVITY AND PROFITABILITY OF PECHAY (*Brassica rapa*) APPLIEDWITH BIO-ORGANIC FERTILIZERS FROM ANIMAL WASTES

Pio P. Tuan[1], Leah C. Tuan[2]

[1]University Research and Development Services, University of Eastern Philippines, University Town, Catarman, Northern Samar, Philippines

[2]College of Agriculture, Fisheries, and Natural Resources, University of Eastern Philippines, University Town, Catarman, Northern Samar, Philippines

ABSTRACT

Non-conventional organic fertilizers from animal wastes such as swine manure, carabao manure and caramanure tea though readily and abundantly available in the backyard, remained untapped for crop production especially vegetable production including pechay. The objectives of the study were to determine the growth and yield, and profitability of organic pechay (*Brassica rapa*) production using different bio-organic fertilizers from animal wastes. The four experimental treatments include swine manure, carabao manure, caramanure tea and control (no fertilizer). These treatments were laid out in a randomized complete block design (RCBD) with three replications. The effect of different bio-organic fertilizers on productivity was measured in terms of plant height, number of leaves, width of leaves, length of leaves and weight of marketable plants, while profitability were determined in terms of gross and net return and return on investment (ROI). Results revealed that all agronomic characteristics of pechay were significantly affected by the different manures applied. The data showed that the growth and yield of pechay applied with swine manure were significantly better than those plants applied with carabao manure, caramanure tea and control. Cost and return analysis indicated that among the different manures, swine manure resulted in positive net return of Php 52,375.00 per hectare and the highest ROI (Return on Investment) of 53.65%, while the rest of the treatments resulted in negative net return and return on investment (ROI). Based on these findings, among the different bio-organic fertilizers from animal wastes tested in this study, swine manure can be used as alternative to in-organic fertilizers and as a stand-alone source of nutrients in organic pechay production.

Keywords: Organic fertilizer, swine manure, carabao manure, caramanure tea

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

INTRODUCTION

Pechay (*Brassica rapa)* is an important vegetable crop and has high nutritional and good commercial value. It is a fast growing crop and requires high nitrogen input. Generally, excessive amounts of inorganic fertilizers are applied to vegetables in order to achieve a higher yield (Stewart *et al.*, 2005) and maximum value of growth (Dauda*et al*., 2008). However, the use of inorganic fertilizers alone may cause problems for human health and the environment (Al-Nasir, 2002). Pechay is one of the most popular vegetables among consumers for it is always available in the market anytime of the year. It is also an important ingredient among Filipinos cuisine such as "puchero" and "nilaga"

Organic manure can serve as alternative option to mineral fertilizers (Gupta *et al*., 1988; Naeem*et al*., 2006) for improving soil structure (Dauda*et al*., 2008) and microbial biomass (Suresh *et al*., 2004). Organic manures such as carabao manure and pig manure improve the soil structure, aeration, slow release nutrient which support root development leading to higher yield and better quality of plants. These are readily available in the backyard but remained untapped for crop production especially vegetables including pechay. Therefore, utilization of locally produced manures in vegetable production may increase crop yields and income with less use of chemical fertilizer. The aim of this study was to determine of the effects of different bio-organic fertilizers from animal wastes on productivity and profitability of organic pechay production.

MATERIALS AND METHODS

Experimental Design and Treatments

The study was conducted at the University of Eastern Philippines (UEP) Agro- Meteorological Station, main campus, Catarman, Northern Samar, Philippines from January – March 2017. The experiment was laid out following the Randomized Complete Block Design (RCBD). Replicated three times, the treatments were: Carabao manure (T1); Swine manure (T2); Caramanure tea (T3); and control-no fertilizer (T4).

Production and Application of Bio-organic Fertilizer

Carabao manure was formulated by gathering dried or partially dried carabao manure from the field. The manure was air-dried for 2-3 weeks or until totally dried (approximately 30% moisture). Big manure particles were pounded into small pieces and mixed with desired amount of carbonized rice hull (CRH). Swine manure was obtained from farmer-adaptor of the no-wash swine growing-fattening technology. Swine manure which was accumulated during the 3-4 months fattening period was air dried for 2-3 weeks or until totally dried with an approximate

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

moisture content of 30%. Manure tea was prepared using fresh or partially dried carabao manure. A bag of fresh manure was place in a 200-liter capacity plastic drum. Fresh water was added and allowed to ferment for a week prior to its use.

One (1) kilogram of dried carabao and swine manure was applied per plant as basal, while manure tea was applied at the rate of 100 ml per plant at planting time and 200 ml per plant every week thereafter until harvest. No fertilizer application was done in control plants.

Planting and harvesting

Two- week old pechay (*Black Benhi* variety) seedlings were transplanted at a distance of 20cm between hills and 40cm between rows. The plants were maintained using recommended cultural management practices such as watering, weeding, and management of pests. Productivity of pechay was measured in terms of plant height, number of leaves, length of leaves, and width of leaves, leaf area and yield of marketable plants. Profitability was determined by calculating the ROI by dividing the net income over production cost. Harvesting was done within 30 days of growing period. Data gathered were analysed employing the analysis of variance (ANOVA) and significant treatment mean differences were determined using the Least Significant Difference (LSD) test at the 5% level of probability.

RESULTS AND DISCUSSION

Effects on Productivity

Plant height

Significant differences were observed in height (Table 1) of pechay applied with different bio-organic fertilizer from animal wastes. Plants fertilized with swine manure were the tallest (35.28 cm) while those fertilized with manure tea were as tall as those applied with carabao manure and control treatment with 24.57 cm, 23.74cm and 23.03 cm, respectively. The increase in plant height as a result of swine manure bio-organicfertilizer application may be attributed to the presence of available nutrients sufficient enough to promote plant growth. El-Tantawy (2009) and El-Magd, et, al (2016), observed accelerated growth of the plants applied with organic manure.

Number of leaves

Leaf count at harvest showed that plants applied with bio-organic fertilizer from animal wastes had more leaves than plants in the control (no fertilizer) treatments. However, no significant differences were observed among the treatments. The production of almost the same number of

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

leaves with or without the application of different bio-organic fertilizers is indicative that the soil in the study area meets the minimum requirement of nutrients for the production of sufficient number of leaves. This observation is true in almost all vegetable (*Brassicas*) researches conducted in the area were the control (without fertilizer application) plants were able to develop considerable number of leaves but of different length, breadth and weight subject to available nutrients in the soil.

Length of leaves

Longest leaves of pechay were manifested among plants fertilized with swine manure with 19.61cm (T2), followed by those with manure tea (11.68 cm) (T1) and carabao manure (T3) at 11.49cm. Shortest leaves were evident among plants without fertilizer (T4) with 10.64 cm. ANOVA test, however, showed no significant difference in length of leaves between applied with manure tea, carabao manure and control plants. The result of the study revealed that the application of bio-organic fertilizers yielded longer leaves compared with plants without fertilizers. This may be attributed to the presence of readily available form of nitrogen preferably ammonium particularly in the urine which was present in swine manure. This implied that the application of swine manure as main source of organic fertilizer complemented with provided the needed nutrient for the growth of pechay.

Width of leaves

Width of individual leaves of pechay at harvest vary in response to the application of different bio-organic fertilizer from animal wastes. Plants fertilized with swine manure produced the widest leaves (16.45 cm) followed by plants applied with carabao manure and manure tea with 10.63 cm and 9.49cm, respectively. Plants without fertilizer had the narrowest leaves (9.24 cm). ANOVA tests, however, showed no significant differences among plants applied with carabao manure, caramanure tea and those without fertilizer. The result obtained in this study revealed that formation of bigger and wider leaves is directly related to the application of different manures as bio-organic fertilizer. The effect of animal manure particularly swine manure on the production of bigger and wider leaves of pechay may be related to the important role of the macro nutrients (N, P and K) which reflect on its vegetable growth. These nutrients play vital roles in plant physiological processes including photosynthesis among others. Swine manure contains all three of these nutrientsincluding micronutrient and was made available to the plants through its application. Gross *et al*. (2008) found that ammonium was the major form of nitrogen present in the extract solutions from all manure types and that the nitrogen released after the 14-day extraction by the different methods from the different manures ranged between 50% and 85%. Alo and Tuan (2014) also obtained almost similar results in cauliflower applied with

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

chicken dung.

Weight of marketable plants

Consistently, those plants applied with swine manure, showed the heaviest weight of marketable plants (250.00 grams) per plant, while those without fertilizer were the lightest with 53.33 grams per plant. Nevertheless, ANOVA tests, revealed no significant difference on weight among plants applied with caramanure tea, carabao manure and control treatment. The variation in marketable plant weight among treatments as recorded in this result is directly related to the size (leaf length, width and area) of the leaves produced. It can be noted that in other growth parameters evaluated the application of swine manure all resulted to the production of longest leaves and widest leaves. The production of heaviest plants in treatment receiving swine manure as bio-organic fertilizer can be attributed to the presence of readily available form of soil nutrient and quality and quantity especially nitrogen which is responsible for the production of vegetable parts especially leaves. The bigger the leaves the more photosynthesizing organs, more manufactured food for the production of bigger and heavier plants. This better availability of soil nutrients and favorable soil condition resulted in healthy plants with large vegetative growth (leaf length and width) which lead to higher photosynthetic rate resulting in more accumulation of carbohydrate in the leaves and thus increase in the overall weight of the plant.

Plant yield

The highest yield was obtained from plants applied with swine manure (10T/ha) followed by those plants applied with manure tea (3.07t/ha). Plants applied with carabao manure produced almost the same yield (2.19t/ha) with those plants without fertilizer with 2.13t/ha. Statistical analysis, however, revealed no significant differences were between plants applied with manure tea, carabao manure and control plants. The results of the study relative to plant yield almost follow similar pattern with the other growth parameters evaluated such as the vegetative parts (number of leaves, leaf length and width). In all these parameters, the results pointed out that the application of swine manure had the tremendous effect in the excessive of growth of vegetative plants parts which resulted to the production of healthy plants. The increase in vegetative growth can be traced back to the positive effects of bio-organic fertilizer particularly swine manure which have contributed to the increase in photosynthetic activity and uptake of soil nutrient. These results are in agreement with the findings of Caser (2009) in cauliflower, Elkhatib, (2009) oncommonbean.

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

Table 1: Growth and yield parameters of *pechayusing different bio- organic fertilizers from animal wastes.*

Treatments	Mean*					
	Number of Leaves	Length of Leaves (cm)	Width of Leaves (cm)	Weight of Leaves (g)	Weight Marketable Plants (g)	Plant Yield (T/ha)
Carabao manure	23.74[b]	8.03	11.49[b]	10.63[b]	54.72[b]	2.19[b]
Swine manure	35.28[a]	8.87	19.61[a]	16.54[a]	250.00[a]	10.00[a]
Caramanure tea	24.57[b]	8.10	11.68[b]	9.49[b]	76.67[b]	3.07[b]
Control (no fertilizer)	23.03[b]	7.50	10.64[b]	9.24[b]	53.33[b]	2.13[b]

**Means followed with same letter are not significant at 5% level, DMRT.*

Effects on Profitability

Cost and Return Analysis

Among the treatments, the application of swine manure as bio-organic fertilizer resulted in the highest return on investment (ROI) (Table 2). The negative ROI in other organic fertilizer indicates that the nutrient supplied by these manures are inferior compared to swine manure to support the needs of pechay for them to give economic yield. These results indicated that swine manure can be a good substitute for inorganic fertilizer in growing pechay and a stand-alone source of soil nutrients in organic pechay production.

Table 2: Economic analysis for one hectare pechay production using different bio- organic fertilizers from animal wastes.

Parameters	Carabao manure	Swine manure	Manure Tea	Control-no fertilizer
Yield (tons)/ha	2.19	10.00	3.07	2.13
Price/kg (Php)	15.00	15.00	15.00	15.00
Cost of Production (Php)	64,195	97,625	47,327	44,023
Gross Return (Php)	32,850.00	150.000.00	46,050	31,950
Net Return (Php)	-31,345.00	52,375.00	-1,277.00	-12,073.00
Return on Investment (ROI)	**-48.83%**	**53.65%**	**-2.70%**	**-27.42%**

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

SUMMARY, CONCLUSION AND RECOMMENDATION

The application of the different bio-organic fertilizer from animal wastes significantly influenced the growth and yield of pechay in terms of plant height, number of leaves, width of leaves, length of leaves and weight of marketable plants; and productivity specifically in terms of total plant yield, gross income, net income and return on investment or ROI.

B. repa grown with swine manure manifested the typical nutrient rich soil which resulted to healthy and vigorously growing plants contributing to the significant increase in individual and total plant weight. Swine manure fertilization in pechay out-yielded the other treatments (carabao manure and caramanure tea) in almost all growth and yield parameters evaluated. A computed yield of 10t/ha was realized in plants applied with swine manure which was significantly higher over the other bio-organic fertilizer treatments ranging from 2.19 to 10.0 tons per hectare or -48.83% to -2.70%. In terms of productivity and profitability, plants fertilized with swine manure registered the highest production of 10t/ha and a net return of Php 52,375.00. The return on investment (ROI) on the use of bio-organic fertilizer for organic pechay production also ranged from -48.83% to 53.65% with swine having the highest ROI which implies that the use of bio-organic fertilizer from animal wastes especially swine manure is very profitable.

Based on the findings, bio-organic fertilizer from animal wastes such as swine manure, carabao manure and manure tea can be used as a stand-alone fertilizer for organic pechay production. However, for maximum yield and profit, the use of swine manure is more superior than other bio-organic fertilizers tested.

ACKNOWLEDGEMENT

The researchers wish to express their profound thanks to the support extended by the University of Eastern Philippines (UEP) administration in the realization of this experiment. To the University Research and Development Services staff, and field workers who assisted the researchers throughout the duration of the experimentation including the gathering, preparation and application of different manures; care and maintenance, data gathering and harvesting. Likewise, to the different offices of the university with support function to Research and Development and all those who directly and indirectly contributed to completion of this study. Most specially GOD to almighty for his providence.

LITERATURE CITED

Aganon, Clarita P., Nestor D. Pagaduan, Luzviminda M. Galang, Tomas D. Gajete, Rex S. Parayno, Arturo M. Alegado, Rafael R. Rafael, Fe L. Potenciuncula, Matlide Mellicent S. Recto, Pablo J. Rafael, Jr. and Gerry Z. Laggui. 2011. Biofertilizer Production and Entrepreneurship Training Manual. Central Luzon State University. Science City of Munoz, Nueva Ecija: CLARRDEC, CVARRD and PCARRD-DOST. 92p.

Alo, L.D. and Tuan, P.P.(2014). Growth and Yield of Cauliflower (Brassica oleracea) Applied with Chicken Dung-based Organic Fertilizer under Polyethylene Pot Culture. UEPGS MS Thesis.

Abou El-Magd, M. M, Hoda, A. Mohamed and Z. F. Fawzy, 2005. Relationship growth, yield of broccoli with increasing N, P or K ratio in a mixture of NPK fertilizers (Brassicooleraceavaritalicaplenck). Annals of Agriculture Science, Moshtohor. Vol. 43(2): 791-805.

Al-Nasir, F., 2002.Effect of organic fertilizers on yield and nutrients concentration of cauliflower plant. *Arch. Acker-Pfl. Boden*, 48: 37–47

Caser G. Abdel.2009. Improving the Production of WellIrrigated Cauliflower (*Brassica oleracea*var. *Botrytis*, Cv. Snowball Y. Imp) by Foliar Spraying of some Growth Regulators. Journal of ZankoySulaimani**12(1),** 29-49.

Dauda, S.N., F.A. Ajayi and E. Ndor, 2008. Growth and yield of water melon (*Citrulluslanatus*) as affected by poultry manure application. *J. Agric. Soc. Sci.*, 4: 121–4

El-Shakweer M.H.A., El-Sayed E.A. and Ewees M.S.A. 1998. Soil and plant analysis as a guide for interpretation of the improvement efficiency of organic conditioners added to different soil in Egypt. Communication Soil Science Plant Anal. 29: 2067-2088.

El-Tantawy, I. M., El-Ghamry, A. M. and Habib, A. H. 2009.Impact of farmyard manure and manure compost tea on potato yield and soil fertility. Journal of Agriculture Science, 34(1): 669 – 678.

Gupta, A.P., S.R. Antil and P.R. Narwal, 1988.Effect of farmyard manure on organic carbon, available N and P contents of soil during different periods of wheat growth. *J. Indian Soil Sci*., 36: 269–73

ISSN: 2455-6939

Volume:05, Issue:03 "May-June 2019"

Knot, J.E. & Deanon, J. Jr. (1997).Cabbage, cauliflower, and brocolli. *Vegetable production in Southeast Asia*. College, Laguna: University of the Philippines.

Naeem, M., J. Iqbal and M.A.A. Bakhsh, 2006.Comparative Study of Inorganic Fertilizers and Organic Manures on Yield and Yield Components of Mungbean (*Vignaradiat*L.).*J. Agric. Soc. Sci*., 2: 227–9

Rosco E.T., 2014. Executive Director, PhilRice Research Institute. Personal Communication

Sharma A.R. and Mittra B. N. 1991.Effect of different rates of application of organic and c. Journal of Agricultural Science (Cambridge). 117: 313-318.

Stewart, M.W., W.D. Dibb, E.A. Johnston and J.T. Smyth, 2005.The Contribution of Commercial Fertilizer Nutrients to Food Production. *Agron. J.*, 97: 1–6

Suresh, K.D., G. Sneh, K.K. Krishn and C.M. Mool, 2004.Microbial biomass carbon and microbial activities of soils receiving chemical fertilizers and organic amendments. *Archives Agron. Soil Sci.,* 50: 641–7

http://fertilizer-machine.net/solution and market/pig-manure-management-methods.html

https://www.linkedin.com/pulse/how-make-pig-manure-organic-fertilizer-allaiance-macinery.

