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Enhanced Nutrient Composition of Vermicompost at CSU-PIAT Applied at Different Rates on Selected High Value Crops

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Abstract

The was conducted at Cagayan State University – Piat Campus to evaluate the nutrient composition of vermicompost produced using different substrates and to test the efficacy of vermicompost at different rates on selected high value crops. The use of the 100% cow manure + 30% filter cake will increase the nutrient composition of the vermicomposting in CSU-Piat of both macro and micro-nutrients. The application of 90-0-0 kg N ha-1 can be at par with the treatments applied with 23-0-0 kg N ha-1 15 bags/ha vermicast since they did not differ significantly with each other when applied at tomato plants. The use of 68-60-68 kg NPK ha-1 + 5 bags/ha vermicast and 45-40-45 kg NPK ha-1 + 10 bags/ha vermicast is the best fertilizer rates for onion production since they did not differ significantly with each other on the yield. On the other hand, decreasing the recommended rate of fertilizer up to 50% will provide a better yield when combined with inorganic fertilizer. Application of vermicast will significantly improves the soil's capacity to store and supply essential nutrients. It allows the soil to cope with changes in soil acidity, and helps soil minerals to decompose faster. A combination of organic and inorganic fertilizer would give profitable yield and this combination could possibly reduce the cost of production in the onion cultivation. The addition of organic fertilizer is responsible to improve the soil structure that needs in the bulb formation of garlic and onion.

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Introduction

Pressures on agricultural land such as increased population, land shortage, and poverty are leading to extensive land degradation. More people to feed, and decreasing land area for food production would all redound in extensive farming systems using hybrids, inorganic fertilizers, chemicals, and others with immediate effects that aggravate soil deterioration. About 5.2 million hectares of Philippine soil are seriously degraded resulting in a 30%-50% reduction in soil productivity (National Action Plan).

The urgency to protect and enhance the nutrient cycle and enhance soil fertility prompted the government to implement the Organic Agriculture Act of 2010. The Department of Agriculture launched a massive campaign on soil conservation and rehabilitation programs through organic farming that resulted in "organic fever". However, the limiting factors are the sources of organic fertilizer, bio-pesticides, and other organic inputs to produce organic foods.

Vermiculture is the science of breeding and raising earthworms. It defines the thrilling potential for waste reduction, and fertilizer production, as well as an assortment of possible uses for the future (Entre Pinoys, 2010). Vermicomposting is the process of producing organic fertilizer or vermicompost from bio-degradable materials with earthworms. Composting with worms avoids the needless disposal of vegetative food wastes and enjoys the benefits of high-quality compost. The earthworm is one of nature's pinnacle "soil scientists." Earthworms are liberated and cost-effective farm relief. The worms are accountable for a variety of elements including turning common soil into superior quality. They break down organic matter and when they eat, they leave behind castings that are an exceptionally valuable type of fertilizer (www.bjmp.gov.ph, 2010).

Fertilizer is indispensable in crop production since it is needed by the crop for them to complete its life cycle. This is true with the application of synthetic fertilizers which are readily absorbed by plants compared to manures. Today we are moving towards organic agriculture, which mandates the use of organically produce pesticides and fertilizers for the production of crops. It aims to produce food while establishing an ecological balance to prevent soil fertility or pest problems.

Organic agriculture takes a proactive approach as opposed to treating problems after they emerge. The impact of organic on natural resources favors interactions within the agroecosystem that is vital for both agricultural production and nature conservation. By opting for organic products, the consumer through his/her purchasing power promotes a less polluting agricultural system. The hidden costs of agriculture to the environment in terms of natural resource degradation are reduced. The study aimed to determine the enhanced nutrient composition of substrates used in vermicomposting applied at different rates on selected high-value crops.

Materials and Methods

Collection of Soil Sample and Analysis

Soil samples were randomly collected within the proposed experimental area with the use of a shovel. The soil samples were spread in newspaper and air-dried. One kilogram of samples was thoroughly pulverized and cleaned to separate foreign matters. The samples were submitted to the Integrated Laboratory Division, Regional Soils Laboratory DA-RO2, Carig Sur, Tuguegarao City for soil analysis. The NPK content of the soil was the basis for the fertilizer recommendation for the study.

Land Preparation

The area was cleared of stubbles, grasses, and stones for thorough land preparation. It was plowed with a tractor and harrowed. The area was left idle for two weeks to allow weeds to decay and to allow weed seeds to germinate before the final plowing. Final harrowing was done before transplanting until the soil was thoroughly pulverized.

Seedling Production

Seedling trays were filled with organic fertilizer and garden soil having a 1:1 ratio. The variety of tomatoes

used in the study was Diamante. One seed per cell was sown and watered. The seedlings were watered as the need arises. The seedling trays were placed under partial shade. Fifty grams of urea was dissolved in four liters of water and applied to the seedlings one week after pricking and follow-up watering was done to wash the fertilizer residues on the leaves of the plants. The seedlings were placed under partial shade until ready to transplant.

Experimental Treatments

The different treatments used in the study were the following:

T_1 - 90-0-0 kg N ha^{-1} (Recommended Rate)

T_2 - 68-0-0 kg N ha^{-1} + 5 bags ha^{-1} vermicast

T_3 - 45-0-0 kg N ha^{-1} + 10 bags ha^{-1} vermicast

T_4 - 23-0-0 kg N ha^{-1} 15 bags ha^{-1} vermicast

T_5 – 10 bags ha^{-1} vermicast (Recommended Rate)

Experimental Layout and Design

After the land preparation, an area of 493 square meters was divided into four blocks, each block measuring 4 meters by 29 meters with an alleyway of one meter between blocks. Each block was further subdivided into six plots, each plot measuring 5 meters by 4 meters with an alleyway of one meter between plots. The treatments were arranged following the procedure in the form of a Randomized Complete Block Design (RCBD).

Making of Holes and Application of Fertilizer

Holes were made at a distance of 75 centimeters between rows and 50 centimeters between hills at 6 centimeters depth and 10 centimeters wide. The computed amount of inorganic and organic fertilizer was based on the fertilizer recommendation per treatment and further divided equally with the number of hills. The vermicompost as treatment was applied 7 days before transplanting.

Transplanting and Replanting

The seedlings were transplanted two weeks after pricking. One seedling was transplanted per hill. Replanting of missing hills was done five days after transplanting.

Care and Management

Cultivation and Weed Control. Cultivation was done to provide aeration of the soil and to control weeds. Hilling-up was done to prevent the plants from excessive moisture. Hand weeding was done in the area to control the growth of weeds.

Irrigation. The plants were watered as the need arises.

Crop Protection. The occurrence of insect pests and diseases was immediately controlled by chemical control.

Harvesting

The fruits were harvested when they were green ripe. All samples were tagged to avoid intermixing of samples.

Data Gathered

1. Plant Height. The plant height of ten representative sample plants was measured at 30 and 60 days after transplanting. It was measured from the base of the plants up to the tip of the primary stem.

2. Number of Fruits per Plant. The number of marketable and non-marketable fruits per treatment was properly counted and recorded every harvest.

All the fruits from the first priming up to the last priming per plant were summed up and divided by ten to obtain the average number of fruits per plant.

3. Weight of Fruits per Plant. The fresh fruits were weighed every priming and recorded. After the last priming, the recorded weights of fruits were summed up and divided by ten to obtain the average fresh weight of fruits per plant.

4. Computed Fruit Yield per Hectare. The computed fruit yield per hectare was computed based on the average yield per sampling area.

Results and discussion

Table 1 shows the nutrient composition of both enhanced vermicast and 100% cow manure. Results

reveled that nutrient composition of enhanced vermicast is higher than the pure cow manure in all parameters. This means that to increase the nutrient content of vermicast is greatly depends on the input material. Hence, the filter cake has a potential as a starting material for vermicomposting and results in a biologically stable product that is free of pathogens, as coliform counting (Kwairakpam, 2009).

Table 1. Summary of nutrient analysis of enhanced nutrient composition of vermicast.

Nutrient	Enhanced Vermicast (100% Cow manure + 30% Filter cake)	*Cow Manure*
Total Nitrogen (%)	*1.65*	*0.7*
Total Phosphorus (%)	*0.31*	*0.25*
Total Potassium (%)	*0.63*	*0.5*
Calcium (%)	*1.5*	*0.9*
Zinc (ppm)	*87.5*	*14.15*
Copper (ppm)	*32.5*	*2.8*
Manganese (ppm)	*8265*	*69.0*
Iron (ppm)	*637.5*	*146.5*
Organic Carbon (%)	*13.07*	*20.4*

Plant Height at 30 and 60 DAT

The height of the plants at 30 and 60 days after transplanting is presented in Table 2. A significant result was observed on the height of the plants 30 days after planting wherein the plants applied with 90-0-0 kg N ha-1 obtained the tallest plants with mean values of 49, 25 cm, followed by 23-0-0 kg N ha-1 + 15 bags vermicast, 68-0-0 kg N ha-1 + 5 bags vermicast and 45-0-0 kg N ha-1 + 10 bags vermicast with a means of 45.01 cm, 44.81 cm and 40.90 cm, respectively. The shortest was obtained in 10 bags/ha vermicast with a mean of 39.89 centimeters. Likewise, a highly significant result was observed on the height of the plants at 60 days after transplanting wherein the plants were applied with inorganic fertilizer at the rate of 23-0-0 kg N ha-1 + 15 bags vermicast ha-1 (T_4) registered the tallest with a mean of 93.96 cm, closely followed by 90-0-0 kg N ha-1 (T_1) and 68-0-0 kg N ha-1 + 5 bags vermicast ha-1 (T_2), 45-0-0 kg N ha-1 + 10 bags vermicast ha-1 (T_3) obtained the tallest plants with mean values of 90.87 cm, 87.17 cm, and 75.74 centimeters, respectively. The shortest was registered in 10 bags vermicast ha-1 (T_5) with 72.93 centimeters. Differences in plant height were attributed to the effects of inorganic fertilizer and vermicast.

Table 2. Summary of Statistical Analysis in Tomato Production as Affected the Application Inorganic Fertilizer Supplemented with Vermicast at Different Rates.

Treatments	Plant Height (cm)		Number of Fruits/Plant	Weight of Fruits/plant	Computed yield (tons/ha)
	30 DAT	60 DAT			
T1 – 90-0-0 kg N ha-1	49.25	90.87	33	1333.91	6.669
T2 – 68-0-0 kg N ha-1 + 5 bags/ha vermicast	44.81	87.17	27	987.33	4.935
T3 – 45-0-0 kg N ha-1 + 10 bags/ha vermicast	40.90	75.74	23	734.10	3.670
T4 – 23-0-0 kg N ha-1 15 bags/ha vermicast	45.01	93.96	30	1150.20	5.751
T5 - 10 bags/ha vermicast	39.89	72.93	15	525.62	3.200
ANOVA RESULT	*	**	*	**	*
C.V. (%)	3.67	1.75	2.14	4.17	3.23

The above results were in support of the findings of Rakesh and Adarsh (2010) that the addition of vermicast to inorganic fertilizer had a significant effect on the growth, fruit, and yield of tomatoes. Additionally, they increase the microbial activity in soil, anion and cation exchange capacity, organic matter, and carbon content of the soil.

Number of Fruits/Plants

Table 2 shows the number of fruits/plants affected by the application of vermicast as soil amendments. Results revealed that T_1 (90-0-0 kg N ha-1) produced

the most number of fruits per hill with a mean of 33, closely followed by T_4 (23-0-0 kg N ha^{-1} + 15 bags vermicast ha^{-1}), T_2 (68-0-0 kg N ha^{-1} + 5 bags vermicast ha^{-1}) and T_3 (45-0-0 kg N ha^{-1} + 10 bags vermicast ha^{-1} with a means of 30, 27 and 23 and the least was observed in T_5 (10 bags vermicast ha^{-1}) with a mean of 15. Analysis of variance revealed significant differences among treatments. Such variation was attributed to the combined effects of inorganic fertilizer and vermicompost as cited by Atiyeh *et al.* (2002) that vermicompost promotes growth due to plant hormone-like activity related to microflora associated with vermicomposting and to metabolites produced as a consequence of secondary metabolism.

Organic sources offer more balanced nutrition to the plants, especially micronutrients which positively affect the number of fruits in plants (Miller, 2007).

Table 3. Cost and Return Analysis of Tomato Production as Affected by Vermicast.

PARTICULARS	TOTAL COST OF PRODUCTION	GROSS INCOME (PhP)	NET INCOME (PhP)	ROI (%)
T_1	52937.40	200070.00	147132.60	277.94
T_2	49912.88	148050.00	98137.12	196.62
T_3	47273.25	110100.00	62826.75	132.90
T_4	51660.22	172530.00	120869.78	233.97
T_5	43320.00	96000.00	52680.00	121.61

Weight of Fruits/Plants

The weight of fruits per plant as affected by the application of vermicast as amendments are reflected in Table 2. A highly significant result was observed on the weight of fruits per plant wherein the application of 90-0-0 kg N ha^{-1} (T_1) obtained the heaviest fruits with 1333.91 grams. It was followed by 23-0-0 kg N ha^{-1} + 15 bags vermicast ha^{-1} (T_4) and 68-0-0 kg N ha^{-1} + 5 bags vermicast ha^{-1} (T_2) and 45-0-0 kg ha-1 + vermicast ha^{-1} (T_3) with 1150.20, 987 and 734 grams. The lightest was obtained by 10 bags/ha vermicast (T_5) with 525.62 grams.

This implies that crops that are given better nutrition might increase the weight of fruits of tomatoes. This means that vermicompost is reported to have hormone-like activity and this has been hypothesized to result in greater root initiation, increased root biomass, enhanced plant growth and development, and altered morphology of plants grown in vermicompost amended soil (Muscolo *et al.*, 2009). Using phytohormone bioassays, compounds with gibberellin, cytokinin, and auxin-like activity have been detected in vermicompost urban and sewage waste (Canellas *et al.*, 2002).

Table 4. Summary of Statistical Analysis in Onion Production Affected by the Application of Inorganic Fertilizer Supplemented with Vermicast as Soil Amendments.

Treatments	Height of Plants at Maturity	Percentage Number of Harvested Bulbs	Diameter of Bulbs	Computed bulb Yield (tons/ha)
T_1 – 90-80-90 kg NPK ha-^{1}	43.22	92.57	3.26	6.52
T_2 – 68-60-68 kg NPK ha-^{1} + 5 bags ha-^{1} vermicast	42.92	93.65	3.42	6.78
T_3 – 45-40-45 kg NPK ha-^{1} + 10 bags ha-^{1} vermicast	41.75	93.48	4.31	7.2
T_4 – 23-20-23 kg NPK ha-^{1} + 15 bags ha-^{1} vermicast	41.86	93.68	3.15	6.12
T_5 - 10 bags ha-^{1} vermicast	41.02	92.13	3.10	5.16
ANOVA RESULT	ns	ns	*	**
C.V. (%)	5.94	11.49	3.35	5.59

Computed Yield (tons/ha)

Table 2 shows the computed yield (tons/ha) as affected by the different combinations of vermicast and inorganic fertilizer. The result further shows that T_1 (90-0-0 kg N ha^{-1}) produced the highest yield of 6.669 tons ha-1 followed by T_4 (23-0-0 kg N ha^{-1} + 15 bags vermicast ha^{-1}), T_2 (68-0-0 kg N ha-1 + 5 bags vermicast ha^{-1}) and T_3 (45-0-0 kg N ha^{-1} +10 bags Vermicast ha^{-1}) with a mean yield of tons ha^{-1} of 5.751 tons, 4.935 tons and 3.670 tones ha^{-1}. The last yield

was obtained in T_5 (10 bags Vermicast ha^{-1}) with a yield of 3.200 tons ha^{-1}. Statistical analysis reveals highly significant differences among the treatments tested. This means that applying vermicast to tomatoes obtained a positive impact on the yield of tomatoes. This result conformed to the study of Satyanarayana *et al.* (2002) found a significant increase in rice yield due to the application of inorganic fertilizer. The yield advantages due to the integration of organic sources and inorganic fertilizers over chemical fertilizers alone might be due to the availability of nutrients for a shorter period as mineralization of nitrogen is more rapid and in turn, the losses of inorganic nitrogen due to volatilization, denitrification, and leaching, etc., would be more. According to Uy *et al.*, (2019) reported from an economic point of view that farmers can use the combination of organic fertilizer and a reduced rate of inorganic fertilizers to boost the yield of rice as well as to maintain and improve soil health.

Table 5. Cost and Return Analysis of Onion Production as Affected by Vermicast.

PARTICULARS	TOTAL COST OF PRODUCTION	GROSS INCOME (PhP)	NET INCOME (PhP)	ROI (%)
T_1	56692.00	195600.00	138908.00	245.02
T_2	56838.00	203400.00	146562.00	257.86
T_3	56720.00	216000.00	159280.00	280.82
T_4	53452.00	183600.00	130148.00	243.49
T_5	47436.00	154800.00	107364.00	226.33

Cost and return analysis

The cost and return analysis of tomato production as affected by vermicompost fertilizers is presented in Table 5. The return on investment in every treatment is arranged in descending order: T_1 had 277.94 percent, T_4 233.97.00 percent, T_2 had 196.62, T_3 had 132.90 percent, and T_5 had 121.61 percent.

Plant height (cm)

Table 4 shows the height of the plants as affected by the application rates. Plants applied with 90-80-90 kg NPK ha-^{1} obtained the tallest plants over other treatments with a mean of 43.22 cm, followed by 68-60-68 kg NPK ha-^{1} + 5 bags/ha vermicast and 23-20-23 kg NPK ha-^{1} + 15 bags ha-^{1} vermicast and 45-40-45 kg NPK ha-^{1} + 10 bags/ha vermicast with a corresponding means of 42.92 cm, 41.86 cm, and 41.75 cm respectively.

The shortest was registered from 10 bags ha-^{1} vermicast with 41.02 cm. Despite the numerical differences, analysis of variance reveals no significant difference among treatments tested. This implies different rates of fertilizer does not affect the plant height of the plants.

Percentage of Number of Harvested Bulbs

Data revealed that plants fertilized with 23-20-23 kg NPK ha-^{1} + 15 bags ha-^{1} vermicast registered the highest number of harvested bulbs and the least was obtained in 90-80-90 kg NPK ha-^{1} with a means of 43.68 and 92.57 respectively. Analysis of variance reveals no significant difference existed among treatments. This means that plants responded equally despite the differences in fertilizer rates.

Equatorial diameter of bulbs

Table 4 presents the diameter of bulbs of onion as affected by different fertilizer rates and vermicast as soil amendments. Plants fertilized with 45-40-45 kg NPK ha-^{1} + 10 bags ha-^{1} vermicast obtained the widest bulbs with a mean of 4.31 centimeters, followed by 68-60-68 kg NPK ha-^{1} + 5 bags ha-^{1} vermicast, 90-80-90 kg NPK ha-^{1} and 23-20-23 kg NPK ha-^{1} + 15 bags ha-^{1} vermicast with a corresponding means of 3.42 cm, 3.26 cm and 3.15 cm in the same order.

The narrowest was obtained from 10 bags ha-^{1} vermicast with 3.10 cm. Statistical analysis reveals significant difference among treatments tested.

Addition of organic fertilizer increases soil organic matter content and soil structure therefore it affects bulb formation when soil will become porous. This is supported with the finding of Jeyarani (1986) who mentioned that addition of organic manures at the higher rate increases the total porosity significantly. Compost provides better environment for the soil organisms and enhances their activities to optimum level. Especially compost promotes actions of microorganisms in soil. Application of compost looses soil structure; hence it is easy to form more number of bulbs per plants. It may be the probable reason for more number of bulbs per plants produced by compost applied onion plants.

Table 6. Summary of Statistical Analysis in Garlic Production as Affected by the Application of Inorganic Fertilizer Supplemented with Vermicast as Soil Amendments.

Treatments	Height of Plants at Maturity	Number of cloves/bulb	Diameter of bulb	Computed bulb yield (tons/ha)
T_1 – 90-80-90 kg NPK ha-1	38.57	10	3.33	3.15
T_2 – 68-60-68 kg NPK ha-1 + 5 bags/ha vermicast	40.21	10	3.27	3.28
T_3 – 45-40-45 kg NPK ha-1 + 10 bags/ha vermicast	39.48	11	3.64	3.86
T_4 – 23-20-23 kg NPK ha-1 + 15 bags/ha vermicast	38.12	8	2.68	2.35
T_5 - 10 bags/ha vermicast	37.97	6	2.56	2.15
ANOVA RESULT	ns	*	*	**
C.V. (%)	2.97	11.02	7.4	7.82

Computed Yield (tons/ha)

Table 4 shows the yield of onion as affected by different fertilizer rates and vermicast as soil amendments. Plants fertilized with 45-40-45 kg NPK ha-1 + 10 bags ha-1 vermicast produced a yield of 7.2 tons per hectare, followed by 68-60-68 kg NPK ha-1 + 5 bags ha-1 vermicast, 90-80-90 kg NPK ha-1 and 23-20-23 kg NPK ha-1 + 15 bags ha-1 vermicast with a corresponding means of 6.78 tons, 6.52 tons and 6.12 tons per hectare in the same order. The lowest yield obtained from 10 bags ha-1 vermicast with 5.16 tons. Statistical analysis reveals significant difference among treatments tested. This means that a 50% recommended rate of inorganic and 10 bags of organic fertilizer will suffice the production of onion. It may be the possible reason for the high yield produced by this treatment. Thus, combination of organic and inorganic fertilizers could produce better yields than organic manure alone. The present result agreed with previous findings obtained on onion (Abbey and Kanton, 2004; Gambo *et al.*, 2008), tomato (Babajide *et al.*, 2008) and broccoli (Ouda and Mahadeen, 2008).

Cost and return analysis

The cost and return analysis of tomato production as affected by vermicompost fertilizers is presented in Table 5. The return on investment in every treatment is arranged in descending order: T_3 had 280.82 percent, T_2 257.86 percent, T_1 had 245.02, T_4 had 243.49 percent, and T_5 had 226.33 percent.

Plant height at maturity (cm)

Table 6 shows the height of the plant at maturity (cm). Plants fertilized with 68-60-68 kg NPK ha-1 + 5 bags ha-1 vermicast considered the tallest plants with a mean height of 40.21 cm, followed by 45-40-45 kg NPK ha-1 + 10 bags ha-1 vermicast, 90-80-90 kg NPK ha-1, 23-20-23 kg NPK ha-1 + 15 bags ha-1 vermicast and 10 bags ha-1 vermicast with a corresponding heights of 39.48 cm, 38.57 cm, 38.12 cm, and 37.97, cm respectively.

Despite the numerical differences, analysis of variance shows no significant difference among treatments. This means that different bedding materials did not influence the height of the plants on this parameter.

Number of Cloves/Bulb

The number of cloves/bulb was presented in Table 6. Plants fertilized with - 45-40-45 kg NPK ha-1 + 10

bags ha-1 vermicast obtained 11 cloves/bulb. The least number of cloves was registered in a treatment with an application rates of 23-20-23 kg NPK ha-1 + 15 bags ha-1 vermicast with a mean of 6 cloves/bulb. Statistical analysis reveals highly significant differences was observed among the treatments tested. As confirmed by Vadala *et al*, (2016), the use of appropriate fertilization can have a significant effect on selected garlic traits. A study by Diriba-Shiferaw *et al*., (2014), admittedly showed that supplementary fertilization could significantly affect the chemical composition of garlic bulb, but only inorganic fertilizers were used in the cultivation of *A. sativum*.

Table 7. Cost and Return Analysis of Tomato Production as Affected by Vermicast.

PARTICULARS	TOTAL COST OF PRODUCTION	GROSS INCOME (PhP)	NET INCOME (PhP)	ROI (%)
T_1	49615.00	94500.00	44885.00	90.47
T_2	49488.00	98400.00	48912.00	98.84
T_3	49706.00	115800.00	66094.00	132.97
T_4	45535.00	70500.00	24965.00	54.83
T_5	41115.00	64500.00	23385.00	56.88

Diameter of Bulbs/Plant (cm)

Table 6 shows the diameter of bulbs as influence by different fertilizer rates. Plants fertilized with 45-40-45 kg NPK ha-1 + 10 bags ha-1 vermicast obtained the wider diameter of bulbs with a mean of 3.64 cm. The narrowest among the treatments was registered in 10 bags ha-1 vermicast with a mean of 2.56 cm. Statistical analysis reveals a significant difference among treatments tested.

This result could be due to combined effect of the contributions of nitrogen to chlorophyll, enzymes, and proteins synthesis; as phosphorus is essential for root growth, phospho-proteins and phospho-lipids. Application of vermicompost looses soil structure; hence it is easy to form more number of bulbs per plants. It may be the probable reason for more number of bulbs per plants produced by compost applied.

Computed bulb yield (t/ha)

Table 6 shows that plants under 45-40-45 kg NPK ha-1 + 10 bags ha-1 vermicast registered the highest yield with 3.86 tons/hectare and the lowest was obtained in treatment with 23-20-23 kg NPK ha-1 + 15 bags ha-1 vermicast having 2.15 tons per hectare. Statistical analysis revealed highly significant differences among the different treatments tested. This means that applying inorganic and organic fertilizers may give higher yield wherein inorganic fertilizers release the nutrients quickly and fulfill the plants need at the opposite time. Therefore, plants would not face any limitation during the yield forming period and it could produce better yield.

Cost and return analysis

The cost and return analysis of tomato production as affected by vermicompost fertilizers is presented in Table 7. The return on investment in every treatment is arranged in descending order: T_3 had 132.97 percent, T_2 98.84 percent, T_3 had 90.47, T_5 had 56.88 percent, and T_5 had 54.83 percent.

Conclusion

Based on the result of the study, decreasing the recommended rate of fertilizer up to 50% will provide a better yield when combined with inorganic fertilizer since they did not differ significantly with each other. The addition of organic fertilizer is responsible to improve the soil structure that needs in the bulb formation of garlic.

Recommendation

Based on the results, the rate 45-40-45 kg NPK ha-1 + 10 bags/ha vermicompost and 68-60-68 kg NPK ha-1 + 5 bags/ha vermicompost were recommended in garlic production and could possibly reduce the cost of production when combined with organic fertilizer.

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