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Growth and Yield of Green Pepper (*Capsicum annum*) as affected by Frequency of Organic Fertilizer Application

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ABSTRACT

Most organic vegetable farmers in Central Luzon apply the required amount of organic fertilizers only once during planting. Hence, nutrient requirement of vegetables during vegetative or reproductive stages are no longer available. This condition seriously affects the growth and development of vegetables and subsequently affecting the yield performance that may result to low yield. In order to reduce the effect of nutrient deficiency on organic vegetable production particularly on green pepper, the research aimed to: a) establish frequency of organic fertilizer application employing split application; and b) determine the yield performance and net return based on the different treatments used. The research was conducted for two consecutive dry seasons (2014 and 2015) under full organic system. Twice application of the recommended rate of organic fertilizer obtained the highest yield of 4.21 t/ha while thrice application of the recommended rate of organic fertilizer obtained the second highest with 4.14 t/ha. Basal application obtained the lowest yield of 3.89 t/ha during the first trial. Second trial of the study showed that comparable yield was obtained by twice application and thrice application with 5.03 t/ha and 5.02 t/ha, respectively. Basal application consistently produced the lowest yield. Cost and return analysis of 1000 m^2 green pepper following the different treatments evaluated showed that the highest net income during the first trial was obtained from twice application of the recommended rate of organic fertilizer with PhP7,740.00 net income with an ROE of 85.05% which was lower than the ROE of the basal application with 89.76%. Lower net income was obtained from basal application of organic fertilizer due to lower yield obtained. Second trial showed that the highest net income was obtained from two split application of the recommended rate of organic fertilizer with PhP11,020.00 registering an ROE of 121.09%, the highest among the three treatments evaluated.

Introduction

One of the challenges in agriculture is the development of sustainable production technologies that can increase productivity but avoid environmental pollution and degradation. Due to this concern, appropriate solution than can reduce the potential effect of nutrient deficiency on organic vegetable production is deemed necessary to ensure crop productivity and sustainability particularly nutrient management aspect such as frequency of organic fertilizer application. Organic agriculture is developing rapidly, not only as a result of technological change but to combat the effect of global warming and climate change. Organic agriculture contributes to sustainable development, environmental protection and food safety (IFOAM, 2009). However, much has been said about the benefits of using organic fertilizer but still, much need to be done particularly on research aspect to answer arising problem in the utilization of organic technologies.

Peppers are one of the promising crops that offers considerable profit if marketing and production issues are properly managed particularly under organic system. Peppers are good options because they come in multiple mature fruit colors (green, red, yellow, orange, purple, and brown), shapes, and varying hotness (from sweet to very hot). Producing a variety of types will enable you to offer your customers a wide selection to meet their pepper preferences.
(PepperProductionWebsite http://extension.psu.edu/business/ag-alternatives/fruit-vegetables/pepper-production).

Green pepper is a very powerful antioxidant, being rich in calcium and also good for skin and hair.
A number of organic vegetable farmers in Central Luzon, Philippines grow organic vegetables year round in large quantity during dry season because of favorable dry and cool weather (Galindez, 2012). However, most of them usually apply the required amount of organic fertilizer only once during planting (Galindez, 2012). Hence, nutrient requirement of vegetables during vegetative or reproductive stages are no longer available. This condition seriously affects the growth and development of vegetables and

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subsequently affecting the yield performance that may result to low yield.

Split application of organic fertilizer into two application was proved to be the best frequency (Chang et al. 1986) as explained by Espanto (2015) that mineralization of organic fertilizer lasts for 30 days. This study was conducted in order to reduce the potential effect of nutrient deficiency on organic vegetable production particularly green pepper, by establishing the frequency of organic fertilizer application employing split application and by determining the yield performance and net return based on the different treatments used.

Materials and Methods

The research was conducted for two consecutive dry seasons (2014 and 2015) under full organic operation system at the Ramon Magsaysay-Center for Agricultural Resources and Environment Studies (RM-CARES) experimental area, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines.

Three organic fertilizer applications were evaluated: T1=basal application; T2=two split application (at seed sowing and at 30 days after seed emergence); and T3=three split application (at seed sowing, 30 DAT and after first harvest). Each application procedure followed the recommended rate of organic fertilizer of 4.5t/ha.

Randomized Complete Block Design (RCBD) was used in the field lay-out where each plot measured 2.5 x 15 m and replicated three times. The area was prepared prior to planting using small rotovator to cultivate and obtain good soil tilth and to remove weeds.

Prior to transplanting, application of organic fertilizer was done. The organic fertilizer used was produced by RM-CARES. Biodegradable wastes from leaf litter, rice straw, carabao manure, banana bracks and kakawate leaves were used for composting as source of organic fertilizer with the guaranteed analysis of N=1.5%, P_2O_5=2.00% and K_2O=2.00%. The required amount of organic fertilizer based on the result of soil analysis was applied. The frequency of application followed the one indicated in each treatment.

Two week-old green pepper seedlings grown in seedling trays were transplanted in prepared plots with planting distance of 0.50 m between hills and 1 m between rows.

The following cultural management procedures were practiced. Mulching was established in row of transplanted test crop using rice straw to control weeds in the experimental plots. Spot weeding was also practiced when there are grown weeds in the experimental plots. Initial irrigation was immediately employed after transplanting using deep well water pump following the furrow irrigation method to ensure availability of moisture in the newly transplanted seedlings and for the recovery of the plants. Succeeding irrigation procedures were done at weekly interval. Insect pest management was also practiced using bio-pesticides extracted from natural sources such as kakawate leaves (*Gliricidia sepium*), hot chili fruits (*Capsicum annuum* L.), yellow ginger (*Curuma longa*) and Acapulco leaves (*Senna alata)* leaf. Bio-pesticide was applied at concentration of 100 ml extract per liter of water. Weekly application was done to prevent or limit the development of pest population and disease occurrence.

All data gathered were analyzed using one way analysis of variance for RCBD. Comparison among treatment means was done using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Results and Discussion

Agronomic and Yield Performance

Performance of green pepper as affected by frequency of organic fertilizer application is shown in Table 1. Plant height at 30 DAT during the first and second trials showed that twice and thrice application of the recommended rate of

Table 1. Agronomic and yield performance of green pepper during 2014 and 2015 dry season (DS) trials as affected by the frequency of organic fertilizer application.

TREATMENT	PARAMETER					
	Plant Height (cm) at 30 DAT		Number of Fruits Harvested/Plant		Computed Yield (t/ha)	
	2014 DS*	2015 DS*	2014 DS*	2015 DS*	2014 DS*	2015 DS*
T1- Basal application of OF (at planting)	35.3[b]	34.40[b]	54[b]	21[c]	3.89[b]	3.69[b]
T2-Two split application of OF (at planting and at 30 DAT)	39.83[a]	40.70[a]	59[a]	33[b]	4.21[a]	5.03[a]
T3-three split application of OF (at planting, 30 DAT and after first harvest)	40.4[a]	39.30[a]	58[a]	39[a]	4.14[ab]	5.02[a]

*Means in each column having similar letters are not significantly different at 5% level by LSD

Table 2. Cost and return analysis for 1000m^2 green pepper, during 2014 and 2015 dry season (DS) trials, by treatment.

PARTICULAR	T1=Basal Application of OF		T2= Two Split Application of OF		T3= Three Split Application of OF	
	2014 DS	2015 DS	2014 DS	2014 DS	2015 DS	2014 DS
Yield (kg)	389	369	421	503	414	502
Price/kg (PhP)	40	40	40	40	40	40
TOTAL INCOME (PhP)	15,560.00	14,760.00	16,840.00	20,120.00	16,560.00	20,080.00
EXPENSES						
Material cost						
Organic Fertilizer	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00
Seed	950	950	950	950	950	950
Labor cost	1,750.00	1,750.00	2,650.00	2,650.00	3,050.00	3,050.00
Other Expenses						
Gasoline	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
TOTAL EXPENSES	8,200.00	8,200.00	9,100.00	9,100.00	9,500.00	9,500.00
NET INCOME	7,360.00	6,560.00	7,740.00	11,020.00	7,060.00	10,580.00
RETURN ON EXPENSES (%)	89.76	80	85.05	121.09	74.31	111.37

organic fertilizer consistently produced taller plants during the first and second trials of the study. During the first trial, number of fruits harvested per plant showed that twice and thrice application of organic fertilizer produced comparable number of harvested fruits with 59 and 58 fruits, respectively, while basal application of the recommended rate of organic fertilizer obtained total fruits of 54, the lowest among the treatments evaluated. Decreased number of harvested fruits during the second trial was observed. However, thrice application of organic fertilizer obtained the highest number of harvested fruits (39), followed by twice application with 33 fruits. Basal application recorded the lowest number of fruits harvested with 21 fruits. Computed yield per hectare showed that twice application of the recommended rate of organic fertilizer obtained the highest yield of 4.21 t/ha while thrice application of the recommended rate of organic fertilizer recorded the second highest with 4.14 t/ha. Basal application recorded the lowest yield of 3.89 t/ha during the first trial. Second trial of the study showed that comparable yield was obtained by twice application and thrice application with 5.03 t/ha and 5.02 t/ha, respectively. Basal application consistently produced the lowest yield. Split application of organic fertilizer was proven to be the best frequency (Chang et.al 1986) as explained by Espanto (2015) that mineralization of organic fertilizer last for 30 days.

Cost and Return Analysis

Cost and return analysis of 1000 m^2 green pepper (Table 2) following the different treatments evaluated showed that the highest net income during the first trial was obtained from the application of the recommended rate of organic fertilizer applied twice with PhP7,740.00 net income, registering an ROE of 85.05% which was lower than the registered ROE of the basal application of organic with 89.76%. Lower net income was obtained from basal application of organic fertilizer due to lower yield obtained.

Second trial showed that the highest net income was obtained from two split application of the recommended rate of organic fertilizer with PhP11,020.00 registering an ROE of 121.09%, the highest among the three treatments evaluated during the second trial of 2015 dry season.

Conclusion

Based on the results, two split application of the recommended rate of organic fertilizer for green pepper is recommended as this generated significant yield and high net return. This finding is very important to establish frequency of organic fertilizer application in organic vegetable production so that practitioners and would be organic enthusiasts will have a guide to follow. This research is very timely in support to the advocacy to adopt organic farming and find solution to mitigate the effect of climate change.

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