Growth and Yield Response of Okra (*Hibiscus esculentus* Linn.) Applied with Foliar Fertilizers and Vermicast

Mary Jane C. Floro, Pedro G. Gavino, Ernie P. Villareal, Nida T. Gavino, and Ma. Socorro Irmina F. Onapan
Capiz State University - Tapaz Satellite College

Abstract

This field research was conducted from August to December 2016 at Barangay Agcococ, Tapaz, Capiz, Philippines to determine the effect of foliar fertilizer and vermicast on the growth and yield of okra (*Hibiscus esculentus* Linn.) and to find out which foliar fertilizer and vermicast combination gave the best growth and highest yield.The experimental design used in the study was Split - Plot Design with treatments replicated three times. The treatments used in the study were the following: Factor A – Foliar Fertilizers consisted of: A1 – Hatake, A2 – Crop Giant, A3 – GrowMax and Factor B – Rates of Vermicast such as: B0 – no vermicast application, B1 – 5,000 kg of vermicast/ha, B2 – 10,000 kg of vermicast/ha. Foliar fertilizer were used as mainplot while rates of vermicast was used as subplot. All sets of data were analyzed using the Analysis of Variance and F-test for Split-Plot Design. Differences among treatment means were determined using DMRT, interpreted at 5% and 1% levels of significance. The growth of okra in terms of height was influenced by both foliar fertilizer and rates of vermicast application. The tallest plants were obtained from plants sprayed with GrowMax and applied with 10,000 kg/ha of vermicast. The yield of okra in terms of the number of fruits was affected by both foliar fertilizer and rates of vermicast applied. The most number of okra fruits were obtained from plants sprayed with Crop Giant and Hatake and applied with 10,000 kg/ha of vermicast. The yield of okra in terms of length of fruits and weight of fruits were not affected by both foliar fertilizer and rates of vermicast. There was no interaction effect observed between foliar fertilizer and rates of vermicast application in all growth and yield parameters measured.

Keywords: growth and yield response, foliar fertilizer, vermicast

Corresponding author: Mary Jane C. Floro, Ph.D.
Address: Capiz State University - Tapaz Satellite College, Tapaz, Capiz, Philippines
E-mail: maryjanefloro@yahoo.com

ISSN 1908-2843 Print

Introduction

Okra, scientifically known as *Hibiscus esculentus* Linn., is a vegetable crop grown both in tropical and subtropical regions of the world (Ahmed et al., 2008). Okra is recommended for consumption by the World Health Organization due to its ability to fight diseases. Okra has been found to be a rich source of vitamin A, C, calcium, thiamine, and riboflavin. It is also rich in iron and is used as medicine in the treatment of peptic ulcer (Naim, 2001). Okra grows in any kind of soil however, it thrives best in well-drained, sandy and sandy clay loam soil rich in organic matter. Here in the Philippines, okra gained acceptance as a vegetable. Indicative of its acceptability and demand is the fact that every market day, vegetable vendors display bundles of okra pods for sale. There is a time in a year when there is a high demand for okra and it commands a higher price.

In view of the many uses and benefits of vegetable crops, many approaches have been introduced to improve its production. Some of the farmers in our locality used inorganic fertilizer to improve its production. According to Akanbi et al. (2007) although inorganic fertilizer can improve crop yields, soil pH, total nutrient content and nutrient availability, their use is limited due to scarcity, high cost, nutrient imbalance, and soil acidity.

Application of foliar fertilizer is an effective way of correcting soil nutrient deficiencies when plants are unable to absorb them directly from the soil (Liang and Silberbush, 2002). When soil-applied fertilizers are not readily available or insufficient, foliar feeding is usually practiced or used as asupplement (Abbas and Ali, 2011). Similarly, Silberbush (2002) stated that foliar fertilization is a widely used practice to correct nutritional deficiencies in plants caused by the improper supply of nutrients to roots. In addition, Victory Global (2010) stated that foliar application will provide precise and accurate replacement of lost nutrient in the soil resulting from abuse use of inorganic granular fertilizers. It is a complete balanced NPK, secondary nutrients and chelated trace elements. It is formulated to ensure rapid foliar absorption. When applied during periods of stress, it will promote healthy growth and help the crop to overcome adverse conditions.

On the other hand, the use of organic fertilizer isthe best way to improve vegetable production. Organic manures improve soil fertility by activating soil microbial biomass (Ayuso et al., 1996 as cited by Akande et al. 2010). And the improvements in environmental conditions, as well as the need to reduce the cost of fertilizing crops are reasons for advocating the use of organic materials (Bayu et al., 2006 as cited by Akande et al. 2010). Organic fertilizers are a good source of nutrients aside from the fact that it is locally available and environment-friendly. Earthworm vermicompost is a highly nutritive organic fertilizer which is rich in humus, nitrogen (2–3%), phosphorus (1.55–2.25%), potassium (1.85–2.25%) micronutrients, beneficial to soil microbes like nitrogen-fixing bacteria and mycorrhizal fungi. This organic fertilizer was scientifically proved as a miracle plant growth promoter (Tiwari et al., 1989; Binet et al., 1998; Chaoui et al., 2003; & Guerrero, 2010 as cited by Sinha, et al. (2010)) and enhance

crop production.

Generally, the nutrients present on the organic fertilizers are not readily available to the crops and early stage of growth is the most critical stage for nutrient deficiency. Therefore, the use of foliar fertilizer in combination with vermicast could be a good source of nutrients for optimum crop production. However, information regarding the combined use of foliar fertilizer and vermicast is still inadequate, hence this study was conducted.

This study generally aims to find out the influence of vermicast and foliar fertilizers on the growth and yield performance of okra. Specifically, it aims to attain the following: 1) to determine the effect offoliar fertilizer onthe growth and yield of okra. 2) to find out the growth and yield response of okra on the rates of vermicast. 3) to evaluate the interaction effect between foliar fertilizer and rates of vermicast application.

Materials and Methods

Materials

The materials used in the study were okra seeds, vermicast, foliar fertilizers (Hatake, Crop Giant, and GrowMax), knapsack sprayer, hand trowel, spade, bolo, labeling materials, weighing and measuring devices, record notebook, office supplies and etc.

Methods

Experimental Design and Treatments

The experimental design used in the study was Split - Plot Design with treatments replicated three times. Foliar fertilizers were used as mainplot while rates of vermicast were used as subplot.

Table 1. Treatments of the study

Factor A (Foliar Fertilizers)	Factor B (Rates of Vermicast)
A1 – Hatake	B0 – Control (no vermicast application)
A2 – Crop Giant	B1 – 5,000 kg of vermicast/ha
A3 – GrowMax)	B2 – 10,000 kg of vermicast/ha

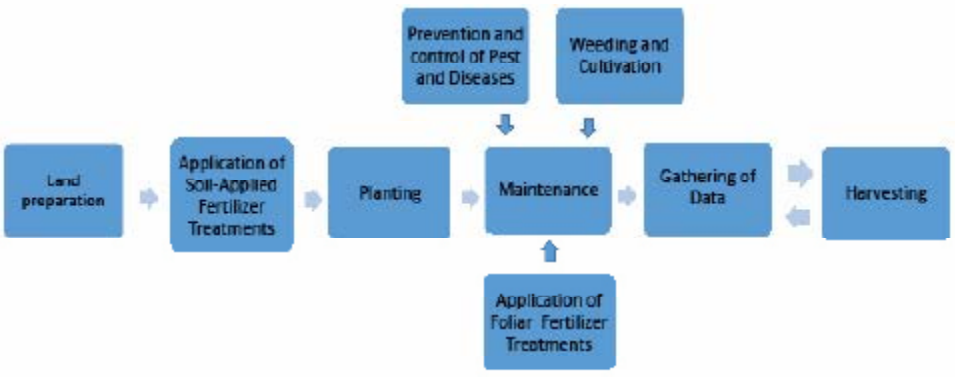

Figure 1. Procedural steps

The experimental area was thoroughly prepared by alternate plowing and harrowing three times with a week interval between operations to allow decomposition of weeds. Stones, rootstocks, and stubbles were removed from the area. The area was divided into 27 plots with a dimension of 2 x 3 m. Planting was done as soon as the experimental area had been thoroughly prepared and the soil has sufficient moisture to hasten the germination of seeds. The distance of planting was 75 cm between rows and 25 cm between hills. One seed was planted in each hill. Cleanliness and sanitation were observed in the experimental area. Weeding was done as soon as considerable number of weed is observed in the experimental area. This was done regularlythroughout the duration of the study. Cultivation was also done near the base of the plants to loosen the soil and to provide aeration, however, proper care was observed to prevent root damage. Foliar fertilizers were used as mainplot while rates of vermicast were used as subplots. First harvesting was done when fruits had attained harvestable size, that is, six days from the time of fruit set. Harvesting was done with 3-5 days interval to prevent the fruits to mature. The fruit was cut at the peduncle, just below the fruits using a sharp knife. Harvested fruits were handled carefully to prevent discoloration and were labeled appropriately by treatment and replication.

The data gathered from the study were growth parameters which included: plant height and yield parameters consisted of number of fruits, length of fruits (cm) and weight of fruits in ton/ha.

All sets of data were analyzed using the Analysis of Variance and F-test for Split-Plot Design. Differences among treatment means were determined usingDuncan's Multiple Range Test (DMRT), interpreted at 5% and 1% levels of significance.

Results and Discussion

F-test results indicated that foliar fertilizer application significantly affected the height of okra in centimeters. The tallest plants were obtained from plants

applied with GrowMax with a mean of 107.39 cm which were taller than okra applied with Crop Giant with a mean of 101.05. The shortest plants were obtained from plants sprayed with Hatake biofertilizer. Similarly, the height of okra was significantly influenced by the different rates of vermicast. Okra fertilized with 10,000 kg/ha gave the tallest plants of 106.10 which were found higher than plants applied with 5,000 kg/ha. Plants without vermicast gave the shortest plants of 97.93 centimeters. This finding conformed with the findings of studies using vermicast on the production of important vegetable crops like tomato, eggplant, and okra which yielded good results (Guerrero and Guerrero, 2006; Gupta et al., 2008; and Sinha et al., 2009). Nevertheless, there was no interaction effect between the two factors studied on this parameter.

For the yield component, the number of fruits produced by okra was significantly influenced by foliar fertilizers. Plants sprayed with Crop Giant produced the most number of fruits of 214.24. This was closely followed by plants sprayed with Hatake biofertilizer with a mean of 213.06. These were higher than the fruits produced by plants sprayed with GrowMax of 204.99. Likewise, the rates of vermicast application had greatly affected the number of fruits produced by okra. Plants applied with 10,000 kg/ha gave the most number of fruits of 226.25 which was found higher than plants applied with 5,000 kg/ha with 220.06. The least number of fruits was obtained from the plants without vermicast with a mean of 186.13. This result supports the claim of Channabasanagowda et al. (2008) as cited by Ramsamy et al. (2011) which mentioned that vermicompost has a slow release of nitrogen due to slow mineralization which helps in the availability of nutrients to the plants throughout the growth of the plant, thus resulting in higher yields. On the other hand, there was no interaction effect between the two factors studied.

Analysis of variance using F-test indicated that length of fruits of okra was not significantly influenced by both foliar fertilizer and rates of vermicast application. For foliar fertilizer, length of fruits ranged from 14.20 to 14.37 while for the rates of vermicast, fruit length ranged from 14.17 to 14.43. -These findings support the results of previous studies indicating that fruit length is probably governed by the genetic make-up of the crop or variety. There was an interaction effect between the two factors studied on fruit length.

Statistical results indicated that the weight of fruits obtained from okra did not significantly differ with foliar fertilizer and rates of vermicast applied. As to foliar fertilizer, the weight of fruits ranged from 8.17 to 8.63 t/ha while as to rates of vermicast the weight of fruits ranged from 7.82 to 8.79 t/ha. It can be observed that the weight of fruits produced by okra increased with foliar fertilizer and vermicast application, however, it did not result in significant yield in terms of fruit weight. Finally, there was no interaction effect observed between foliar fertilizer and rates of vermicast application on the weight of fruits in ton/ha.

Table 2. Summary of data on the growth and yield components of okra as influenced by foliar fertilizers.

Treatment	Growth Parameter Plant Height	Yield Parameter Number of fruits	Lenght of fruits (cm)	Weight of fruits (t/ha)
A_1B_0 - Hatake without vermicast	94.77	187.72	14.2	7.82
A_1B_1 - Hatake + 5,000 kg/ha	97.37	220.10	14.2	8.13
A_1B_2 - Hatake + 10,000 kg/ha	101.93	23.36	14.2	8.56
Mean	98.02	213.06	14.20	8.17
A_2B_0 - Crop Giant without vermicast	93.74	189.13	14.1	7.90
A_3B_1 - Grow Max + 5,000 kg/ha	106.93	214.65	14.5	8.69
A^3B_2 - Growth Max + 10,000 kg/ha	109.97	218.80	14.4	8.78
Mean	107.39	204.99	14.37	8.41

Table 2.0 Summary of data on the growth and yield components of okra as influenced by rates of vermicast.

Treatment	Growth Parameter Height (cm)	Yield Parameter Number of fruits	Lenght of fruits (cm)	Weight of fruits (t/ha)
A_1B_0 - Hatake without vermicast	94.77	187.72	14.2	7.82
A_2B_0 - Crop Giant without vermicast	93.74	189.13	14.1	7.90
A_3B_0 - GrowMax without vermicast	105.27	181.53	14.2	7.75
Mean	97.93	186.13	14.17	7.82
A_1B_1 - Hatake + 5,000 kg/ha	97.37	220.10	14.2	8.13
A_2B_1 - Crop Giant + 5,000 kg/ha	103.00	225.44	14.6	8.97
A_3B_2 - Growth Max + 5,000 kg/ha	106.93	214.65	14.5	8.69
Mean	102.43	220.06	14.43	8.60
A_1B_2 - Hatake + 10,000 kg/ha	101.93	231.36	14.2	8.56
A_2B_2 - Crop Giant + 10,000 kg/ha	106.40	228.14	14.4	9.03
A_3B_2 - Growth Max + 10,000 kg/ha	109.97	218.80	14.4	8.78
Mean	106.10	226.25	14.33	8.79

Table 3.0 Statistical analysis of data of okra applied with foliar fertilizer and rates of vermicast.

Parameters	Foliar Fertilizer	Rates of Vermicast	F x R	cv (%) a	b
A. Growth Component					
1. Plant height (cm)	**	*	ns	9.06	5.42
B. Yield Components					
1. Number of fruits	**	**	ns	11.81	7.90
2. Lenght of fruits (cm)	**	ns	ns	3.18	2.68
3. Weight of fruits (t/ha)	**	ns	ns	7.16	5.11

ns- not significant * - significant ** - highly significant

Conclusions

The growth of okra in terms of height was influenced by both foliar fertilizer and rates of vermicast application. The tallest plants were obtained from plants sprayed with GrowMax and applied with 10,000 kg/ha of vermicast. The yield of okra in terms of the number of fruits was affected by both foliar fertilizer and rates of vermicast applied. The most number of okra fruits was obtained from plants sprayed with Crop Giant and Hatake and applied with 10,000 kg/ha of vermicast. The yield of okra in terms of length of fruits and weight of fruits were not affected by both foliar fertilizer and rates of vermicast. There was no interaction effect observed between foliar fertilizer and rates of vermicast application in all growth and yield parameters measured.

Recommendations

Apply GrowMax foliar fertilizer for taller okra plants; Apply Crop Giant foliar fertilizer and Hatake biofertilizer for more okra fruits; Apply 10,000 kg/ha of vermicast for taller okra plants and for more fruits; Conduct other relevant studies using foliar fertilizer and vermicast on other crops to gather more comprehensive information.

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