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Varietal Test Of Lettuce (*Lactuca Sativa*) Applied With Bokashi

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Abstract
Global production and sale of organically grown food and fiber continue to increase exponentially and Bokashi is a fermented organic fertilizer containing indigenous microorganisms and nutrients which are beneficial to soil and plants. This study had conducted to determine the effects of bokashi on the agronomic characteristics of lettuce such as plant height, width, number of leaves, yield and infested number of plants and to recommend the most adaptive variety of lettuce. Four varieties, including T1-romaine, T2-corelle, T3-red rapid and T4-ice-berg, were used to check effect of bokashi. The experiment was laid out using Simple Randomized Complete Block Design. The experimental area of 7.2 m^2 was used in the experiment. Each variety was divided into 3 replications. Lettuce varieties were potted in 15 cm diameter polyethylene bags with 13 cm height. The ANOVA was used as a statistical tool. After a thorough observation and based on the results presented, the application of bokashi organic fertilizer on the length of plants (cm), was significantly different, and that on the number of infected plants was highly significantly different. However, no significant difference was observed for the diameter of plants (cm) and number of plants. The result of the study revealed that the most adaptive variety with least number of infested plants were Red Rapid, Corelle and Romaine. Thus, the varieties of lettuce, Romaine, Corelle and Red Rapid, were recommended to be alternatives to the ice-berg, which had succumbed to insect pest infestation in continual planting.

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I. Introduction

Lettuce (Lactuca sativa) is a major fresh vegetable and its leaves are commonly found in salad mixtures and sandwiches. Million tons of lettuce are grown annually worldwide since it is one of the most important leafy vegetables in the whole world. The largest part of this production comes from China as the biggest producer of lettuce. Other countries in the ranking include United States, India, Spain, Italy, Belgium, France, Japan and Mexico (worldatlas.com). According to the USDA National Agricultural Statistics Service (NASS), lettuce was produced on 166,800 acres, down 7% from 2014, which may be attributed to the severe drought in California. The number of farms producing lettuce on 5 acres or less increased 38% between 2007 and 2012. The average yield of head lettuce in 2015 was 36,200 pounds. Lettuce is considered as one of the important salad crops in the Philippines. It grows in places like that of Benguet where temperature is generally low and climate is distinctly cool. It is easily affected by high temperature, so carefully managed with respect to the vegetative growth is essential for the attainment of satisfactory growth, development and head-yield. Besides temperature, this crop is much affected by the cultural practices, affecting growth and yield with the application of organic vegetable (Jerry, 2002). It is also one of the most common salad vegetable crops being produced in the highlands of the Cordillera Administrative Region (CAR), which command high price not only in the local but also in the national markets (Estero, 2007). As reported by Kudan (1999), 293 hectares was planted to lettuce in 1994 producing 2,995.50 metric tons (BAS, 1999).

Global production and sale of organically grown food and fiber continue to increase exponentially. The 2009 tally from 160 countries reporting organic production data finds 37.2 million hectares under organic management involving 1.8 million farmers (Willer and Kilcher 2011). Nowadays, organic agriculture shares many techniques used by other sustainable agricultural practices (e.g. intercropping, mulching, integration of crops and livestock). However, the use of natural inputs, the improvements of soil structure and fertility make organic agriculture a unique agricultural management system. Organically grown foods are perceived as better quality, healthier and more nutritious than conventional counterparts (Warman and Havard, 1997). These practices may include cover crops, manures, compost, crop rotation, intercropping, and biological pest control (Badgley C. et al., 2007). The organic fertilizers might as well be considered as soil improving matters, since they increase the macro and micro element contents in the soil as well as the organic matter and humus contents, the biological activity and improve the physical-chemical characteristics. Based on the results of their study, Badgley C. et al. (2007) suggested that organic methods of food production can contribute substantially to feeding the current and future human population on the current agricultural land base, while maintaining soil

fertility. Lettuce is among the most important crops that need to be grown organically. It is the most sought green vegetables for salad and sandwiches. Furthermore, it is eaten raw, and it comes into direct contact with soil during a great part of its production cycle. It contains incredible sources of essential nutrients and could help in proper digestion, lowering cholesterol level, promotes healthy liver, cancer control, sleep induction, anxiety control and lowers inflammation.

Bokashi is an organic soil amendment originally formulated in Japan, where it is widely used. It was first advocated by the Japanese philosopher Mokichi Okada in 1935. Bokashi is a fermented organic fertilizer containing indigenous microorganisms and nutrients which are beneficial to soil and plants. Bokashi can be used as a basic fertilizer during soil preparation and also as a supplementary fertilizer during the fruiting stage. Kyan et al., (1999) states that Bokashi is the Japanese term for 'fermented' organic matter and is equivalent to compost used in traditional organic farming which is mostly prepared with the addition of EM. The Fermented Bokashi Compost is a mixture of several types of organic matter subjected to predominantly lactic fermentation. It can be prepared under complete anaerobic or aerobic conditions. The latter means that partial anaerobic conditions occur in the middle of the compost pile while the outer layers remain aerobic. The preparation of Anaerobic Bokashi is prepared in closed vessels, while aerobic Bokashi is prepared similarly to traditional composting with additional usage of a cover such as a jute bag, straw mat, or similar material. Yan and Xu (2002) concluded in their research with peanut crops, that crops treated with bokashi fertilizer had higher growth rates, increased nodulation and higher yield than crops treated with chemical fertilizer. Practical advantages associated with the use of bokashi include the rapid preparation time (only 2-4 weeks) relative to traditional compost (6 months) and the reduced cost compared to commercial fertilizers because it is manufactured from low-cost, locally available materials. Moreover, it is easily substituted for chemical fertilizers without requiring much additional training. As such, it is an appropriate tool for farmers who are in the process of making the transition from conventional to organic agriculture.

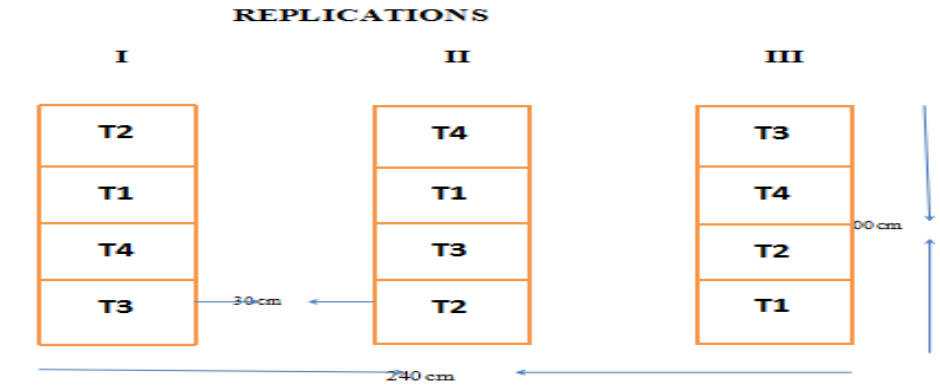
II. Materials And Method

Materials

The materials and tools used in this study are as follows: (1) pack seed of red rapid (lollorosa) variety of lettuce, 1 pack seed of Romaine, 1 pack seed of Iceberg (emperor) variety of lettuce, 1 pack seed of romaine (corelle) variety of lettuce, 1 sack of Organic Matter (OM) plus bokashi blend organic fertilizer, 240 pieces of black bag, 1 litre of LABs (Lactic Acid Bacillus), 500 ml. of FPJ (Fermented Plant Juice), 300 ml. of Oriental Herbal Nutrients), chilli pepper, 200 ml. attractant, 2 pieces of 120 ml. Sprinkler, 2 pieces of Sprinkler with 2 gallons capacity, digging tools, cutter, hand cultivator, wheel barrow, ruler, net, wire, bamboo, weighing scale, cell phones, video cam and record book.

Experimental Design Lay-out

An area of 7.2m^2 was utilized in this study using Simple Randomized Complete Blocku



(Figure 1.)

Seed Procurement

Different Lettuce variety was purchased from RAMGO seed distributor. The seeds were secured two (2) weeks before conducting the study to allow ample time. Certified seed of the seed breeder/distributor was a symbol of quality seed.

Fertilizer Procurement

The OM PLUS bokashi blend organic fertilizer was bought at Buro-Buro Springs. The organic fertilizer was secured upon sowing the different seed varieties of Lettuce.

LABs, FPJ, FAA, attractant and OHN were fermented a month ago before conducting the experimental research.

Cultural Management

Land Preparation

The area to be planted was cleaned, cultivated and divided into 3 equal size of plots using spade and hand cultivator.

Sowing the seeds

Recycled sowing trays were usedin sowing the seeds. The seeds were uniformly and thinly scattered in the trays filled with soil. The seedlings were allowed to grow for 5 days inside the rain protective area before transplanting to seedling plugs.

Preparing the seedling plugs

The pot medium for seedlings plugs was the mixture of garden soil and carbonized rice hull. The seedling plugs sized 2 inch in diameter and 2 1/2 inch in length.

Preparing of Soil Medium

The soil medium for lettuce was 2:1 ratio of soil garden and carabao manure. It was mixed uniformly and was put in black polyethylene bags as potted medium.

Transplanting

Transplanting of seedling per bag was done by digging a hole in the middle of the growing media with 2 inch depth in the black bag. The transferred seedlings were standing firmly by slightly pressing the dug media to the base of the seedling.

Fertilizer Application

The application of Bokashi was done upon the transplanting of lettuce as basal which was 18 grams per plant. The application of LABs and FFJ was done 3 days after transplanting. The 2nd application was done with 1-week interval after the first application. The application of FAA was done 10 days after transplanting. It was applied once.

Water Management

The experiment was watered manually and uniformly every day in the morning and in the afternoon.

Control of Pests and Disease

As organic practitioners, the control of pests and diseases was done mechanically by hand pricked. Oriental Herbal Nutrients (OHN) and fermented chili pepper were applied on lettuce upon the damaged of pests. Attractants were put in the area.

Harvesting of lettuce varieties and Data gathering

Harvesting of Lactuca sativa (Lettuce) was done 21 days after transplanting. Weighing of lettuce was immediately taken to avoid weight loss due to respiration.

Gathering of Data

The following data gathered and recorded;
Average plant height per treatment
Average plant width per treatment
Average no. of leaves per treatment
Total yield per treatment
Average Number of infested plant per treatment

Statistical Analysis

The data gathered were subjected to Analysis of Variance.

III. Results And Discussion

Table 1. Summary of means on length of leaves (cm), diameter of leaves (cm), number of leaves, yield (tons/ha) and number of infested plants.

Treatments	Length of leaves (cm)	Diameter of leaves (cm)	Number of leaves	Yield (tons/ha)	Number of Infested plants
T1=Romaine	22.92 **a**	12.15	12.84 **a**	31.16	3.00 **b**
T2=Corelle	18.24 **b**	10.36	8.11 **b**	28.22	3.00 **b**
T3=Red Rapid	17.29 **b**	10.07	11.56 **a**	29.42	2.00 **b**
T4=Ice berg-Emperor	16.87 **b**	10.88	7.16 **b**	28.40	11.67 **a**
Pr	*	ns	**	ns	**
CV (%)	8.22	11.09	5.75	9.01	44.32

Based on ANOVA, the parameters taken in this experiment such as length of plants (cm), was significantly different, while number of leaves and number of infested plants was highly significantly different. However, the diameter of plants (cm) and yield (tons/ha) were not significantly different among the varieties of lettuce applied with bokashi.

Plant height (cm)

Based on ANOVA the plant height of lettuce varieties applied with bokashi at Minoyan, Murcia, Negros Occidental condition was significantly different. The longest plant height was the variety T1 (Romaine) with a mean length of 22.93 cm, which was significantly different from the rest of the varieties T2 (Corelle), T3 (Red Rapid), and T4 (Ice Berg-Emperor) with 18.24 cm, 17.28 cm, and 16.87 cm, respectively.

Based on the figure below, the tallest plant height was the T1 (Romaine) variety of lettuce.

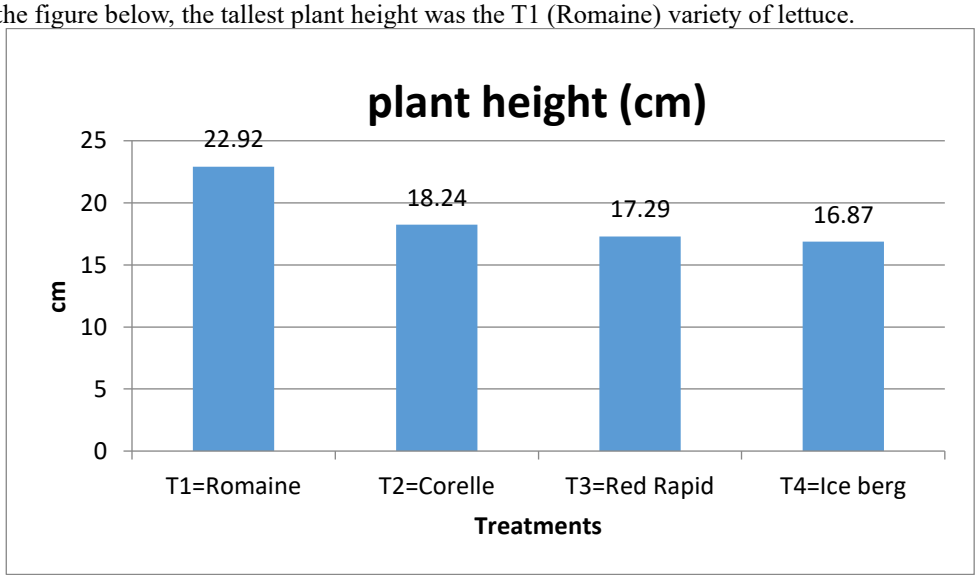


Figure 1. Plant height (cm) for lettuce varieties applied with bokashi.

Treatment (Lettuce Variety)		Replication			Mean
	I	II	III	Total	
T1=Romaine	21.77	22.77	24.24	68.77	22.92
T2=Corelle	18.57	17.11	19.05	54.73	18.24
T3=Red Rapid	16.89	17.29	17.67	51.86	17.29
T4=Ice berg-Emperor	18.30	17.87	14.43	50.60	16.87
Total	75.53	75.03	75.40		
Grand Total					225.97
Grand Mean					18.83

Table 2. Lenth of leaves (cm) of *Lactuca Sativa* (lettuce) applied with Bokashi

Sources of Variation	DF	Sum of Squares	Mean Square	F computed	Pr>F	
Treat	3	70.12113333	23.37371111	9.74	0.0101	*
(Block)	2	0.03185	0.015925	0.01	0.9934	Ns
Error	6	14.40001667	2.40000278			
Total	11	84.553				

CV= 8.22%

Table 2a. Analysis of variance on Lenth of leaves (by cm) of Lactuca Sativa (lettuce) applied with Bokashi

Treatment (Location)	LSD
T1=Romaine	22.93 **a**
T2=Corelle	18.24 **b**
T3=Red Rapid	17.28 **b**
T4=Ice berg-Emperor	16.87 **b**

Table 2b. LSD on plant height (by cm) of *Lactuca Sativa* (lettuce) applied with Bokashi

Diameter of plants (cm)

Based on ANOVA the diameter of plants of lettuce varieties applied with bokashi at Minoyan, Murcia, Negros Occidental condition was not significantly different. The range of the diameter was from 10.36 cm (Corelle) to 12.15 (Romaine).

Based on the figure below, the widest plant diameter was the T1 (Romaine) variety of lettuce.

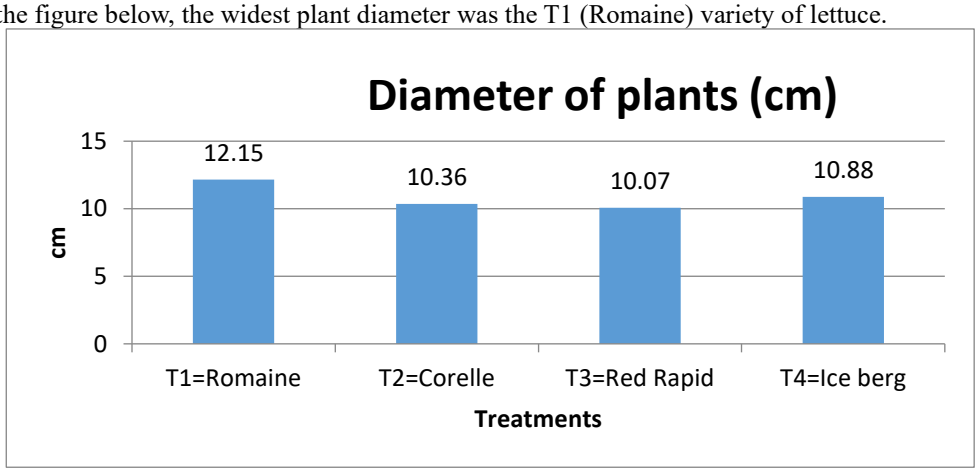


Figure 2. Diameter of plants (cm) for lettuce varieties applied with bokashi

Treatment (Lettuce Varieties)	Replication				Mean
	I	II	III	Total	
T1=Romaine	10.61	12.63	13.21	36.45	12.15
T2=Corelle	10.94	9.57	10.59	31.09	10.36
T3=Red Rapid	10.08	9.92	10.21	30.21	10.07
T4=Ice berg-Emperor	11.77	11.60	9.25	32.63	10.88
Total	43.40	43.72	43.27		
Grand Total					130.39
Grand Mean					10.87

Table 3. Diameter (cm) of *Lactuca Sativa* (lettuce) applied with Bokashi

Sources of Variation	DF	Sum of Squares	Mean Square	F computed	Pr>F	
Trt	3	7.59496667	2.53165556	1.74	0.2576	ns
Rep	2	0.0278	0.0139	0.01	0.9905	ns
Error	6	8.72053333	1.45342222			
Total	11	16.3433				

CV=11.09%

Table 3a. Analysis of variance on plant Diameter (cm) of Lactuca Sativa (lettuce) applied with Bokashi

Number of leaves

Based on ANOVA the number of leaves of lettuce varieties applied with bokashi at Minoyan, Murcia, Negros Occidental condition was not significantly different. The range of the number of leaves ranged from 12.84 (Romaine) to 7.16 (Ice-berg).

The figure below, the most number of leaves was the T1 (Romaine) variety of lettuce.

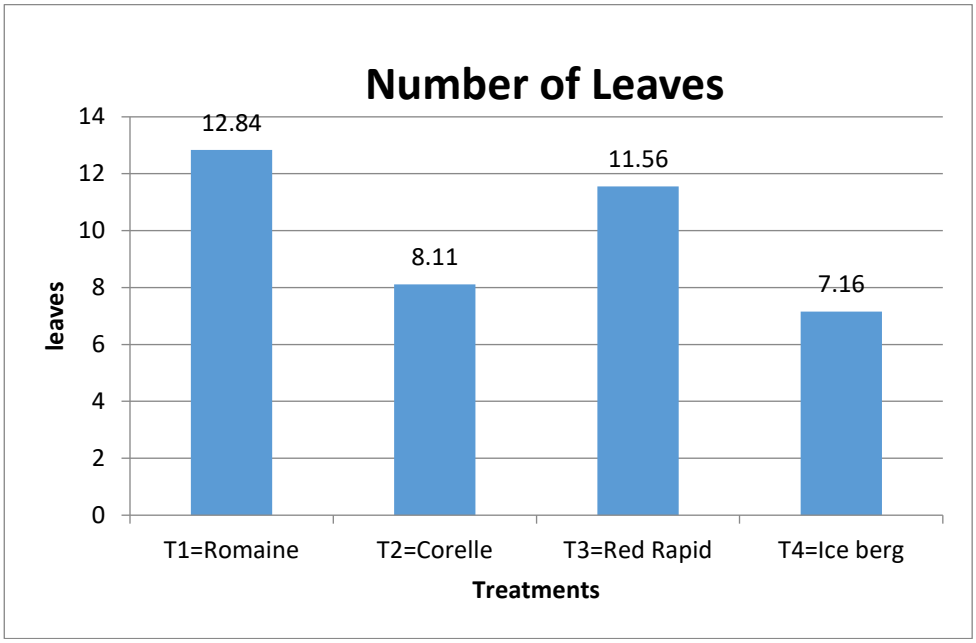


Figure 3. Number of leaves (cm) for lettuce varieties applied

Treatment (Lettuce Varieties)		Replication			Mean
	I	II	III	Total	
T1=Romaine	12.33	12.93	13.27	38.53	12.84
T2=Corelle	8.40	7.60	8.33	24.33	8.11
T3=Red Rapid	11.67	11.07	11.93	34.67	11.56
T4=Ice berg-Emperor	7.53	7.53	6.40	21.47	7.16
Total	39.93	39.13	39.93		
Grand Total					119.00
Grand Mean					9.92

Table 4. No. Of leaves of *Lactuca Sativa* (lettuce) applied with Bokashi

Sources of Variation	DF	Sum of Squares	Mean Square	F computed	Pr>F	
Trt	3	66.46509167	22.15503056	67.16	<.0001	**
Rep	2	0.10666667	0.05333333	0.16	0.8543	ns
Error	6	1.97933333	0.32988889			
Total	11	68.55109167				

CV=5.79%

Table 4a.Analysis of variance on No. Of leaves of Lactuca Sativa (lettuce) applied with Bokashi

Treatment (Location)	LSD
T1=Romaine	12.84 **a**
T3=Red Rapid	11.56 **b**
T2=Corelle	8.11 **c**
T4=Ice berg-Emperor	7.15 **c**

Table 4b. LSD on No. Of leaves of Lactuca Sativa (lettuce) applied with Bokashi

Yield (tons/ha)

Based on ANOVA, the yield in tons per hectare of lettuce applied with bokshi was not significantly different. The yield of lettuce varieties (tons/ha) ranged from 28.22 tons (Corelle) to 31.16 tons (Romaine).

As shown in the figure below, the highest yield was obtained by the Romaine variety of lettuce.

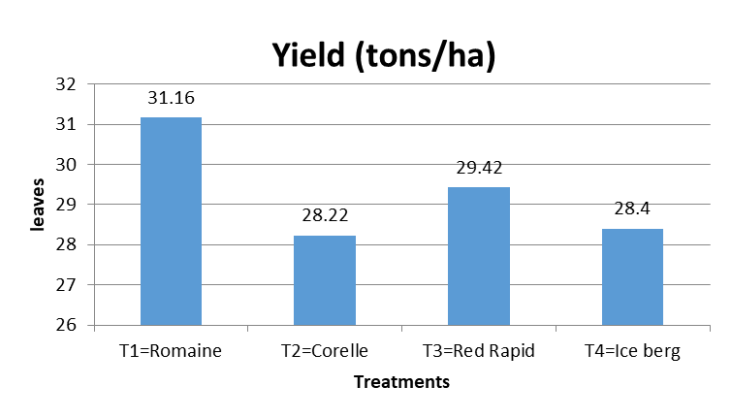


Figure 4. Yield (tons/ha) of romaine applied with bokashi

Treatment (Lettuce Varieties)		Replication			Mean
	I	II	III	Total	
T1=Romaine	31.61	29.63	32.24	93.48	31.16
T2=Corelle	27.78	27.26	29.63	84.67	28.22
T3=Red Rapid	29.63	28.36	30.28	88.27	29.42
T4=Ice berg-Emperor	29.93	31.56	23.70	85.19	28.40
Total	118.95	116.80	115.85		
Grand Total					351.60
Grand Mean					29.30

Table 5. Yield (tons/ha) of *Lactuca Sativa* (lettuce) applied with Bokashi

Sources of Variation	DF	Sum of Squares	Mean Square	F computed	Pr>F	
Trt	3	16.35009167	5.45003056	0.78	0.5464	ns
Rep	2	1.25926667	0.62963333	0.09	0.915	ns
Error	6	41.87753333	6.97958889			
Total	11	59.48689167				

CV=9.01%

Table 5a. Analysis of variance on Yield (tons/ha) of *Lactuca Sativa* (lettuce

Number of Infested Plants

Based on ANOVA, the number of infested plants was highly significantly different, the variety that is susceptible to infestation of pest was Ice-berg with an average of 11.67 infested plants, while the least infestation was the Red Rapid variety.

As shown in the figure below, the most resistant or least infested variety was Red Rapid.

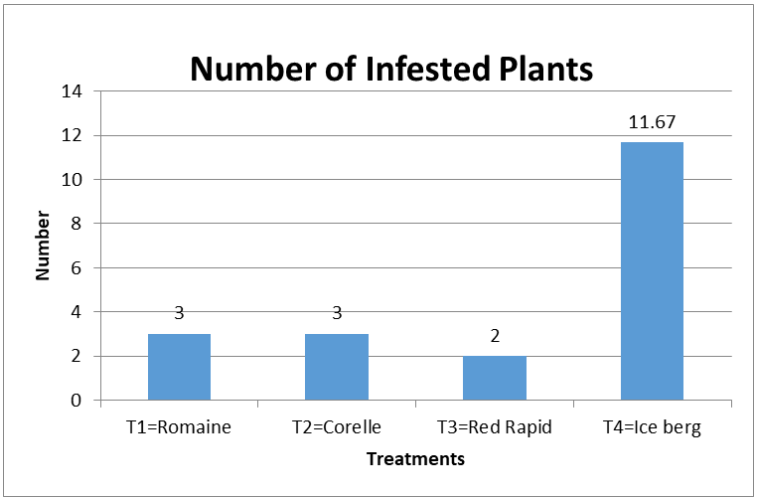


Figure 5. Number of infested plants applied with bokashi

Treatment (Lettuce Varieties)		Replication			Mean
	I	II	III	Total	
T1=Romaine	4.00	4.00	1.00	9.00	3.00
T2=Corelle	3.00	2.00	4.00	9.00	3.00
T3=Red Rapid	2.00	2.00	2.00	6.00	2.00
T4=Ice berg-Emperor	14.00	14.00	7.00	35.00	11.67
Total	23.00	22.00	14.00		
Grand Total					59.00
Grand Mean					4.92

Table 6. Number of infested plants on the of *Lactuca Sativa* (lettuce)

Sources of Variation	DF	Sum of Squares	Mean Square	F computed	Pr>F	
Trt	3	184.25	61.4166667	12.93	0.005	**
Rep	2	12.1666667	6.0833333	1.28	0.3442	ns
Error	6	28.5	4.75			
Total	11	224.9166667				

CV=44.32%

Table 6a. Analysis of variance on Number of infested plants

Treatment (Location)	LSD
T4=Ice berg- Emperor	11.67 **a**
T1=Corelle	3.00 **b**
T2=Red Rapid	3.00 **b**
T3=Romaine	2.00 **b**

Table 6b. LSD on Number of infested plant

IV. Conclusion

After a thorough observation and based on the results presented, the application of bokashi organic fertilizer on the parameters such as the length of plants (cm), was significantly different among varieties of lettuce, while the number of infected plants was highly significantly different. However, the diameter of plants (cm) and number of plants was not significantly different.

The results revealed that the most adaptive variety with least number of infested plants were Red rapid, Corelle, and Romaine.

V. Recommendation

Based on the results presented, the researchers have come up with the following recommendations:

1.To use Red Rapid, Corelle, and Romaine are suggested to alternative the Ice-berg (control) because Ice berg variety with continual planting had succumb to insect pest infestation.

References

[1] Estero, O.P 2007. Variety Evaluation Of Romain Type Lettuce Under La Trinidad, Benguet Condition. Bs Thesis, Benguet State University, La Trinidad, Benguet.
Jensen, H., L. Guilaran, R. Jaranilla And G. Garingalao, 2006. Organic Amendments Adopted And Adapted By Farmers In The Western Visayas Region Of The Philippines, Canadian International Development Agency (Cida).
[2] Kudan, S.L. 1999. Lettuce Production, Office Of The Director Of Extension, Benguet State University, La Trinidad, Benguet.
[3] Naz, S., S. Jabeen, S. Ilyas, F. Manzoor, F. Aslam, And A. Ali. 2010. Antibacterial Activity Of Curcuma Longa Varieties Against Different Strains Of Bacteria. Pak. J. Bot. 42:455–462.
[4] Sarker, S.D. And L. Nahar. 2004. Natural Medicine: The Genus Angelica. Curr. Med. Chem. 11:1479–1500.
[5] Tagotong, M.B. And Corpuz, O.S., 2015. Bio-Organic Fertilizer On Pechayhomegarden In Cotabato. American Journal Of Agriculture And Forestry Special Issue: Agro-Ecosystems, Vol. 3, No. 6, Page 6-9.
[6] Tagotong, M.M., 2014. Pechay Applied With Kinds And Levels Of Organic Fertilizer. Unfinished Masteral Thesis, Cotabato Foundation College Of Science And Technology.