BIBLIOGRAPHY

PUYAO, JERRY B. APRIL 2010. <u>Growth and Yield of Romaine Lettuce 'Xanadu' Base-dressed with Varying Rates of Plantmate Organic Fertilizers.</u> Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted from December 2009 to January 2010 at Balili Experement Areaa Benguet State University, La Trinidad, Benguet to evaluate the growth and yield of romaine lettuce applied with different rates of plantmate organic fertilizer, determine the best rate of plantmate organic fertilizer to romaine lettuce, and the profitability of romaine lettuce using the varying rates of plantmate organic fertilizer.

Results of the study revealed that there were no significant differences on all the growth and yield of romaine lettuce base-dressed with varying rates of plantmate organic fertilizer in he experiment area having a pH of 6.6, 2% organic matter content, 126 ppm phosphorous and366 ppm potassium. However, there was a general trend of increasing yield as the rate of plantmate application was increased from 0 to 60 grams per hill though the differences were slight. Economically, there turn on investment was highest from the highest rate of 60 grams per hill with 462.0% or P4.62 for every peso invested in the production. This was followed by the rate of 50 grams per hill with 443.0% ROI or P4.443 return for every peso spent in the production. The rest of the treatments with lower of application obtained lower return on investments.

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INTRODUCTION

Lettuce is one of the most important vegetable crops in Benguet because it matures early and has higher price. This is especially true to organically grown lettuce, which leads all salad crops in terms of demand. The trend in vegetable production is towards organic which is synonymous to “biological” or “ecological” according to the Philippine National Standard. This trend is due to the observation that the quality of food production is low and has direct relation to health problems, environmental pollution contributing to weather changes aside from the expensive inputs affecting the income of the farmers.

Throughout the past decades, fertilizers were being used extensively on vegetable crops. Nowadays the leading fertilizer materials were the inorganic or chemical ones. Organic one is seldom used. This situation resulted to the acidic condition of the soil, decline of soil fertility and proliferation of soil form diseases, thus decreasing the total yield of crops and several cases like bankruptcy of farmers.

The old method of farming which uses fertilizers such as manure and compost increases the organic content of the soil. The problem of acidic condition of the soil, decline of soil fertility and other diseases to be reduced, hence this study.

The importance of the study will guide the farmers in planning the rate of organic fertilizer that would enhance growth and yield of romaine lettuce. Aside from the information for farmers to use as a guide in the production of romaine lettuce, researchers who would like to improve the cultural practices in growing the crop will have the baseline information how to begging. Results of the study will also be added to the science and technology to benefit the next generations.

The objectives of the study are to determine the effect of the different rates of the organic fertilizer on the growth and yield of romaine lettuce, to determine the best rates of the organic fertilizer on the growth and yield of romaine lettuce and to determine the economic value of using the different rates of plantmate organic fertilizer.

The study was conducted at Balili Experiment Station, Benguet State University, La Trinidad, Benguet from December 2009 to January 2010.

REVIEW OF LITERATURE

Description of the Crop

According to Groman (1997), there are three main kinds of lettuce (1) head (2) leaf and (3) romaine. Head lettuce had leaves that curl around the center of the plant forming a ball-shaped head. Crisp lettuce or ice burg has tight head and brittle, juicy leaves. Leaf lettuce forms dense, leafy clumps instead of head. Gardeners grow more of it than any kinds. Most leaf lettuce has tight green leaves but a few red varieties have been developed for their taste and for the attractive color they give to salads. The waxy crinkled leaves vary in shaped among various type of leaf lettuce.

On the other hand, romaine lettuce grows long and upright and its leaves are inward. The leaves are tender can be easily damage in shipment. Romaine lettuce is the most nutritious.

Tied Jeams (1964), stated that lettuce a smooth annual plant of the family Compositae is extremely grown for its crisp tender leaves use as salad. Lettuce grows on well limed soil or sandy texture that permits adequate access to oxygen.

McCollum (1942), said that after the leaf formation, leaf branching and flowering stem developed. These stem range in height from 90-120 cm and bear clusters of small yellow flowering heads.

Pharmacological Importance and
Nutritional Value

Ensmiger *et al* (1986), romaine lettuce is guaranteed to be packet with nutrients. The vitamins and minerals found in romaine lettuce are especially good for the alleviation or preservation of many healthy complaints due to its extremely calories content and high water volume. Romaine lettuce while over cooked in the nutrition world is actually nutritious food. Based on its nutrient density the food ranking system qualified it as excelled source of vitamin A, C, folute mangganese and a good source of dietary fiber. The fiber adds another plus in its collism of heart healthy effects. In the colon, fibers bind to bile salts and remove them from the body. This force the body to make more bile which is helpful because it must breakdown cholesterol. Folic acid (Vitamins B) in needed by the body to convert a damaging chemical called "homocysteinc" into another, beneath substance. In addition, romaine lettuce is very good source of potassium which is useful in lowering high blood pressure.

Soil and Climate Adaptation

Temperature requirement Groman (1997), wrote that most kinds of commercial lettuce grow well in 21ºC and 24ºC. In contrast, Wallace (1975), mentioned that the optimum high for lettuce is 10-15 ºC which a day temperature of 15-20 ºC. Seed germination in 6-10 days, can be directly planted.

According to McCollum (1942), lettuce can be grown in wise variety of soil, including much of sandy or silty loam prefers a moist but well-drained soil type, rich in organic matter, sandy loam or loam which pH ranging from 6.5-7.5.

Importance of Organic Fertilizer

Plants use nutrients at different rates and at different time, during the growing season, for best results ensure that the nutrients are available on a consistent basis organic fertilizer are like an insurance policy. Most contain rock powder and complex proteins that are not very water-soluble. This means organic fertilizers persist in the soil for many months or even years. They become part of the soil, improving its texture and long-term fertility.

Organic fertilizers (including compost) also feed the diverse food web of bacteria, fungi, earth worms and other beneficial soil life. These organisms convert soil minerals into available nutrients that can be absorbed by plant roots. These organisms also improve the texture of the soil by creating passage way for air and water and aggregating soil particles into “crumbs”.

Organic matter added to garden soil improves the soil structure and feeds the micro-organism and insects. The more beneficial micro-organism your soil can support the less bad organism will survive. The good guys feed on harmful microbes like nematodes and certain soil born diseases.

They also release their nutrients into the soil when they die. So the more beneficial micro-organisms that are in the soil, the more nutrients will be in the soil. And many types of organic matter add still more soil nutrients to be mix.

<u>Effects of Organic Fertilizer</u>

In Bulacan, Abalos (2004), reported that the processing of chicken dung into compost is used to improve the condition of the soil with the element needed by plant to achieve good harvest while maintaining health safety to the produce. It was proven that the use of organic fertilizers help farmers reduce production cost and help conserve the biodiversity of the environment.

Sabas (2002), also emphasized that the beauty of composting is that can be done from virtually any biodegradable waste in almost any quality… its full potential as the basis of organic food growing and as an expensive yet highly marketable replacement of synthetic chemical fertilizers is only now becoming wide appreciated.

In 1982, Cooke reported that organic fertilizers increase organic content. As a result, soil alkalinity is increased. In addition simple supply of organic matter helps to keep the soil loose and prevents packing, facilitates digging, cultivation and enables roots of crop to penetrate the soil, readily increase water holding capacity, provides essential nutrients needed for plant growth.

For centuries, the use of farm manure has been synonymous with a successful and stable agriculture. It supplies organic matter and plant nutrients to the soil and generally; farm manure are conserving and protecting (Brady, 1974).

According to Abadilla (1982), crops applied with organic matter have a greater resistance to pest and diseases. The author mentioned that humic acid and growth substances are absorb into plant tissue through the roots and that they favor their formation protein by influencing the synthesis of enzymes that will increase the vigor of insect resistance of the plant. Moreover, soil high in organic matter allow little or no soil borne diseases because of the oxygen-ethyline cycle in the soil. Besides, the sap of the plant fertilized with organic matter, not only does humus confer immunity to plant pest and diseases, it also improves the quality of crops characteristics that has a very definite commercial value.

Furthermore, Cadiz and Aycardo (1977) believed that for a successful and continuous multiple cropping practices with vegetable crops, there is a need for a sustained application of compost to provide the food supply needs of a crops as well as feed the beneficial flora and faunal especially the microbes that makes the field-up nutrients available.

Plantmate Organic Fertilizers

According to brochure, the plantmate organic fertilizer product is the result of an accelerated decomposition of bio-degradable materials, both of plants and animals origin through an advance biofermentation process involving more than twenty (20) naturally-occuring beneficial micro-organisms to enhance its efficacy as a functional compound.

Plantmate consists\ of chemical properties such as the total of nitrogen 2.44% (4.14% by basis), total phosphorus 3.74% (6.34% on dry basis), total potassium 3.61% (6.13% on dry basis), total calcium 4.46% (7.5% on dry basis), total magnesium 0.17% (0.32% on dry basis). It is also chelated micronutrient and amino acid that is adequate and well balanced. Growth promotants and functional compounds are adequate.

Physical appearance of plantmate is loose, friable and very stable organic matter with high humus content, dark brown to black in color. It does not have any burning effects on plants, safe and no pathogen. The pH is 7.5, which is lightly basis.

MATERIALS AND METHODS

The materials used in the study were seeds of romaine lettuce plantmate (organic fertilizer), seedling trays, soil media for seedling (rice hull + compost + garden soil), weighing scale and farm tools and equipment.

The study was laid out in randomized complete block design (RCBD) with three replication. The rates of organic fertilizer application were the treatments as follows:

CODE	Treatment	Application per plot
R_1	no application (check)	0
R_2	10 g per hill	1.0 kg.
R_3	20 g per hill	2.0 kg
R_4	30 g per hill	3.0 kg
R_5	40 g per hill	4.0 kg
R_6	50 g per hill	5.0 kg
R_7	60 g per hill	6.0 kg

Land Preparation

Twenty one plots measuring 1m x 5m were prepared for the study. The plots were dug, leveled then applied with the organic fertilizer specified in the treatments. The organic fertilizer was mixed thoroughly with the soil ready for planting.

Seedling Production

Seedling trays were used in growing the seedlings. The soil media was sterilized, placed into the seedling trays then each hole was planted with a seed of romaine lettuce.

Watering was done immediately after sowing the seeds and this was done twice a week up to transplanting the seedling which was 21 days after sowing the seeds.

Transplanting

The 21-day old seedling were carefully pushed out of the seedling tray and were transplanted following the triangular arrangement with four rows at 20cm x 20cm spacing or 100 seedlings per plot.

Care and Management

The experiment area was irrigated after transplanting the seedlings and was done every after three days or twice a week up to harvest. Weeds was uprooted as they emerge and if there were insects, they were collected and crushed. Liquid Bio fertilizer was applied two weeks after transplanting to supplement the alnus compost mixed with the soil before transplanting the seedling.

Harvesting

The plants were harvested 35 to 40 days from transplanting the seedlings. The plants were cut at the base with a sharp knife and these were packed in biodegradable polyethelyne bags at 250 grams and were sold to the organic market.

Data Gathered

The data to be gathered, tabulated, computed and means subjected to separation test by the Duncan's Multiple Range Test (DMRT) were the following:

1. Number of days from transplanting to harvesting. This was the number of days from transplanting the seedlings to the day the plant was harvested.

2. Plant height at harvest (cm). Ten sample plants were randomly selected and measured with a foot rule from the base of the plant to the tip of the longest leaves at harvest time.

3. Weight of the marketable yield (kg/plot). This was the weight of all the plants that were sold in the market without defects.

4. Weight of non-marketable yield (kg/plot). This was the weight of non-marketable plants with defects such as malformed plants, disease-and insect-damaged that were not be sold to the market.

5. Total yield (kg/plot). This was the total weight of marketable and non-marketable plants per treatment plot.

6. Weight of individual plant (g). This was taken using the formula:

$$\text{Plant weight (g)} = \frac{\text{Total plant weight/plot}}{\text{Number of harvested plants/plot}}$$

7. Computed yield per hectare (tons/ha). The yield per plot was converted to tons per hectare by multiplying the yield per plot by 2000 then the answer was divided by 1000. Two thousand is the number of plots per hectare based on the plot size (1m/x/5/m) used in the study. Meanwhile 1000 is the weight of one ton.

8. Cost and return analysis. All expenses that were incurred in the study were recorded and the return on investment (ROI) was computed using the formula:

$$ROI\ (\%) = \frac{\text{Gross sales} - \text{Total expenses}}{\text{Total expenses}} \times 100$$

9. Documentation through pictures. Observations that cannot be measured were recorded in a photograph.

RESULTS AND DISCUSSION

Number of Days from Transplanting to Harvest

There were no significant differences among the treatments in the number of days from transplanting to harvesting (Table 1). This means that the different rates of applying the organic fertilizer did not affect the maturity period.

Plant Height at Harvest

As presented in Table 2 and Figure 1, there were no significant differences among the treatments on the plant height at harvest. Based on the control plots with no fertilizer application which did not differ from those plots with organic fertilizer, this result may suggest that the area used in the study may still support romaine lettuce.

Table 1. Number of days from transplanting to harvest

TREATMENTS	NUMBER OF DAYS
0 (no plantmate application)	48[a]
10 grams per hill	48[a]
20 grams per hill	48[a]
30 grams per hill	48[a]
40 grams per hill	48[a]
50 grams per hill	48[a]
60 grams per hill	48[a]

Means with the same letter are not significantly different at 5% level by DMRT

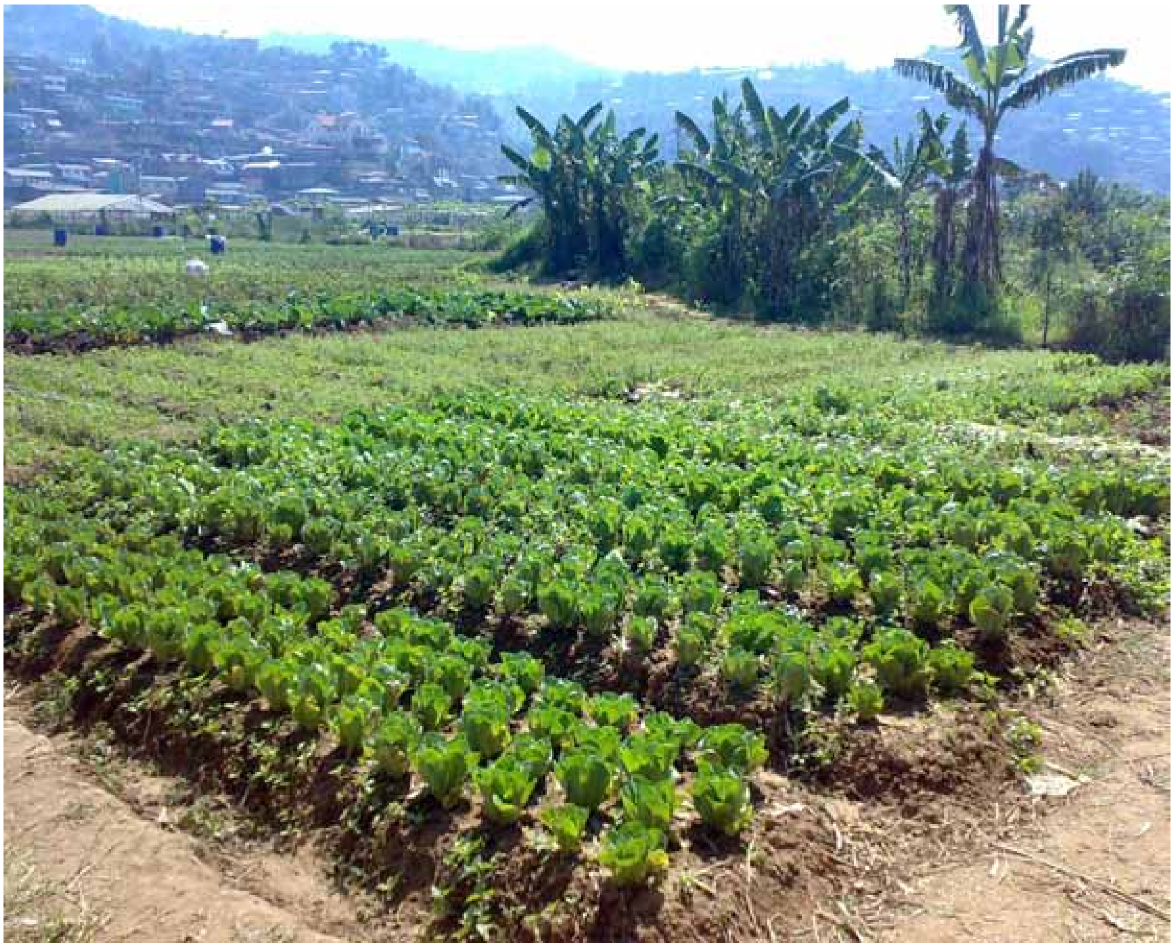


Figure 1. Photograph showing the similar plant height on the treatment plots

Table 2. Plant height at harvest

TREATMENT	HEIGHT (cm)
0 (no plantmate application)	20.71[a]
10 grams per hill	21.29[a]
20 grams per hill	21.02[a]
30 grams per hill	21.00[a]
40 grams per hill	21.23[a]
50 grams per hill	21.53[a]
60 grams per hill	21.69[a]

Means with the same letter are not significantly different at 5% level by DMRT

Weight of Marketable Yield

Table 3 shows that there was a general increase in the marketable yield of romaine lettuce as the rate of organic fertilizer was increased. However, statistical analysis shows slight differences among the increasing rates, including the plots without fertilizer as control. It might be that the soil with 6.6 pH, 2% organic matter, 126 ppm phosphorous and 366 ppm potassium is enough to support the romaine lettuce.

Weight of Non-marketable Yield

There were no significant differences among the treatments in the non-marketable yield (Table 4). This means that the varying rates of plantmate organic fertilizer did not influence the non-marketable yield. However, Figure 2 shows some plants infected with rotting and damaged by insect larvae.

Table 3. Weight of marketable yield

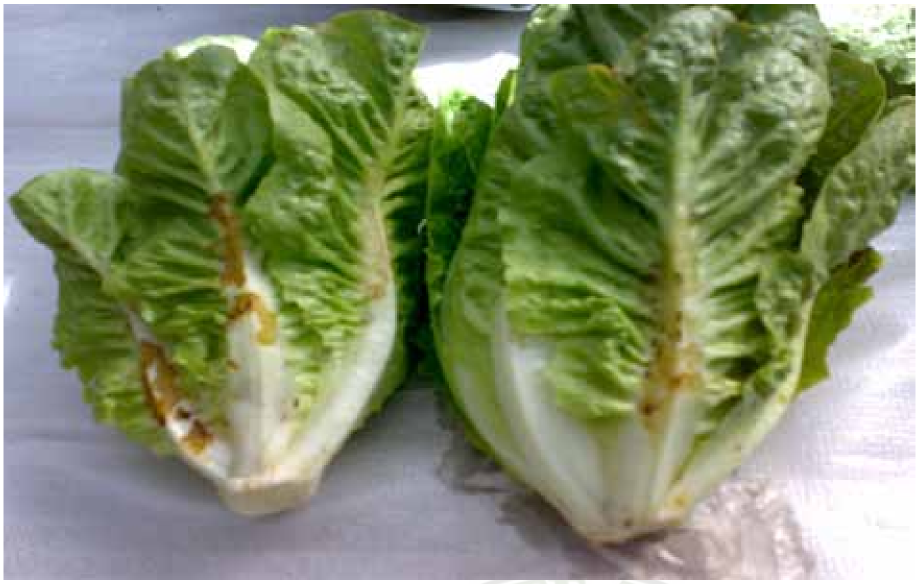
TREATMENT	MARKETABLE YIELD (kg/plot)
0 (no plantmate application)	6.58[a]
10 grams per hill	6.75[a]
20 grams per hill	7.17[a]
30 grams per hill	8.33[a]
40 grams per hill	7.92[a]
50 grams per hill	9.42[a]
60 grams per hill	10.75[a]

Means with the same letter are not significantly different at 5% level by DMRT

Table 4. Weight of non-marketable yield

TREATMENT	NON-MARKETABLE YIELD (kg/plot)
0 (no plantmate application)	4.17[a]
10 grams per hill	3.92[a]
20 grams per hill	3.83[a]
30 grams per hill	3.75[a]
40 grams per hill	3.92[a]
50 grams per hill	5.03[a]
60 grams per hill	4.83[a]

Means with the same letter are not significantly different at 5% level by DMRT



Damaged by insect larvae by eating the midribs

Base of leaves rotting

Figure 2. The plants infected with disease and damaged by insect larvae

Total Yield

The total yield from the different treatments did not show significant differences among the treatment (Table5). This may be due to the slight differences in plant height, weight of marketable yield and weight of non-marketable yield presented earlier. More over, the high pH of 6.6, 126 ppm phosphorous, 366 ppm potassium and 2% organic matter of the area used in the study may have provide the plants enough nutrients foe similar yield performance.

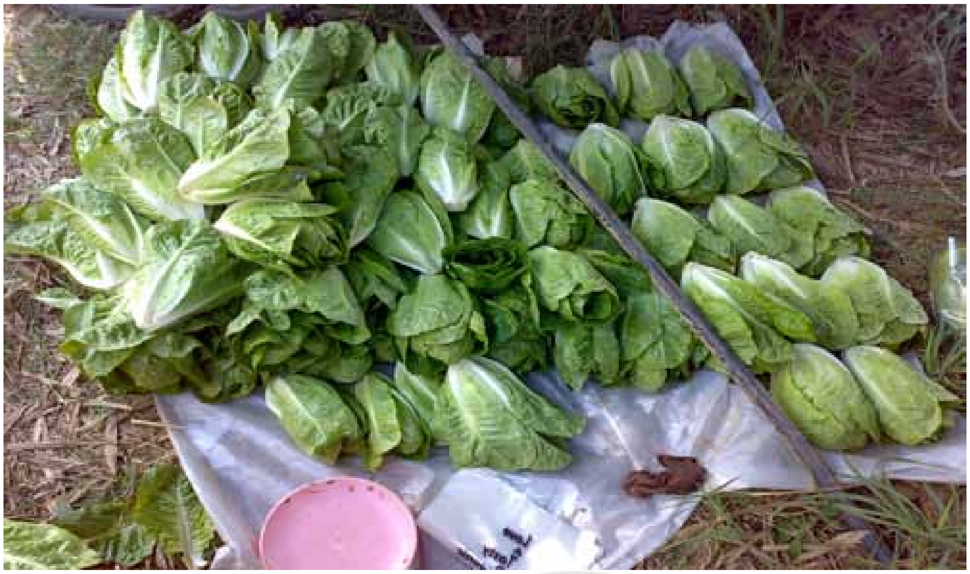
Weight of Individual Plants

Table 6 shows that weight of individual plant. The expected trend of gradual increase in weight of individual plants as the rate of plantmate organic fertilizer was increased was not attained. However, Figure 3 shows the smaller and higher rates such as 50 and 60 grams per hill have obviously bigger plats.

Table 5. Total yield

TREATMENT	TOTAL YIELD (kg/plot)
0 (no plantmate application)	10.75[a]
10 grams per hill	10.67[a]
20 grams per hill	11.00[a]
30 grams per hill	12.08[a]
40 grams per hill	11.83[a]
50 grams per hill	14.50[a]
60 grams per hill	15.58[a]

Means with the same letter are not significantly different at 5% level by DMRT



Sample of harvested romaine lettuce ready to be packed

Figure 3. The lower photograph shows the expected trend of increasing size of plant as the rate of organic fertilizer application increased

Table 6. Weight of individual plants

TREATMENT	WEIGHT OF INDIVIDUAL (g)
0 (no plantmate application)	118.00[a]
10 grams per hill	114.33[a]
20 grams per hill	119.00[a]
30 grams per hill	132.00[a]
40 grams per hill	128.00[a]
50 grams per hill	151.33[a]
60 grams per hill	163.33[a]

Means with the same letter are not significantly different at 5% level by DMRT

Computed Yield per Hectare

The computed yield per hectare following an increasing trend from 6.58 tons to 10.75 tons as the rate of applying plantmate organic fertilizer started from 0 to 60 grams per bill (Table 7). However, statistical analysis did not show any significant differences on the computed yield per hectare.

This result follows the non-significant differences obtained from all the data gathered which was explained earlier that the experiment area has high nutrient elements which might have negated the effect of the rates if the fertilizer application.

Table 7. Computed yield per hectare

TREATMENTS	COMPUTED YIELD (tons/ha)
0 (no plantmate application)	6.58[a]
10 grams per hill	6.75[a]
20 grams per hill	7.17[a]
30 grams per hill	8.33[a]
40 grams per hill	7.92[a]
50 grams per hill	9.42[a]
60 grams per hill	10.75[a]

Means with the same letter are not significantly different at 5% level by DMRT

Cost and Return Analysis

Table 8 presents the yield and sales from the 15 sq m. area planted with romaine lettuce and the expenses incurred. Although the differences in yield showed slight increases as the rate of applying plantmate was increased, the highest rate of 60 grams per hill obtained the highest return on investment of 462.0% or Php 4.62 return for every peso spent in the production. This was followed by the rate of 50 grams per hi9ll with an ROI of 443.0% while the lowest of 10 grams per hill had the lowest ROI of 362.0%. This means that even if there were no significant differences in the yield, the return on investment can pinpoint the rate of application to give highest profit.

Table 8. Cost and return analysis in 15 sq m area

ITEM	RATES OF PLANTMATE APPLICATION						
	Control	10g	20g	30g	40g	50g	60g
Yield (kg)	32.25	32.00	33.00	36.25	35.50	43.50	46.75
Sales (Php)	3,225	3,200	3,300	3,625	3,550	4,350	4,675
Farm Inputs:							
Plantmate	0	15.00	30.00	45.00	60.00	75.00	90.00
Packing materials	142.00	141.00	145.00	160.00	156.00	191.00	206.00
Gasoline	42.86	42.86	42.86	42.86	42.86	42.86	42.86
Labor cost							
Digging plots	38.57	38.57	38.57	38.57	38.57	38.57	38.57
Transplanting	34.28	34.28	34.28	34.28	34.28	34.28	34.28
Irrigation	51.43	51.43	51.43	51.43	51.43	51.43	51.43
Harvesting	68.57	68.57	68.57	68.57	68.57	68.57	68.57
Expenses (Php)	677.71	692.00	711.00	741.00	752.00	801.00	832.00
Net/ loss	2,547	2,508	2,589	2,884	2,798	3,549	3,845
ROI%	376.00	362.00	364.00	389.00	372.00	443.00	462.00

Note: The selling price per kilo was Php 100.00

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted from December 2009 to January 2010 at Balili Experiment Area, Benguet State University, La Trinidad, Benguet to evaluate the growth and yield of romaine lettuce applied with different rates of plantmate organic fertilizer; determine the best rate of plantmate application to romaine lettuce, and the profitability using the various rates.

There were no significant differences on the growth and yield of romaine lettuce applied with the different rates of plantamte organic fertilizer, thus, This study did not determine the best rate with the fertility level that the experiment area used in the study. However, there was an increasing yield as the rate of plantmate was increased. The cost and return analysis show that the 60 grams plantmate per hill obtained the highest ROI of 462.0% or Php 4.62 return for every peso spent in the production followed by 50 grams with an ROI of 443.0% while the lowest of 10 grams per hill had the Lowest ROI of 362.0%.

Conclusion

Based on the result presented and discussed, the application of plantmate organic fertilizer to a soil with 6.6 pH, 126 ppm phosphorous, 366 ppm potassium and 2% organic matter content can not show significant differences in growth and yield of romaine lettuce applied with varying rates from 0 to 60 grams per hill.

Recommendation

It is therefore recommended, that with the soil fertility level of 2% organic matter content, 126 ppm phosphorus, 366 ppm potassium and with soil pH of 6.6, romaine lettuce may not need the application of plantmate organic fertilizer. However, when the grower want to obtain higher return on investment, the application of 50 to 60 grams per hill or 5 to 6 kilos of plantmate per 1m x 5m plot with 100 romaine lettuce plant density is still economically beneficial when the selling price per kilo is Php 100.00 as in the study.

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APPENDICES

Appendix Table 1. Number of days from transplanting to harvesting

TREATMENT	BLOCKS			TOTAL	MEAN
	I	II	III		
T1	48	48	48	144	48
T2	48	48	48	144	48
T3	48	48	48	144	48
T4	48	48	48	144	48
T5	48	48	48	144	48
T6	48	48	48	144	48
T7	48	48	48	144	48
TOTAL	336	336	336	1008	336

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0	0			
Treatment	6	0	0	0ns	3.00	4.82
Error	12	0	0			
TOTAL	20	0				

ns- not significant

Coefficient of variation: 0%

Appendix Table 2. Plant height at harvest

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	20.34	21.48	20.32	62.18	20.73
T2	20.48	22.18	21.20	63.86	21.29
T3	20.19	21.55	21.31	63.05	21.02
T4	21.11	21.48	20.91	63.20	21.17
T5	21.61	21.28	20.81	63.70	21.23
T6	21.53	20.38	21.85	63.76	21.25
T7	2.48	20.58	23.00	65.06	21.69
TOTAL	146.74	148.93	149.40	445.11	149.38

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.520	0.260			
Treatment	6	1.581	0.264	0.41ns	3.00	4.82
Error	12	7.679	0.640			
TOTAL	20	7.02				

ns- not significant

Coefficient of variation: 3.78%

Appendix Table 3. Weight of marketable yield

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	6.75	9.00	4.00	19.75	6.58
T2	7.75	8.25	4.25	20.25	6.75
T3	7.00	8.50	6.00	21.50	7.17
T4	8.25	7.75	9.00	25.00	8.33
T5	8.00	7.25	8.50	23.75	7.92
T6	7.75	8.25	12.25	28.25	9.42
T7	8.25	6.75	17.25	32.25	10.75
TOTAL	53.75	55.75	61.25	170.75	56.92

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	4.310	2.155			
Treatment	6	41.494	6.916	0.84ns	3.00	4.82
Error	12	99.149	8.262			
TOTAL	20	144.952				

ns- not significant

Coefficient of variation: 35.35%

Appendix Table 4. Weight of non-marketable yield

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	5.00	4.25	3.25	12.50	4.17
T2	6.00	3.25	2.50	11.75	3.92
T3	5.00	2.50	4.00	11.50	3.83
T4	4.50	2.75	4.00	11.25	3.75
T5	4.25	1.50	6.00	11.75	3.92
T6	5.50	3.00	6.75	15.25	5.08
T7	5.75	2.75	6.00	14.50	4.48
TOTAL	36.00	20.00	32.50	88.50	29.50

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	20.214	10.107			
Treatment	6	5.036	0.839	0.59ns	3.00	4.82
Error	12	17.036	1.420			
TOTAL	20	42.286				

ns- not significant

Coefficient of variation: 28.27%

Appendix Table 5. Total yield

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	11.75	13.25	7.25	32.25	10.75
T2	13.75	11.00	6.75	32.00	10.67
T3	12.00	11.00	10.00	33.00	11.00
T4	12.75	10.50	13.00	36.25	12.08
T5	12.25	8.75	14.50	35.50	11.83
T6	13.25	11.25	19.00	43.50	14.50
T7	14.00	9.50	23.25	46.75	15.58
TOTAL	89.75	75.75	93.75	259.25	86.41

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	25.524	12.762			
Treatment	6	67.893	11.315	0.79ns	3.00	4.82
Error	12	172.768	14.387			
TOTAL	20	266.185				

ns- not significant

Coefficient of variation: 30.74%

Appendix Table 6. Weight of individual plants

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	130	144	80	354	118.00
T2	146	120	77	343	114.33
T3	129	121	107	357	119.00
T4	138	118	140	396	132.00
T5	129	102	153	384	128.00
T6	139	117	198	454	151.33
T7	146	109	235	490	163.33
TOTAL	957.00	831.00	990.00	2778.00	925.99

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	2011.714	1005.857			
Treatment	6	6144.286	1024.048	0.75ns	3.00	4.82
Error	12	16424.286	1368.690			
TOTAL	20	24580.286				

ns- not significant

Coefficient of variation: 27.97%

Appendix Table 7. Computed yield per hectar

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	23.50	27.50	14.50	65.50	21.83
T2	27.50	23.00	13.50	64.00	21.33
T3	24.00	22.00	20.00	66.00	22.00
T4	25.50	21.00	26.00	72.50	24.17
T5	24.50	17.50	29.00	11.00	23.67
T6	27.50	22.50	38.00	88.00	29.33
T7	28.00	19.00	46.50	93.50	31.17
TOTAL	180.00	152.50	187.50	520.00	173.50

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	98.00	49.000			
Treatment	6	274.286	45.714	0.78ns	3.00	4.82
Error	12	701.500	58.458			
TOTAL	20	1073.786				

ns- not significant

Coefficient of variation: 30.85%