BIBLIOGRAPHY

PILPILING, JEROME E. APRIL 2010. Growth and Yield of Pak Choi 'Cherokee' Grown on Soil with and without Pine Needle Litters. Banguet State University, La Trinidad Benguet.

Adviser: Silvestre L. Kudan, Ph.D.

ABSTRACT

Result of the study shows that pak choi grown in plots far from pine trees stand applied with alnus compost produced longer leaves, has slightly more number of leaves per plant, heavier weight of individual plants and heavier marketable yield.

Soil under pine trees stand had lower pH compared to the soil far from pine trees stand before and after harvesting the crop, but the application of alnus compost has improved the growth and yield of pak choi.

In the return on investment, the plants far from pine trees stand obtained the highest return on investment (ROI) of 87.32% or PhP 0.87 for every peso spent in the production. This was followed by the plants under pine trees stand and the plants far from pine trees stand plus alnus compost with 67.48%, 32.70% respectively. The lowest return on investment of 30.23% was obtained from the plants under pine trees stand applied with alnus compost.

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INTRODUCTION

The continuous application of synthetic fertilizer has resulted to depletion of humus in the soil and acidic soil in Benguet and Mountain Province .This can be seen in the report of Laurean and Badayos (2009) during the agency in house review where soil samples taken from Ngano-an, Boboc, Benguet with 2.19% organic matter has 3.96 pH; Ballay, Kabayan, Benguet with 4.44% organic matter has 4.45 pH; Lib-atan, Guinaoang, Mankayan, Benguet with 0.99% organic matter and 3.72 pH; Batauan, Nangalisan, Tuba with 0.96 % organic matter and 4.17 pH; and Magmagaling, Buguias, Benguet with 2.60 % organic matter and 5.08 pH.

Aside from the continuous application of synthetic fertilizer, the continuous planting of vegetables lead to the depletion of organic matter and nutrient element in the soil. Although farmers continuously apply undecompost chicken dung every cropping, the chicken manure cannot provide enough organic matter to the soil.

While some farmers complain that there is no other source of organic fertilizer aside from the chicken manure, there are still wide forests of pine trees where pine needle can be collected. However, several farmers are asking if the pine needles are acidic because their plants near pine trees where pine needles are falling do not grow. In order to provide the answer to the question, experiment be conducted under pine tree stand so that pine needles will be falling on the plots planted with pak choi while another area not receiving pine needles also be planted to compare. The extremely acidic soils in most area of Benguet where vegetables are produced require improvement and rehabilitation. This can only be done through the continuous application of organic matter from plant compost and animal manure.

Pine needles are abundant in the locality and are claimed to be acidic without basis. The result of this study will be of help to the vegetable industry. When it is proven that there are no bad effect to pak choi, this will encourage farmers to utilized pine needles in improving the fertility which has very low organic matter due to the continuous application of inorganic fertilizers. The information that will be attained from this study will be added to knowledge for the following generation to use.

The study was conducted to evaluate the growth and yield of pak choi planted on soil with pine needles and without pine needles, compare the chemical properties of the soil with pine needles and without pine needles in terms of pH, N, P, and K before and after harvesting the crop and determine the profitability of pak choi from with and without pine needles

The study was conducted at the College of Forestry Area, Benguet State University, La Trinidad, Benguet from December 2009 to January 2010.

REVIEW OF LITERETURE

Description of Pak Choi

Pak choi (*Brassica chenensis* l.) is a leafy vegetable that provide nutrition to human. It's grown in all part of the world, although it is not well popular in the Philippines (Tamayo, 1975). Pak choi is an Asian vegetable, which is being cultivated in China since Century.

Pak choi contains 14 g calories of food energy, 1.0 g protein, 2.73 g carbohydrates, 0.18 g total fat, and 0.84 fibers (Kinoshita, 1972). The heads formed loose upright with dark green leave and the seeds are round, dark brown weight of 1000 seeds is 3 g (Tindall, 1983). Pak choi is succulent and mild in flavor, and may be eaten either cooked or raw (Mc Donald, 1993). Both part is edible and use frequently in stir fries. The stalks can be consumed raw with dip or chopped and include in salad. Pak choi has high water content and becomes limp very quickly upon cooking. It should be cooked very quickly over high temperature so that the leaves become tender and stalks stay crisp.

Importance of the Crop

Next to the water we drink and the air we breathe, food is basic to our existence. Food is necessary for our health and well being. The main constituents of food may be classified in to six groups: carbohydrate, protein, fat, vitamins, mineral, and water.

At present the demand of pak choi in the local market is quit well due to its nutrient content. Its importance food source of medicine due to its sweet astringent and cool nature flavor affecting the stomach and large intestine (Doubrava, 2000). Can cool fever quench thirst, and benefit intestine and stomach. Pingalo (2008) stated that Chinese

medicinal doctors use it for petrol poisoning, small fibers in the eye, and other needs. The plant help to eliminate poison disperse blood poisoning and diminish swelling.

Climate and Soil Requirement

Pak choi is tolerant to a wide range of soil condition, including pH; although excessively well drained soil is unsuitable for this crop which matures rapidly. Normally grown at elevation up to 1,500 m sea level. although the leaves are liable to damage by wind in exposed situation. Withstand periods of relatively high rainfall but require full exposure to sun for optimum development. Flowering is reduces under high temperature condition but relatively low temperature of less than 16 c promote precocious flower production. High yielding, firm headed crop of the pak choi are produced at high elevation during weather at lower elevation during weather, at lower elevation heading is less likely to occur (Tindall, 1983).

Pak choi withstands wet weather relatively well if not flooded. Fertile alluvial sandy to clayey loam with pH 5.5 to 7 is preferred for cultivation. However, other soil type such as peat and latasols are also suitable if well provided with organic manure and fertilizer (Prosea, 1994). In addition Pears (2002) stated that the soil must be humus rich, moisture retensive to ensure the past growth for a good crop.

Importance of Soil Organic Matter

Organic matter enhances water and nutrient holding capacity and improves soil structure, managing for soil carbon can enhance productivity and environmental quality, and can reduce the severity and costs of natural phenomena, such as drought, flood, and

disease. In addition, increasing soil organic matter levels can reduce atmospheric CO_2 levels that contribute to climate change (Anonymous, nd).

Healthy soil is the foundation of the food system. It produces healthy crops that in turn nourish people. Soil organic matter provide nutrient to plant and providing nutrient and habitat to organisms living in the soil. Healthy soil is teeming with microscopic and larger organisms that perform many vital functions including converting dead and decaying matter as well as minerals to plant nutrients. Different soil organisms feed on different organic Substrates. Their biological activity depends on the organic matter.

MATERIALS AND METHODS

The materials used were pak choi seeds, garden tools, identifying tags, measuring tape and weighing scale.

The experiment was laid out in two adjacent areas where one is near pine trees whose leaves are falling on the area while the other area is not. The treatments were replicated three times were as follows:

Treatment Code	Description
T_1	plants grown under pine trees stand
T_2	plants grown under pine trees stand + compost of alnus leaves
T_3	plants grown far from pine trees stand
T_4	plants grown far from pine trees stand + compost of alnus leaves

Soil Sampling

Before preparing the plots and after harvesting the crops, soil samples from each area were taken and brought to the soils laboratory at Pacdal, Baguio City for OM, N, P, K and pH analysis.

Land Preparation

An area of 60 sq. m was prepared for the study. The area of 30 sq m was prepared into six plots measuring 1m x 5 m under pine trees stand while another 30 sq m not under pine trees stand was prepared into six plots measuring 1m x 5m each.

After digging the experiment plots, these were leveled, and those plots that should be applied with 10 kg compost of alnus leaves were applied and mixed with the soil.

Planting the Seeds and Irrigating

One seed of pak choi 'Cherokee' per hill were planted directly on the plot at a distance of 15 cm x 15 cm within rows and between rows. There were four rows of plants per plot with 33 plants per row or a total of 132 plants per plot. The plots were watered after planting the seeds and irrigating the plots was done after three days or twice a week up to harvest (Figure 1 and Figure 2).

Care and Management

The plants were taken cared of by uprooting weeds, collecting insect larvae and destroying them in order to ensure optimum growth and yield of all the plants, because agricultural chemicals were not used in the experiment.

Harvesting

The plants were harvested 40-45 days after planting by cutting the base of the plant with a sharp knife. Harvesting was done by replication so that gathering data and marketing was not done in just one day.

(a)

(b)

Figure 1. (a) Upper photo shows the researcher being helped during planting while (b) the lower photo shows the plants spaced at 15 cm x 15 cm on plots under pine trees stand at 40 days after planting

(a)

(b)

Figure 2. (a) Upper photo shows the researcher irrigating the planted seeds and (b) the lower photo shows the 40-day old plants far from the pine trees stand

Data Gathered

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

1. Soil pH. Soil pH of the different treatment plots was monitored weekly after planting to harvesting.

2. Leaf length (cm). This was measured from the base of the leaf petiole to the tip of longest leaf from ten samples plants per plot.

3. Number of leaves produced at harvest. Ten sample plants were harvested per plot and the leaves were counted, recorded, and the average number of leaves per plant were computed.

4. Weight of marketable plants per plot (kg). This was the weight of all harvested plants per plot without defects that was sold to the market.

5. Weight of non-marketable plants per plot (kg). This was the weight of plants per plot that was not sold in the market due to defect such as rotting, deformation, and severe pest damage.

6. Weight of individual plant (g). The weight of marketable plants per plot was divided by the number of marketable plants per plot.

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

8. Computed yield per hectare (t/ha). The yield per plot was converted to yield per hectare by multiplying with 2000 then dividing by 1000. Two thousand is the number of plots per hectare based on the dimension of plot (1m x 5m) used in the study while the one thousand is the weight per ton.

9. Return on Investment (ROI). This was computed by deducting the total expenses from the total sales per plot and the difference was divided by the total expenses multiplied by 100.

10. Documentation in picture. All observations which cannot be measured such as the color of the leaves, and other abnormalities of the plant were recorded in pictures (photograph).

RESULTS AND DISCUSSION

Weekly Changes in Soil pH

With the use of portable pH meter, the different treatment plots were monitored weekly, the result of which is presented in Figure 3. As presented, the plots under pine tree stand had the lowest pH on the fifth week while the plots away from pine tree stand had highest pH on the fifth week. The application of alnus compost to plots under pine tree stand seem to increase the soil pH five week after application while the pH of the plots without alnus compost decreased, which imply that the falling pine needles release some compound that will lower the soil pH.

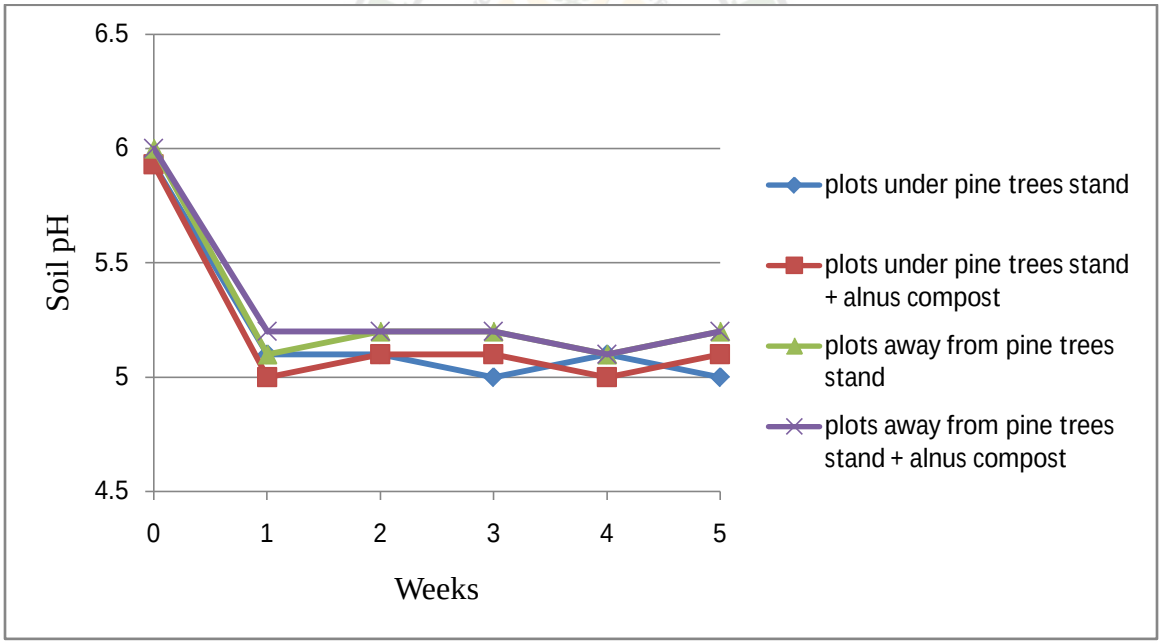

Figure 3. Soil pH of the different treatments monitored weekly with the use of pH meter

Leaf Length

As presented in Table 1, the plants under pine trees stand had significantly shorter leaves compared to the rest of the treatments. Plants far from pine trees stand and the plants under pine trees stand but applied with alnus compost had similar leaf length.

Before planting the area, the soil under pine tree stand had lower pH, organic matter content and potassium compared to the soil far from pine trees stand (Table 2). The soil pH decreased after planting which is even lower in plots under pine trees stand as shown in the soil analysis. This may explain the significantly shorter leaves from the plant grown under pine trees stand.

Number of Leaves Produced at Harvest

There were no significant differences among the treatment in the number of leaves produced at harvest (Table 3). This means that the number of leaves was not affected by the presence or absence of falling pine needles.

Table 1. Leaf length of plant grown in plot under and far from pine trees stand

TREATMENT	LEAF LENGTH (cm)
Plants grown under pine trees stand	18.81[b]
Plants grown under pine trees stand + Compost of alnus leaves	19.41[a]
Plants grown far from pine trees stand	19.63[a]
Plants grown far from pine trees stand + Compost of alnus leaves	19.92[a]

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

Table 2. Soil analysis of the experiment area before planting and after harvesting the crop by the Department of Agriculture, Baguio Soil Laboratory

Before Planting	Soil pH	OM	P,ppm	K,ppm	N
Soil under pine trees stand	5.93	2.5	7	350	1.25
Soil far from pine trees stand	6.0	5	4	386	2.5
After Planting					
Soil under pine trees stand	4.73	3.50	2	206	1.75
Soil far from pine trees stand	5.22	2.5	5	206	1.25

Table 3. Number of leaves produced per plant at harvest

TREATMENT	NUMBER OF LEAVES
Plants grown under pine trees stand	13.59[a]
Plants grown under pine trees stand + Compost of alnus leaves	13.62[a]
Plants grown far from pine trees stand	13.66[a]
Plants grown far from pine trees stand + Compost of alnus leaves	14.20[a]

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

Weight of Individual Plant

Table 4 shows that plants far from pine trees stand and applied with alnus leaves compost had the heaviest weight of individual plant followed by plants under pine trees stand and applied with alnus compost, plants far from pine trees stand and plants under pine trees stand, but the differences are not significant statistically

The result clearly shows that the weight of pak choi is heavier when planted on plots not under pine trees stand and applied with alnus compost. However, even the plants grown in plots under pine trees stand when the soil is applied with alnus compost before planting, there is slight advantage over the plants under pine trees stand without application of alnus compost.

Table 4. Weight of individual plant

TREATMENT	WEIGHT (g)
Plants grown under pine trees stand	29.25[b]
Plants grown under pine trees stand + Compost of alnus leaves	32.15[ab]
Plants grown far from pine trees stand	30.12[b]
Plants grown far from pine trees stand + Compost of alnus leaves	34.43[a]

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

Weight of Marketable Plants per Plot

Table 5 shows the marketable plants per plot from the different treatments studied. Marketable plants from plots far from pine trees stand applied with alnus compost significantly surpassed the weight of marketable plants from the other treatment studied, which obtained similar weight.

This observation seems to confirm the observation of farmers who were asking if pine needles make the soil acidic because the growth and yield of vegetable crops they plant under pine trees is affected.

Weight of Non-marketable Plants

As presented in Table 6, there were no significant differences among the treatments in terms of weight of non-marketable plants per plots. This may suggest that the weight of non-marketable plants was not affected by any of the treatments studied.

Table 5. Weight of marketable plant per 1x5 plot

TREATMENT	WEIGHT (kg)
Plants grown under pine trees stand	3.30[b]
Plants grown under pine trees stand + Compost of alnus leaves	3.72[b]
Plants grown far from pine trees stand	3.69[b]
Plants grown far from pine trees stand + Compost of alnus leaves	4.36[a]

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

Table 6. Weight of non-marketable plants per plot

TREATMENT	WEIGHT (kg)
Plants grown under pine trees stand	0.13[a]
Plants grown under pine trees stand + Compost of alnus leaves	0.08[a]
Plants grown far from pine trees stand	0.13[a]
Plants grown far from pine trees stand + Compost of alnus leaves	0.12[a]

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

Total Yield per Plot

The total yield per plot from the different treatments shows slight differences as presented in Table 7. However, the lowest yield per plot was harvested from those under pine tree stand which has the lowest soil pH after harvesting (Table 2 and Figure 3). As mentioned earlier, the weight of individual plant (Table 4) from plots under pine tree stand was lighter due to some smaller plants as shown in Figure 4 compared to the plants grown far from pine tree stand shown in Figure 5.

Table 7. Total yield

TREATMENT	TOTAL YIELD (kg)
Plants grown under pine trees stand	3.44[b]
Plants grown under pine trees stand + Compost of alnus leaves	4.01[ab]
Plants grown far from pine trees stand	3.82[ab]
Plants grown far from pine trees stand + Compost of alnus leaves	4.31[a]

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

Figure 4. Plant samples harvested under pine tree stand without alnus compost (T1) and with alnus compost (T2).

Figure 5. Sample plants harvested from plots away from the pine tree stand, so no falling pine needles.

Computed Yield per Hectare

The yield per plot was converted to yield per hectare and the differences among the treatments were not significant (Table 8). Statistically, the difference between the highest computed yield of 8.98 tons and 6.88 tons which is 2,100 kg is not negligible on the part of farmer because the value is PhP 84,000.00 based on PhP 40.00 selling price during the harvest of the pak choi. Interestingly, the application of alnus compost under pine tree stand resulted to 1,140 kg more harvest compared to the plots without compost which means PhP 45,600.00 additional income for the farmers which still have economic importance.

Table 8. Computed yield from 5 sq m plot to tons per hectare

TREATMENT	COMPUTED YIELD (ton)
Plants grown under pine trees stand	6.88[b]
Plants grown under pine trees stand + Compost of alnus leaves	8.02[ab]
Plants grown far from pine trees stand	7.64[ab]
Plants grown far from pine trees stand + Compost of alnus leaves	8.98[a]

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

Cost and Return Analysis

Table 9 presents the economic analysis of the different treatments studied. The different total yield and levels of expenses resulted to varying net profit and return on investment. As shown in the Table, plants grown on plots far from pine trees stand obtained the highest return on investment (ROI) of 87.32 % or PhP 0.87 for every peso invested in the production. This was followed by the plants grown on plots under pine trees stand, plants grown on plots far from pine trees stand and applied with alnus compost with 67.48 % and 32.70%, respectively. The lowest return on investment of 32.23% was obtained from the plants grown on plots under pine trees stand plus alnus compost application. It was computed that with the total marketable yield and total expenses, PhP 25.88 was spent to produce a kilo of pak choi.

Table 9. Cost and Return analysis of each treatment in 15 sq m plot

ITEMS	TREATMENT			
	T_1	T_2	T_3	T_4
Yield (kg)	9.91	11.79	11.09	13.09
Sales (PhP)	396.72	471.92	443.72	523.60
Expenses				
Inputs:				
1. Seeds	18.12	18.12	18.12	18.12
2. Alnus Compost	____	120.00	____	120.00
Labor cost (PhP)				
3. Land Preparation	37.5	37.50	37.50	37.50
4. Planting	25.00	25.00	25.00	25.00
5. Irrigation	75.00	75.00	75.00	75.00
6. Weeding	18.75	18.75	18.75	18.75
7. Harvesting	37.50	37.50	37.50	37.50
8. Marketing	25.00	25.00	25.00	25.00
Total expenses (PhP)	236.87	356.87	236.87	356.87
Net income (PhP)	159.85	115.05	206.85	166.73
ROI (%)	67.48	32.23	87.32	32.70

Note: The selling price during the harvest was PhP 40.00/kg.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at the College of Forestry area of Benguet State University, La Trinidad, Benguet from December 2009 to January 2010. To evaluate the growth and yield of pak choi planted in soil with litters of pine needles and without pine needles, compare the chemical properties of soil with pine needles and without pine needles in terms of pH, N, P and K before and after harvesting and determine the profitability of pak choi planted on with and without pine needles.

Result of the study shows that pak choi grown on plots far from pine trees stand plus alnus compost produced longer leaves, has slightly more number of leaves per plant, heavier weight of individual plant and has heavier marketable yield.

Soil under pine trees stand had 5.9 pH and soil far from pine trees stand had a pH of 6.0 before planting, but after harvest the plots under pine trees stand had a pH of 4.73 and plots not under pine trees stand had a pH of 5.22. In the return on investment, the plots not under pine trees stand gave the highest return on investment (ROI) of 87.32% or PhP 0.87 for every peso spent in the production. This was followed by the plots under pine trees stand and plots not under pine trees stand plus alnus compost with 67.48%, 32.70% respectively. The lowest return on investment of 30.23% was obtained from the plots under pine trees stand plus alnus compost.

Conclusion

Based on the results presented and discussed, plots not under pine trees stand produced higher yield of pak choi compared to those plots under pine trees stand where

pine needles are falling. However, the effect of pine needles litters can be minimized by the application of alnus compost. It appears that pine needles falling on the soil make the soil acidic.

Recommendation

It is therefore recommended, that pak choi should be grown on soil far from pine trees stand to obtain higher yield and return on investment. However, pak choi can still be grown on plots under pine trees stand with the application of alnus compost to minimize the effect of pine needles in the plants and still obtain a good yield.

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APPENDICES

Appendix Table 1. Leaf length (cm)

TREATMENT	BLOCKS			TOTAL	MEAN
	I	II	III		
T1	18.59	18.83	19.01	56.43	18.81
T2	19.25	19.40	19.60	58.25	19.42
T3	19.34	20.00	19.57	58.91	19.64
T4	20.17	19.61	20.00	59.78	19.93
Total	77.35	77.84	78.18	233.37	77.80

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.087	0.044			
Treatment	3	2.018	0.673	8.92*	4.76	9.78
Error	6	0.453	0.075			
Total	11	2.558				

* Significant Coefficient of variation: 1.41%

Appendix Table 2. Number of leaves produced at harvest

TREATMENT	BLOCKS			TOTAL	MEAN
	I	II	III		
T1	13.07	13.70	14.00	40.77	13.59
T2	14.00	13.50	13.38	40.88	13.63
T3	13.30	14.00	13.70	41.00	13.67
T4	14.50	14.40	13.70	42.60	14.20
Total	54.87	55.60	54.78	165.25	55.09

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.101	0.051			
Treatment	3	2.746	0.249	1.25ns	4.76	9.78
Error	6	1.192	0.199			
Total	11	2.039				

ns- not significant Coefficient of variation: 3.24%

Appendix Table 3. Weight of individual plant (g)

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	26.59	31.54	29.62	87.75	29.25
T2	32.40	32.03	32.02	96.45	32.15
T3	26.58	31.71	32.07	90.36	30.12
T4	34.45	34.88	33.98	103.31	34.44
Total	120.02	130.16	127.69	377.87	127.96

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	13.979	6.990			
Treatment	3	14.039	16.013	5.39*	4.76	9.78
Error	6	17.839	2.973			
Total	11	79.857				

*Significant Coefficient of variation: 5.48%

Appendix Table 4. Weight of marketable plants per plot (kg)

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	2.89	3.88	3.14	9.91	3.30
T2	3.92	3.87	4.00	11.79	3.93
T3	3.05	4.02	4.00	11.09	3.69
T4	4.41	4.50	4.18	13.09	4.36
Total	14.27	16.25	15.32	45.88	15.28

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.885	0.443			
Treatment	3	1.724	0.575	5.77*	4.76	9.78
Error	6	0.597	0.110			
Total	11	3.207				

*Significant Coefficient of variation: 8.36%

Appendix Table 5. Weight of non-marketable plants per plot (kg)

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	0.120	0.180	0.110	0.410	0.137
T2	0.111	0.075	0.058	0.244	0.081
T3	0.168	0.104	0.124	0.396	0.132
T4	0.130	0.145	0.108	0.383	0.128
Total	0.529	0.504	0.400	1.383	0.461

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.004	0.002			
Treatment	3	0.006	0.002	1.84ns	4.76	9.78
Error	6	0.006	0.001			
Total	11	0.017				

ns- not significant Coefficient of variation: 27.46%

Appendix Table 6. Total yield per plot (kg)

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	3.018	4.060	3.250	10.328	3.442
T2	4.031	3.951	4.060	12.042	4.014
T3	3.225	4.131	4.113	11.489	3.829
T4	4.540	4.645	4.288	12.959	4.319
Total	14.814	16.787	16.711	46.818	15.604

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	4.52	2.26			
Treatment	3	1.21	0.40	1.82*	4.76	9.78
Error	6	1.29	0.22			
Total	11	7.02				

*Significant Coefficient of variation: 12.02%

Appendix Table 7. Computed yield (t/ha)

TREATMENT	BLOCKS I	II	III	TOTAL	MEAN
T1	6.03	8.12	6.50	20.65	6.88
T2	8.06	7.90	8.12	24.08	8.02
T3	6.45	8.26	8.26	22.93	7.64
T4	9.08	9.29	8.57	26.94	8.98
Total	29.62	33.57	31.45	94.60	31.52

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	2.58	1.29			
Treatment	3	6.84	2.28	4.65*	4.76	9.78
Error	6	2.92	.49			
Total	11	12.34				

*Significant Coefficient of variation: 8.87%

Weekly Changes in soil pH

TREATMENT	WEEKS					
	0	1	2	3	4	5
T1		5.1	5.1	5.0	5.1	5.0
T2		5.0	5.1	5.1	5.0	5.1
T3		5.1	5.2	5.2	5.1	5.2
T4		5.2	5.2	5.2	5.1	5.2