BIBLIOGRAPHY

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ABSTRACT

The study was conducted at Cosmic Organic Farm, Beckel, La Trinidad, Benguet from December to March 2009 to evaluate the growth and yield of potato entries under organic production and identify the best potato entries based on yield and resistance to diseases and insects.

CIP 380241.17 and MLUSA 5 had a highest percent survival and tallest plants which was not significantly different with MLUSA 5. Igorota produced the highest canopy cover at 75 DAP. CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota were rated moderately vigorous at 75 DAP. Igorota and MLUSA 3 were highly resistant to late blight while the other entries were rated moderately resistant to leaf miner at 75 DAP. MLUSA 5 produced the highest number of marketable tuber while CIP 380241.17 produced the heaviest weight of marketable tubers and highest total yield and highest ROCE.

CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota are adapted under organic production at Beckel La Trinidad, Benguet. However, further evaluation of potato entries

should be conducted to determine their adaptability, stability in terms of yield and resistance to diseases and insects.

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INTRODUCTION

The potato (*Solanum tubersom L.)* is an annual plant belongs to the Solanaceae family and grown for its starchy tuber. In recent centuries, potatoes have been the world's most important tuber crop and fourth most important source of energy (after rice, wheat and maize) (Anonymous, 2008).

Potato is one of the major crops grown in Benguet and Mountain Province because of its adaptability to semi-temperate climate. However, it was reported that potato is the most chemically sprayed crop. To avoid the harmful effects of using pesticides and chemical fertilizers alternative methods should be done. One of these alternative practices is organic farming.

Organic production is a method of production that practices biologically enhancing soil and plants and the economical balance of the environment (Petzoldt, 2005). An important practice in organic farming is the use of variety that performs well and resistant to pest and diseases.

As cited by Wang, *et.al.* (2001), organic production is practical, long term and environmentally safe means of limiting damage from the attack of pest and diseases.

At present organic production is being promoted in Benguet and Mountain Province. This is due to high cost of pesticide and chemical fertilizers. The farmers are looking for the alternative production system that would require lesser and cost of production. Once a variety for organic production is identified, it could be integrated in the system for use of the farmers.

The study was conducted to evaluate the growth and yield of potato entries under organic production at Beckel, La Trinidad, Benguet and to identify the best potato entry based on yield and resistance to diseases and insects.

The study was conducted at the Cosmic Organic farm, located at Beckel, La Trinidad, Benguet from December 2008 to March 2009.

REVIEW OF LITERATURE

Importance of Organic Production

Organic production is a holistic system that aims to increase the productivity and fitness of diverse communities within the agro ecosystem, including soil organism, plant, livestock and people. The development of enterprises that are sustainable and harmonious with the environment is the aim of organic production (CAN/CGSB-32.310, 2006).

Recently, there are many farmers who practice diverse method of farming from conventional to the organic farming because of the unstable price of oil. Oil is the major ingredient for making chemical fertilizers. The farmers realized to look for an alternative low cost of fertilizers that are not harmful but beneficial to the environment and the plant (Razzaq, 2008). According to the PCARRD (2000), organic production is the traditional method used by the farmers to practice the diverse farming which avoided the use of synthetic chemicals.

Organic farming conserves and maintains the ecological balance of the environment. It avoids the contamination of the air, soil, water, and the crop itself. According to Balfour (2000), organic farming preserves and enhances top soil and it increases the chances that future generation can continue growing food.

Organic production is highly recommended in the Cordillera. This production strategy enhances safety and quality, environmental sustainability and gives concern to the health and welfare of the farmer in the future (Briones, 1997).

Varietal Evaluation on Organic Production

Varietal evaluation or crop selection in agronomic crops is important for managing crops under organic production. There is need to evaluate the variety under organic contest to know what variety is good for organic production. According to Wang, *et.al.* (2001), the desirable method in organic production is the cultivation of resistant varieities.

In wheat, Lammerts van Bueren (2002), suggested to implement plant traits evaluation through recovery from mechanical harrowing, tillering, speed of closing the crop, canopy density, canopy habit, green index, distance of ear-flag leaf, compactness of the ear and resistance to sprouting.

Similarly, DEFRA (Department for Environment, Food and Rural Affairs) (2006) as cited by Bueren (2002), suggests that cereal varieties for organic production are characterized by growth habit and weed suppression capacity, in early vigor, long straw, and tolerance to weeds.

Furthermore, sweetpotato for being one of agronomic crops is evaluated in California under organic production. One variety found to be suitable for organic production was the White Regal potato. The White Regal is resistant to fusarium wilt and the southern root-knot nematode and it can be stored also for several months (Adam, 2006).

In China, studies have shown that sweetpotato yield can be increased by as much as 30%-40% without adding of fertilizer, using of pesticide or genetic improvement (Adam, 2006).

Varietal Evaluation on Organic Potato Production

HARRDEC (1996), stated that achieving maximum production requires the best variety to be selected in the locality. Series of varietal evaluation must be conducted in order to determine the adapted variety and the performance of newly introduced varieties.

Lem-ew (2007), found that CIP 13.1.1 and CIP 5.119.2.2 are the best potato entries under organic production at Bakun, Benguet exhibiting resistance to late blight and high yield. In a related study by Montes (2006), potato genotype CIP 676089 is the best under organic production at Puguis, La Trinidad, Benguet as evidenced by highly vigorous and tall plants, high yield, high dry matter content of tubers and resistance to late blight.

During the wet season, Laweng (2006), found that the potato entry Catani produced high yield but susceptible to late blight. CIP 676089 is resistant to late blight and had comparable yield with Catani.

The study of Gayomba (2006), revealed that CIP 13.1.1 is the best genotype for organic production at Sinipsip, Buguias due to its canopy cover, high resistance to late blight and high total yield. Genotype 13.1.1 also had the highest ROCE (Return On Cash Expense) for both seed and table potato production.

Balas (2006), also found that canopy cover at 75 DAP, number of secondary stem and haulm weight could be used as indices for selection of varieties or genotypes for organic production.

MATERIALS AND METHODS

The farm

The study was conducted at Cosmic Farm, Beckel, La Trinidad, Benguet. It has an area of 5000 m^2. Cosmic farm is operating as an organic farm for the last 11 years and member of OPTA (Organic Producers Traders Association) of the Philippines and produces mainly vegetables.

The owner is Mr. Rogel Marzan, 49 years old and an organic practitioner for 11 years. Mr. Marzan practices organic production in all his crops produced.

Land Preparation

An area of 90 m^2 was first cleared of weeds. Plots were prepared measuring 1 m x 5 m (Fig. 1).

Organic Fertilizer Preparation and Application

Grasses of different species were collected within the locality. These grasses were shredded and composted within 10 days with the aid of effective microorganisms. Compost was applied at a rate of 8 kg/ 5 m^2 two weeks before planting (Fig. 2).

The fermented plant juice (FPG) composed of “Kangkong” chopped thinly and molasses fermented for seven days. The ratio was 4 kg of chopped “Kangkong” in 1 gallon of molasses. Application was one cup of fermented plant juice in one basin of water every seven days (Fig. 4).

Figure 1. Preparation of plot

Figure 2. Application of compost

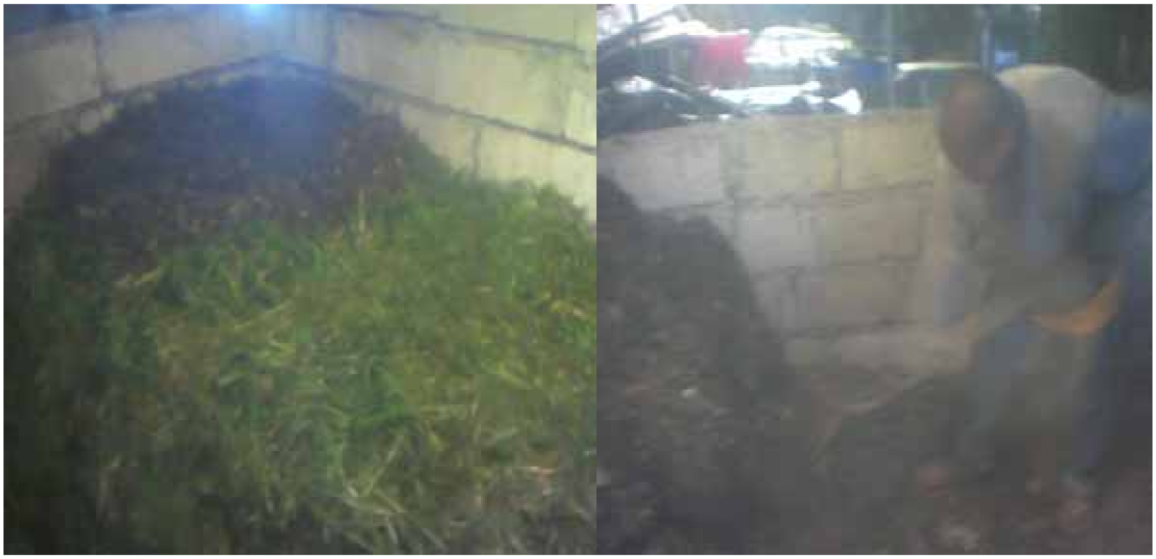

Figure 3. Making of compost

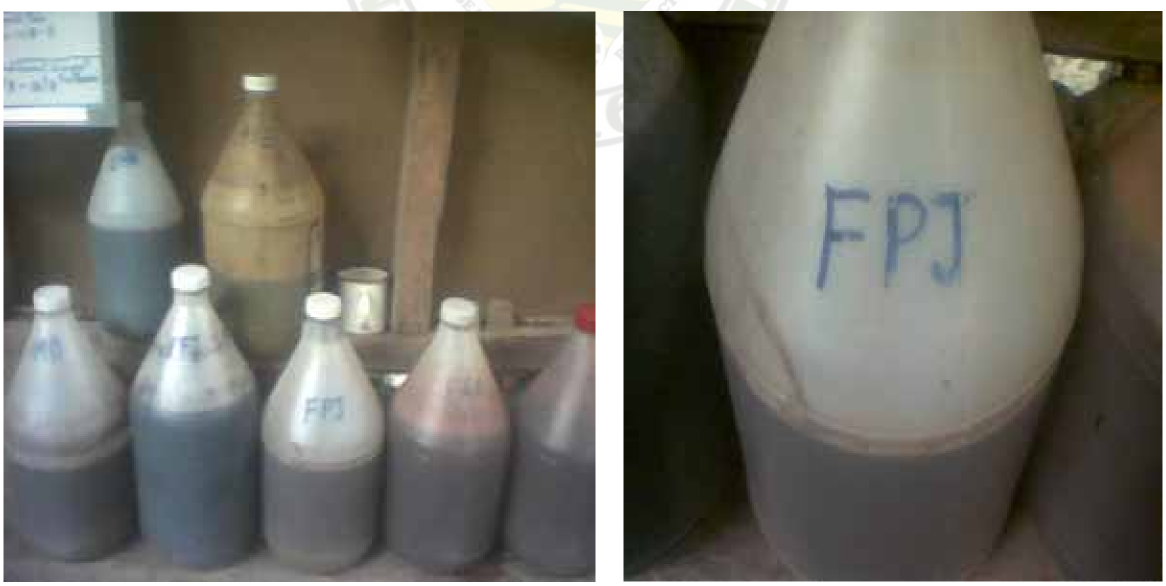

Figure 4. Finished fermented plant juice

Lay-out of the Experiment

The experiment was laid-out following the randomized complete block design (RCBD) with three replications.

Code	Entry
E1	MLUSA 2
E2	MLUSA 3
E3	MLUSA 5
E4	MLUSA 8
E5	IGOROTA
E6	CIP 380241.17

Cultural Management Practices

Cultural practices such as hilling up, weeding, and irrigation were uniformly done in all the treatments.

Data Gathered

A. Vegetative Characters

1. Plant survival (%). The number of plants that survived were counted 30 days after panting (DAP) and calculated using the formula.

$$\text{\% Plant Survival} = \frac{\text{No of Plant Survived}}{\text{Total Number of Plants Planted}} \times 100$$

2. Plant Height. Height was taken at 30, 45, 60 and 75 DAP using a meter stick.

3. Canopy cover. This was gathered at 30, 45, 60, and 75 DAP using a wooden frame which measures 120 cm x 60 cm having equal size 12 cm x 6 cm grids.

4. Plant vigor. Plants were rated at 30, 45, 50, 60, and 75 days DAP based on a rating scale by CIP (Gonzales *et al;* 2004)

Scale	Description	Reaction
5	Plants are strong with robust stem and leaves, light color to dark green in color.	Highly vigorous
4	Plants are moderately strong with robust stem and leaves were light green in color.	Moderately vigorous
3	Better than less vigorous	Vigorous
2	Plants are weak with few thin stems and leaves, pale.	Less Vigorous
1	Plants are weak with few stems and leaves, very pale.	Poor Vigorous

B. Reaction to Pest and Disease

1. Reaction to leaf miner. The reaction to leaf miner was recorded at 30, 45, 60, and 75 DAP using the following rating scale (CIP, 2001):

Scale	Description	Reaction
1	Leaf infested (1-20%)	Highly Resistant
2	Infested (20-40%)	Moderately Resistant
3	Moderately infested (41-60%)	Susceptible
4	Severely infested (61-80%)	Moderately Susceptible
5	Most Serious (81-100%)	Very Susceptible

2. Reaction to late blight. Ratings were done at 30, 45, 60 and 75 DAP using the CIP (Henfling, 1987) rating scale as follows:

Blight	Scale	Description
1	1	No blight to be seed
01-1	2	Very few plants in larger treatment with lesions not more than 2 lesions 10m or row (+/-30 plants).
1.1-2	2	Up to 10 lesions per plant.
3.1-10	3	Up to 30 small lesions per plant or up to 1 inch leaflets attacked.
10.1-24	4	Most plants are visibly attacked and 1 m 3 leaflets infected. Multiple infections per leaflets.
5-49	5	Nearly every leaflets with lesion. Multiple infections per leaflets are common. Field of plot look green, but all plants are pots are blighted.
50-74	6	Every plant blighted and half the leaf area destroyed by blight fields look green, flecked, and brown, blight is very obvious.
75-90	7	As previous but ¾ of each plant blighted. Lower branches may be overwhelmingly killed off, and the only green leaves, if any, are spindly due to extensive foliage loss, field looks neither brown nor green.
91-97	8	Some leaves and most stems are green, filed looks brown with some leaves patches.
97.1-99.9	9	Few green leaves almost all with blight lesions remain. Many stems lesions field look brown.
100	9	All leaves and stem dead.

Description: 1- highly resistant, 2-3 -resistant, 4-5- moderately resistant, 6-7- moderately susceptible, 8-9- susceptible.

C. Yield and Yield Components

1. Number and weight of marketable tubers per plot (kg). All tubers that were of marketable size, not malformed, free from cuts, cracks and with out more than 10% greening of the total surface was counted and weighed at harvest.

2. Number and weight of non-marketable tubers per plot (kg). This was obtained by counting and weighing all tubers that are malformed, damaged by pests and diseases and with more than 10% greening.

3. Total yield plot (kg). This is sum of the weight of marketable and non-marketable tubers.

4. Computed yield (tons/ha). This was computed on a hectare basis using the formula:

$$\text{Computed Yield} = \text{Total Yield per Plot (kg)} \times 2$$

*where: 2 is the factor use to convert yield in tons per hectare assuming one hectare effective area.

D. Dry matter content of tubers (%). Twenty gram tubers were weighed and sliced into cubes and oven dried at 80^{o}C for 24 hours. This was recorded and computed using the following formula:

Dry Matter = 100 - % moisture content

$$\text{Where: \% moisture content} = \frac{\text{Fresh Weight- Oven Dry Weight}}{\text{Fresh Weight}} \times 100$$

E. ROCE. This was computed using the formula:

$$\text{ROCE} = \frac{\text{Net Income}}{\text{Total Cost of Production}} \times 100$$

Data Analysis

All quantitative data were analyzed using the Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) with three replications. The significance of difference among the treatment means was tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Meteorological Data

Table 1 shows the temperature, relative humidity, rain fall and sunshine duration during the conduct of the study. Results show that temperature ranged from 13.6 ºC to 25.2 ºC. In the month of March high relative humidity was observed. Rainfall amount of 0.10 mm, 0.03 mm, 3. 45 mm and 1.6 mm were recorded in December, January, February and March, respectively. Potato production was best with temperature ranging from 17 to 22 ºC and with an average relative humidity of 86 % (HARRDEC, 1996).

Chemical Properties of the Soil

Chemical properties of the soil before and after taken at the experimental area are shown in Table 2. It was observed that pH decreased after planting, the soil pH in the place where the study was conducted may not favor in the growth of potato since the optimum pH for potato production ranged from 5.6 to 6.5.

The organic matter present in the soil is 2 % before and after planting. According to Lambert (1996), organic matter present in the soil is sufficient since the optimum content of organic matter for potato production is ranges from 1-4 %.

As shown in Table 2, there was a decrease in the phosphorus content of the soil after harvest. This could be due to high phosphorus requirement of the potato plants.

Potassium content of the soil increased after harvest which could be due to the compost applied.

Table 1. Temperature, relative humidity, rainfall and sunshine duration during the conduct Of the study

MONTH	TEMPERATURE ºC		RELATIVE HUMIDITY(%)	RAINFALL AMOUNT(mm)	SUNSHINE DURATION (kj)
	MAX	MIN			
December	24.4	13.6	82.0	0.10	369.8
January	24.6	13.4	85.0	0.03	349.0
February	24.5	14.05	85.25	3.45	387.2
March	25.8	17.0	86	1.6	310.9

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Table 2. Chemical properties of the soil taken before and after planting.

SAMPLING TIME	PH	ORGANIC MATTER (%)	PHOSPHORUS (ppm)	POTASSIUM (ppm)
Before planting	6.8	2	47	340
After planting	6.7	2	13	384

Plant Survival

The percent survival of the entries taken a 30 DAP is shown in Table 3. No significant differences were observed among the entries. Generally, there was low percent survival which could be attributed to unfavorable weather conditions such as low temperature and low sunshine duration.

Plant Height at 30 and 75 DAP

Highly significant differences were observed on the plant height of the different potato entries at 30 and 75 DAP (Table 4). CIP 380241.17 produced tallest plants at 30 and 75 DAP which was not significantly different with MLUSA 5 and MLUSA 8. At 75

DAP, CIP 380241.17 also produced tallest plants followed by MLUSA 5. MLUSA 5 produced shortest plant at 30 and 75 DAP.

The differences of height among the entries could be due to genotypic characteristics and response of potato entries to the low temperature as shown in Table 1.

Canopy cover

Table 5 shows the canopy cover of the six potato entries. Numerically, at 30 DAP CIP 380241.17 has the highest canopy cover of 19, this is followed by MLUSA 5 and MLUSA 8 trailing at 12. MLUSA 3 produced the lowest canopy cover. All entries increased in canopy cover at 45 DAP,

The decrease of canopy cover could be due to senescence of potato entries due to the attack of pest (red ants) and late blight infection during the period

Table 3. Plant survival of the different potato entries at 30 days after planting

ENTRY	PLANT SURVIVAL (%)
MLUSA 2	61
MLUSA 3	71
MLUSA 5	88
MLUSA 8	85
CIP 380241.17	90
Igorota	83
CV (%)	20.07

Table 4 . Plant height of the different potato entries at 30 and 75 DAP

ENTRY	PLANT SURVIVAL (cm)	
	30 DAP	75 DAP
MLUSA 2	3.09[c]	13.22[b]
MLUSA 3	2.6[c]	2.93[c]
MLUSA 5	6.46[a]	24.99[a]
MLUSA 8	5.44[ab]	19.2[ab]
CIP 380241.17	6.89[a]	26.32[a]
Igorota	4.17[bc]	21.96[a]
CV (%)	18.57	27.58

Means with the same letter are not significant by DMRT (P>0.05)

Table 5. Canopy cover of the potato entries at 30, 45, 60 and 75 DAP

ENTRY	CANOPY COVER			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 2	8[bc]	17	35[a]	28[bc]
MLUSA 3	5[c]	11	9[b]	9[c]
MLUSA 5	12[b]	27	52[a]	42[ab]
MLUSA 8	12[b]	20	42[a]	38[ab]
CIP 380241.17	19[a]	32	51[a]	46[ab]
Igorota	9[bc]	21	46[a]	53[a]
CV (%)	23.08	15.98	20.49	22.09

Means with the same letter are not significantly different by DMRT (P>0.05)

Plant Vigor

Table 6 shows the plant vigor of thedifferent potato entries at 30, 45, 60 and 75 DAP. CIP 380241.17 and MLUSA 5 were found to be moderately vigorous while MLUSA 3, MLUSA 8 and Igorota were vigorous while MLUSA 2 was less vigorous. CIP 380241.17 was found to be highly vigorous followed by MLUSA 5 and MLUSA 8 for being moderately vigorous at 45 DAP. MLUSA 3 produced the lowest vigor. Plant vigor of potato entries consistently increased at 60 DAP except MLUSA 3 which had decreased in vigor. At 75 DAP, CIP 380241.17 and MLUSA 5 had decreased vigor while the other entries retaind in their vigor

There was decrease in vigor of some entries which might be due to late blight at 75 DAP, and senescence of some plants due to the attack of red ants

Table 6. Plant vigor of the different potato entries at 30, 45, 60 and 75 days after planting.

ENTRY	CANOPY COVER			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 2	2^{b}	3^{bc}	3^{bc}	3^{ab}
MLUSA 3	3^{ab}	2^{c}	2^{c}	2^{b}
MLUSA 5	4^{a}	4^{ab}	5^{a}	4^{a}
MLUSA 8	3^{ab}	4^{ab}	4^{ab}	4^{a}
CIP 380241.17	4^{a}	5^{a}	5^{a}	4^{a}
Igorota	3^{ab}	3^{bc}	4^{ab}	4^{a}
CV (%)	13.23	22.74	20.31	24.47

Means with the same letter are not significantly different by DMRT (P>0.05)

Late Blight Incidence

Table 5 shows late blight ratings of the six potato entries at 75 DAP. It was observed that entries MLUSA 3 and Igorota are highly resistant while the other entries are resistant to late blight.

The resistance of the entries could be due to the organic matter applied to the plants, and the organic fungicide (fermented plant juice and seaweed extract) sprayed on the plants.

Leaf Miner Incidence

Table 6 shows the leaf miner incidence of the six potato entries at 75DAP. It was observed that all the entries at 30, 45 and 60 days after planting were no incidence of leaf miner while in 75 DAP all entries were moderately resistant.

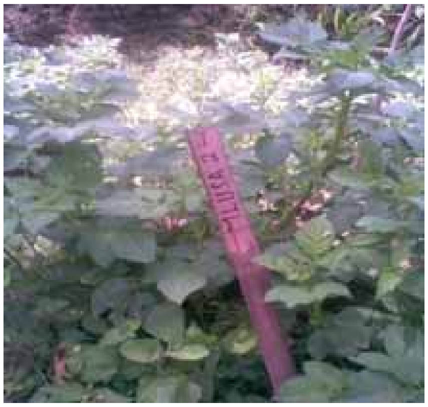
The occurrence of leaf miner incidence at 75 days after plating could be due to the aging of the plants

Number and weight of Marketable Tubers per Plot

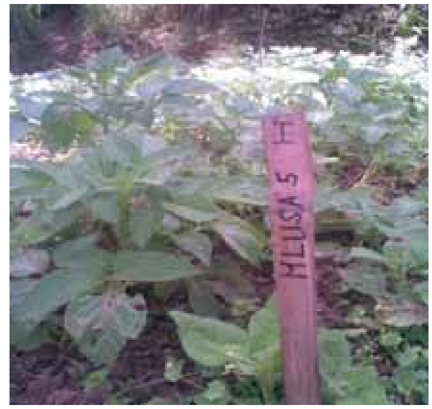
Significant differences among the six entries of potato on the number of marketable tubers were observed (Table 7). MLUSA 5 produced highest number of marketable tubers while MLUSA 3 produced the lowest.

On weight, CIP 380241.17 produced the heaviest marketable tubers while MLUSA 2 produced the lowest.

More tubers produced in MLUSA 5 and Igorota could be due to high percent of survival and highly vigorous plants.

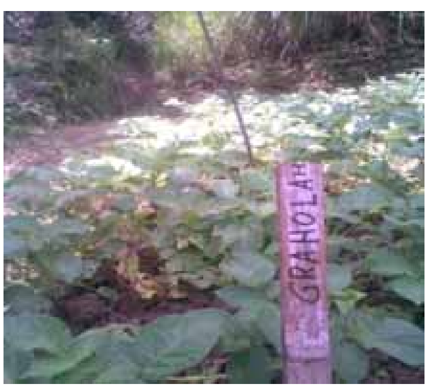


a. MLUSA 2 at vegetative stage

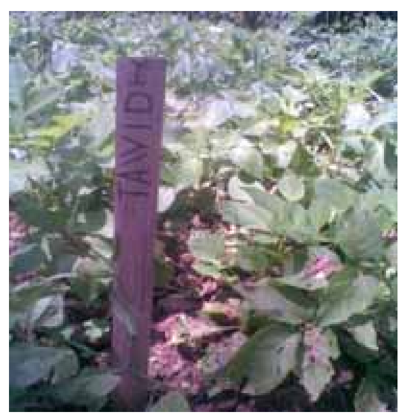


b. MLUSA 5 at vegetative stage

c. MLUSA 8 at vegetative stage



d. Igorota at vegetative stage



e. CIP 380241.17 at vegetative stage

Figure 5, a-e. Vegetative growth of the potato entries

Table 7. Number and weight of marketable tubers of the six potato entries

ENTRY	MARKETABLE TUBER	
	NUMBER	WEIGHT (g)
MLUSA 2	56[b]	242
MLUSA 3	28[b]	548
MLUSA 5	207[a]	1248
MLUSA 8	78[b]	1238
CIP 380241.17	82[b]	1983
Igorota	112[ab]	1283
CV (%)	29.26	20.07

Means with the same letter are not significant by DMRT (P>0.05)

Number and Weight of Non-marketable Tubers per Plot

Table 8 shows the number and weight of non-marketable tubers of six potato entries. Numerically, MLUSA 5 produced highest number and weight of non-marketable tubers while MLUSA 3 produced the lowest number and weight

Total Yield per Plot

Statistical analysis shows highly significant differences among the entries in terms of total yield (Table 9). CIP 380241.17 produced the highest yield per plot 2.08 kg followed by MLUSA 5, Igorota and MLUSA 8 of 1.37 kg, 1.32 kg and 1.28 kg, respectively. MLUSA 2 produced the lowest yield per plot. Low yield of entries could be due to the effect of low temperature from December to February and high relative humidity which may not favor to the optimum yield of the potato.

Since, management practices were done uniformly in all entries, the genotypic characteristic as influenced by the environment might have contributed the low yield.

Computed Yield (tons/ha)

Statistical analysis show that there were no significant differences among the six entries of potato in terms of computed yield (tons/ha) as shown in table 9. CIP 380241.17 produced the highest yield of 4.15 tons followed by MLUSA 5, Igorota and MLUSA 8 with yields of 2.74, 2.65 and 2.56 tons respectively. The other entries produced a yield ranging from 0.59 to 1.17 tons. Figure 6 shows the tubers harvested from the different entries.

Table 8. Number and weight of non- marketable tubers of the six potato entries.

ENTRY	NON-MARKETABLE TUBER	
	NUMBER	WEIGHT (g)
MLUSA 2	41^{b}	32^{b}
MLUSA 3	8^{b}	38^{b}
MLUSA 5	88^{a}	123^{a}
MLUSA 8	16^{b}	42^{b}
CIP 380241.17	11^{b}	93^{ab}
Igorota	27^{b}	42^{b}
CV (%)	26.30	21.39

Means with the same letter are not significant by DMRT (P>0.05)

Table 9. Total yield and computed yield of the six potato entries.

ENTRY	TOTAL YIELD (kg/plot)	COMPUTED YIELD (tons/ha)
MLUSA 2	0.27 [b]	.547
MLUSA 3	0.59 [b]	1.17
MLUSA 5	1.37 [b]	2.74
MLUSA 8	1.28 [b]	2.56
CIP 380241.17	2.08 [a]	4.15
Igorota	1.32 [b]	2.65
CV (%)	15.38	25.01

Means with the same letter are not significant by DMRT (P>0.05)

Dry Matter Content

There were no significant differences amongthe six potato entries in terms of dry matter content. It was observed that all entries are good for processing. According to Montes (2006), DMC of tuber ranged from 18-24% is an indication of good processing type of potato.

Sugar Content

There were no significant differences for sugar content among the six potato entries. However, the results show that entries MLUSA 3 and Igorota obtained the highest sugar content while remaining entries had the same sugar content of 3 ^{O}Brix.

Table 10.Dry matter and sugar content of the six potato entries.

ENTRY	DMC (%)	SUGAR CONTENT (^{O}Brix)
MLUSA 2	22	3
MLUSA 3	22	4
MLUSA 5	20	3
MLUSA 8	22	3
CIP 380241.17	20	3
Igorota	23	4
CV (%)	10.16	16.46

Means with the same letter are not significantly different by DMRT (P>0.05)

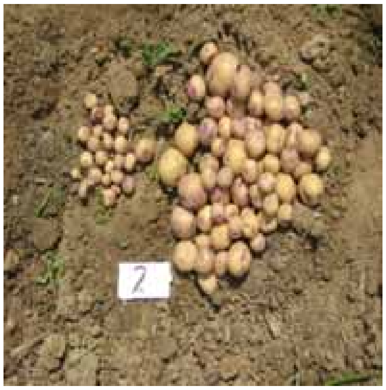
Return of Cash Expense

Positive ROCE was obtained from the entries CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota. CIP 380241.17 had a highest ROCE with 103.13 % followed by Igorota, MLUSA 5, and MLUSA 8 of 31.44 %, 27.85 % and 26.83 %, respectively.

Mlusa 2 and MLUSA 3 obtained negative ROCE

Table 11. Return on cash expense of the six potato entries.

ENTRY	COST OF PRODUCTION (Php.)	GROSS INCOME (Php.)	NET INCOME (Php)	ROCE (%)
MLUSA 2	234.33	58.00	-184.33	-78.00
MLUSA 3	234.33	131.6	-102.73	-43.84
MLUSA 5	234.33	299.6	65.27	27.85
MLUSA 8	234.33	297.2	62.87	26.83
CIP 380241.17	234.33	476.00	241.67	31.44
Igorota	234.33	308.00	73.67	103.13



a. MLUSA 2 tubers

b. MLUSA 3 tubers

c. MLUSA 5 tubers

d. MLUSA 8 tubers

e. Igorota tubers

f. CIP 380241.17

Figure 6, a-f. Tubers of six potato entries

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was conducted at the Cosmic Farm, Beckel, La Trinidad, Benguet from December 2008 to March 2009 to evaluate the growth and yield of potato entries under organic production and to identify the best potato entries based on yield and resistance to diseases and insects.

CIP 380241.17 and MLUSA 5 had a highest percent of survival, tallest plant which was not significantly different with MLUSA 5. Igorota produced the highest canopy cover at 75 DAP. CIP 380241.17 MLUSA 5, MLUSA 8 and Igorota were rated moderately vigorous at 75 DAP. Igorota and MLUSA 3 were highly resistant to late blight and all entries were rated moderately resistant to leaf miner at 75 DAP. MLUSA 5 produced the highest number of marketable tubers. CIP 380241.17 produced the heaviest weight of marketable tubers and highest total yield. CIP 380241.17 had the highest ROCE.

Conclusion

CIP 380241.17 produced the heaviest weight of marketable tubers followed by MLUSA 5. CIP 380241.17 obtained the highest ROCE. MLUSA 2 produced the lowest yield.

Recommendation

Under the condition of the study CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota are adopted to organic production at Beckel, La Trinidad, Benguet. However, further evaluation of potato entries should be conducted to further determine their adaptability and stability in terms of yield and resistance to diseases and insects.

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APPENDICES

Appendix Table 1. Plant survival at 30 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	31	38	71	183	61
MLUSA 3	81	53	78	212	71
MLUSA 5	96	78	90	256	88
MLUSA 8	81	75	100	256	85
IGOROTA	100	71	78	249	83
TAWID	84	87	100	271	90
TOTAL	473	445	517	1435	80

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	439.111	219.556			
Treatment	5	1967.611	393.522	1.55^{ns}	3.33	5.74
Error	10	2544.889	254.489			
TOTAL	17	4951.611				

^{ns}= Not significant

Coefficient of Variation (%)= 20.01

Appendix Table 2. Initial plant height at 30 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	3.06	3.3	2.9	9.26	3.09 [c]
MLUSA 3	3.3	2.2	2.3	7.8	2.6 [c]
MLUSA 5	6.42	6.6	6.36	19.38	6.46 [a]
MLUSA 8	4.94	4.68	6.7	16.32	5.44 [ab]
IGOROTA	6	2.3	4.2	12.5	4.17 [bc]
TAWID	7.4	6.16	7.1	20.66	6.89 [a]
TOTAL	31.12	25.24	29.56	85.92	4.76

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	8.093	1.546			
Treatment	5	47.075	9.415	11.98**	3.33	5.64
Error	10	7.858	0.786			
TOTAL	17	58.026				

**= highly significant

Coefficient of Variation (%)= 18.57

Appendix Table 3. Final plant height at 75 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	9	17	13.66	39.66	13.22 [b]
MLUSA 3	0	4.8	4	8.8	2.93 [c]
MLUSA 5	30.6	22	22.38	74.98	24.99 [a]
MLUSA 8	26.4	17.34	13.86	57.6	19.2 [ab]
IGOROTA	29.3	17.48	19.2	65.88	21.96 [a]
TAWID	29.2	19.68	16.28	63.96	26.32 [a]
TOTAL	123.2	98.3	89.38	310.88	18.10

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	102.409	51.205			
Treatment	5	971.148	194.230	8.56**	3.33	5.64
Error	10	226.966	22.697			
TOTAL	17	1300.523				

**= highly significant Coefficient of Variation (%)= 27.58

Appendix Table 4. Canopy Cover at 30 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	8	8	7	23	8 [bc]
MLUSA 3	4	8	4	16	5 [c]
MLUSA 5	11	10	14	35	12 [b]
MLUSA 8	10	12	13	35	12 [b]
IGOROTA	13	5	8	26	9[bc]
TAWID	21	17	20	58	19 [a]
TOTAL	67	60	66	193	11

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	5.776	2.889			
Treatment	5	357.778	71.556	12.43**	3.33	5.64
Error	10	57.556	5.756			
TOTAL	17	421.111				

**=highly significant Coefficient of Variation (%)= 23.08

Appendix Table 5. Canopy Cover at 45 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	12	23	16	51	17
MLUSA 3	7	20	5	32	11
MLUSA 5	24	29	27	80	27
MLUSA 8	22	16	23	61	20
IGOROTA	27	9	26	62	21
TAWID	40	28	28	96	32
TOTAL	132	125	125	382	21

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	5.444	2.722			
Treatment	5	828.444	165.689	3.12**	3.33	5.64
Error	10	531.222	53.122			
TOTAL	17	1365.111				

ns= Not significant

Coefficient of Variation (%)= 15.98

Appendix Table 6. Canopy Cover at 60 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	28	46	30	104	35 [a]
MLUSA 3	0	24	4	28	9 [b]
MLUSA 5	57	55	44	156	52 [a]
MLUSA 8	52	43	32	127	42 [a]
IGOROTA	57	37	43	137	46 [a]
TAWID	76	37	40	153	51 [a]
TOTAL	270	242	193	705	39

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	506.333	253.167			
Treatment	5	3801.833	760.367	5.17*	3.33	5.64
Error	10	1470.333	147.033			
TOTAL	17	5778.500				

*= significant

Coefficient of Variation (%)= 20.49

Appendix Table 7. Canopy Cover at 75 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	30	30	24	84	28 [b]
MLUSA 3	0	24	2	26	9 [c]
MLUSA 5	50	40	36	126	42[ab]
MLUSA 8	49	45	21	115	38 [ab]
IGOROTA	65	53	42	160	53 [a]
TAWID	72	30	36	138	46 [ab]
TOTAL	266	222	161	649	36

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	926.778	463.389			
Treatment	5	3758.944	751.789	5.73**	3.33	5.64
Error	10	1311.222	131.122			
TOTAL	17	5996.944				

**= highly significant

Coefficient of Variation (%)= 22.09

Appendix Table 8. Plant vigor at 30 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	1	3	3	7	2 [b]
MLUSA 3	3	3	3	9	3 [ab]
MLUSA 5	3	4	4	11	4 [a]
MLUSA 8	3	3	4	10	3 [ab]
IGOROTA	3	2	3	8	3 [ab]
TAWID	4	4	4	12	4 [a]
TOTAL	17	19	21	57	3

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	1.333	.0667			
Treatment	5	5.533	1.167	3.5*	3.33	5.64
Error	10	3.333	0.333			
TOTAL	17	10.500				

*= Significant

Coefficient of Variation (%)= 18.23

Appendix Table 9. Plant vigor at 45 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	3	4	3	10	3 [bc]
MLUSA 3	2	3	1	6	2[c]
MLUSA 5	4	4	5	13	4 [ab]
MLUSA 8	4	3	4	11	4 [ab]
IGOROTA	4	2	3	9	3[bc]
TAWID	5	4	5	14	5 [a]
TOTAL	22	20	21	63	4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	0.333	0.167			
Treatment	5	13.833	2.767	4.37*	3.33	5.64
Error	10	6.333	0.633			
TOTAL	17	20.500				

*= Significant

Coefficient of Variation (%)= 22.74

Appendix Table 10. Plant vigor at 60 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	3	4	3	10	3 [bc]
MLUSA 3	1	3	1	5	2[c]
MLUSA 5	5	5	5	15	5[a]
MLUSA 8	4	4	4	12	4[ab]
IGOROTA	5	3	4	12	4[ab]
TAWID	5	4	5	14	5 [a]
TOTAL	23	23	22	68	4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.111	0.056			
Treatment	5	21.111	4.222	7.17**	3.33	5.64
Error	10	5.889	0.589			
TOTAL	17	21.111				

**= Highly Significant

Coefficient of Variation (%)= 20.31

Appendix Table 11. Plant vigor at 75 days after planting

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	3	4	3	10	3 [ab]
MLUSA 3	1	3	1	5	2[b]
MLUSA 5	5	4	4	13	4 [a]
MLUSA 8	4	4	3	11	4 [a]
IGOROTA	5	3	4	12	4[a]
TAWID	5	3	4	12	4 [a]
TOTAL	23	21	19	63	4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	1.333	0.667			
Treatment	5	13.833	2.767	3.77*	3.33	5.64
Error	10	7.333	0.733			
TOTAL	17	22.500				

*= Significant

Coefficient of Variation (%)= 24.47

Appendix Table 12. Late blight incidence at 75 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	1	2	3	6	2
MLUSA 3	1	1	1	3	1
MLUSA 5	1	3	2	6	2
MLUSA 8	1	1	4	6	2
IGOROTA	1	1	1	3	1
TAWID	1	2	3	6	2
TOTAL	6	10	14	30	2

Appendix Table 13. Leaf miner at 75 days after planting

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	2	2	2	6	2
MLUSA 3	1	2	2	5	2
MLUSA 5	2	3	2	7	2
MLUSA 8	2	1	2	5	2
IGOROTA	2	2	2	6	2
TAWID	2	2	2	6	2
TOTAL	11	12	12	35	2

Appendix Table 14. Number of marketable tubers of six potato entries

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	60	73	36	169	56[b]
MLUSA 3	5	72	7	84	28[b]
MLUSA 5	356	136	130	622	207[a]
MLUSA 8	90	89	55	234	78[b]
IGOROTA	198	55	82	335	112[ab]
TAWID	93	68	84	245	82[b]
TOTAL	803	493	394	1689	94

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	15097.000	7548.500			
Treatment	5	58017.833	11603.567	3.37*	3.33	5.64
Error	10	34343.667	3434.367			
TOTAL	17	107458.500				

*= Significant Coefficient of Variation (%)= 29.26

Appendix Table 15. Number of non-marketable tubers of six potato entries

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	24	43	57	124	41[b]
MLUSA 3	4	17	4	25	8 [b]
MLUSA 5	129	94	42	265	88 [a]
MLUSA 8	12	16	21	49	16[b]
IGOROTA	28	32	20	80	27[b]
TAWID	16	17	1	34	11 [b]
TOTAL	213	219	145	577	32

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
Block	2	563.111	281.556			
Treatment	5	13564.944	2712.989	6.45**	3.33	5.64
Error	10	4206.889	420.689			
TOTAL	17	18334.944				

**= Highly significant   Coefficient of Variation (%)= 26.30

Appendix Table 16. Weight of marketable tubers of six potato entries

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	325	300	100	725	242
MLUSA 3	20	1600	25	1645	548
MLUSA 5	2325	620	800	3745	1248
MLUSA 8	2300	1065	350	3715	1238
IGOROTA	2800	350	700	3850	1283
TAWID	2850	1500	1600	5950	1983
TOTAL	10620	5435	3575	19630	1091

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	4443103.778	2221551.389			
Treatment	5	5686694.444	1137338.889	2.02^{ns}	3.33	5.64
Error	10	5590997.222	559099.722			
TOTAL	17	15720794.4444				

^{ns} = Significant

Coefficient of Variation (%)= 20.07

Appendix Table 17. Total yield per plot of six potato entries

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	350	350	120	820	273.03
MLUSA 3	30	1700	30	1760	587.00
MLUSA 5	2475	770	870	4115	1372
MLUSA 8	2375	1105	360	3840	1280
IGOROTA	2850	400	725	3975	1325
TAWID	2950	1675	1605	6230	2077
TOTAL	11030	6000	3710	20740	1152

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	21798233.333	10899116.667			
Treatment	5	117307333.333	23461466.667	9.91**	3.33	5.64
Error	10	23669083.333	2366908.333			
TOTAL	17	162774650.000				

**= Highly significant

Coefficient of Variation (%)= 15.38

Appendix Table 18. Weight of non-marketable tubers of six potato entries

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	25	50	20	95	32[b]
MLUSA 3	10	100	5	115	38 [b]
MLUSA 5	150	150	70	370	123 [a]
MLUSA 8	75	40	10	125	42 [b]
IGOROTA	50	50	25	125	42[b]
TAWID	100	175	5	280	93[ab]
TOTAL	410	565	135	1110	62

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	15808.333	7904.167			
Treatment	5	21150.000	4230.000	3.60*	3.33	5.64
Error	10	11741.667	1174.167			
TOTAL	17	48700.000				

*= Significant Coefficient of Variation (%)= 21.39

Appendix Table 19. Dry matter content

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	25	20	20	65	22
MLUSA 3	20	25	20	65	22
MLUSA 5	20	20	20	60	20
MLUSA 8	20	25	20	65	22
IGOROTA	25	25	20	70	23
TAWID	20	20	20	60	20
TOTAL	130	135	120	385	21

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	19.444	9.722			
Treatment	5	23.611	4.722	1.0 ^{ns}	3.33	5.64
Error	10	47.222	4.722			
TOTAL	17	90.278				

^{ns} = Not Significant

Coefficient of Variation (%)= 10.16

Appendix Table 20. Computed yield (tons/ha)

ENTRIES	REPLICATION			TOTAL	MEAN
	I	II	III		
MLUSA 2	.7	.7	2.04	1.64	.547
MLUSA 3	.06	3.4	.06	3.52	1.173
MLUSA 5	4.95	1.54	1.74	8.23	2.743
MLUSA 8	4.75	2.21	.720	7.68	2.560
IGOROTA	5.7	.8	1.45	7.95	2.650
TAWID	5.9	3.35	3.21	12.46	4.153
TOTAL	22.06	12.00	7.42	41.48	23.04

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	15.211	7.605			
Treatment	5	19.067	3.813	1.37 ns	3.33	5.64
Error	10	27.802	2.780			
TOTAL	17	62.080				

ns = Not Significant

Coefficient of Variation (%)= 25.01

Appendix Table 21. Sugar content (% Brix) of six potato entries

ENTRIES	REPLICATION I	II	III	TOTAL	MEAN
MLUSA 2	3.2	3.2	3.9	10.3	3
MLUSA 3	4.1	4	4.6	12.7	4
MLUSA 5	3.8	2.2	2.4	8.4	3
MLUSA 8	3.1	3.3	3.9	10.3	3
IGOROTA	4.4	3.8	3.9	12.1	4
TAWID	2.3	3	4.1	9.4	3
TOTAL	20.9	19.00	22.8	63.2	4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F 0.05	0.01
Block	2	0.914	0.457			
Treatment	5	4.364	0.873	2.61 ns	3.33	5.64
Error	10	3.339	0.334			
TOTAL	17	8.618				

ns = Not Significant   Coefficient of Variation (%)= 16.46