BIBLIOGRAPHY

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ABSTRACT

The study was conducted at Loo, Buguias, Benguet from November 2009 to March 2010 to evaluate potato entries for organic production; determine the best performing potato entries in terms of yield, and resistance to pests; determine the profitability of growing organic potato entries for organic production and document the practices on organic potato production.

Ganza obtained the highest percent survival, exhibited the tallest plants, highest canopy cover, and highly vigorous plants at 75 DAP. MLUSA 5, MLUSA 8 and Ganza were rated moderately resistant to late blight at 75 DAP. Ganza was rated highly resistant and MLUSA 5 and MLUSA 8 were moderately resistant to frost injury at 60 and 75 DAP. All of the entries were moderately resistant to leaf miner. Ganza produced the heaviest marketable and non-marketable tubers and had the highest return on cash expense (ROCE).

Potato entries MLUSA 5 and MLUSA 8 produced marketable tubers were resistant to late blight and had a positive ROCE under organic production.

Under the condition of the study MULSA 5 and MLUSA 8 can be recommended for organic production at Loo, Buguias, Benguet.

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INTRODUCTION

The potato *(Solanum tuberosum L.)* is a tuberous-rooted tropical and subtropical plant grown in temperate countries as an annual. It is mostly used as a vegetable, a source of starch, and for other commercial purpose. Though not widely grown in home gardens, it can be a most satisfying producer (Mosley, 2003). Potato is one of the most planted crops in the Cordillera particularly in Benguet and Mt. Province. The production of this crop is more profitable, thus, gives farmers a higher income compared with other crops in the highlands.

Organic production practices maximize the use and recycling of on-farm nutrient sources, including animal and green manures. Techniques such as accurate soil analysis and nutrient crediting help producers avoid excess fertilizer applications. Sustainable farming methods also include soil-building and conserving practices such as adding organic matter and minimum tillage approaches. Biointensive integrated pest management is also a sustainable farming method (NSAI, 2005).

Organic potato production needs a variety that is suitable to the environment, resistant against insects and diseases and high yielding. In addition, resistant varieties can help farmers minimize the use of synthetic fungicides and insecticides. It is, therefore, important to evaluate varieties for organic production.

The study was conducted to:

1. evaluate potato entries for organic production under Loo, Buguias, Benguet;

2. determine the best performing potato entries for organic production in terms of yield, and resistance to pests under Loo, Buguias condition;

3. determine the profitability of growing organic potato entries for organic production at Loo, Buguias; and

4. document the practices employed in organic potato production in Loo, Buguias, Benguet.

The study was conducted at Ludeg, Loo, Buguias, Benguet from November 2009 to March 2010.

REVIEW OF LITERATURE

Organic Farming Defined

Organic agriculture encompasses all agricultural systems that promote environmentally, socially and economically sound production of food and fibers. These systems take soil fertility as a key to successful production. It aims to optimize quality in all aspects of agriculture and the environment. Organic agriculture dramatically reduces external inputs by avoiding from the use of chemo-synthetic fertilizers, pesticides, and pharmaceuticals. Instead, it allows the powerful laws of nature to increase both agricultural yields and disease resistance (PCARRD, 2006).

Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including bio-diversity, biological cycle and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system (PCARRD, 2006).

Benefits of Using Organic Fertilizer

Organic fertilizers add the nutrients to the soil that plants need to be more productive. These vital nutrients include phosphorous, nitrogen and potassium. These nutrients allow for the plant to grow larger blooming flowers and larger fruits. Not only does the quality increase, but so do the quantity, allowing the grower to harvest more and better fruits and flowers. Plants receiving the proper amounts of the nutrient potassium grow tougher cell walls and coarser vegetation. This makes them much more resistant to pests and diseases. Plants receiving enough phosphorous also use water more efficiently, which allows them to survive cold and dry spells. Organic fertilizers have positive effects on all types of soil. Looser soils, such as sand, are held together better by a strong root system that nitrogen promotes. In this case, the fertilizer helps plants grow stronger and also helps slow erosion. Soils that are denser and harder to penetrate, such as clay, may be loosened up by a similar root structure. In this case, the soil becomes more easily workable for farming and also more oxygenated to promote photosynthesis. Organic fertilizers release their nutrients slowly and consistently. It is this slow release that keeps plants growing healthy for longer periods of time. The slow absorption rate of nutrients from organic fertilizers means that there will not be a period of extreme bloom followed by a period of plant dormancy. Organic fertilizers keep plants growing healthy and productive longer into the season despite changing weather and soil temperatures. Organic fertilizers break down slowly, which means they need to be applied much less frequently than other types of fertilizers (Newsome, 2009).

Organic farming produced either the same yield or lower but consume less energy crops yield may be lower in 20% in organic system, but inputs and of fertilizer and energy is reduced by 34% to 53% and pesticides inputs by 77% (Madder and Fliebach, 2002).

Varietal Evaluation for Organic Potato Production

Aguirre (2006) found out that potato entries from NPRCRTC could be recommended for organic production in La Trinidad, Benguet since no significant differences were observed in terms of their yield. However CIP 13.1.1 is highly recommended due to its high yield and resistance to late blight. In addition, entries CIP

575003 and CIP 676089 can be also recommended for processing due to their high dry matter content.

Gayomba (2006) found that CIP 13.1.1 is the best genotype for organic production at Sinipsip, Buguias due to its high 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 end table potato production.

Imarga (2009) found that CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota are adapted under organic production at Beckel, La Trinidad, Benguet. 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, high yield and highest ROCE.

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.

Montes (2006) also found that 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.

MATERIALS AND METHODS

The Organic Farm

The organic farm is located at Ludeg, Loo, Buguias, Benguet with an elevation of 1,636 masl. The farm was conventional for a long time but was transformed to organic farming in 2004.

The owner of the farm is Mr. Pio Toyaoan, 67 years old and an organic practitioner for 5 years.

Land Preparation

An area of 60 m^2 in Mr. Pion Toyaoan's farm was thoroughly prepared before planting and, divided into three blocks, which corresponds to three replications. Each block was divided into five plots measuring 1m x 5 m each.

Organic Fertilizer Preparation and Application

Bio-organic fertilizer was equally applied at the rate of 5 kg/plot two weeks before planting. Fermented sunflower was mixed with bio-organic fertilizer with the aid of effective microorganisms within 15 days. The ratio of fermented plant juice was; 5 kg sunflower per 16 liters of water and 2 kg of bio-organic fertilizer applied 2 weeks after planting.

Planting Materials and Treatments

Rooted stem cuttings were planted at a distance of 30 cm x 30 cm between hills and rows.

The treatments were the following:

Code	Entry	Source
E_1	MLUSA 5	Maine, USA
E_2	MLUSA 8	Maine, USA
E_3	Granola (check)	CIP, Lima, Peru
E_4	Ganza (check)	CIP, Lima, Peru

Experimental Lay-out

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

Cultural Management Practices

Cultural practices such as hilling up, weeding, and irrigation were uniformly done in all entries. All practices were considered organic, that is , no application of synthetic chemicals and fertilizers.

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 were tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Data Gathered

A. Agro-Climatic Data. Temperature, relative humidity, rainfall were recorded during the conduct of study.

B. Soil Chemical Properties. Soil samples were taken from the experimental area before and right after harvest. The organic matter, nitrogen, phosphorous, and potassium content of the soil and pH were analyzed at the Department of Agriculture, Soils Laboratory, Pacdal, Baguio City.

C. Vegetative Characters

1. Plant survival (%). The number of plants that survived were counted at 30, 45, 60, and 75 days after planting (DAP) and calculated using the formula:

$$\% \text{ Plant Survival} = \frac{\text{Number of Plants Survived}}{\text{Total Number of Plants Planted}} \times 100$$

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

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

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, poor vigor very pale.

D. 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 infected (1-20%)	Highly Resistant
2	Infected (20-40%)	Moderately Resistant
3	Moderately infected (41-60%)	Susceptible
4	Severely infected (61-80%)	Moderately Susceptible
5	Most Serious (81-100%)	Very Susceptible

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

Blight	Scale	Description
1	1	No blight to be seen
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 3leaflets infected. Multiple infections per leaflets.
5-4	5	Nearly every leaflets with lesion. Multiple infections per leaflets are common. Field or plot look green, but all plants are pots 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.

3. Frost Injury. This was recorded at 30, 45, 60, and 75 DAP using the following scale (CIP, 2003):

Scale	Description	Reaction
1	No apparent injury	Highly Resistant
2	Injury confined to youngest leaves	Moderately Resistant
3	Some older leaves exhibiting injury	Susceptible
4	Over 50% of the leaves injured	Moderately Susceptible
5	Over 90% of the leaves injured	Very Susceptible

E. Yield and Yield Components

1. Number and weight of marketable tubers per hill (g). 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 hill (g). This was obtained by counting and weighing all tubers that are malformed, damaged by pests and diseases and those with more than 10% greening.

3. Total yield per hill (g). This was the sum of the weight of marketable and non-marketable tubers per hill.

4. Total yield per $5m^2$ (kg). This was the sum of the weight of marketable and non-marketable tubers per plot.

F. ROCE. This was computed using the formula:

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

G. Post Harvest Characteristics

1. Dry matter content of tubers. Twenty gram tubers were weighed and sliced into cubes and oven dried at 80^oC for 24 hours. This was recorded and computed using the following formula:

Dry Matter = 100% - % moisture content

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

2. Sugar Content (°Brix). This was taken by extracting the juice of 20 g potato tubers and read on a digital refractometer.

H. Documentation of Practices. All cultural management practices done on organic potato production such as fertilizer application, crop protection, hilling-up, harvesting and other practices were documented. Documentation was done through the use of digicam.

RESULTS AND DISCUSSION

Agroclimatic Data

Table 1 shows the temperature, relative humidity and rainfall during the conduct of the study. Result shows that temperature ranged from 11 °C to 22.6 °C. The lowest temperature was recorded in January while the highest was recorded in March. High relative humidity was observed in March. The average temperature of 17°C to 22 °C is best for potato production (HARRDEC, 1996).

Maximum yield are normally obtained when the average temperature throughout the growing season ranges between 15-18 °C (NPRCRTC, 1998).

Table 1. Temperature, relative humidity and rainfall during the conduct of the study

MONTH	TEMPERATURE (°C)		RELATIVE HUMIDITY (%)	RAINFALL (mm)
	MIN	MAX		
November	12.1	21.3	56	0.6
December	11.9	21.4	55	1.8
January	11.0	20.8	53	3.1
February	12.4	22.6	53	4.8
March	15.1	23.8	58	4.5

Chemical Soil Properties

Table 2 shows that there was a decrease of soil pH after planting showing that the place where the study was conducted may 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 had increased after planting which might be due to the compost application during the conduct of study. Both potassium and phosphorus decreased after planting which might indicate the high nutritive requirements of the potato plants.

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

SAMPLING TIME	PH	ORGANIC MATTER (%)	PHOSPHORUS (ppm)	POTASSIUM (ppm)
Before planting	6.39	2.5	380	472
After planting	5.99	4.0	330	234

<u>Percent Survival</u>

Table 3 shows the percent survival of the potato entries taken at 30, 45, 60 and 75 DAP. Highly significant differences among the entries were observed. Ganza obtained the highest percent survival at 30 DAP followed by MLUSA 5 and MLUSA 8. Granola obtained the lowest percent survival. Generally, results show that there was a decrease in percent survival at 45 DAP up to 75 DAP except for Ganza which maintained its survival.

The survival percentage of the entries could be attributed to cutworm infestation and unfavorable weather conditions such as low temperature during the conduct of the study. Cutworms were observed to cause damage by cutting the stems of the plants.

Table 3. Plant survival of potato entries at 30, 45, 60 and 75 days after planting

ENTRY	PLANT SURVIVAL (%)			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	64^{b}	50^{bc}	48^{bc}	39^{bc}
MLUSA 8	67^{b}	62^{ab}	63^{ab}	19^{ab}
Ganza (check)	96^{a}	93^{a}	91^{a}	91^{a}
Granola (check)	43^{c}	23^{c}	14^{c}	7^{c}
CV (%)	11.03	9.30	26.89	25.73

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

<u>Plant Height</u>

Table 4 shows significant differences on the plant height of the potato entries at 30 and 45 DAP. Ganza produced the tallest plants followed by MLUSA 5. Significant differences were also observed at 60 and 75 DAP and still Ganza was the tallest. Granola produced the shortest plants at 60 and 75 DAP.

The differences on the height of potato entries could be attributed to their genotypic traits and might also be affected by the environmental conditions during the conduct of the study.

Table 4. Plant height of potato entries at 30, 45, 60 and 75 days after planting

ENTRY	PLANT HEIGHT (cm)			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	4.0^{b}	5.7^{c}	8.3^{ab}	11.7^{a}
MLUSA 8	3.0^{c}	5.3^{b}	7.3^{b}	12.0^{a}
Ganza (check)	5.0^{a}	8.7^{a}	11.7^{a}	15.3^{a}
Granola (check)	3.3^{c}	5.7^{c}	4.7^{b}	6.0^{b}
CV (%)	7.53	10.19	28.26	24.77

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

Canopy Cover

Table 5 shows the canopy cover of the potato entries. Ganza had the widest canopy followed by MLUSA 5 and MLUSA 8 at 30 DAP. There was an increase in canopy cover of all entries at 45 DAP. At 60 DAP, all of the entries except Granola had decreased in canopy.

The decrease of canopy cover of the entries might due to the occurrence of late blight incidence, frost injury and the aging of the plants.

Table5. Canopy cover of potato entries at 30, 45, 60 and 75 days after planting

ENTRY	CANOPY COVER			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	10[b]	21[b]	27[b]	18[b]
MLUSA 8	9[b]	20[b]	26[b]	20[b]
Ganza (check)	20[a]	41[a]	56[a]	63[a]
Granola (check)	8[b]	11[b]	6[c]	2[c]
CV (%)	13.82	26.36	24.99	24.29

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

Plant Vigor

Table 6 shows the plant vigor of the potato entries at 30, 45 60 and 75 DAP. Ganza, MLUSA 5 and MLUSA 8 were found to be moderately vigorous while Granola was found to be vigorous. The same result was found by Imarga (2009) that MLUSA 5 was moderately vigorous at 30 DAP. Figure 1-4 shows the different entries at 30 DAP.

Ganza was found to be highly vigorous at 45 to 75 DAP. MLUSA 8 and MLUSA 5 were moderately vigorous at 45 DAP and vigorous at 60 and 75 DAP.

The higher vigor of Ganza might due to its characteristic of bigger leaves than that of the other entries. There was a decreased vigor on the other entries which might be due to the occurrence of late blight and frost causing early senescence of the plants.

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

ENTRY	PLANT VIGOR			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	4[a]	3[bc]	3[b]	3[b]
MLUSA 8	4[a]	4[ab]	3[b]	3[b]
Ganza- (check)	4[a]	5[a]	5[a]	5[a]
Granola-(check)	3[b]	2[c]	1[c]	1[c]
CV (%)	7.53	19.63	21.70	26.19

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

Legend: 5- Highly vigorous, 4- moderately vigorous, 3- vigorous, 2- less vigorous, 1- poor vigor

Figure 1 Ganza at 30 DAP

Figure 2 Granola at 30 DAP

Figure 3 MLUSA 5 at 30 DAP

Figure 4 MLUSA 8 at 30 DAP

<u>Leaf Miner Incidence</u>

Table 7 shows the leaf miner incidence of the four potato entries at 30, 45, 60, and 75 DAP. All the potato entries were found to be highly resistant at 30 and 45 DAP except for MLUSA 8 which was found to be moderately resistant at 45 DAP. MLUSA 5 was found to be susceptible while the other entries were found to be moderately resistant at 75 DAP. Simongo *et al.*, (2006) also found that Ganza was resistant to leaf miner.

Table 7. Leaf miner incidence of the potato entries at 30, 45, 60 and 75 days after planting

ENTRY	LEAF MINER INCIDENCE			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	Highly resistant	Highly resistant	Moderately resistant	Susceptible
MLUSA 8	Highly resistant	Moderately resistant	Moderately resistant	Moderately Resistant
Ganza (check)	Highly resistant	Highly resistant	Highly resistant	Moderately Resistant
Granola (check)	Highly resistant	Highly resistant	Highly resistant	Moderately Resistant

Late Blight Incidence

Table 8 shows the late blight ratings of the potato entries at 30, 45, 60 and 75 DAP. Ganza, MLUSA 5 and MLUSA 8 were moderately resistant at 30, 45 and 60 DAP. Granola was observed to be moderately susceptible at 30 and 45 DAP and susceptible at 60 and 75 DAP.

The resistance of the entries could be due to their genotypic characteristics that can tolerate late blight incidence. Granola is susceptible to late blight as reported in past studies by Tad-awan *et al.*,(2008) .

Tad-awan *et al.*,(2008) also found out that Ganza was moderately resistant in different locations in the highlands.

Table 8. Late blight incidence of the potato entries at 30, 45, 60 and 75 days after planting

ENTRY	LATE BLIGHT RATING			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	Moderately resistant	Moderately resistant	Moderately resistant	Moderately Resistant
MLUSA 8	Moderately resistant	Moderately resistant	Moderately resistant	Moderately Resistant
Ganza (check)	Moderately resistant	Moderately resistant	Moderately resistant	Moderately Resistant
Granola (check)	Moderately susceptible	Moderately susceptible	Moderately susceptible	Moderately susceptible

Frost Injury Rating

Table 9 shows the frost injury rating of the four potato entries. Ganza was found to be highly resistant to frost at 30 to 75 DAP. MLUSA 5 and MLUSA 8 were found to be moderately resistant at 45 to 75 DAP. Granola was found to be moderately susceptible at 30 and 45 DAP and susceptible at 60 and 75 DAP.

The occurrence of frost injury could be due to low temperature.

Table 9. Frost injury of the potato entries at 30, 45, 60 and 75 days after planting

ENTRY	FROST INJURY RATING			
	30 DAP	45 DAP	60 DAP	75 DAP
MLUSA 5	Susceptible	Moderately resistant	Moderately resistant	Moderately Resistant
MLUSA 8	Susceptible	Moderately resistant	Moderately resistant	Moderately Resistant
Ganza (check)	Highly resistant	Highly resistant	Highly resistant	Highly Resistant
Granola (check)	Moderately susceptible	Moderately susceptible	Susceptible	Susceptible

Number of Marketable and Non-marketable Tubers per Hill

Table 10 shows the total number of marketable and non-marketable tubers of the potato entries. There were significant differences among the potato entries on marketable tubers. It was observed that Ganza produced the highest number of marketable tubers followed by MLUSA 5 and MLUSA 8 while Granola produced the lowest.

There were no significant differences among the entries of potato on the non-marketable tubers. It was observed that MLUSA 5 and MLUSA 8 produced the highest number of non-marketable tubers followed by Ganza while Granola produced the lowest number.

The high number of tubers produced by Ganza could be due to high percent survival, highly vigorous plants at vegetative stage and resistance to late blight. Low yield of some entries could be due to low percent survival, low vigor of plants and susceptibility to late blight.

Table 10. Number of marketable and non-marketable tubers of the potato entries

ENTRY	NUMBER OF TUBERS PER HILL	
	MARKETABLE	NON-MARKETABLE
MLUSA 5	3^{b}	4^{a}
MLUSA 8	3^{b}	4^{a}
Ganza (check)	4^{a}	2^{c}
Granola (check)	2^{c}	3^{b}
CV (%)	18.18	14.50

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

Weight of Marketable and Non-marketable Tubers per Hill

Table 11 shows the total weight of marketable and non-marketable tubers of the four potato entries. Highly significant differences among the entries were observed on both marketable and non-marketable tubers of the potato entries. Ganza produced the heaviest marketable and non-marketable tubers followed by MLUSA 8 and MLUSA 5.

The high yield obtained from Ganza could be due to the fact that the check variety was recommended for organic production by Tad-awan *et al.* (2008).

Table 11. Weight of marketable and non-marketable tubers of the potato entries

ENTRY	YIELD/HILL	
	MARKETABLE (g)	NON-MARKETABLE (g)
MLUSA 5	87[b]	12[b]
MLUSA 8	79[bc]	10[b]
Ganza (check)	118[a]	22[a]
Granola (check)	59[c]	10[b]
CV (%)	14.54	24.03

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

Yield per Hill and Yield per $5m^2$

Table 12 shows highly significant differences among the four potato entries in terms of yield per hill. Ganza produced the highest yield of 140 g followed by MLUSA 5 and MLUSA 8 (100 g and 89 g, respectively). Granola produced the lowest yield which might be due to the effect of low temperature during the conduct of study.

The four potato entries significantly differed on the total yield per $5m^2$ with Ganza producing the highest. Figures 5-8 show the harvested tubers of the different potato entries.

Table 12. Yield per hill and yield per $5m^2$ of the potato entries

ENTRY	AVERAGE YIELD (g/hill)	TOTAL YIELD ($kg/5m^2$)
MLUSA 5	100^{b}	2.00^{b}
MLUSA 8	89^{bc}	1.78^{bc}
Ganza (check)	140^{a}	2.80^{a}
Granola (check)	69^{c}	1.37^{c}
CV (%)	15.22	15.22

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

Figure 5 Harvested Ganza tubers

Figure 6 Harvested Granola tubers

Figure 7 Harvested MLUSA 5 tubers

Figure 8 Harvested MLUSA 8 tubers

Dry Matter and Sugar Content

Table 13 shows the dry matter and sugar content of the four potato entries. There were no significant differences for both parameters of the four entries. However, Ganza obtained the highest dry matter content followed by MLUSA 5 and MLUSA 8. All the entries had the same sugar content of 3.6 °Brix.

Table 13. Dry matter and sugar content of the potato entries

ENTRY	DRY MATTER CONTENT (%)	SUGAR CONTENT (°Brix)
MLUSA 5	20	3.6
MLUSA 8	20	3.6
Ganza (check)	22	3.6
Granola (check)	17	3.6

Return on Cash Expense

Positive ROCE was obtained from Ganza followed by MLUSA 5 and MLUSA 8. Granola obtained a negative ROCE.

Table 14. Return on cash expense of the potato entries

ENTRY	COST OF PRODUCTION (Php)	GROSS INCOME (Php)	NET INCOME (Php)	ROCE (%)
MLUSA 5	125.17	159.2	33.5	26.8
MLUSA 8	125.17	142.4	17.2	13.8
Ganza (check)	125.17	224	1.8	78.9
Granola (check)	125.17	109.6	-15.6	-12.5

Documentation of Cultural Practices on
Organic Potato Production at Loo, Buguias

Preparation of Liquid Organic Fertilizer. The materials for making compost are sunflower leaves, 2 kg of bio-organic fertilizer and 16 liters of water with the aid of effective microorganisms. The sunflower leaves are chopped and mixed thoroughly in 16 liters of water then added with effective microorganism (Figures 9-12).

Figure 9 Chopping of sunflower leaves and mixing in water

Figure 10 Mixing the sunflower leaves and water with effective microorganism

Figure 11 Stirring and proper covering of compost

Figure 12 Liquid fertilizer ready for application

Land Preparation and Application of Bio-organic Fertilizer. Land preparation and application of bio-organic fertilizer is done 15 days before planting at a rate of 5 kg per $5m^2$ (Figure 13).

Figure 13 Land preparation and application of bio-organic fertilizer

Figure 14 Mixing of compost and lay-outing

Planting. Planting of stem cuttings is at a distance of 30 cm x 30 cm between hills and rows (Figure 15).

Figure 15 Planting of potato rooted stem cuttings

Irrigation. Irrigation is done with the use of sprinkler three times a week at 4 hours per station (Figure 16).

Figure 16 Irrigation with the use of sprinkler

Application of Liquid Fertilizer. Application of liquid fertilizer is at 15 days after planting. The application is 100 ml per hill at 15 days after planting and 22 DAP (Figure 17).

Figure 17 Application of liquid fertilizer

Crop Protection. Crop protection against insect pest is done by spraying once a month with 2 cups of wood vinegar mixed with 16 liters of water and use of traps (Figures 18-21). Wood vinegar is a liquid substance that is obtained when organic materials such as wood, coconut shell, bamboo, grass, and other plants are placed in a heating chamber. Wood vinegar contains organic substances such as organic acids, phenol substances, carbon substances, alcohol, neutral materials, and base acidic substances.

Insect traps are made up of yellow plastic applied with grease and installed at the end of each plot (Figure 20).

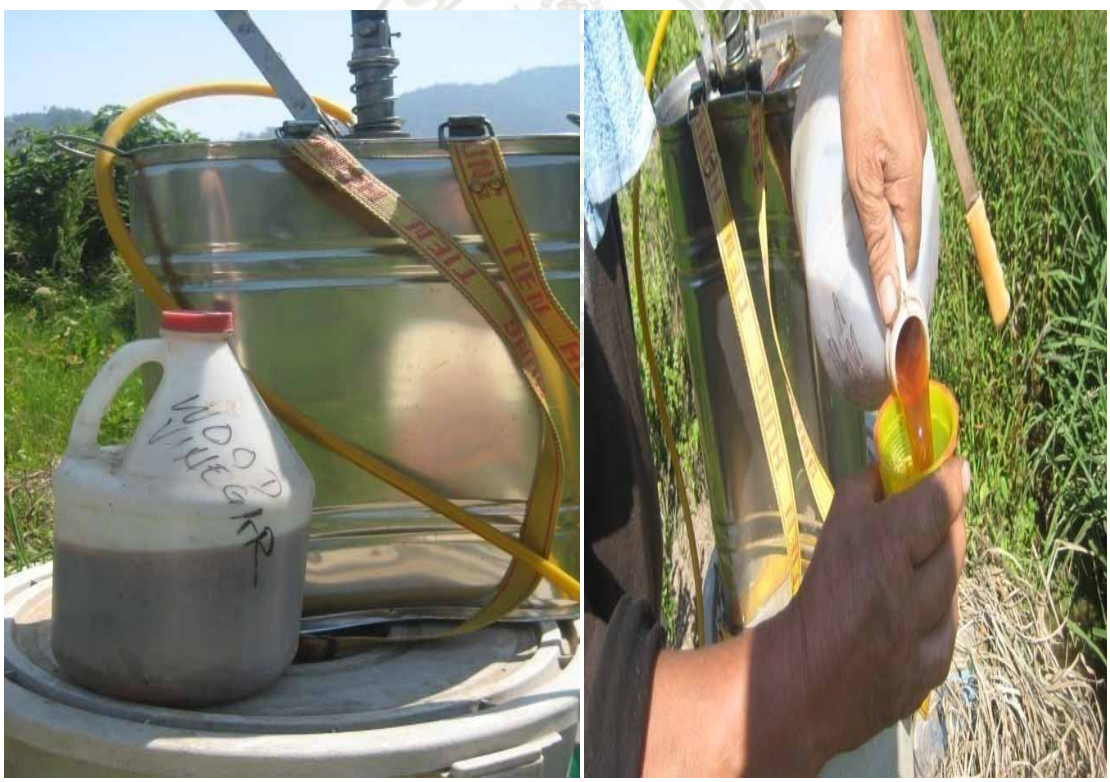

Figure 18 Materials used in spraying (2 cups of wood vinegar per 16 liters of water)

Figure 19 Spraying

Figure 20 Applying of grease to plastic

Figure 21 Insect traps installed at the end of the plot

Hilling-up. Hilling-up is done at 30 and 45 days after planting using a grab hoe (Figures 22-23).

Figure 22 Hilling-up at 30 days after planting

Figure 23 Hilling-up at 45 days after planting

Harvesting. Harvesting of the potato tubers is done using pointed stick as a digging material (Figure 24).

Figure 24 Harvesting using a pointed stick

Figure 25 Gathering of harvested tubers

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was conducted at, Loo, Buguias, Benguet from November 2009 to March 2010 to evaluate potato entries for organic production; determine the best performing potato entries in terms of yield; and resistance to pests; determine the profitability of growing organic potato entries for organic production and document the practices on organic potato production.

Ganza obtained the highest percent survival, exhibited the tallest plants, highest canopy cover, and highly vigorous plants at 75 DAP. MLUSA 5, MLUSA 8 and Ganza were rated moderately resistant to late blight at 75 DAP. Ganza was rated highly resistant and MLUSA 5 and MLUSA 8 were rated moderately resistant to frost injury at 60 and 75 DAP. All of the entries were moderately resistant to leaf miner. Ganza produced the heaviest marketable and non-marketable tubers and had the highest ROCE.

Conclusion

Potato entries MLUSA 5 and MLUSA 8 produced marketable tubers, were resistant to late blight and had a positive ROCE under organic production.

Recommendations

Under the conditions of the study, MULSA 5 and MLUSA 8 can be recommended for organic production at Loo, Buguias, Benguet. Further evaluation of the potato entries should be conducted to achieve stability in yield and resistance to pest and diseases.

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APPENDICES

Appendix Table 1.Plant survival (%) of potato entries at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	63	74	55	192	64^{b}
MLUSA 8	60	68	73	201	67^{b}
Ganza (check)	97	93	97	287	96^{a}
Granola (check)	50	40	40	130	43^{c}
TOTAL	270	275	265	810	68

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	12.500	6.250			
Treatment	3	4169.667	1389.889	25.06**	4.76	9.78
Error	6	332.833	55.472			
TOTAL	11	4515.000				

** = Highly Significant

Coefficient of Variation (%) = 11.03

Appendix Table 2.Plant survival (%) of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	33	80	36	149	50[bc]
MLUSA 8	30	75	80	185	62[ab]
Ganza (check)	97	90	93	280	93[a]
Granola (check)	25	27	17	69	23[c]
TOTAL	185	272	226	683	57

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	947.167	473.583			
Treatment	3	7654.917	2551.639	7.53**	4.76	9.78
Error	6	2034.833	333.139			
TOTAL	11	2034.833	339.139			

** = Highly Significant Coefficient of Variation (%) = 9.30

Appendix Table 3.Plant survival (%) of potato entries at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	30	83	30	143	48[bc]
MLUSA 8	20	87	83	190	63[ab]
Ganza (check)	93	87	93	273	91[a]
Granola (check)	10	17	0	27	14[c]
TOTAL	153	274	206	633	54

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1839.500	919.750			
Treatment	3	10544.917	3514.972	6.96**	4.76	9.78
Error	6	3027.833	504.639			
TOTAL	11	15412.250				

** = Highly Significant   Coefficient of Variation (%) = 26.89

Appendix Table 4.Plant survival (%) of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
GANZA	30	63	25	118	39[bc]
GRANOLA	20	80	83	183	19[ab]
MLUSA 5	93	87	93	273	91[a]
MLUSA 8	7	6	0	13	7[c]
TOTAL	150	236	201	201	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	935.167	467.583			
Treatment	3	11989.583	3996.528	9.61**	4.76	9.78
Error	6	2496.167	416.028			
TOTAL	11	15420.167				

** = Highly Significant Coefficient of Variation (%) = 25.73

Appendix Table 5.Plant height of potato entries at 30 DAP (cm)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	4	4	4	12	4^{b}
MLUSA 8	3	3	3	9	3^{c}
Ganza (check)	5	5	5	15	5^{a}
Granola (check)	4	3	3	10	3.3^{c}
TOTAL	16	15	15	46	3.8

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.167	0.083			
Treatment	3	7.000	2.333	28**	4.76	9.78
Error	6	0.500	0.083			
TOTAL	11	7.667				

** = Highly Significant

Coefficient of Variation (%) = 7.53

Appendix Table 6.Plant height of potato entries at 45 DAP (cm)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	5	6	6	17	5.7[c]
MLUSA 8	5	6	5	16	5.3[b]
Ganza (check)	9	8	9	26	8.7[a]
Granola (check)	6	5	6	17	5.7[c]
TOTAL	25	25	26	76	6.4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.167	0.083			
Treatment	3	22.000	7.333	17.60**	4.76	9.78
Error	6	2.500	0.417			
TOTAL	11	24.667				

** = Highly Significant   Coefficient of Variation (%) = 10.19

Appendix Table 7.Plant height of potato entries at 60 DAP (cm)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	10	7	8	25	8.3^{ab}
MLUSA 8	8	7	7	22	7.3^{b}
Ganza (check)	12	10	13	35	11.7^{a}
Granola (check)	8	6	0	14	4.7^{b}
TOTAL	38	30	28	96	8

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	14.000	7.000			
Treatment	3	75.333	25.111	4.92*	4.76	9.78
Error	6	30.667	5.111			
TOTAL	11	120.000				

* = Significant Coefficient of Variation (%) = 28.26

Appendix Table 8.Plant height of potato entries at 75 DAP (cm)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	12	12	11	35	11.7[a]
MLUSA 8	11	13	12	36	12[a]
Ganza (check)	15	15	16	46	15.3[a]
Granola (check)	10	8	0	18	6[b]
TOTAL	48	48	39	135	8.8

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	13.500	6.750			
Treatment	3	134.917	44.972	5.89*	4.76	9.78
Error	6	45.833	7.639			
TOTAL	11	194.250				

* = Significant Coefficient of Variation (%) = 24.77

Appendix Table 9.Canopy covers of potato entries at 30DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	10	12	9	31	10[b]
MLUSA 8	10	9	9	28	9[b]
Ganza (check)	18	23	20	61	20[a]
Granola (check)	9	7	8	24	8[b]
TOTAL	47	51	46	144	12

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	3.500	1.750			
Treatment	3	286.000	95.333	34.67**	4.76	9.78
Error	6	16.500	2.750			
TOTAL	11	306.000				

** = Highly Significant Coefficient of Variation (%) = 13.82

Appendix Table 10. Canopy covers of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	24	23	16	63	21[b]
MLUSA 8	13	22	25	60	20[b]
Ganza (check)	39	44	39	122	41[a]
Granola (check)	19	9	4	32	11[b]
TOTAL	95	98	84	277	23

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	27.167	13.583			
Treatment	3	1431.583	477.194	12.89**	4.76	9.78
Error	6	222.167	37.028			
TOTAL	11	1680.917				

** = Highly Significant

Coefficient of Variation (%) = 26.36

Appendix Table 11. Canopy covers of potato entries at 60 DAP

ENTRY	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
MLUSA 5	13	41	28	82	27[b]
MLUSA 8	10	32	35	77	26[b]
Ganza (check)	57	55	55	167	56[a]
Granola (check)	10	8	0	18	6[c]
TOTAL	90	136	118	344	29

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	268.667	134.333			
Treatment	3	3760.667	1253.556	13.54**	4.76	9.78
Error	6	555.333	92.556			
TOTAL	11	4584.667				

** = Highly Significant

Coefficient of Variation (%) = 24.99

Appendix Table 12. Canopy covers of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	6	28	19	53	18[b]
MLUSA 8	6	27	28	61	20[b]
Ganza (check)	65	64	60	189	63[a]
Granola (check)	4	2	0	6	2[c]
TOTAL	81	121	107	309	26

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	206.000	103.000			
Treatment	3	6138.917	2046.306	33.24**	4.76	9.78
Error	6	369.333	61.556			
TOTAL	11	6714.250				

** = Highly Significant

Coefficient of Variation (%) = 24.29

Appendix Table 13. Plant vigor of potato entries at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	4	4	4	12	4^a
MLUSA 8	4	4	4	12	4^a
Ganza (check)	4	5	4	13	4^a
Granola (check)	3	3	3	9	3^b
TOTAL	15	16	15	46	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	0.167	0.083			
Treatment	3	3.000	1.000	12.0**	4.76	9.78
Error	6	0.500	0.083			
TOTAL	11	3.667				

** = Highly Significant

Coefficient of Variation (%) = 7.53

Appendix Table 14. Plant vigor of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	4	2	9	3^{bc}
MLUSA 8	3	4	4	11	4^{ab}
Ganza (check)	5	5	5	15	5^{a}
Granola (check)	2	2	3	7	2^{c}
TOTAL	13	15	14	42	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	0.500	0.250			
Treatment	3	11.667	3.889	8.24**	4.76	9.78
Error	6	2.833	0.472			
TOTAL	11	15.000				

** = Highly Significant   Coefficient of Variation (%) = 19.63

Appendix Table 15. Plant vigor of potato entries at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	4	4	9	3[b]
MLUSA 8	2	4	4	10	3[b]
Ganza (check)	5	5	5	15	5[a]
Granola (check)	1	1	0	2	1[c]
TOTAL	11	14	13	36	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	1.167	0.583			
Treatment	3	29.667	9,889	20.94**	4.76	9.78
Error	6	2.833	0.472			
TOTAL	11	33.667				

** = Highly Significant　　Coefficient of Variation (%) = 21.70

Appendix Table 16. Plant vigor of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	2	4	3	9	3^{b}
MLUSA 8	2	3	4	9	3^{b}
Ganza (check)	5	5	5	15	5^{a}
Granola (check)	1	1	0	2	1^{c}
TOTAL	10	13	12	35	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	1.167	0.583			
Treatment	3	28.250	9.417	16.14**	4.76	9.78
Error	6	3.500	0.583			
TOTAL	11	32.917				

** = Highly Significant Coefficient of Variation (%) = 26.19

Appendix Table 17. Leaf miner incidence of potato entries at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	1	1	1	3	1
MLUSA 8	1	1	1	3	1
Ganza (check)	1	1	1	3	1
Granola (check)	1	1	1	3	1
TOTAL	4	4	4	12	1

Appendix Table 18. Leaf miner incidence of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	1	1	1	3	1
MLUSA 8	2	2	1	5	2
Ganza (check)	1	1	1	3	1
Granola (check)	1	2	1	4	1
TOTAL	5	6	4	15	1

Appendix Table 19. Leaf miner incidence of potato entries at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	2	2	2	6	2
MLUSA 8	2	2	2	6	2
Ganza (check)	1	1	2	4	1
Granola (check)	2	2	0	4	1
TOTAL	7	7	6	20	2

Appendix table 20. Leaf miner incidence of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	2	3	8	3
MLUSA 8	3	2	2	7	2
Ganza (check)	2	2	2	6	2
Granola (check)	3	3	0	6	2
TOTAL	11	9	7	27	2

Appendix Table 21. Late blight incidence of potato entries at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	4	5	5	14	5
MLUSA 8	5	5	5	15	5
Ganza (check)	4	4	4	12	4
Granola (check)	4	5	8	17	6
TOTAL	17	19	22	58	5

Appendix Table 22. Late blight incidence of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	5	5	5	15	5
MLUSA 8	5	4	4	13	4
Ganza (check)	4	4	4	12	4
Granola (check)	7	7	8	23	7
TOTAL	21	20	21	68	5

Appendix Table 23. Late blight incidence of potato entries at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	5	4	4	13	4
MLUSA 8	5	5	4	14	5
Ganza (check)	4	4	4	12	4
Granola (check)	9	9	0	18	6
TOTAL	23	22	12	57	5

Appendix Table 24. Late blight incidence of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	5	4	4	13	4
MLUSA 8	5	5	4	14	5
Ganza (check)	4	4	4	12	4
Granola (check)	9	9	0	18	6
TOTAL	23	23	12	57	5

Appendix Table 25. Frost injury rating of potato entries at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	2	3	8	3
MLUSA 8	3	3	2	8	3
Ganza (check)	1	1	1	3	1
Granola (check)	4	4	4	12	4
TOTAL	11	10	10	31	3

Appendix Table 26. Frost injury rating of potato entries at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	2	2	7	2
MLUSA 8	3	2	2	7	2
Ganza (check)	1	1	1	3	1
Granola (check)	4	4	5	13	4
TOTAL	11	9	10	30	2

Appendix Table 27. Frost injury rating of potato entries at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	2	2	3	7	2
MLUSA 8	2	2	2	6	2
Ganza (check)	1	1	1	3	1
Granola (check)	5	5	0	10	3
TOTAL	10	10	6	26	2

Appendix Table 28. Frost injury rating of potato entries at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	2	2	7	3
MLUSA 8	2	2	2	6	2
Ganza (check)	1	1	1	3	1
Granola (check)	5	5	0	10	3
TOTAL	11	10	5	26	2

Appendix Table 29. Number of marketable tubers per hill

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3	3	3	9	3^b
MLUSA 8	2	3	3	8	3^b
Ganza (check)	4	3	4	11	4^a
Granola (check)	2	1	2	5	2^c
TOTAL	11	10	12	33	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	0.500	0.250			
Treatment	3	6.250	2.083	8.33*	4.76	9.78
Error	6	1.500	0.250			
TOTAL	11	8.250				

* = Significant

Coefficient of Variation (%) = 18.18

Appendix Table 30. Number of non-marketable tubers per hill

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	4	3	4	11	4[a]
MLUSA 8	4	4	4	12	4[a]
Ganza (check)	2	3	2	7	2[c]
Granola (check)	3	3	3	9	3[b]
TOTAL	13	13	13	39	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	0.000	0.000			
Treatment	3	4.917	1.639	7.37[ns]	4.76	9.78
Error	6	1.333	0.222			
TOTAL	11	6.250				

[ns] = Not Significant

Coefficient of Variation (%) = 14.50

Appendix Table 31. Weight of marketable tubers per hill (g)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	96	68	98	264	87[b]
MLUSA 8	74	69	94	237	79[bc]
Ganza (check)	140	90	125	355	118[a]
Granola (check)	60	29	88	177	59[c]
TOTAL	370	256	405	1,033	86

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	3035.167	1517.583			
Treatment	3	5475.583	1825.192	11.70*	4.76	9.78
Error	6	936.176	156.028			
TOTAL	11					

* = Significant Coefficient of Variation (%) = 14.54

Appendix Table 32. Weight of non- marketable tubers per hill (g)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	14	14	9	37	12[b]
MLUSA 8	11	9	11	31	1[b]
Ganza (check)	26	18	21	65	22[a]
Granola (check)	9	6	14	29	10[b]
TOTAL	60	47	55	162	14

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	21.500	10.750			
Treatment	3	278.333	92.778	8.81*	4.76	9.78
Error	6	63.167	10.528			
TOTAL	11	363.000				

*= Significant Coefficient of Variation (%) = 24.03

Appendix Table 33. Total y yield per hill (g)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	110	82	107	299	99.6[b]
MLUSA 8	85	78	105	268	89.3[bc]
Ganza (check)	166	108	146	420	140[a]
Granola (check)	69	35	102	206	68.7[c]
TOTAL	130	303	460	1193	143.7

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	3473.167	1736.583			
Treatment	3	8082.917	2694.306	11.78**	4.76	9.78
Error	6	1372.833	228.806			
TOTAL	11	12928.917				

** = Highly Significant   Coefficient of Variation (%) = 15.22

Appendix Table 34. Total yield per $5m^2$ (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	2.20	1.64	2.14	5.98	1.99[b]
MLUSA 8	1.70	1.56	2.10	5.36	178[bc]
Ganza (check)	3.32	2.16	2.92	8.40	2.80[a]
Granola (check)	1.38	0.70	2.04	4.12	1.37[c]
TOTAL	8.60	6.06	9.20	25.56	1.98

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.389	0.695			
Treatment	3	3.233	1.078	11.78**	4.76	9.78
Error	6	0.549	0.092			
TOTAL	11	5.172				

** = Highly Significant

Coefficient of Variation (%) = 15.22

Appendix Table 35. Dry matter content of potato tubers

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	20	20	20	60	20
MLUSA 8	20	20	20	60	20
Ganza (check)	20	25	20	65	22
Granola (check)	15	15	20	50	17
TOTAL	75	75	80	285	20

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	4.167	2.083			
Treatment	3	39.583	13.194	2.71^{ns}	3.59	6.22
Error	6	29.167	4.861			
TOTAL	11	72.917				

^{ns} = Not Significant

Coefficient of Variation (%) = 11.26

Appendix Table 36. Sugar content of potato tubers (°Brix)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
MLUSA 5	3.6	3.6	3.6	10.8	3.6
MLUSA 8	3.6	3.6	3.6	10.8	3.6
Ganza (check)	3.6	3.6	3.6	10.8	3.6
Granola (check)	3.6	3.6	3.6	10.8	3.6
TOTAL	14.8	14.8	14.8	43.2	3.6