BIBLIOGRAPHY

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ABSTRACT

The study was conducted at the experimental area of Benguet State University, Balili, La Trinidad, Benguet from January to May 2011 to: evaluate the potato entries for organic production; determine the best performing potato entries in terms of yield, resistance to pest and diseases; and determine the profitability of growing the organic potato entries for organic production.

Among the potato entries under organic production, Gukungu, 676008 and Tubira had the highest percentage of survival. All entries were observed to be highly vigorous at 30 to 60 DAP. Gukungu had the tallest plants. Canopy cover was comparable among the potato entries at 45 and 75 DAP. At 30 to 75 DAP Gukungu had the widest canopy. In terms of leaf miner incidence, all entries were highly resistant at 30 to 45 DAP. There was no late blight occurrence observed.

Gukungu produced the highest number and heaviest weight of marketable tubers. Gukungu, 676008 and Tubira were noted to have pink skin while Santa Ana had violet tubers. Entry 676008 and Montañosa had smooth skin type while the other entries were

rough. In terms of flesh color, Gukungu and 676008 had yellow-cream while the other entries had white. In terms on return cash expense, all entries obtained positive ROCE.

INTRODUCTION

The potato *(Solanum tuberusum* L.) plays an important role in our economy since it is one of the profitable crops grown in Benguet and Mountain Province. It remains to be a high value crop because of its local and export potential and growing market demand (Aguirre, 2005). Potato as good contains high nutrition value, good source of carbohydrates, proteins, minerals, vitamins and calcium (Smith, 1997). At present, the demand of potato continues to increase. Rapid urbanization and the emerging importance of potato processing will generate additional demand. This is to maintain and increase number of fast food chain and the snack industry that requires high supply of potato. The increase demand for potatoes has also included the clamor for pesticide-free produce. It is a common observation that in Benguet and Mountain Province, potato production is done through the conventional way.

At present organic production is recommended as an alternative to chemical-based potato production. Organic production is the traditional practice utilizing diverse farming system which avoided the use of synthetic chemical inputs such as fertilizers, pesticides, herbicides growth stimulant and others. Organic farming depends on crop rotation, green manuring and others. Pest control is done by applying non-chemical method such as biological controls, mechanical cultivation, mulches, and other forms of natural control (Kuepper, 2002).

Potato is one of the banner crops of Benguet, thus, practices that can boost production should be encouraged. Organic potato production is now being promoted to farmers in the locality in order to have a sustained production. One of the practices to have sustainable production is the use of varieties that can adapt to organic farming. Varieties for organic

production should be resistant to pest and diseases and acceptable to consumers. One of the inherent characteristics of potato varieties that may contribute to the acceptability to consumers is the color of the skin. Organic practitioners claim that pink, red and violet-colored potatoes are promising under organic production and demand higher price than yellow or white-skinned potato varieties.

The study was conducted to:

1. evaluate the growth, yield and postharvest characters of pink and violet skin potato entries for organic production;

2. identify the best performing potato entries based on yield and resistance to pest and diseases; and

3. determine the profitability of growing the potato entries under organic production.

The study was conducted at the Balili experimental area of the Benguet State University, Balili, La Trinidad, Benguet from February 2011 to June 2011.

REVIEW OF LITERATURE

Organic Farming Defined

Organic farming is a form of agriculture inputs, especially not using of synthetic fertilizer and pesticides. 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 chemical methods. As opposed to using synthetics materials, to fulfill any specific function within the system (PCARRD, 2006). Organic farming is related to the principle beyond cultural practices such as fair trade and environmental stewardship (IFOAM, 2005).

Benefits of Organic Farming

The benefits of organic farming are mostly health related since produce has little or no pesticide residue. Some practitioners of organic farming believe that organic food is more nutrients that food produces by conventional farming (Hynes, 2006).

Organic farming maintains, improves soil organic matter and reduces the occurrence of pest and diseases. It can also control of weeds combined with soil cultivation. Organic agriculture also contributes to food security by increasing yields in low input areas, concerning biodiversity and nature resources on the farm in the surrounding (IFOAM, 2005). Organic farming promotes crop diversity through crop rotation, mixed cropping, multiple cropping, and relay inter cropping. The benefits of diversity include, reduce pest incidence, improves weed control, reduce soil erosion and the recycling of nutrient reserves from depth of the soil, and transfer of nitrogen fixing species and increase yield (Lem-ew, 2007).

Varietal Evaluation under Organic Production

The best variety to plant suited in organic production is a major decision to make. For maximum production, the best variety that is adapted to the locality should be planted (Singh, 1999). Organic farmer's needs varieties that are adopted selection of variety; farmer must also consider the maturity, market demand and consumer requirement to attain the best production needed. Choosing the right varieties it is very important for marketing, storage and pest management reason. Variety should produce good yield with moderate resistant to common scab.

In a potato trial conducted under organic production in La Trinidad, CIP 96-06, PHIL. 5.19.2.2 and CIP 676089 produced the highest total yield. CIP 13.1.1, CIP 67608, PHIL. 5.19.1.1 and CIP 96-06 had moderate resistance to leaf miner at 60 DAP and highly resistant to late blight. CIP 676089 obtained the highest return on cash expense (Ambales, 2009).

Montes (2006) in his study at Puguis, La Trinidad, Benguet found out that potato genotype CIP 676080 was the best entry under organic production system as evidenced by its highly vigorous and tall plants, high yield, high dry matter content of tubers and resistance to late blight.

Imarga (2009) found that CIP 380241.17, MLUSA 5, MLUSA 8 and Igorota were adapted under organic production at Beckel, La Trinidad, Benguet. Igorota and MLUSA 3 were highly resistant to late blight. MLUSA 5 produced the heaviest weight of marketable tubers.

Laweng (2006) in her study in La Trinidad found that potato entry CIP 13.1.1 had the highest canopy cover and the most resistant to late blight. Catani produced the highest marketable yield but was the susceptible to late blight.

MATERIALS AND METHODS

Land Preparation and Application of Organic Fertilizer

An area of 120 m^2 was thoroughly prepared before planting and divided into four blocks, which corresponds to four replications. Each block was further subdivided into five plots measuring 1 m x 5 m. Compost was equally applied at 5kg per 5 m^2 one week before planting. The experiment was laid-out following the randomized complete block design (RCBD) with four replications.

Planting and Cultural Management Practices

Sprouted potato tubers were planted in a double-row plot at a distance of 30 cm x 30 cm between hills and between rows. Cultural management practices such as irrigation, weeding, pest control and hilling-up were uniformly employed in all the treatments through-out the growing duration. All management practices were done the organic way, that is, non-application of synthetic fertilizers and pesticides, 10% diversity and application of compost.

The treatments were the following:

Treatment	Name/ Skin Color
E_1	Gukungu (Pink)
E_2	Santa Ana (Violet)
E_3	676008 (Pink)
E_4	Tubira (Pink)
E_5	Montañosa (Yellow)

Data Analysis

All quantitative data was analyzed using analysis of variance (ANOVA) for RCBD. The significance of difference among treatment means was tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Data Gathered

A. Agro-climatic data. The temperature, relative humidity, rainfall were recorded during the conduct of the study.

B. Soil chemical properties. Soil samples were taken from the experimental area before and 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. Growth Parameters

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:

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

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

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

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

Scale	Description	Reaction
5	Plants are strong with robust stem and leaves, light color to dark green color.	High 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

D. Reaction to Pest and Diseases

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

Blight	Scale	Description
0	1	No blight
0.1-1	2	Very few plants in larger treatment with lesions not more than 2 lesion 10m or row (+/-30 plants)
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 leaflet with lesion. Multiple infections per leaflets are common. Field of plot look green, but all plants are pots are blighted.

Blight	Scale	Description
50-74	6	Every plant blighted and half the leaf is 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 overwhelming killed off, and the only green leaves, if any, are spindly due to extensive
91-97	8	Some leaves and most steam are green, filed looks brown with some leaves patches.
97.1-99.9	9	Few green leaves almost all with blight lesion remain. Many stems lesions field look brown.
100	10	All leaves and stem dead.

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

2. 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

E. Yield and Yield Components

1. Number and weight of marketable tubers per plot (kg). All tubers that were of marketable size, not malformed, free form cuts, cuts and without more than 10% greening of the total surface were counted and weighed at harvest.

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

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

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

Computed Yield (t/ha) = Total Yield per Plot ($kg/5m^2$) x 2

*Where: 2 is the factor used to convert yield in $kg/5m^2$ to tons per hectare assuming one hectare effective area.

F. Return on Cash Expense (ROCE). This was computed using the formula:

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

G. Tuber Characters

1. Tuber skin color. This was described by visual observation as:

1 = White-cream
2 = Yellow
3 = Orange
4 = Brownish
5 = Pink
6 = Red
7 = Purplish-red
8 = Purple
9 = Dark purple-black

2. Tuber skin type. This was recorded using the CIP descriptors list.

1 = Smooth

2 = Rough (flaky)

3 = Partially netted

4 = Totally netted

5 = Very heavily netted

6 = Other

3. Predominant tuber flesh color. Code indicating the flesh color present in most of the tuber, expressed as:

1 = White

2 = Cream

3 = Yellow – cream

4 = Yellow

5 = Red

6 = Violet

7 = Purple

8 = Other

4. Secondary tuber flesh color. Code representing a secondary flesh color in the tuber, expressed as:

1 = Absent

2 = White

3 = Cream

4 = Yellow – cream

5 = Yellow

6 = Red

7 = Violet

8 = Purple

9 = Other

5. General tube shape. Code describing the tuber outline, expressed as:

1 = Compressed (oblate) – major axis is the shortest axis.

2 = Round – an almost circular outline

3 = Ovate – an outline resembling an egg,The broadest part is within 1/3 of the distance from the stolen end.

4 = Obovate – an outline which is inversely ovate and broadest part is within 1/3 of the distance from the apical end (rose or eye end).

5 = Elliptic – an outline showing the same breadth when measured at equal distance from both the stolon and apical ends.

6 = Oblong – an almost rectangular outline with the sides nearly parallel but the corners rounded. The length/breadth ration should not be more than 3/2.

7 = Long-Oblong – an oblong outline with a length/breath ratio closer to 2/1.

8 = Elongate – a long rectangular outline with a length/breadth ratio equal to or more than 3/1.

6. Unusual tuber shape. Code representing those variants of tuber shapes which cannot be described under general tuber shape. It is expressed as follows:

1 = Absent

2 = Flattened – when the length of a transverse section, at any point of the tuber, it's more than three times longer than its breadth.

3 = Clavate – resembling an elongated club, thickened at one end.

4 = Reniform – shaped like a kidney

5 = Fusiform – spindle – shaped, tapering gradually at both ends

6 = Falcate – curved or shaped like a sickle or horseshoe

7 = Spiral – long and colored

8 = Digitate – resembling a hand or a fist

9 = Concertina – shaped – resembling a concertina

10 = Tuberoses – covered with few or many small lumps and tubers. It includes those shaped like a pineapple, a cluster of grapes, and raised internodes.

7. Depth of tuber eyes. Code indicating the depth of the eyes in the tuber, expressed as:

1 = Protruding

2 = Shallow

3 = Medium

4 = Deep

5 = Very deep

G. Postharvest Characteristics

1. Dry mater content (%). One hundred gram tubers were weighed and sliced into cubes and oven dried at 100°C for 24 hours. This was recorded and computed using the following formula:

% Dry Matter = 100% - % Moisture Content

Fresh Wei Where: % Moisture Content = Fresh Weight x 100

2. Sugar content. This was taken before and after storage using a digital refractro meter.

3. Percentage weight loss. Tubers were weighted every 3 days for one month and computed using the formula;

Initial Weight Percentage Weight Loss = x 100
Initial Wei

4. Number of sprouts. Sprouts per tuber were counted weekly for the month.

5. Visual quality rating. This was obtained weekly for one month using the rating scale (Salda, 2003).

Scale	Grade	Remarks
1	Firm (no defect)	Fresh
2	Minimal (moderate defect)	Good
3	Limit of stability (severe defect)	Poor

6. Degree of decay. This was taken weekly for one month using the scale of Bayogan (1986).

Scale	Description
1	No Decay
2	1-19 % decay/rotting of tuber surface area
Scale	Description
3	20-49% decay/rotting of tuber surface area.
4	50 – 79% decay/rotting of tuber surface area.
5	80% and above decay/rotting of tuber surface area.

RESULTS AND DISCUSSION

Meteorological Data

Table 1 shows the temperature, relative humidity, sunshine duration and rainfall during the conduct of the study. There was an extreme range of temperature during the conduct of the study from 8.9 ^{0}C to 29.3 ^{0}C. The lowest temperature was recorded in February while the highest was recorded in April. This temperature extreme was not favorable for potato production since the optimum temperature is from 17 ^{0}C to 22 ^{0}C (HARRDEC 1996). NPRCRTC (1996) also reported that the maximum yield of potato was produced when the average temperature during the growing season which ranged from 15 ^{o}C to 18 ^{o}C. Rainfall was low from January to April. Thus, irrigation was done. Relative humidity ranged from 80-94%.

Table 1. Meteorological data gathered during the conduct of the study (January-May 2011)

MONTH	TEMPERATURE		RELATIVE HUMIDITY (%)	RAINFALL (mm)	DAILY SUNSHINE DURATION (min)
	Max. (^{0}C)	Min. (^{0}C)			
January	25.7	15.5	80	1.0	368.3
February	17.7	8.9	85	1.0	214.3
March	23.0	13.3	82	1.0	250.3
April	29.3	16.7	86	2.9	345.0
May	28.6	11.0	94	13.7	150.1

Chemical Properties of the Soil

Soil pH. The pH of the soil before and after harvest was 6.0 which favored the growth of potato entries since the optimum pH for potato production ranged from 5.6 - 6.5.

Soil organic matter. The organic matter present in the soil increased from 2.5 to 3.0 % after planting. This might be due to the compost application. According to Lambert (1996) the normal organic content for potato production ranged from 1 to 4 %.

Phosphorus (ppm). There was a decrease in the phosphorus content of the soil from 139 to 125 at harvest. HARRDEC (1996) reported that during the early development of the crop and early tuberization phosphorus is needed to increase the number of tubers produced by the plant. For this reason, the decrease in phosphorus content may be caused by the high phosphorus requirement of the potato plant.

Potassium (ppm). There was an increase in potassium content of the soil after harvest from 208 to 229 ppm. The increase could be attributed to the application of compost and vermi compost.

Nitrogen (%). No change had been observed on the amount of nitrogen before and after planting. This may imply that the nutrient content of the compost was sufficient for the growth and development of the plants.

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

SAMPLING TIME	pH	OM (%)	N (%)	P (ppm)	K (ppm)
Before planting	6.0	2.5	0.33	139	208
After harvest	6.0	3.0	0.33	125	229

Percent Survival

The percent survival of the potato entries at 75 days after planting (DAP) is shown in Table 3. Significant differences among the entries were noted. Gukungu, 676008 and Tubira had a 100% survival while Santa Ana had the lowest percent survival of 84.17%.

The decreased in survival of Montañosa and Santa Ana could be attributed to unfavorable weather conditions such as the high temperature. Some of the tubers were also observed to have been affected by bacterial wilt.

Plant Height

Table 4 shows the height of the plants at 30 DAP, 45 DAP, 60 DAP and 75 DAP. Highly significant differences among the potato entries were noted. Gukungu produced the tallest plants in all dates while Tubira produced the shortest plants.

Table 3. Plant survival of potato entries at 75 days after planting

ENTRY	PLANT SURVIVAL (%)
Gukungu	100.00[a]
Santa Ana	84.17[b]
676008	100.00[a]
Tubira	100.00[a]
Montañosa	92.50[ab]
CV (%)	6.74

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

Table 4. Plant height of potato entries at 30, 45, 60 and 75 DAP

ENTRY	PLANT HEIGHT (cm) (DAYS AFTER PLANTING)			
	30	45	60	75
Gukungu	20.55[a]	49.16[a]	70.68[a]	77.48[a]
Santa Ana	15.13[c]	28.72[d]	41.73[d]	54.70[d]
676008	17.83[b]	41.02[b]	65.02[b]	71.82[b]
Tubira	12.31[d]	24.55[e]	35.45[e]	51.88[e]
Montañosa	13.23[cd]	31.51[c]	60.71[c]	69.28[c]
CV (%)	10.41	4.92	2.56	2.51

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

Canopy Cover

Table 5 shows the canopy cover of the potato entries. Canopy covers of the potato entries at 30 DAP, 45 DAP, 60 DAP and 75 DAP significantly differed. Highest canopy cover was obtained by Gukungu in all dates while the lowest canopy cover was obtained by Tubira. There was an increase in canopy cover for all entries. This could be attributed to late blight resistance. On other hand, Tubira having obtained 100% survival had low canopy cover. This could be due to high temperature and susceptibility to leaf miner at 75 DAP.

Plant Vigor

Table 6 shows the plant vigor of the potato entries at 30, 45, 60 and 75 DAP. Most of the potato entries were highly to moderately vigorous. However, Santa Ana was rated vigorous at 75 DAP. The extreme temperatures might have contributed to the

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

ENTRY	CANOPY COVER (DAYS AFTER PLANTING)			
	30	45	60	75
Gukungu	40.50[a]	54.00[a]	62.00[a]	67.50[a]
Santa Ana	25.25[b]	37.62[bc]	42.25[bc]	51.25[b]
676008	36.00[a]	47.50[ab]	55.00[ab]	62.50[a]
Tubira	22.25[b]	30.25[c]	37.00[c]	46.25[b]
Montañosa	20.50[b]	34.00[c]	39.00[c]	48.75[b]
CV (%)	13.86	18.44	18.14	12.11

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

Table 6. Plant vigor of potato entries at 30, 45, 60 and 75 DAP

ENTRY	PLANT VIGOR (DAYS AFTER PLANTING)			
	30	45	60	75
Gukungu	5.00[a]	5.00	5.00[a]	5.00[a]
Santa Ana	4.50[ab]	4.75	4.25[b]	3.25[b]
676008	5.00[a]	5.00	4.25[b]	4.00[b]
Tubira	4.25[b]	4.50	4.00[b]	3.50[b]
Montañosa	4.00[b]	4.50	4.25[b]	3.50[b]
CV (%)	8.03	9.80	9.62	14.62

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

Legend:
5 - Highly vigorous
4 - Moderately vigorous
3 - Vigorous
2 - Less vigorous
1 - Poorly vigorous

decrease in plant vigor during the conduct of the study. A number of studies show that high temperatures affect the growth of the plants.

Leaf Miner Incidence

Table 7 shows the leaf miner incidence of the potato entries at 30, 45, 60 and 75 DAP. It was observed that all the entries were highly resistant at 30 and 45 DAP. At 60 DAP, there was no leaf miner occurrence observed. However, at 75 DAP, Santa Ana and Tubira were found to be susceptible while the other entries were found to be moderately resistant. The occurrence of leaf miner of Santa Ana and Tubira at 75 DAP could have been caused by the aging of the plants.

Late Blight Incidence

Late blight incidence of the potato entries at 30, 45, 60 and 75 DAP is presented in Table 8. Low late blight occurrence was observed.

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

ENTRY	LEAF MINER INCIDENCE (DAYS AFTER PLANTING)			
	30	45	60	75
Gukungu	Highly resistant	Highly resistant	Highly resistant	Moderately resistant
Santa Ana	Highly resistant	Highly resistant	Moderately resistant	Susceptible
676008	Highly resistant	Highly resistant	Moderately resistant	Moderately resistant
Tubira	Highly resistant	Highly resistant	Moderately resistant	Susceptible
Montañosa	Highly resistant	Highly resistant	Highly resistant	Moderately resistant

Table 8. Late blight incidence of potato entries at 30, 45, 60 and 75 DAP

ENTRY	LATE BLIGHT RATING (DAYS AFTER PLANTING)			
	30	45	60	75
Gukungu	Highly resistant	Highly resistant	Resistant	Resistant
Santa Ana	Highly resistant	Highly resistant	Resistant	Moderately resistant
676008	Highly resistant	Highly resistant	Resistant	Moderately resistant
Tubira	Highly resistant	Highly resistant	Resistant	Moderately resistant
Montañosa	Highly resistant	Highly resistant	Resistant	Resistant

Number and Weight of Marketable Tubers per Plot

Table 9 shows the number and total weight of marketable tubers per plot of the potato entries. Significant differences among the entries were observed. Gukungu produced the highest number and the heaviest weight of marketable tubers. Entry 676008 also produced high number and heavy weight of tubers. Santa ana and Tubira produced the lowest number of tubers. It was observed that entries with the widest canopy also produced the highest number and heaviest weight of marketable tubers (Figure 1-5).

The potato entries generally produced low yield which might be due to the extreme temperature during the conduct of the study.

Number and Weight of Non-marketable Tubers per Plot

Table 10 shows the number and weight of non-marketable tubers of potato entries per plot. There were no significant differences among the entries on the number and weight of non-marketable tubers. Entry 676008 produced the lowest number and weight of non-marketable tubers.

Table 9. Number and weight of marketable tubers of potato entries

ENTRY	MARKETABLE TUBERS	
	Number	Weight (kg)
Gukungu	86	2.49
Santa Ana	65	1.63
676008	85	2.31
Tubira	69	1.63
Montañosa	70	1.93
CV (%)	11.52	8.91

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

Table 10. Number and weight of non-marketable tubers of potato entries per plot

ENTRY	NON-MARKETABLE TUBERS	
	Number	Weight (kg)
Gukungu	11	0.73
Santa Ana	11	0.70
676008	10	0.63
Tubira	11	0.70
Montañosa	12	0.75
CV (%)	9.59	14.11

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

Yield per 5 m^2 and Computed Yield

Table 11 show the total yield of potato entries were Gukungu produced the highest yield while Santa Ana and Tubira produced the lowest. Low yield could be attributed to the unfavorable environmental condition specifically erratic temperature.

Gukungo also registered the highest yield per hectare. The high yield might be attributed to its resistance to late blight and leaf miner and wide canopy.

Return on Cash Expense (ROCE)

The return on cash expense of organic potato production is presented in Table 12. Entry 676008 had a return on cash expense of 59.40% which is the highest among the entries. Gukungu follows with 47.80%, then by Montañosa with 24.20%. Santa Ana and Tubira recorded the lowest return on cash expense with both 4.40%. All the entries obtained a positive ROCE.

Table 11. Yield per plot and computed yield of the potato entries

ENTRY	YIELD	
	PER PLOT (kg/5m^2)	COMPUTED (t/ha)
Gukungu	3.11[a]	6.23[a]
Santa Ana	2.33[c]	4.65[c]
676008	3.04[a]	6.08[a]
Tubira	2.33[c]	4.65[c]
Montañosa	2.69[b]	5.38[b]
CV (%)	7.02	7.02

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

Table 12. Return on cash expense of potato entries under organic production

TREATMENT	YIELD	COST OF PRODUCTION	GROSS INCOME	NET INCOME	ROCE (%)
Gukungu	2.31	125	184.75	59.75	47.80
Santa Ana	1.63	125	130.50	5.50	4.40
676008	2.49	125	199.25	74.25	59.40
Tubira	1.63	125	130.50	5.50	4.40
Montañosa	1.94	125	155.25	30.25	24.20

*Total cost of production includes organic fertilizers and labor.
*Selling price of potato tuber was Php80.00 per kg

Primary Characters of Tubers

Table 13 summarizes the predominant tuber skin color, tuber skin type and predominant tuber flesh color of potato entries. Gukungu and Tubira were noted to have pink skin while Santa Ana had violet, 676008 had purplish-red and Montanosa had yellow. Among the five entries, 676008 and Montanosa had a smooth tuber skin type compared with the other three entries which was rough. In terms of the predominant tuber flesh color, Gukungu and 676008 were yellow-cream and other entries were white. The tuber with colored skinned may be used as selection index for gourmet potato. Both yellow and cream white are presently accepted for table processing purposes. For more beta-carotene, yellow colored ones are preferred (Rastovski, 2003).

Secondary Characters of Tubers

All the entries were noted to have no secondary tuber flesh color. For the depth of tuber eyes, all entries have shallow eyes. Shallow eyes are preferred since tubers gave

Table 13. Predominant skin color, tuber skin type and predominant tuber flesh color of the five potato entries

ENTRY	PREDOMINANT SKIN COLOR	TUBER SKIN TYPE	PREDOMINANT TUBER FLESH COLOR
Gukungu	Pink	Rough	Yellow-cream
Santa Ana	Violet	Rough	White
676008	Purplish-red	Smooth	Yellow-cream
Tubira	Pink	Rough	White
Montañosa	Yellow	Smooth	White

less trimming loss, shorter time in trimming, and higher volume of materials for chips (Sabiano, 2006).

Tuber Shape

Generally, the following potato entries: 676008, Tubira and Montañosa have an oblong shape while Gukungu has elliptic and Santa Ana has compressed tubers (Table 14). The entries have unusual tuber shape, too. Gukungu, 676008 and Tubira were observed to have clavate shape while Santa Ana and Montañosa have flattered shapes.

Dry Matter and Sugar Content

Table 15 shows the tuber dry matter and sugar content of the potato entries. There were no significant differences on the dry matter content of the entries. However, 676008 obtained the highest dry matter content with 23.50%. Numerically, the dry matter content of all the potato entries were observed to be good for processing of chips since it ranges from 18 to

Table 14. Tuber shapes of the potato entries

ENTRY	GENERAL TUBER SHAPE	UNUSUAL TUBER SHAPE
Gukungu	Elliptic	Clavate
Santa Ana	Compressed	Flattered
676008	Oblong	Clavate
Tubira	Oblong	Clavate
Montañosa	Oblong	Flattered

Table 15. Dry matter and sugar content of the potato entries

ENTRY	DRY MATTER CONTENT (%)	SUGAR CONTENT (^{o}Brix)
Gukungu	20.50	4.88
Santa Ana	22.25	4.48
676008	23.50	4.78
Tubira	21.25	4.48
Montanosa	23.25	4.78
CV (%)	2.93	1.70

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

The potato entries did not also differ on their sugar content as shown in Table 15. Gukungu had the highest sugar content with 4.88 ^{o}Brix. Santa Ana and Tubira had the lowest sugar content of 4.48 ^{o}Brix.

Percent Weight Loss

The percent weight loss of the potato entries is presented in Table 16. Accordingly, the potato entries significantly differed at 7, 14 and 21 days. At 28 days, however no significant differences on percent weight loss among the five entries were observed.

Generally, Santa Ana had obtained the highest percentage of weight loss followed by Tubira while entry 676008 had the least weight loss. Furthermore, the difference of weight loss among these entries might be due to the well suberized peel which could be more resistant to respiration of some entries as compared to the thinner skin of other entries and genetic characteristics where some entries possess thick skin and cuticles (Rastovski *et al*., 1979).

Table 16. Percent weight loss of the potato entries

ENTRY	DAYS AFTER STORAGE				
	7	14	21	28	TOTAL
Gukungu	2.25^{abc}	4.68^{cd}	5.94^{abc}	6.43	19.27
Santa Ana	2.80^{a}	6.82^{a}	7.30^{a}	7.82	24.74
676008	1.90^{c}	3.90^{d}	4.43c	5.86	16.09
Tubira	2.72^{ab}	6.32^{ab}	6.72^{ab}	7.43	23.19
Montañosa	2.19^{bc}	5.42^{bc}	4.82bc	6.91	19.34
CV (%)	15.01	13.69	21.64	15.64	

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

Visual Quality Rating

After one month of storage, the tubers of the potato entries were still firm. No defects were observed. Tubers with none or less defects even if stored for a longer period of time is favorable for storage since potato can be preserved for future use without affecting its quality and marketable. Hence, tuber could be sold at a better price (Myers, 1996).

Degree of Decay

No incidence of decay during one month of storage was observed.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was conducted at the experimental area of Benguet State University, Balili, La Trinidad, Benguet to: evaluate the potato entries for organic production; determine the best performing potato entries in terms of yield and resistance to pest and diseases; and determine the profitability of growing organic potato entries for organic production.

Among the five potato entries under organic production, Gukungu, 676008 and Tubira had the highest percentage of survival. All entries were observed to be highly vigorous at 30 to 60 DAP. Gukungu had the tallest plants while Tubira registered the shortest plants. Canopy cover was comparable among the five entries at 45 and 75 DAP. At 30 to 75 DAP, Gukungu had the widest canopy while Tubira was noted to have the narrowest canopy cover. In terms of leaf miner incidence, all entries were highly resistant at 30 and 45 DAP. At 75 DAP, Santa Ana and Tubira were observed to be susceptible. There was no late blight occurrence observed.

Gukungu produced the highest number and heaviest weight of marketable tubers. Primary characters of tubers, Gukungu, 676008 and Tubira noted to have pink skin color while Santa ana was violet. Entry 676008 and Montañosa had smooth skin type while the other entries were rough. As to flesh color, Gukungu and 676008 had yellow-cream while the rest of the entries had white. All entries were noted to have no secondary flesh color. All entries were observed to have shallow eyes. Entry 676008, Tubira and Montañosa had oblong tubers while Gukungu had elliptic while Santa Ana had compressed tubers. Gukungu, 676008 and Tubira had clavate shaped tubers, while Santa Ana and Montañosa

had flattered tubers. For return of cash expense, all entries had positive ROCE. Gukungu obtained the highest ROCE.

Conclusion

Entries Gukungu and 676008 were the best performers based on marketable yield and return on cash of expense under organic production at La Trinidad Benguet.

Recommendations

Based on the conditions and results of the study, Gukungu and 676008 can be recommended for organic production under La Trinidad condition. However, further evaluation of these entries should be conducted to determine their stability in terms of growth, yield, resistant to pest and diseases and acceptability to famers.

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