BIBLIOGRAPHY

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Adviser: Esther Josephine D. Sagalla, MSc.

ABSTRACT

The study was conducted to determine the growth and yield of different potato entries under Mankayan condition; identify the best performing variety based on yield and resistance to pest and disease; and to determine the profitability of the different potato entries.

Among all the entries evaluated, CIP 380241.17, Igorota, and Ganza had the highest number and weight of tubers, highest total and computed yield, and return on cash expense. These entries were also observed to be resistant to leaf miner and late blight.

TABLE OF CONTENTS

INTRODUCTION

Potato *(Solanum tuberosum)* ranks among the high value crops grown in Mankayan during the months of September until January.

Farmers in this locality usually grow one variety namely, 'granola' every year. As a result, the variety becomes more prone to pest and diseases such as leaf miner and late blight (Perez *et al.*, 2006) leading to losses in yield. For instance, yield losses of about 70 -100% is mainly due to the infestation of pest particularly leaf miner (Verzola *et al*, 1999).

One way to overcome the problem on yield loss and pest and disease occurrence is to evaluate other varieties that are high yielding and resistant to pest and diseases.

Moreover, evaluation of different varieties of potato may provide a wide range of traits which could guide farmers to select their preferred varieties (Baidu – Forson, 1997)

Thus, it is the objective of this study to:

1. determine the growth and yield of different potato entries under Mankayan condition;

2. identify the best performing variety based on yield and resistance to pest and disease; and

3. determine the profitability of the different potato entries.

This study was conducted at Bulalacao, Mankayan, Benguet from December 2008 to March 2009.

REVIEW OF LITERATURE

Climatic Requirement of Potato

Potato grows mainly in cool, high altitude areas with well distributed rainfall (Simongo, 2007). It is best grown in areas with temperature ranging from 17- 21^{o}C and an average humidity of 86%. Potato can be produced on wide range of soils, ranging from sandy loam, silt loam, loam and clay soil. The soil should be well aerated, fairly deep and well supplied with organic matter. Well drained sandy loam and loam soils, rich in humus are most suitable for potato (Liejder, 1996).

Importance of Potato

From utilization perspective, the importance of potato is related to the importance of the food crops it represents. Potato is the world's 4th most important food crop (after rice, wheat and maize) in terms of production and area cultivated (Razdan and Matto, 2005).

Potato exceeds all other crops in providing calories, protein and several other nutrients and a very good source of vitamin C. Potatoes are both affordable and can be prepared in a greater variety of ways than most food so people are quite happy eating them as a major component of their diets. The potato crop is one of the most important of all in the rural economy (Guilford and Grubb, 2006).

Evaluation of Potato

Beukema in 1985 stated that clonal selection and evaluation is important in a breeding program. Procedures involve the production of healthy good looking plants, resistance to pest and disease and high yielding. Tubers of each selected varieties are

harvested and kept separate to be planted in the next trials. Plants are carefully inspected for any abnormalities. First generation (F1), which are found to have some abnormalities are rejected and removed away from fields.

Importance of Elevation in Potato Production

Production system in temperature and high elevation areas particularly over 2,000 meters ASL is more common with each other than with lowland production systems. Systems in Mediterranean and mid elevation highlands are intermediate in many respects. For some examples, temperate and high elevation areas have cold winters so farmers usually grow potatoes on summer, which is favorable in the growth of potato. Lowland zones have hot summers so farmer usually grows potato in the winters. In mid elevation and Mediterranean zones, farmers grow potatoes at various times of the year depending on market and climate conditions. Seed potatoes are produced in temperate and highland zones and shipped to lowland and Mediterranean zones. Storage is easier in temperate and high zones where potatoes are harvested at the beginning of hot season (Horton, 1987).

Potatoes are grown in higher elevation than any other major crops. In the tropics, the typical mountain areas that produce potatoes is cold, best temperature fluctuated sharply from day to night. And the average relative humidity is high. Soils are well drained, but there is great variation in altitude, slopes, soil fertility and other environmental variables that influence yields. Production hazards like frost causes low yields in highland areas, where the chances of crop failure are great, Farmers often economize to purchase inputs in order to minimize their financial risks (Horton, 1987).

Harvesting of Potato

Time to harvest is determined largely by price prospect on the market, the weather and to some extent the availability of labor. It is highly desirable to allow the crops to attain as much maturity as possible for harvesting. A more mature potato usually is for higher specific gravity or higher solid content and can be harvested with less skinning and bruising injuries (Smith, 1997).

Result of Past Studies

Lem-ew in 2007 said that entries 5.19.2.2 and 380241.17 significantly obtain the highest plant survival, plant height, plant vigor and canopy cover at Cabutotan, Benguet. Also they were highly resistant to leaf miner and least infected with late blight and produced the highest yield.

Tabon in 2007 conducted his study in mid and high elevation and results revealed that accession 5.19.2.2 obtained the highest percentage of plant survival, highly vigorous plants, widest canopy cover, tallest plants, and resistance to late blight infection and produced the highest computed and total yield.

MATERIALS AND METHODS

An area of 165m^2 was thoroughly prepared and divided into three blocks. Each block was subdivided into 11 plots measuring 1m x 5m. One tuber was planted per hill at a distance of 25cm x 30 cm in between hills and rows. Chicken manure and Triple 14 were applied following the recommended rate for potato production.

All recommended cultural management practices were done uniformly in all treatments.

The treatments which were replicated 3 times were:

Code	Entry	Source
E1	2.21.6.2	Philippines
E2	5.19.2.2	Philippines
E3	573275	CIP
E4	676070	CIP
E5	96-06 / 380241.17	CIP
E6	IGOROTA	Philippines
E7	GANZA	CIP
E8	GRANOLA	Germany
E9	FARMER	BPI
E10	RECOLTA	BPI
E11	SIGNAL	BPI

Figure 1. Overview of experimental area and harvesting of eleven potato entries at Bulalacao, Mankayan

Data Gathered

1. Meteorological data. Temperature, relative humidity and rainfall were taken every two weeks. Temperature and relative humidity were taken using a compact hygrometer while rainfall was taken by placing cans in the field to collect water during precipitation. The volume of water collected will be measured using a beaker.

2. Percent plant survival. This was taken at 30 days after planting (DAP) using the formula:

$$\% \text{ Plant survival} = \frac{\text{Number of plants survived}}{\text{Number of plants planted}} \times 100$$

3. Plant vigor. This was taken at 30, 45, and 60 days after planting using the following scale (CIP, 2004):

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

4. Canopy cover. This was gathered at 30, 45, 60 DAP using a wooden frame measuring 120cm x 60cm and having equal sized 12cm x 6cm grids.

5. Initial plant height (cm). This was measured at 30 days after planting from the base of the plant to tallest shoot of ten sample plants.

6. Final plant height (cm). This was measured at maturity from base of the plant to tallest shoot of ten sample plants.

7. Leaf miner incidence. This was observed at 30, 45, 60, 75 DAP using the following scale (CIP, 2001):

Scale	Description	Remarks
1	Less infested (1-20%)	Highly Resistant
2	Infested (21-40%)	Moderately Resistant
3	Moderate infested (41-60%)	Susceptible
4	Several infested (61-80%)	Moderately Susceptible
5	Most infested (81-100%)	Very Susceptible

8. Late blight incidence. This was observed at 30, 45, 60, 75 DAP using the following rating scale (Henfling, 1987):

Blight (%)	CIP Scale Value	Description of Corresponding Symptoms
0	1	No blight can be observed.
Trace - >5	2	Late blight present; maximum of 10 lesions/plant
5 ->15	3	Plant look healthy but lesions are easily seen at closer distance. Maximum foliage area affected by lesions or destroyed corresponds to know more than 20 leaflets.
15 - <35	4	Late blight easily seen on most plant about 25 % of the foliages is covered with lesions or destroyed.
35 - <65	5	Plot look green; however all plants are affected, lower leaves are dead. About half of foliage are destroyed.
65 - <85	6	Plot look green with brown flecks about 75% of each plant is affected leaves of the lower half the foliage are destroyed.

85 - <95	7	Plot neither predominantly green nor brown; only top leaves are green; many stems have large lesions.
95 - < 100	8	Plot is brown colored; few leaves still have green areas; most stem have lesion or are dead.
100	9	All dead.

9. Bacterial wilt infestation. This was obtained at 30, 45, 60, 75 DAP using the formula:

$$\% \text{ Bacterial wilt infestation} = \frac{\text{Number of Plant Infested}}{\text{Number of Plant Planted}} \times 100$$

10. Number and weight of marketable tubers per plot (kg). Marketable tuber free from injuries, cracks, not malformed and not attacked by pests were counted and weighed at harvest.

11. Number and weight of non-marketable tubers per plot (kg). Non-marketable tubers such as those malformed, damaged by pest and injured were counted and weighed at harvest.

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

13. Computed yield per hectare (tons/ha). This was computed using the formula:

$$\text{Yield (ton/ha)} = \frac{\text{Total Weight Per Plot}}{\text{Plot Size } (m^2)} \times 10,000/1000$$

14. Dry matter content (DMC). Tubers were weighed into 100g/sample, sliced into cubes, and oven dried at 80°C for 72 hours. The DMC was computed using the formula:

% Dry Matter Content (DMC) =100% -% MC

Where:

$$\% \text{ Moisture Content (MC)} = \frac{\text{Fresh Weight} - \text{Oven Dry Weight}}{\text{Oven Dry Weight}} \times 100$$

15. Return on cash expense (ROCE). This was computed by using the formula:

$$\text{ROCE} = \frac{\text{Gross Sale-Total Expenses}}{\text{Total Expenses}} \times 100$$

Analysis of Data

All quantitative data were analyzed using analysis of variance (ANOVA) for randomized complete block design (RCBD) with 3 replications. The significance of difference among treatments was tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Meteorological Data

The temperature during the conduct of the study ranged from 16°C to 24°C which is within the optimum temperature favorable for potato growth (Table 1). The optimum temperature for potato growth is ranging from 17°C to 22°C (Horton, 1987).

The highest relative humidity recorded was 91% during the eighth and eleventh week of potato growth. The average relative humidity during the twelve weeks of potato growth is within the optimum relative humidity for potato production which is 86% (Horton, 1987).

There was no rain fall from first to sixth week. The highest rainfall was during February (2.7 L). This minimal rainfall is favorable for potato growth since potatoes are adapted to low rainfall (HARRDEC, 1996).

Table 1. Rainfall, temperature and relative humidity from December to March

MONTH	WEEK	TEMPERATURE (°C)	RELATIVE HUMIDITY (%)	RAINFALL (L)
December	1st week	18	73	-
January	2nd week	16	80	-
January	3rd week	17	81	-
January	4th week	22	84	-
January	5th week	22	83	-
January	6th week	21	76	-
February	7th week	23	84	1.73
February	8th week	24	91	2.70
February	9th week	23	84	1.13
February	10th week	23	84	1.33
March	11th week	21	91	0.07
March	12th week	23	84	-

Percent Survival

Significant difference on percent survival can be observed among the different potato entries. Entries Recolta, Farmer, Signal and the two check varieties Igorota and Ganza gave the highest percentage survival of 100% while PHIL 5.19.2.2 and the check variety Granola had the least survival.

The high percentage of survival could be due to the favorable environmental condition during the growth of potato entries. The potato seed tubers used were also disease-free.

Plant Vigor

Significant differences in plant vigor were noted from the potato entries at 45 and 60 DAP (Table 2). All entries were vigorous (3) to highly vigorous (5) at 30 and 45 and at 60 DAP.

Entries Farmer and Recolta were observed to have poor vigor (1) at 60 DAP.

The decrease of vigor in some entries could be due to late blight infection and leaf miner infestation observed at 45 DAP. The entries which were highly vigorous may indicate resistance against late blight and leaf miner.

Table 2. Percentage survival and plant vigor at 30, 45, and 60 DAP

ENTRY	SURVIVAL (%)	PLANT VIGOR DAYS AFTER PLANTING		
		30	45	60
PHIL 2.21.6.2	83	4	5[a]	5[a]
PHIL 5.19.2.2	75	4	5[a]	5[a]
CIP 380241.17	84	4	5[a]	5[a]
CIP 676070	93	4	5[a]	5[a]
CIP 573275	80	5	5[a]	5[a]
Signal	100	4	4[b]	4[b]
Recolta	100	3	3[c]	1[c]
Farmer	100	3	3[c]	1[c]
Granola	76	3	4[b]	4[b]
Ganza	100	4	5[a]	5[a]
Igorota	100	5	5[a]	5[a]
CV (%)	3.76	8.27	8.27	5.79

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

Rating Scale: 1–poor vigor; 2– less vigorous; 3–vigorous; 4-moderately vigorous;
5 –highly vigorous

Canopy Cover

Analysis shows significant differences on the canopy cover of potato entries from 30 to 75 DAP (Table 3). Increasing canopy was noted in all entries at 30, 45, and 60 DAP except entries Recolta and Farmer. These entries had decreasing canopy due to late blight infection.

Entries CIP 573275, PHIL 2.21.6.2 and the two check varieties Ganza and Igorota had the widest canopy cover at 75 DAP.

The widening canopy of most potato entries could be attributed to the optimum environmental condition and an indication of their resistance to late blight.

The difference also in canopy cover of the entries might be attributed to the earliness or lateness of tuber formation. It was found that entries which tuberize later develop more canopies of longer duration than entries which tuberize earlier. (Cardesa *et al.*, 2001).

Table 3. Canopy cover at 30, 45, 60 and 75 DAP of the eleven potato entries

ENTRY	CANOPY COVER DAYS AFTER PLANTING			
	30	45	60	75
PHIL 2.21.6.2	42[ab]	56[abc]	61[a]	68
PHIL 5.19.2.2	30[b]	38[bcde]	47[ab]	61
CIP 380241.17	37[b]	44[abcde]	50[ab]	58
CIP 676070	30[b]	38[bcd]	49[ab]	55
CIP 573275	45[ab]	58[ab]	63[a]	71
Signal	45[ab]	53[abcd]	56[a]	71
Recolta	30[b]	33[de]	27[b]	0
Farmer	28[b]	30[e]	26[b]	0
Granola	31[b]	36[cde]	45[ab]	56
Ganza	42[ab]	54[abcd]	59[a]	65
Igorota	55[a]	62[a]	63[a]	67
CV (%)	24.37	24.25	20.09	14.65

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

0 = no canopy cover

Plant Height

Highly significant differences were observed in both initial and final plant height of different potato entries (Table 4). Igorota had the tallest plants at 30 DAP while entries PHIL 5.19.2.2 and Ganza had the shortest plants.

CIP 380241.17 was the tallest among all entries at 80 DAP. Entries Farmer and Recolta died at 75 DAP due to late blight and leaf miner incidence.

Table 4. Plant height at 30 and 80 DAP of the eleven potato entries

ENTRY	HEIGHT (cm)	
	30DAP	80DAP
PHIL 2.21.6.2	22.7^{bc}	56.1^{a}
PHIL 5.19.2.2	10.7^{e}	56.2^{a}
CIP 380241.17	20.0^{bcd}	56.4^{a}
CIP 676070	18.3^{cd}	47.5^{bc}
CIP 573275	18.8^{bcd}	45.0^{c}
Signal	26.0^{ab}	33.2^{d}
Recolta	21.5^{bc}	0
Farmer	12.9^{de}	0
Granola	15.3^{cde}	46.3^{bc}
Ganza	10.6^{c}	36.1^{e}
Igorota	30.4^{a}	48.0^{b}
CV (%)	20.92	3.90

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

**Note: Entries with 0 = died at 75 DAP

The difference in height of potato entries might be due to their genotypic characteristics (Sano, 1980).

Late Blight Incidence

All entries except for Farmer and Recolta were rated as highly resistant to late blight at 30 DAP (Table 5). At 45 DAP, Recolta was rated as moderately susceptible while Farmer and Granola were rated as moderately resistant and the rest of the entries

were resistant to highly resistant. Most of the entries at 60 DAP were resistant to moderately resistant. At 75 DAP, most of the entries were rated as moderately resistant except for PHIL 2.21.6.2, CIP 676070 and Ganza which remained to be moderately resistant. Granola and Signal had shown susceptibility to late blight infection at 75 DAP.

Incidence of late blight in entries Farmer and Recolta at 45 DAP might be attributed to their genetic make up and reflected by their deteriorating canopy cover during their growth period. Resistance of most entries to late blight may be due to the favorable conditions such as minimal rainfall and optimum temperature. Late blight is usually prevalent during heavy rain and during wet and cool seasons (Ganga, *et al* 1989).

Bacterial Wilt Infestation

There was no bacterial wilt observed during the conduct of the study. The planting materials used and the area where potato entries were planted were bacterial wilt-free.

Table 5. Reaction to Late blight incidence at 30, 45, 60 and 75 DAP of potato entries

ENTRY	REACTION TO LATE BLIGHT DAYS AFTER PLANTING			
	30	45	60	75
PHIL 2.21.6.2	1	1	2	3
PHIL 5.19.2.2	1	1	2	3
CIP 380241.17	1	1	2	3
CIP 676070	1	1	2	3
CIP 573275	1	1	2	4
Signal	1	2	4	7
Recolta	4	6	8	9
Farmer	4	5	8	9
Granola	1	3	4	6
Ganza	1	1	2	3
Igorota	1	2	3	4

Rating Scale: 1 –highly resistant; 2 – 3 – moderately resistant; 4 – 5 – resistant
6 – 7 - moderately susceptible; 8 – 9 – highly susceptible

Leaf Miner Incidence

Result shows that all entries at 30 DAP were highly resistant to leaf miner (Table 6). At 45 DAP, entries Signal, Recolta and Farmer were susceptible to the pest.

CIP 380241.17, CIP 573275 and Ganza were moderately resistant at 60 DAP but at 75 DAP all entries became susceptible to leaf miner except CIP 380241.17 which remained moderately resistant.

Occurrence of leaf miner during the conduct of the study may be due to late planting. When most of the farmers had harvested their potato, leaf miner was prevalent in the area.

Table 6. Reaction to Leaf miner incidence at 30, 45, 60 and 75 DAP of eleven the potato entries

ENTRY	REACTION TO LEAF MINER DAYS AFTER PLANTING			
	30	45	60	75
PHIL 2.21.6.2	1	2	2	3
PHIL 5.19.2.2	1	2	2	3
CIP 380241.17	1	2	2	2
CIP 676070	1	2	3	3
CIP 573275	1	2	2	3
Signal	1	3	4	4
Recolta	1	3	5	-
Farmer	1	3	5	-
Granola	1	2	3	4
Ganza	1	2	2	3
Igorota	1	2	3	3

Rating Scale: 1 –highly resistant; 2 –moderately resistant; 3-susceptible
4 -moderately susceptible; 5 –very susceptible

Number of marketable and non marketable tubers

Table 7 shows significant differences on the number of marketable and non-marketable tubers (Fig. 2). Marketable tubers were classified as super extra large (SXL), extra big, big and marble tubers.

The number of super extra large tubers was highest in entries PHIL 5.19.2.2, CIP 380241.17 and Ganza. Entry igorota had the highest number (110) of extra large tuber while entry signal had the highest number for big and marble-sized tubers. Check variety Ganza had the highest number of non-marketable tubers among all entries.

High number of super extra large tubers of entries CIP 380241.17, PHIL 5.19.2.2 and Ganza (cv) might be attributed to their wide canopy, good vigor, resistance to late blight and leaf miner and favorable environmental condition such as minimal rainfall and optimum relative humidity.

Weight of marketable and non marketable tubers

Entries CIP 380241.17 and Ganza obtained the heaviest super extra large tubers (Table 8). Igorota and Signal had the heaviest extra large, big and marble tubers, respectively (Fig. 2).

For non-marketable tubers, CIP 573275 had the heaviest tubers while entry Farmer had the least.

The low yield of entries Farmer and Recolta may be attributed to their poor vigor and susceptibility to late blight and leaf miner.

Table 7. Number of marketable and non–marketable tubers of eleven potato entries

ENTRY	MARKETABLE TUBERS					NON-MARKETABLE TUBERS
	Super Extra-large	Extra Big	Big	Marble	TOTAL	
PHIL 2.21.6.2	35^{a}	97^{ab}	81^{ab}	31^{bc}	244	28^{abc}
PHIL 5.19.2.2	42^{a}	72^{bcd}	49^{bc}	29^{bc}	192	26^{abc}
CIP 380241.17	42^{a}	84^{bc}	65^{abc}	32^{bc}	227	22^{abcd}
CIP 676070	37^{a}	64^{bcd}	53^{bc}	28^{bc}	183	7^{cd}
CIP 573275	30^{a}	60^{bcd}	60^{bc}	30^{bc}	180	14^{bcd}
Signal	12^{b}	60^{bcd}	98^{a}	72^{a}	243	28^{abc}
Recolta	1^{b}	12^{d}	31^{c}	34^{bc}	78	23^{abcd}
Farmer	0^{b}	3^{bcd}	55^{bc}	49^{b}	107	5^{d}
Granola	32^{a}	50^{cd}	34^{c}	20^{c}	135	8^{bcd}
Ganza	42^{a}	62^{bcd}	55^{bc}	37^{bc}	195	37^{a}
Igorota	38^{a}	110^{ab}	72^{ab}	53^{ab}	273	29^{ab}
CV (%)	12.74	27.75	9.79	12.12	21.00	21.29

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

Table 8. Weight of marketable and non-marketable tubers of eleven potato entries

ENTRY	MARKETABLE TUBERS (Kg/5m^2)					NON-MARKETABLE TUBERS (Kg/5m^2)
	Super Extra-large	Extra Large	Big	Marble	TOTAL	
PHIL 2.21.6.2	3.0^{ab}	3.07^{d}	1.67^{ab}	0.22^{c}	8.00	0.38
PHIL 5.19.2.2	3.0^{a}	2.9^{bc}	1.05^{bcd}	0.30^{bc}	8.55	0.47
CIP 380241.17	4.0^{a}	3.55^{ab}	1.58^{abc}	0.30^{bc}	9.48	0.22
CIP 676070	3.0^{a}	2.47^{bc}	0.87^{cd}	0.22^{c}	6.73	0.10
CIP 573275	2.0^{ab}	2.35^{bc}	1.68^{ab}	0.32^{bc}	7.63	0.53
Signal	1.0^{bc}	1.98^{c}	2.12^{a}	0.92^{a}	5.67	0.15
Recolta	0.0^{c}	0.35^{d}	0.37^{e}	0.25^{bc}	1.37	0.12
Farmer	0.0^{c}	0.1^{d}	0.83^{cd}	0.38^{bc}	1.34	0.03
Granola	3.0^{a}	1.83^{c}	0.75^{cd}	0.22^{c}	5.93	0.13
Ganza	4.0^{a}	3.55^{ab}	1.25^{bcd}	0.42^{bc}	9.30	0.42
Igorota	3.0^{ab}	4.2^{a}	1.58^{abc}	0.53^{b}	9.10	0.13
CV (%)	15.9	27.88	11.74	10.35	23.95	15.37

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


PHIL 2.21.6.2


IGOROTA


CIP 573275


PHIL 5.19.2.2


GRANOLA


RECOLTA


SIGNAL


GANZA


FARMER


CIP 676070


CIP 380241.17

Figure 2. Marketable and non-marketable tubers of the eleven potato entries

Total Yield and Computed Yield

Analysis revealed highly significant differences on the yield per plot of potato entries (Table 9). Entry CIP 380241.17 produced the highest total yield of 9.48 Kg/5m^2. The rest of the entries except for Farmer and Recolta produced more yield than the check variety Granola.

Similarly, entry CIP 380241.17 had the highest computed yield of 18.97 t ha^{-1} significantly outyielding the check variety Ganza and Igorota with yields of 18.60 and 18.20 t ha^{-1} respectively. The lowest yield was noted from entries Recolta and Farmer which were observed to be susceptible to late blight and leaf miner.

The yield was generally high due to the optimum environmental condition, good growth stand, and resistance to pest and diseases during the growth period of the potato entries.

Dry Matter Content

Results show significant differences on tuber dry matter content of the entries grown at Bulalacao, Mankayan (Table 10). All entries evaluated had high dry matter content ranging from 17 to 23%.

PHIL 2.21.6.2 had the highest tuber dry matter content of 23% while entry Recolta had the lowest tuber dry matter of 17%.

Table 9. Total and computed yield of eleven potato entries

ENTRY	TOTAL YIELD ($Kg/5m^2$)	COMPUTEDYIELD ($t\ ha^{-1}$)
PHIL 2.21.6.2	8.00^{ab}	16.00^{ab}
PHIL 5.19.2.2	8.55^{ab}	17.10^{ab}
CIP 380241.17	9.48^{a}	18.97^{a}
CIP 676070	6.73^{ab}	13.51^{ab}
CIP 573275	7.63^{ab}	15.27^{ab}
Signal	5.67^{b}	11.33^{b}
Recolta	1.37^{c}	2.73^{c}
Farmer	1.34^{c}	2.67^{c}
Granola	5.93^{b}	11.87^{b}
Ganza	9.30^{a}	18.60^{a}
Igorota	9.10^{a}	18.20^{a}
CV (%)	23.95	23.95

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

The high tuber dry matter content of the different potato entries might be due to their genotypic characteristics since dry matter is an inherited characteristic (Rastovski, 1981).

Kellock in 1995 stated that tubers with high dry matter content are suitable for processing. Results also show that tubers with high dry matter have good keeping quality, high yield, and is the most suitable for cultivation, table consumption, and chip production (Panley and Singh, 2008).

Table 10. Dry matter content of the potato entries

ENTRY	DRY MATTER CONTENT (%)
PHIL 2.21.6.2	23[a]
PHIL 5.19.2.2	21[ab]
CIP 380241.17	20[abc]
CIP 676070	19[bc]
CIP 573275	21[ab]
Signal	18[bc]
Recolta	17[c]
Farmer	20[abc]
Granola	19[bc]
Ganza	20[abc]
Igorota	21[ab]
CV (%)	10.03

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

Return on Cash Expenses (ROCE)

The potato entries gave a positive return on cash expense except for entries Signal, Recolta and Farmer (Table 11). CIP 382241.17 gave the highest ROCE of 66.97% followed by Ganza (63.73%) and Igorota (60.27%) while the entries Recolta, Farmer and Signal gave negative ROCE. Entries with negative ROCE had low yield as a result of their susceptibility to leaf miner and late blight.

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

ENTRY	COST OF PRODUC-TION (PhP)	MARKETABLE TUBERS ($kg/5m^2$)	GROSS SALE (PhP)	NET INCOME (PhP)	ROCE (%)
PHIL 2.21.6.2	153.30	8.00	216.00	62.70	40.90
PHIL 5.19.2.2	153.30	8.50	230.85	77.85	50.78
CIP 380241.17	153.30	9.48	255.96	102.66	66.97
CIP 676070	153.30	6.73	181.76	28.46	18.56
CIP 573275	153.30	7.63	206.01	52.71	34.38
Signal	153.30	5.67	153.09	-0.21	-0.14
Recolta	153.30	1.37	36.99	-116.31	-75.87
Farmer	153.30	1.34	36.18	117.12	-76.39
Granola	153.30	5.93	160.11	6.81	4.44
Ganza	153.30	9.30	251.10	97.70	63.73
Igorota	153.30	9.10	245.70	92.40	60.27

* Total cost of production includes cost of planting materials, insecticides, fertilizers and labor.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted to determine which entries of potato perform best based on growth and yield and resistance to pest and diseases and to know the economic value of each potato entry grown under Bulalacao, Mankayan, Benguet condition.

Temperature, relative humidity and rainfall from December to March were noted to be at optimum level for potato production.

Highest plant survival was obtained from entries Recolta, Farmer, Signal, Ganza and Igorota while PHIL 5.19.2.2 had the lowest survival. Most of the entries were vigorous except entries Farmer and Recolta.

Igorota (cv) and CIP 573275 had the widest canopy at 60 DAP. Igorota and CIP 380241.17 were the tallest at 30 and 80 DAP, respectively.

Most of the entries at 60 DAP were resistant to moderately resistant to late blight except entries Farmer and Recolta which were susceptible to the disease as early as 45 DAP.

All entries at 30 DAP were recorded to be highly resistant to leaf miner and at 45 DAP most of the entries were moderately resistant. Most entries at 75 DAP were susceptible to leaf miner except CIP 380241.17 which was moderately resistant to leaf miner.

PHIL 5.19.2.2, CIP 380241.17, Ganza, Igorota and PHIL 2.21.6.2 had the most number and heaviest weight of Super Extra Large (SXL) tubers. Ganza had the highest number and weight of non-marketable tubers.

CIP 380241.17 had the highest total (kg/5m2) and computed yield (t ha^{-1}) while Farmer had the lowest.

The highest tuber dry matter was obtained from PHIL 2.21.6.2 and the lowest was from entry Recolta.

Out of the eleven potato entries planted, CIP 380241.17 gave the highest return on cash expense followed by Ganza and Igorota.

Conclusion

Among all the potato entries evaluated under Bulalacao, Mankayan, Benguet condition from December to March, CIP 380241.17, Igorota and Ganza performed best. These entries produced high yields, were resistant to leaf miner and late blight and gave high returns on cash expense.

Recommendation

Based on findings, Ganza, Igorota, and CIP 380241.17 are recommended for cultivation at Bulalacao, Mankayan, Benguet.

Continuous evaluation and selection of potato entries is recommended at Bulalacao and some part of Mankayan until a variety with a stable performance will be recommended.

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APPENDICES

Appendix Table 1. Percent survival at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	90	85	75	250	83
PHIL 5.19.2.2	80	75	70	225	75
CIP 380241.17	93	80	78	251	84
CIP 676070	95	90	93	278	93
CIP 573275	85	80	75	240	80
Signal	100	100	100	300	100
Recolta	100	100	100	300	100
Farmer	100	100	100	300	100
Granola	78	78	73	229	76
Ganza	100	100	100	300	100
Igorota	100	100	100	300	100
TOTAL	1021	988	964	2973	90

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	148.909	74.455			
Treatment	10	3310.061	331.006	28.81**	2.35	3.37
Error	20	229.758	11.488			
TOTAL	32	3688.727				

**= Highly significant Coefficient of Variation (%) = 3.76

Appendix Table 2a. Plant vigor at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	4	4	4	12	4
PHIL 5.19.2.2	5	3	4	12	4
CIP 380241.17	5	3	4	12	4
CIP 676070	4	4	4	12	4
CIP 573275	5	5	4	14	5
Signal	3	5	5	13	4
Recolta	2	3	3	8	3
Farmer	3	3	3	9	3
Granola	3	4	3	10	3
Ganza	5	3	4	12	4
Igorota	4	5	5	14	5
TOTAL	45	43	43	131	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	0.727	0.364			
Treatment	10	26.303	2.630	20.18**	2.35	3.37
Error	20	2.606	0.130			
TOTAL	32	29.636				

**= Highly significant Coefficient of Variation (%) = 8.27

Appendix Table 2b. Plant vigor at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	5	5	5	15	5[a]
PHIL 5.19.2.2	5	5	5	15	5[a]
CIP 380241.17	5	5	5	15	5[a]
CIP 676070	5	5	5	15	5[a]
CIP 573275	5	5	5	15	5[a]
Signal	3	4	4	11	4[a]
Recolta	3	2	3	8	3[c]
Farmer	2	3	3	8	3[c]
Granola	4	4	5	13	4[b]
Ganza	5	5	5	15	5[a]
Igorota	4	5	5	14	5[a]
TOTAL	46	48	50	144	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	0.727	0.364			
Treatment	10	26.303	2.630	20.18**	2.35	3.37
Error	20	2.66	0.130			
TOTAL	32	29.636				

**= Highly significant Coefficient of Variation (%) = 8.27

Appendix Table 2c. Plant vigor at 60 DAP.

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	5	5	5	15	5[a]
PHIL 5.19.2.2	5	5	5	15	5[a]
CIP 380241.17	5	5	5	15	5[a]
CIP 676070	5	5	5	15	5[a]
CIP 573275	5	5	5	15	5[a]
Signal	3	4	4	11	4[b]
Recolta	1	1	1	3	1[c]
Farmer	1	1	1	3	1[c]
Granola	4	4	4	12	4[b]
Ganza	5	5	5	15	5[a]
Igorota	4	5	5	14	5[a]
TOTAL	43	45	45	133	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	0.242	0.121			
Treatment	10	73.636	7.364	135.0**	2.35	3.37
Error	20	1.091	0.055			
TOTAL	32	74.970				

**= Highly significant Coefficient of Variation (%) = 5.79

Appendix Table 3a. Canopy cover at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	41	38	47	126	42[ab]
PHIL 5.19.2.2	30	29	30	89	30[b]
CIP 380241.17	45	43	23	111	37[b]
CIP 676070	20	30	40	90	30[b]
CIP 573275	40	50	46	136	45[ab]
Signal	24	50	60	134	45ab
Recolta	40	29	21	90	30[b]
Farmer	30	25	28	83	28[b]
Granola	24	31	37	92	31[b]
Ganza	40	43	43	126	42[ab]
Igorota	45	51	69	165	55[a]
TOTAL	379	419	444	1242	38

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	195.455	97.727			
Treatment	10	2330.303	233.030	2.77*	2.35	3.37
Error	20	1681.636	84.094			
TOTAL	32	4207.636				

*= Significant Coefficient of Variation (%) = 24.37

Appendix Table 3b. Canopy covers at 45 DAP.

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	69	43	57	169	56^{abc}
PHIL 5.19.2.2	42	33	39	114	38^{bcde}
CIP 380241.17	50	55	28	133	44^{abcde}
CIP 676070	26	32	56	114	38^{bcd}
CIP 573275	61	59	53	173	58^{ab}
Signal	30	70	60	160	53^{abcd}
Recolta	40	34	25	99	33de
Farmer	32	25	33	90	30^{e}
Granola	34	38	37	109	36^{cde}
Ganza	52	57	54	163	54^{abcd}
Igorota	54	63	69	186	62^{a}
TOTAL	490	509	511	1510	46

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	24.424	12.212			
Treatment	10	3812.061	381.206	3.10*	2.35	3.37
Error	20	2461.061	123.079			
TOTAL	32	6298.061				

*= Significant Coefficient of Variation (%) = 24.25

Appendix Table 3c. Canopy covers at 60 DAP.

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	71	49	63	183	61
PHIL 5.19.2.2	60	39	43	142	47
CIP 380241.17	53	59	38	150	50
CIP 676070	36	47	65	148	49
CIP 573275	68	60	60	188	63
Signal	30	75	64	169	56
Recolta	30	25	25	81	27
Farmer	26	27	26	78	26
Granola	50	43	43	136	45
Ganza	55	65	57	177	59
Igorota	60	65	63	188	63
TOTAL	559	563	556	1678	51

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	10.242	5.121			
Treatment	10	5087.636	508.764	4.22**	2.35	3.37
Error	20	2411.091	120.555			
TOTAL	32	7508.970				

*= Significant Coefficient of Variation (%) = 22.09

Appendix Table 3d. Canopy covers at 75 DAP.

ENTRY	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
PHIL 2.21.6.2	75	56	73	204	68
PHIL 5.19.2.2	73	52	59	184	61
CIP 380241.17	61	63	51	175	58
CIP 676070	41	53	70	164	55
CIP 573275	72	67	75	214	71
Signal	71	75	67	213	71
Recolta	0	0	0	0	0
Farmer	0	0	0	0	0
Granola	63	50	56	169	56
Ganza	63	71	60	194	65
Igorota	68	60	73	201	67
TOTAL	627	547	584	1758	53

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	90.242	90.242			
Treatment	10	20811.879	20811.879	35.77**	2.35	3.37
Error	20	1163.758	58.188			
TOTAL	32	22065.879				

** = Highly significant Coefficient of Variation (%) = 14.65

Appendix Table 4a. Initial Plant height at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	25.3	18.2	24.6	68.1	22.7
PHIL 5.19.2.2	12.7	115	8.4	32.2	10.7
CIP 380241.17	22.6	14.6	23.0	60.2	20.0
CIP 676070	22.0	18.0	15.1	55.1	18.3
CIP 573275	20.4	21.3	14.8	56.5	18.8
Signal	21.7	29.8	26.5	78.0	26.0
Recolta	21.5	28.6	14.5	64.6	21.5
Farmer	12.7	15.2	11.0	38.9	12.9
Granola	12.6	21.3	12.2	44.1	15.3
Ganza	11.3	11.0	9.6	31.9	10.6
Igorota	29.4	36.5	25.5	91.4	30.4
TOTAL	212.5	226.0	184.8	620.8	18.83

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	80.494	40.247			
Treatment	10	1173.069	117.307	7.51*	2.35	3.37
Error	20	312.466	15.622			
TOTAL	32	1566.009				

**= Highly significant Coefficient of Variation (%) = 20.92%

Appendix Table 4b. Final Height at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	55.0	58.3	55.0	168.3	56.1
PHIL 5.19.2.2	55.8	57.4	55.5	168.7	56.2
CIP 380241.17	56.2	56.8	56.2	169.2	56.4
CIP 676070	46.8	47.6	46.9	141.3	47.1
CIP 573275	43.7	44.5	46.8	135.0	45.0
Signal	32.3	33.6	33.7	99.6	33.2
Recolta	0	0	0	0	0
Farmer	0	0	0	0	0
Granola	46.4	46.9	46.7	139.1	46.3
Ganza	32.2	36.3	40.1	108.3	36.1
Igorota	48.6	49.4	46.2	144.2	48.0
TOTAL	417	429.6	427.1	1273.7	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	8.092	4.046			
Treatment	10	12637.510	1263.751	558.09**	2.35	3.37
Error	20	45.228	2.264			
TOTAL	32	12690.890				

**= Highly significant Coefficient of Variation (%) = 3.90

Appendix Table 5a. Late blight incidence at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	1	1	1	3	1
PHIL 5.19.2.2	1	1	1	3	1
CIP 380241.17	1	1	1	3	1
CIP 676070	1	1	1	3	1
CIP 573275	1	1	1	3	1
Signal	1	1	1	3	1
Recolta	3	5	5	13	4
Farmer	4	4	4	12	4
Granola	1	1	2	4	1
Ganza	1	1	1	3	1
Igorota	1	1	1	3	1
TOTAL	16	18	19	53	2

Appendix Table 5b. Late blight incidence at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	1	1	1	3	1
PHIL 5.19.2.2	1	1	1	3	1
CIP 380241.17	1	1	1	3	1
CIP 676070	1	1	1	3	1
CIP 573275	1	1	1	3	1
Signal	3	1	2	6	2
Recolta	6	6	5	17	6
Farmer	4	5	5	14	5
Granola	4	4	2	10	3
Ganza	1	1	1	3	1
Igorota	3	1	2	6	2
TOTAL	26	24	22	72	2

Appendix Table 5c. Late blight incidence at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	2	2	2	6	2
PHIL 5.19.2.2	2	2	2	6	2
CIP 380241.17	2	2	2	6	2
CIP 676070	3	2	2	7	2
CIP 573275	2	3	2	7	2
Signal	5	5	4	13	4
Recolta	8	8	8	24	8
Farmer	8	8	8	24	8
Granola	4	5	4	13	4
Ganza	3	2	2	7	2
Igorota	3	2	3	8	3
TOTAL	44	43	42	129	4

Appendix Table 5d. Late blight incidence at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	3	3	3	9	3
PHIL 5.19.2.2	4	3	4	11	4
CIP 380241.17	3	3	3	9	3
CIP 676070	4	3	3	10	3
CIP 573275	4	4	4	12	4
Signal	7	7	7	21	7
Recolta	9	9	9	27	9
Farmer	9	9	9	27	9
Granola	5	7	6	18	6
Ganza	4	3	3	10	3
Igorota	4	3	4	12	4
TOTAL	56	54	56	166	5

Appendix Table 6a. Leafminer incidence at 30 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	1	1	1	3	1
PHIL 5.19.2.2	1	1	1	3	1
CIP 380241.17	1	1	1	3	1
CIP 676070	1	1	1	3	1
CIP 573275	1	1	1	3	1
Signal	2	1	1	4	1
Recolta	2	1	1	4	1
Farmer	1	1	1	3	1
Granola	1	1	1	3	1
Ganza	1	1	1	3	1
Igorota	1	1	1	3	1
TOTAL	13	11	11	35	1

Appendix Table 6b. Leafminer incidence at 45 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	2	2	1	5	2
PHIL 5.19.2.2	2	2	2	6	2
CIP 380241.17	1	2	2	5	2
CIP 676070	1	4	2	7	2
CIP 573275	2	1	2	5	2
Signal	3	3	3	9	3
Recolta	3	3	4	10	3
Farmer	4	2	4	10	3
Granola	3	1	2	6	2
Ganza	2	2	2	6	2
Igorota	2	3	2	7	2
TOTAL	26	25	27	78	2

Appendix Table 6c. Leafminer incidence at 60 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	2	2	3	7	2
PHIL 5.19.2.2	3	2	2	7	2
CIP 380241.17	2	2	3	7	2
CIP 676070	2	4	2	8	3
CIP 573275	2	2	2	6	2
Signal	4	5	3	12	4
Recolta	5	5	5	15	5
Farmer	5	5	5	15	5
Granola	3	4	3	10	3
Ganza	2	3	2	7	2
Igorota	2	3	2	7	2
TOTAL	33	39	32	104	3

Appendix Table 6d. Leaf miner incidence at 75 DAP

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	3	3	3	9	3
PHIL 5.19.2.2	3	3	3	9	3
CIP 380241.17	2	2	3	7	3
CIP 676070	3	4	3	10	3
CIP 573275	2	3	3	7	3
Signal	4	5	4	13	4
Recolta	-	-	-	-	-
Farmer	-	-	-	-	-
Granola	4	4	3	11	4
Ganza	3	3	2	8	3
Igorota	3	4	3	10	3
TOTAL	38	41	38	117	4

Appendix Table 7a. Number of super extra-large tubers per plot

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	23	39	43	105	35
PHIL 5.19.2.2	46	35	43	125	42
CIP 380241.17	45	60	32	127	42
CIP 676070	36	28	46	110	37
CIP 573275	32	19	38	89	30
Signal	9	14	13	36	12
Recolta	1	0	1	2	1
Farmer	0	0	0	0	0
Granola	26	14	56	96	32
Ganza	37	38	50	125	42
Igorota	37	24	54	115	38
TOTAL	292	271	376	939	28

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	561.273	280.636			
Treatment	10	8133.515	813.352	8.22**	2.35	3.37
Error	20	1979.394	98.970			
TOTAL	32	10674.182				

**= Highly significant Coefficient of Variation (%) = 12.74

Appendix Table 7b. Number of extra large tubers per plot

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	96	120	74	290	97
PHIL 5.19.2.2	47	125	45	217	72
CIP 380241.17	75	87	91	253	84
CIP 676070	58	81	54	193	64
CIP 573275	42	59	78	179	60
Signal	58	73	50	181	60
Recolta	8	16	13	37	12
Farmer	2	7	0	9	3
Granola	47	46	56	149	50
Ganza	42	75	69	186	62
Igorota	80	144	107	331	110
TOTAL	555	833	637	2025	61

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	3709.818	1854.909			
Treatment	10	30757.636	3075.764	10.61**	2.35	3.37
Error	20	5798.182	289.909			
TOTAL	32	40265.636				

**= Highly significant Coefficient of Variation (%) = 27.75

Appendix Table 7c. Number of big tubers per plot

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	70	99	75	244	81
PHIL 5.19.2.2	52	75	21	148	49
CIP 380241.17	80	48	67	195	65
CIP 676070	53	61	46	160	53
CIP 573275	26	95	60	181	60
Signal	87	86	122	295	98
Recolta	30	25	38	93	31
Farmer	69	47	50	166	55
Granola	13	25	63	101	34
Ganza	45	64	56	165	55
Igorota	66	83	66	215	72
TOTAL	591	708	664	1963	59

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	634.970	317.485			
Treatment	10	11466.909	1146.691	3.15*	2.35	3.37
Error	20	7274.364	363.718			
TOTAL	32	19376.242				

*= Significant Coefficient of Variation (%) =9.79

Appendix Table 7d. Number of marble tubers per plot

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	32	34	27	93	31
PHIL 5.19.2.2	21	47	18	86	29
CIP 380241.17	22	30	43	95	32
CIP 676070	40	16	29	85	28
CIP 573275	12	60	18	90	30
Signal	62	87	67	216	72
Recolta	34	31	38	103	34
Farmer	53	39	54	146	49
Granola	17	10	33	60	20
Ganza	25	31	54	110	37
Igorota	47	53	58	158	53
TOTAL	365	438	439	1242	38

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	327.455	163.727			
Treatment	10	6468.970	646.897	3.79*	2.35	3.37
Error	20	3411.212	170.561			
TOTAL	32	10207.636				

*= Significant Coefficient of Variation (%) =12.12

Appendix Table 7e. Number of non-marketable tubers per plot

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	6	40	39	85	28
PHIL 5.19.2.2	33	29	16	78	26
CIP 380241.17	23	25	18	66	22
CIP 676070	18	1	3	22	7
CIP 573275	2	13	28	43	14
Signal	22	20	42	84	28
Recolta	24	23	23	70	23
Farmer	9	5	0	14	5
Granola	2	4	19	25	8
Ganza	21	31	58	110	37
Igorota	24	36	27	87	29
TOTAL	184	227	273	684	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	360.182	180.091			
Treatment	10	3303.879	330.388	2.75*	2.35	3.37
Error	20	2406.485	120.324			
TOTAL	32	6070.545				

*= Significant Coefficient of Variation (%) =21.29

Appendix Table 8. Total number of marketable tubers kg/5m^2

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	221	292	219	732	244
PHIL 5.19.2.2	166	282	127	575	192
CIP 380241.17	222	225	233	680	227
CIP 676070	187	186	175	548	183
CIP 573275	112	233	194	539	180
Signal	216	260	252	728	243
Recolta	73	72	90	235	78
Farmer	124	93	104	321	107
Granola	103	95	208	406	135
Ganza	149	208	229	586	195
Igorota	230	304	285	819	273
TOTAL	1803	2250	2116	6169	187

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	9567.697	4783.848			
Treatment	10	109076.545	10907.655	7.08**	2.35	3.37
Error	20	30817.636	1540.882			
TOTAL	32	149461.879				

**= Highly significant Coefficient of Variation (%) = 21.00%

Appendix Table 9a. Weight of super extra-large tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	1.4	3.0	3.6	8	3.0
PHIL 5.19.2.2	4.0	3.1	3.1	10.2	3.0
CIP 380241.17	3.9	5.1	2.5	11.5	4.0
CIP 676070	3.0	3.0	3.3	9.3	3.0
CIP 573275	2.5	2.0	2.5	7	2.0
Signal	0.5	1.4	0.9	2.8	1.0
Recolta	0.1	0	0.1	0.2	0.0
Farmer	0	0	0	0	0.0
Granola	2.0	1.3	5.8	9.1	3.0
Ganza	3.0	3.7	3.8	10.5	4.0
Igorota	2.8	1.9	3.3	8	3.0
TOTAL	23.2	24.5	28.9	76.6	2.0

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	1.622	0.811			
Treatment	10	55.768	5.577	5.98**	2.35	3.37
Error	20	18.644	0.932			
TOTAL	32	76.035				

**= Highly significant Coefficient of Variation (%) =15.9

Appendix Table 9b. Weight of extra large tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	3.5	2.0	3.7	9.2	3.07
PHIL 5.19.2.2	3.0	2.0	3.7	8.7	2.9
CIP 380241.17	2.9	3.75	4.0	10.65	3.55
CIP 676070	2.1	3.4	1.9	7.4	2.47
CIP 573275	2.0	2.3	2.75	7.05	2.35
Signal	1.8	2.75	1.4	5.95	1.98
Recolta	0.25	0.4	0.4	1.05	0.35
Farmer	0.1	0.2	0	0.3	0.1
Granola	1.9	2.0	1.6	5.5	1.83
Ganza	2.90	3.75	4.0	10.65	3.55
Igorota	3.5	5.5	3.6	12.6	4.2
TOTAL	23.95	28.05	27.05	79.05	2

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.831	0.415			
Treatment	10	49.720	4.972	11.15**	2.35	3.37
Error	20	8.921	0.446			
TOTAL	32	59.472				

**= Highly significant Coefficient of Variation (%) = 27.88

Appendix Table 9c. Weight of big tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	1.5	1.9	1.6	5	1.67
PHIL 5.19.2.2	1.5	1.25	0.4	3.15	1.05
CIP 380241.17	1.75	1.25	1.75	4.75	1.58
CIP 676070	1.25	0.6	0.75	2.6	0.87
CIP 573275	1.7	2.1	1.25	5.05	1.68
Signal	1.75	2.0	2.6	6.35	2.12
Recolta	0.25	0.25	0.6	1.1	0.37
Farmer	1.0	0.75	0.75	2.5	0.83
Granola	0.25	0.5	1.5	2.25	0.75
Ganza	1.0	1.25	1.5	3.75	1.25
Igorota	1.6	1.75	1.4	4.75	1.58
TOTAL	13.55	13.6	14.1	41.25	1.25

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.017	0.008			
Treatment	10	8.177	0.818	5.34**	2.35	3.37
Error	20	3.062	0.153			
TOTAL	32	11.255				

**= Highly significant Coefficient of Variation (%) =11.74

Appendix Table 9d. Weight of marble tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	0.15	0.25	0.25	0.65	0.22
PHIL 5.19.2.2	0.4	0.3	0.2	0.9	0.30
CIP 380241.17	0.25	0.25	0.4	0.9	0.30
CIP 676070	0.3	0.1	0.25	0.65	0.22
CIP 573275	0.1	0.6	0.25	0.95	0.32
Signal	0.75	1.0	1.0	2.75	0.92
Recolta	0.25	0.25	0.25	0.75	0.25
Farmer	0.3	0.25	0.6	1.15	0.38
Granola	0.2	0.1	0.35	0.65	0.22
Ganza	0.25	0.25	0.75	1.25	0.42
Igorota	0.6	0.4	0.6	1.6	0.53
TOTAL	3.55	3.75	4.9	12.2	0.37

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.097	0.048			
Treatment	10	1.276	0.128	5.84**	2.35	3.37
Error	20	0.437	0.022			
TOTAL	32	1.810				

**= Highly significant Coefficient of Variation (%) =10.35

Appendix Table 9e. Weight of non-marketable tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	0.05	0.5	0.6	1.15	0.38
PHIL 5.19.2.2	1.1	0.15	0.15	1.4	0.47
CIP 380241.17	0.15	0.25	0.25	0.65	0.22
CIP 676070	0.25	0.02	0.02	0.29	0.10
CIP 573275	0.1	1.1	0.4	1.6	0.53
Signal	0.1	0.1	0.25	0.45	0.15
Recolta	0.1	0.15	0.1	0.35	0.12
Farmer	0.05	0.02	0.02	0.09	0.03
Granola	0.1	0.05	0.25	0.4	0.13
Ganza	0.25	0.4	0.6	1.25	0.42
Igorota	0.1	0.15	0.15	0.4	0.13
TOTAL	2.35	2.89	2.79	8.03	0.24

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.015	0.008			
Treatment	10	0.901	0.090	1.26^{ns}	2.35	3.37
Error	20	1.429	0.071			
TOTAL	32	2.345				

^{ns}= Not significant Coefficient of Variation (%) =15.37

Appendix Table 10. Total weight of marketable tubers per plot (kg)

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	6.6	7.65	9.75	24	8.00
PHIL 5.19.2.2	10.0	10.3	5.35	25.65	8.55
CIP 380241.17	8.95	10.6	8.9	28.45	9.48
CIP 676070	6.9	7.12	6.17	20.19	6.73
CIP 573275	6.4	8.1	8.4	22.9	7.63
Signal	4.9	6.85	5.25	17	5.67
Recolta	0.95	1.05	2.1	4.1	1.37
Farmer	1.45	1.22	1.35	4.02	1.34
Granola	4.45	3.9	9.45	17.8	5.93
Ganza	7.45	8.85	11.6	27.9	9.30
Igorota	8.55	9.75	9.0	27.3	9.10
TOTAL	66.6	75.39	77.32	219.31	6.65

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	5.937	2.968			
Treatment	10	255.146	25.515	10.07**	2.35	3.37
Error	20	50.658	2.533			
TOTAL	32	311.741				

**= Highly significant Coefficient of Variation (%) = 23.95

Appendix Table 11. Computed yield t ha^{-1}

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	13.2	15.3	19.5	48	16.00
PHIL 5.19.2.2	20.0	20.6	10.7	51.3	17.10
CIP 380241.17	17.9	21.2	17.8	56.9	18.97
CIP 676070	13.8	14.4	12.34	40.54	13.51
CIP 573275	12.8	16.2	16.8	45.8	15.27
Signal	9.8	13.7	10.5	34	11.33
Recolta	1.9	2.1	4.2	8.2	2.73
Farmer	2.9	2.41	2.7	8.01	2.67
Granola	8.9	7.8	18.9	35.6	11.87
Ganza	14.9	17.7	23.2	55.8	18.60
Igorota	17.1	19.5	18.0	54.6	18.20
TOTAL	133.2	150.91	154.64	438.75	13.30

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	23.855	11.928			
Treatment	10	1021.283	102.128	10.07**	2.35	3.37
Error	20	202.804	10.140			
TOTAL	32	1247.943				

**= Highly significant Coefficient of Variation (%) = 23.95

Appendix Table 12. Dry matter content of potato entries

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
PHIL 2.21.6.2	24	22	24	70	23
PHIL 5.19.2.2	18	22	24	64	21
CIP 380241.17	22	18	20	60	20
CIP 676070	20	18	18	56	19
CIP 573275	20	20	22	62	21
Signal	18	20	16	54	18
Recolta	16	14	20	50	17
Farmer	20	18	22	60	20
Granola	20	20	16	56	19
Ganza	20	18	22	60	20
Igorota	20	20	22	62	21
TOTAL	218	210	226	654	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	11.636	5.818			
Treatment	10	96.242	9.624	2.43*	2.35	3.37
Error	20	79.909	3.952			
TOTAL	32					

*= Highly significant Coefficient of Variation (%) = 10.03