BIBLIOGRAPHY

SABIANO, JOHN PAUL L. APRIL 2006. Agronomic and Postharvest Characters of Potato Entries for Ware and Seed Tubers in Calasipan, Atok, Benguet. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

Thirteen potato entries namely: 380579.3, 377852.1, 720071, 387039.15, 15.97.8, 381530.1, G.T, Alpha, Dejima, Ganza, Granola and Igorota were evaluated for their growth and agronomic characters of potato entries grown in Calasipan, Atok, Benguet from May 2005 to February 2006 to determine entries suited for table seed, and processing purposes.

Significant differences among thirteen potato entries were found for plant vigor, plant survival, pest and diseases incidence, number and weight of marketable and non-marketable tubers, computed yield per hectare, dry matter content while percentage weight loss, degree of greening and number of sprouts were not significantly different among the entries evaluated.

Despite of typhoon damages during their growth, Ganza and 387039.15 produced the highest marketable yield with low pest and disease infection. Entries 377852.1 and G.T produced the low marketable yield. This result could be a basis of recommendation for planting under Calasipan Atok, Benguet condition during the wet season.

Furthermore, stored tubers from the different potato entries showed no defects nor decay during the four months of storage. Sprouting is visible among the thirteen entries during the first week. Igorota had the highest percentage weight loss and 285378.27 had the lowest weight loss. Greening was visible in the different entries but minimal in entries with violet-skinned.

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INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the major vegetable crops in Benguet. It is mainly grown for its tubers due to its varied uses such as food. The crop has good market prospect, but potato producers are often troubled by several problems such as the production of quality tubers accepted in the market (Sano, 1977).

With the insufficient supply of certified potato seed tubers and the high cost of imported seeds, majority of low income farmers depends on their potato seeds obtained from previous cropping. Generally, the yield capacity and quality of the planting materials are not considered. Nevertheless, this problem could be solved with the use of stem cuttings to provide clean seed tubers of potato (Dalang, 1986). As a means of obtaining clean planting materials and increasing yield, potatoes varieties, Dalisay and Montañosa developed at Benguet State University were evaluated using stem cuttings. Stem cuttings from Granola, Igorota and Montañosa were found feasible as source of planting materials aside from the use of seed tubers.

The increasing population growth of our country demand for more food and energy sources. Local growers barrel these increasing demand until sufficiently surplus the demand for table purpose. However, there is low production which is attributed with the use of traditionally produced seed tubers.

The fast expansion of processing companies in the country also command production of the processing type varieties. In lieu of the unsustained supply, these manufacturing companies continue importing billion worth of pre-processed potatoes. These amount could have been saved if only the country adequately give due attention to these demand.

A number of processing and table potato varieties are available at BSU-NPRCRTC. However, evaluation of these varieties be a continuing activity. Evaluating other potential clones and varieties in different locations is vital to determine their performance under different soil, temperature and elevation conditions. This will also guide farmers especially in Atok to select adopted varieties. Production of the desired potatoes will also help the farmers market their produce, the consumer and processors to avail of locally produce varieties, boost the locally potato industry, and change the mentality of the importers who claimed that Benguet produce are of poor quality.

Apart from the problem of low yield, the potato growers also lacks knowledge on proper seed storage. Their storage techniques for seed tubers are poorly done by packing them in sacks for two to three months. These results to severe sprouting, utilizing the food reserves that should be used for establishing new healthy shoots.

Continuous varietal development should be done to cope up with genetic degeneration caused by pests and diseases.

The study aimed to: evaluate the growth and agronomic characters of potato entries grown in Calasipan, Atok, Benguet and determine entries suited for table potato and seed tubers; and processing.

This study was conducted at Calasipan, Atok, Benguet from the month of May 2005 to January 2006.

REVIEW OF LITERATURE

Background of the Potato Industry

Eighteen of the largest potato producers grow nearly 90% of the world's production since 1961. However, an estimated 60% of potato production in developing countries is for human consumption, 15% for fee, 10% for seed, 5% for processing and about 10% is lost to waste (Hampson, 1987).

In the tropics, potato performs one of four different functions in the human diet serving as a basic staple, complementary vegetables, seasonal vegetable, on delicacy to be consumed on special occasion (Poats, 1983).

In Peru and Bolivia, potato is traditionally grown for human consumption and typical potato is solar dried (Yamamoto, 1987).

The potato is relatively a costly commodity especially in most developing countries (Gitomer, 1987). When value is added to potato through transformation, the resulting product is either prohibitively expensive for all but the highest income households or simply cannot compete with cheaper substitutes in industrial uses (Gomez and Wong, 1989).

Morphology of the Potato Tubers

The morphological characteristics of potato differs. The shape may range from compressed or ovate to elongate. Also the depth of eyes may range from protruding to very deep. Together with the flesh is one of the main basis in selecting or rejecting a variety. In tuber skin type, majority of potato varieties have smooth skin but some may have rough or even netted skin (Zamora, 1994).

Importance of Varietal Evaluation

According to HARRDEC (1996), the first decision in planting is to know the best variety of plant. To achieve maximum production, the best variety that is adapted to the locality should be selected. Excellent cultural management practices may not determine the best suited variety, a series of a varietal evaluations must can be conducted to determine the performance of anew or previously untried variety.

In 1990, Sunil stated that varietal evaluation is a process in plant breeding, which provides comparison of promising lies developed by breeders. It is through varietal evaluation that a breeder select the best performing variety among developed lines terms of yield, quality, adaptability, stress, tolerance and resistance to pest and disease. Furthermore, selecting the right variety farmer may initially accept a new variety that will suit in his/her farm, thus minimize problems associated with water and fertilizer management. The variety to be selected should be high yielding, pest and disease resistant and hence, ensure more profit.

Harvesting

In Atok, harvesting is preferably done early in the morning. Harvesting is done manually using spading forks, or loosening hoe for exposing the tubers. Digging of tubers could be done in loose friable soils.

Care in harvesting is necessary to avoid skinning, cuts, cracks and bruises that may serve as an entry points for the tuber month and other pest (Ganga, 1996).

Furthermore, in 1980, Balaoing stated that three months after planting, the crop is ready for harvest. This time, 70 – 75 percent of the foliage would have turned to pale

yellow and dry indicating maturity of the crop. Matured tubers peel off readily. The time of harvest is when the temperature is cool and less humid and the soil is dry.

Postharvest Handling and Practices

Sinclair (2000) stated that postharvest is concerned with the harvesting treatment, handling, storage, distribution and marketing of potatoes. It is not simply concerned in maintaining the quality of the produce but is also considers maximum income for the producer or trader income generation is a vitally important role of postharvest horticulture. Other important considerations include meeting the nutritional and casthetic requirement of human beings and minimizing waste. Also insuring that quality loss between harvest and consumption is minimal.

Sorting and grading are classified according to size and grade; large, big, medium, small and marbles. Cabal (1996) said that exact size range within any grades varies from farmer to farmers. If the supply is low, the farmer lowers the base limit to each size.

Furthermore after grading potatoes are packed into red bags, plastic, or thick-laced bamboo basket. Red bags (25-32 kg capacity) are the most suitable packing materials.

In 1983 Estalin stated that the grade of the commodity describes its quality as procured by the consumers or the exporter. The grade tells the marketing men if the produce can withstand storage or whenever it has to be released immediately to the marketing area. Grades also provides a basis for a division of price at any point in the market.

Criteria for Seed Tubers of Potatoes

Leopold (1975) stated that during the development of the tubers on the plant, the buds on the eyes of the tubers successively become dormant, starting at the stem end. The apical eye is the last to become dormant. At the end of the dormancy period, the eyes again sprout. It the tubers are placed under appropriate temperature conditions, one or more sprouts form in each tuber.

The rate of growth of the sprout after the seed potato has been planted is directly correlated with the length and nature of the sprout at the time of planting, also the conditions during the growth temperature, and other storage conditions-influence the growth rate and the are thus very important.

Varieties in which the vines develop rapidly, those with second growth and those drought resistant often have a short dormant period. Krijthe, as cited by Smith (1977), found no correlation with early maturity or starch content. Maturity or tubers at harvest is important in determining length of the dormant period. Growing conditions such as soil, fertilizers, and climatic factors such as rainfall cause differences in length of dormant period between lots of the same variety and between the different years. Weight of sprouts increase with age f tubers as a result of sprout growth and an increase in the number of sprouts per tuber. The increase in the number of sprouts is a result of decreasing dominance of apical growing point of the tuber. When the apex of the sprout becomes inactive or damaged, branching results.

As number of stems increases, the number of tuber formed also increases, and average size of tubers is likely to decrease. Some varieties produce many stems and consequently a high proportion of small tubers. Sprouted seeds of such varieties with

only one or two sprouts per seed piece result in a crop with a higher proportion of large potatoes. Toosey (1958) reported that one variety produced on average of 9.5 stems and 45.7 tubers per plant, few of them of marketable size. When all but sprout were removed before planting, an average of 20.5 tubers per plant were produced, many of sellable size. When seed pieces were restricted to one stem, the number of tubers was reduced and a high proportion of large tubers were formed.

Toosey (1958) found out that seed stored under warm conditions soon after harvest produced few sprouts. The seed was still in the single sprouting phase when the heat induced it to sprout. Without artificial heat, sprout growth was low and seed pieces averaged 5 to 7 sprouts each. De-sprouted seed further increased number of sprouts per seed piece. The larger the seed pieces, the greater the number of sprouts per seed piece.

Baldwin (1963) found in England that yields from sprouted seed in general were higher than those from unsprouted seeds. Placing fertilizer partly in contact with seed pieces had no serious effect on unsprouted seeds but depressed the yields from sprouted seeds.

The number and size of tubers produced are affected by sprouting treatment, seed size and spacing, early sprouting results in fewer sprouts per seed piece and fewer plants per hill than late sprouting. The number of tubers produced is directly related to tuber numbers (Toosey, 1958). Early sprouting, small seed, and wide spacing increase tuber size, but early sprouted seed planted closely gave higher yields than late sprouted seed planted farther apart. Burghausen (1962) as cited by Smith (1977) also noted that acceleration of sprout development reduces the interval between planting and emergence.

The period of productive growth is prolonged and maturity is advanced. There were fewer missing hills and growth of planting was more uniform throughout the field.

Sprout growth during storage is related linearly to the amount of available tuber substrate. Light intensity and day length influence sprout growth very little, temperature variety are much more important. Increase in sprout size at planting time results in earlier emergence and tuber initiation, and the relative rate of plant growth is reduced (Headford, 1962). Temperature and light are the principal weather factors which modify tuber initiation and growth; photo-period is relatively unimportant (Headford, 1962). Pre-germination of tubers results in a greater development of the root system and a higher proportion of root to top than those not pre-sprouted. Early varieties react more in this manner than those late ones (Birecki and Roztropowicz, 1962).

Sprouting seed potatoes before planting results in early growth of the plants and usually increases the yield. The form of growth of the tops and the production of stolons and tubers is related to the number of sprouts developed before planting. Removal of some or all of the sprouts before planting may have a marked effect on growth and production of the plant. All varieties do not react to similar conditions in the same way.

Beukemia and Zaag, 1970 stated that the effect of storage on the growth and yield of potato is a important factor to consider it higher yield is desired. On the other hand, Estalin (1983), found out that full gown seeds planted after five months of storage produced higher yield of marketable sized potatoes.

Criteria for the Table Potatoes

In 2004 Edward mentioned that 3,508 acres of potatoes were grown for the fresh market. The most popular variety grown was the Russet Norkotah, followed by the Red

Norland and then the Russet Burbank. Other popular varieties grown are Ranger Russet, Bintje and Sangre. Gournet and specially varieties are also grown for fresh market sales. The main factors of table potatoes are texture, color, flavor and smell.

Furthermore white or yellow-fleshed potatoes will have a creamy colour and should not discolour after cooking. Potatoes when cooked should smell like a normal cooked potato. Potatoes that have green colour on the surface should be peeled and remove all the green skin. Small amount are okay to eat but may add bitterness to the taste of the potato. Pre-peeled potatoes are also available for the food service industry. They re vacuum-sealed and must be refrigerated, they have a limited shelf-life. Table potatoes are marketed through potato packing facilities, where they are washed, graded and delivered to the wholesale and retail costumer. Fresh potatoes will be a welcome additional breakfast, lunch or dinner.

Potatoes are fully developed when the tops die naturally. A mature potato tuber has a firm skin and solid flesh. Immaturity in potatoes is shown by feathering, or peeling of the skin. This defect is usually accompanied by scalds (brownish discolorations), which are really injuries to the exposed flesh. Potatoes posses the best table quality when they are well matured (Edward, 2004).

Martin (2006) stated that sunburned tubers (greened by light) should be discarded in favor of those with normal coloring. The normal skin of the potato variety shows a light golden-green translucence, potatoes with enlarged lenticels and other skin defects should not be remove. Purity of variety - the tuber characteristics of the variety should be true in all respects. Some points to consider are shape: size, color of skin, color of flesh

and eyes, depth and placement of eyes, prominence and correctness of eyebrows, netting, smoothness and any other feature listed in the official description.

Potatoes are also classified as early, mid-season on late, to describe their maturity. There are minor modifications of these terms. General appearance – samples should have a bright, clean, smooth, attractive appearance. Care should be taken that the natural color and bloom of the skin are not destroyed by excessive rubbing or brushing. "Bright" describes potatoes that are free from dirt, or other foreign matter, damage or discoloration from any cause (Martin, 2006).

Important Criteria for Processing
Chips and Tuber Characteristics

Shallow eyes, round or elongated tuber shape, smooth skin, and freedom from defects are among the external characteristics of potatoes preferred by the processors. These characteristics are important for lesser trimmings (Ludwig, 1985), the preferred sizes for high chip yield, the absence of discoloration or browning during frying, to give uniform yellow to light brown chips, and good quality for food safety. Diseased tubers (i.e. bacterial wilt) when chipped exhibit rings of worn color that is unfit for food. Preliminary studies of BSU showed that bacterial wilt infected tuber causes allergenic reactions especially to susceptible individuals.

Another important processing criteria is the dry matter content that finally affects the frying quality. Ideally, processing potatoes should have at least 21% and above dry matter. Lower percentage dry matter gave soggy and less crispy chips. Thus, could be used for other food products such as salad, creamed potatoes, breads, cookies, candies ad as ingredient to vegetable dishes (Raceris, 1959).

In 1985 Ludwig mentioned that specific gravity and dry matter content are related and that they greatly influence the cooking quality. When their values are higher, the output of the frying process is also higher and up take of oil is lower.

A very low sugar content is apparently important to prevent darkening of chips. Quality wise, sugar content should be below 2%. Potatoes of low sugar content result in lighter color chips (Smith, 1977).

Greening of Potatoes

Greening in potatoes indicates an increase solanine levels. Greening is the result of exposure to light and this can occur in potato storage cellars, in the store shelf and at home on the counter. The green color is caused by the presence of chlorophyll. This is a natural plant pigment which is tasteless and harmless. The tendency toward greening differs among potato varieties. This varietal difference has been found toe specially significant when potatoes are exposed to the artificial light found in retail stores, including storage and sales areas (Vandre, 2003).

Sinden (1992) stated that steroid alkaloids (solanine and chaconine) are present in all potato tubers as a process product. There are no reports of ill effects from consuming potatoes that have normal levels of these potentially toxic compounds. Solanine will only be toxic to human when solanine content rise from 20 mg/100g fresh weight.

Smith (1977) stated that greening is caused by the exposure of tubers to natural or artificial light in the field, transit, or in the storage. The green colored tissue is usually accompanied by the formation of solanine, an alkaloid that my be poisonous if consumed in sufficient amount.

Storage of Potatoes

Rastovski (2003) stated that storage is necessary for a continuous supply to the market of fresh potatoes. This means that part of the crop must be stored from 8-10 months. The demands for steady supply of potatoes increased ever since potato has been used for industrial processing.

Baldasan (1980) observed that dark condition enhanced shorter dormancy period of tubers and pointed out that the size of tuber sprouted was significantly affected by the storage condition and not by the varietal nature of tubers. Tubers sprouted under dark storage condition were etiolated with long unhealthy slender stem, and with small leaves.

Packaging/Transportation of Potatoes

Packaging is designed for promotions and product placement to make a product attractive to consumers. Packaging includes any materials used by the consumer to transport the goods to be sold (Sinclair, 2000). Ratstovski (1981) also stated that the quality of potatoes must be maintained in the packaging containers like fiber board, crates and Styrofoam. The packaging must afford adequate ventilation. The respiration of the tubers are eliminated and fresh air (oxygen) is supplied.

Marketing of Potato Tubers

USDA (1992) stated that quality is of paramount importance to market acceptance. The fresh market appearance of potato tubers strongly influence sales color, size, shape and defects shape consumer's first impression of quality. Texture, flavor, and nutritive value are less obvious but still important quality components. Jimenez (2000) also stated that specially potato varieties with range in yield potential, tuber size

distribution, maturity, and flesh color intensity is available for conventional and alternative marketing system. Consumer evaluations indicates a widely variable preference in color, taste, texture and other quality parameters.

Fresh potato tubers pass through agents, assemblers, wholesalers, Financier-whosaler, wholesaler-retailers to consumers. Processing firms procure their raw materials directly from farmers or farmers group or through an agent or middlemen. In 1992, Mercado stated that the farmer problems on vegetables industries are inadequate transportation facilities, absence of reliable price information and lack of merchandizing techniques where these results to wastage and poor quality of farm produce. These problems were also the cause of high marketing cost and low price for farmers but high price for the consumers.

MATERIALS AND METHODS

The study was planted and stored during the wet season from May to December 2004.

An area of 390 square meters was thoroughly prepared and divided in three equal parts which accommodated the thirteen treatments with three replications. Each plot measured 1m x 10m. The treatments were laid out following the randomized complete block design (RCBD). The organic fertilizer was applied as basal fertilizer after land preparation. Triple 16 NPK inorganic fertilizer as supplemental was applied during hilling-up. The pre-sprouted potato tubelets from the different entries were planted at one tuberlet per hill, distanced of 25 cm x 30 cm between hills and rows. After which all the necessary cultural management practices for potato seed production such as weeding, pest control and hilling up were strictly employed.

The pre-harvest and post harvest data such as plant vigor, plant survival, pest and disease incidence, yield components, postharvest characteristics, and sensory evaluation of boiled and chip products were taken aside from other related observations.

Newly harvested potato tubers obtained from the different accessions were weighed (1 kg) per treatment and per replication. The tubers were displayed in a diffused light condition for four months. Each accession served as the treatment, and were replicated three times following the completely randomized design (CRD).

All other cultural practices required in potato production such as weeding, pest control, irrigation and hilling-up were strictly employed throughout the growing season.

Treatments were the following:

		Accession	Source
V_1	-	380579.3	CIP - Peru
V_2	-	377852.1	CIP - Peru
V_3	-	720071	CIP - Peru
V_4	-	387039.15	CIP - Peru
V_5	-	285378.27	CIP - Peru
V_6	-	15.97.8	CIP - Peru
V_7	-	381530.1	CIP - Peru
V_8	-	G. T.	Korea
V_9	-	Alpha	USA
V_{10}	-	Dejima	Japan
V_{11}	-	Ganza	CIP-Peru
V_{12}	-	Granola**	Germany
V_{13}	-	Igorota**	Philippines (NPRCRTC)

** check variety

Data gathered:

A. Growth Performance

1. Plant vigor. This was obtained through visual observation using the rating scale of 1-5 taken starting at one month after planting and until two and half months (Palomar and Sanico, 1994).

Scale	Description
5	Highly vigorous

3 Moderately vigorous

1 Very poor vigor

2. Plant survival. This was obtained one month after planting using the formula:

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

3. Pest and diseases incidence. This was obtained using the following rating scale of CIP (2000).

a. Insect (leaf miner)

Scale	Description	Remarks
1	No infection	Highly resistance
2	1-20% leaf surface infected	Resistance
3	21-40% leaf surface infected	Moderately resistance
4	41-60% leaf surface infected	Moderate Susceptible
5	Heavily damaged with 81% leaf surface infected	Susceptible

b. Disease (blight). This was taken by using the following scale of Potato International Center (2000) and Highland Technoguide Potato (Henfling, 1982).

Blight	CIP Scale	Description of Corresponding Symptoms (Henfling, 1984)
1	1	No blight were seen.
0.1-1	1	Very few plants in larger plants with lesions, not more than 2 lesion per 10 m of row (11-30 plants).
1.1-2	2	Up to small lesions per plant.
3.1-10	3	Up to 30 small lesions per plant or up to 1in each 20 leaflet attached.
10.1-24	4	Most plant are visibly attached and 1 and 3 leaflets infected few

		multiple infections per leaflets.
25-29	5	Nearly every leaflets with lesions multiple infections per leaflets are common. Field or plot green, but all plants in pots are blighted.
50-74	6	Every plant blighted and half the leaf area destroyed by blight. Plots looks green freckled ad brown, blight is very obvious.
75-90	7	AS previous but ¾ of each plant blighted lower branches maybe overwhelming killed off and the only green leaves, if any are top of the plant shade of plants maybe more spindly due to extensive foliage loss. Plot looks neither brown nor green.
91-97	8	Some leaves and most stem are green plot looks brown with some green patches.
97.1-99.9	9	Few green leaves almost blight lesions remains many stem lesions plot look brown.
100.0	10	All leaves and stem dead.

c. Early blight incidence

Scale	Description	Remarks
1	No infection	Highly resistance
2	1-25% of the plant infected	Resistance
3	26-50% of the plant infected	Moderately resistance
4	51-70% of the plant infected	Moderate Susceptible
5	76-100% of the plant infected	Susceptible

B. Yield and Postharvest Characters

1. Number and weight of marketable tubers per plot (kg). Tubers of marketable quality from small to large was weighed after harvest and recorded.

2. Number and weight of non-marketable tubers per plot (kg). All tubers which are less than 10 grams with defects such as malformed, cuts, cracks, and 10% greening was considered as non-marketable.

3. Computed yield per hectare (tons). This was computed by using the formula (Palomar and Talatala Sanico, 1994).

Yield (t/ha) = Yield (kg)/plot x 1.28205

4. Tuber characteristics. Characterization of tubers were done from yield of ten sample plants per plot at 99 days after planting (DAP). Characterization involved the following (NPRCRTC, 2003).

a. Tuber shape. This was described by visual observation.

Scale	Description
1	Round
2	Ovate
3	Oblong
4	Elliptic
5	Long/elongate

b. Tuber size. This was obtained through visual observation of the size, diameter and weight.

Scale	Size	Diameter (cm)	Weight
7	Large	6.1 and above	60g and above
5	Medium	4.5 – 6.0	15 – 25g
3	Small	3.0 and below	5 – 10g

c. Skin texture. This was recorded using the description listed below:

Scale	Description
1	Smooth
2	Moderately smooth

3	Very smooth
4	Rough
5	Very rough

d. Depth of eyes. This was recorded by using the description listed below:

Scale	Description
1	Shallow
3	Deep
5	Moderate

e. Skin color. This was described by visual observation.

Scale	Description
1	Yellow
2	Pale yellow
3	Dark yellow

f. Tuber flesh color. This was described by visual observation.

Scale	Description
1	Yellow
2	White
3	Cream

C. Storage

1. Degree of greening. This was taken every 15 days based on surface area using the rating scale (Salda, 2003).

Scale	Description
1	No greening

2	1-5% greened surface area
3	6-10% greened surface area
4	11% and above greened surface area

2. Degree of decay. This was taken every after 15 days intervals using the rating scale (Bayogan, 1986).

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

3. Percentage weight loss. The tubers were weighed every after 7 intervals for one month and computed using the formula.

$$\% \text{ Weight Loss} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100$$

4. Number of sprouts per tuber. The number of sprouts per tuber was counted at the end of the experiment.

D. Eating Qualities of Boiled Potatoes

This were taken by using the rating scale of NPRTRTC (2003) in terms of appearance, color, flavor, texture, general acceptability.

E. Processing Qualities

a. Dry matter content. This was taken by oven method using 30 grams of sliced potatoes from 3 tubers per replicate per variety.

$$\% \text{ Moisture} = \frac{\text{Fresh Weight} - \text{Oven Weight}}{\text{Fresh Weight}} \times 100$$

% DMC = 100% - % MC

b. Chipping quality. Chipping quality was assed using the processing scheme of the NPRCRTC (2003) as follows.

Tuber
↓
Peel thinly
↓
Slice at 1-2 mm
↓
Wash remove starch at cuter surface
↓
Drain and wipe with clean cloth to remove moisture
↓
Deep fry using coconut oil (palm oil)
↓
Drain and pack for sensory evaluation

The potato chips were evaluated as to the degree of browning of chips, % recovery and sensory evaluation of chips.

The degree of browning was evaluated using the rating scale of 1-4, as:

Scale	Description
1	Severe browning (6% browning)
2	Moderate browning (3-5% browning)
3	Slight browning (1-2% browning)
4	No browning (0% browning)

The % recovery was taken by getting the initial weight of tubers processed into chips and the final chips yield. These were based on the following:

a. Weight of whole tubers

b. Peeling/trimming loss

c. Weight of peeled tubers

d. Weight of chips

The sensory test was done by 10 panelists composed of students and faculty.

a. Crispiness description and acceptability (Hedonic scale)

Scale	Remarks
1	Extremely crispy
2	Very crispy
3	Moderately crispy
4	Slightly crispy
5	Soggy/not crispy

b. Oiliness description and acceptability (Hedonic scale)

Scale	Remarks
1	Extremely oily
2	Oily
3	Moderately oily
4	Slightly oily
5	Hot oily/too dry

c. Flavor acceptability (hedonic scale)

Scale	Remarks
1	Very strong potato flavor
2	Strong potato flavor
3	Little potato flavor
4	Very little potato flavor
5	No potato flavor

d. General acceptability

Scale	Remarks
6	Like extremely
5	Like very much
4	Like much
3	Like moderately
2	Like slightly
1	Not like/dislike

RESULTS AND DISCUSSION

Climatic Condition During the Study Period

Air temperature, relative humidity, rainfall and total sunshine from May to February 2006 are presented in Table 1. Minimum air temperature ranged from 10.10-14.80^{o}C while maximum air temperature is from 19.2-22.80^{o}C. Mean relative humidity and rainfall recorded were 88.1% and 3.42mm, respectively. Total sunshine ranges from 110.35 to 498.10cm with a mean of 327.12.

According to HARRDEC (1996) potato grows best in areas with temperature ranging from 17-22^{o}C and average relative humidity of 86%. At lower light intensity, haulm growth is stimulated and tuber formation may be delayed. Likewise, lower light intensity enhances the effect of long day length delaying tuberization and promoting canopy growth. However, these meteorological parameters may vary depending on the adaptation of the entries.

Table 1. Climatic data during the study period

MONTH	AIR TEMPERATURE		RELATIVE HUMIDITY (%)	RAINFALL (mm)	TOTAL SUNSHINE (cm)
	Minimum	Maximum			
May	14.80	22.80	95.00	6.80	438.20
June	13.20	21.70	94.00	6.90	498.10
July	13.40	21.00	90.00	5.50	438.10
August	13.30	21.70	94.00	5.10	460.50
September	12.40	20.10	90.00	4.20	396.70
October	12.10	20.30	91.00	2.80	387.00
November	12.20	21.50	85.00	2.00	317.40
December	11.30	20.30	79.00	1.30	111.90
January	10.50	20.10	82.00	0.04	113.00
February	10.10	19.20	81.00	70.05	110.35
Mean	26.9	26.9	88.11	3.42	3.27.12

Growth Performance

Plant Vigor

Table 2 and Fig. 1 shows the plant vigor at 30 and 60 DAP, where entries 380579.3, 387039.15, 285378.27, 15.97.8, 381530.1, Ganza, Granola and Igorota exhibited highly vigorous rating while entries Alpha, Dejima, 377852.1, 720071 and G.T gave moderately vigorous.

Ideally, potato plants should have vigorous growth for better yield. In this study, however, the vigor rating effect to yield, eating and chipping qualities depend on the varieties.

Fig. 2 and 3 shows the overview of the field before and after harvest.

Table 2. Plant vigor at 30 DAP and 60 DAP of thirteen potato entries evaluated

ENTRY	PLANT VIGOR	
	30 DAP	60 DAP
380579.3	Highly vigorous	Highly vigorous
377852.1	Moderately vigorous	Moderately vigorous
720071	Moderately vigorous	Moderately vigorous
387039.15	Highly vigorous	Highly vigorous
28537827	Highly vigorous	Highly vigorous
15.97.8	Highly vigorous	Highly vigorous
381530.1	Highly vigorous	Highly vigorous
G.T	Moderately vigorous	Moderately vigorous
Alpha	Moderately vigorous	Moderately vigorous
Dejima	Moderately vigorous	Moderately vigorous
Ganza	Highly vigorous	Highly vigorous
Granola**	Highly vigorous	Highly vigorous
Igorota**	Highly vigorous	Highly vigorous

** Check variety

A.

B.

Figure 1. Overview of the field at (A) 45 DAP (B) 75 DAP

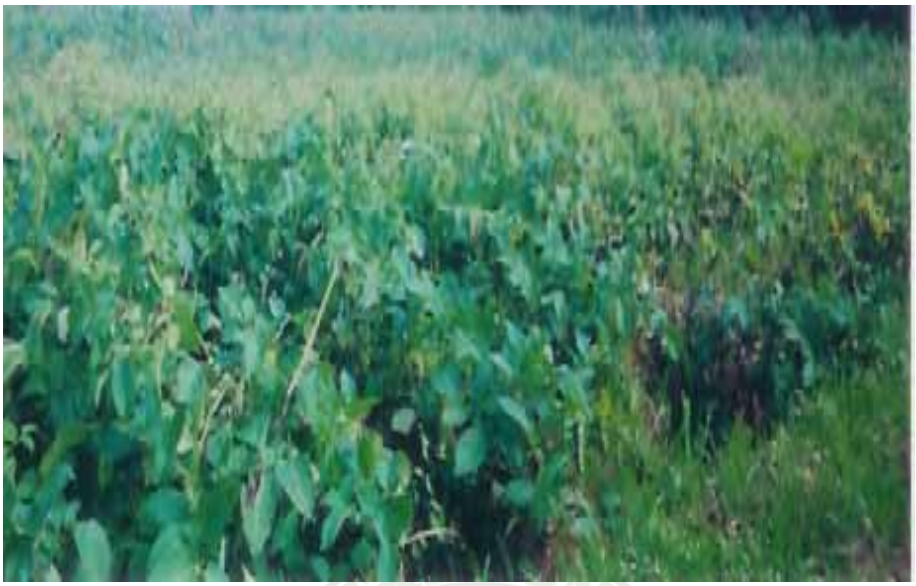

Figure 2. Overview of the field before harvest

Figure 3. Overview of the field at harvest

Table 3. Plant survival of thirteen potato entries evaluated at 45 DAP

ENTRY	SURVIVAL (%)
380579.3	97[ab]
377852.1	95[b]
720071	83[c]
387039.15	98[a]
28537827	97[ab]
15.97.8	97[ab]
381530.1	98[a]
G.T	83[c]
Alpha	85[c]
Dejima	83[c]
Ganza	98[a]
Granola**	95[b]
Igorota**	97[ab]
CV (%)	1.64

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

Plant Survival

Potato entries with 98% plant survival at 45 DAP were 387039.15, 381530.1 and the new variety released Ganza. These were followed by 380579.3, 285348.27, 15.97.8, anther check variety Igorota, Granola, and 377852.1 with 97% and 95% plant survival, respectively the rest had poor survival rater at 83% to 85%. The varied percentages could be due to genetic differences where some varieties easily establish growth and tolerate wet condition while others are susceptible.

Reaction to Leafminer and Late Blight

Leafminer and late blight incidence at 45 DAP in Table 4 reveals that majority of the potato entries were highly resistant except for entries Alpha, G.T and Dejima that were rated only as resistant. The low infection may be attributed to minimal spraying of insecticide and fungicides.

Table 4. Reaction to leafminer and late blight of thirteen potato entries evaluated at 45 DAP

ENTRY	PEST (leafminer)	DISEASE (late blight)
380579.3	Highly resistance	Highly resistance
377852.1	Highly resistance	Highly resistance
720071	Highly resistance	Highly resistance
387039.15	Highly resistance	Highly resistance
28537827	Highly resistance	Highly resistance
15.97.8	Highly resistance	Highly resistance
381530.1	Highly resistance	Highly resistance
G.T	Resistance	Resistance
Alpha	Resistance	Resistance
Dejima	Resistance	Resistance
Ganza	Highly resistance	Highly resistance
Granola**	Highly resistance	Highly resistance
Igorota**	Highly resistance	Highly resistance

These low leaf miner infestation and late blight infection may be attributed by minimal spraying of fungicides.

Yield and Postharvest Characters

Number and Weight of Marketable Tubers

The number and weight of marketable tubers indicates high economic returns in potato production (Fig. 4).

As per number and weight of marketable tubers classified as super extra large (SXL), extra big (XL), and medium entries 387039.15 and Ganza are preferred for processing and table purposes. These data were obtained despite of the typhoons that affected the crop during its growth.

Super XL classification come from entries 387039.15 and Ganza. The rest were comparable with 380579.3, 285378.27, 381530.1, Granola and Igorota.

Table 5. Number and weight of marketable tubers of thirteen potato entries evaluated (10 sq. m)

ENTRY	NUMBER			WEIGHT		
	Super XL (60g and above)	Extra Big (26-59g)	Medium (15-25g)	Super XL (60g and above)	Extra Big (26-59g)	Medium (15-25g)
380579.3	19[b]	30[b]	112[c]	155[b]	1.67[b]	2.28[cd]
377852.1	7[b]	12[c]	45[d]	0.58[b]	0.67[b]	0.47[e]
720071	8[b]	15[c]	63[cd]	2.48[b]	0.65[b]	0.88[e]
387039.15	76[a]	92[a]	191[b]	7.00[a]	4.88[a]	5.03[a]
28537827	18[b]	40[b]	244[a]	1.12[b]	1.52[b]	3.92[b]
15.97.8	17[b]	29[b]	110[c]	1.30[b]	1.15[b]	1.60[cde]
381530.1	16[b]	23[b]	73[cd]	1.02[b]	0.80[b]	1.07[e]
G.T	8[b]	15[b]	30[d]	0.68[b]	0.55[b]	0.58[e]
Alpha	9[b]	16[b]	53[d]	0.72[b]	0.73[b]	1.30[de]
Dejima	9[b]	17[b]	63[cd]	0.60[b]	0.65[b]	0.98[e]
Ganza	64[a]	73[a]	107[c]	5.83[b]	3.53[a]	2.52[c]
Granola**	14[b]	21[b]	68[d]	0.88[b]	0.85[b]	1.43[de]
Igorota**	19[b]	32[b]	75[d]	1.53[b]	1.13[b]	1.57[cde]
CV (%)	26.96	29.72	29.32	21.83	22.97	24.00

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

For the extra big size, entries 37039.15 and Ganza still had the significantly of 92 and 76. Entries 285378.27, Igorota and 380579.2 give comparable number to the rest except 377852.1 and 720071 that had the lowest number.

The highly significant numerous number of classified medium size tubers came from entry 285378.27, followed by the prolific 387039.15. The lowest came from the other entries led by G.T entry.

In terms of weight, entry 387839.15 followed the same trend having the heaviest weight. It's super XL weighed 7.00 kg. per 10 m2 plot. This was followed by variety Ganza with 5.83 kg. These two entries similarly gave the highest weight of extra big tubers.

This difference in terms of weight could be due to their outstanding genetic characteristics on plant establishment, pest and disease resistance. Super XL and XL the least weight was consistently obtained from 377852 .1 and G.T.

For medium size tubers, the significantly heaviest tubers of 5.03 kg/10m2 still came from the best entry 387039.15, out growing the weight of the prolific medium-sized, tubers of entry 285378.27 having only 3.92 kg/10m^2. The lowest was obtained from 377852.1 having 0.47 kg/10m^2. The differences in terms of number and weight was seen to be the effect of the different entries yielding characteristics.

Number of Non-marketable Tubers

Entry 285378.27, that gave medium sized tubers similarly showed the highest number of non-marketable small tubers. The number was, however, comparable to the number obtained from the highest yielder 387039.15. Entry G.T was observed to have the least number of marketable tubers with a mean of 25. It was observed that entries which had the most number of non-marketable tubers were the most affected by the typhoon.

Weight of Non-Marketable Tubers

As indicated in Table 6, weight of non-marketable tubers from entry 387039.15 still significantly out weighed, the weight of the highest number of tubers from entry 377851.1. The differences could be due to genetic characteristics.

The non-marketable tubers considered in these study include very small, greened and cracked tubers (Fig. 4).

A.

B.

Figure 4. Tubers of (A) marketable and (B) non-marketable

A.

B.

Figure 5. Tubers per plot (A) Ganza and (B) 387039.15

Table 6. Number and weight of non-marketable tubers of thirteen potato entries evaluated

ENTRY	NUMBER	WEIGHT ($kg/10m^2$)
380579.3	103^{b}	0.68^{abc}
377852.1	67^{bc}	0.27^{cd}
720071	57^{bc}	0.33^{cd}
387039.15	152^{a}	0.95^{a}
28537827	161^{a}	0.83^{ab}
15.97.8	75^{bc}	0.33^{cd}
381530.1	67^{bc}	0.33^{cd}
G.T	25^{d}	0.13^{d}
Alpha	65^{bc}	0.40^{bcd}
Dejima	64^{c}	0.43^{bcd}
Ganza	83^{b}	0.60^{abcd}
Granola**	85^{b}	0.68^{abc}
Igorota**	57^{c}	0.367^{bcd}
CV (%)	15.62	14.69

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

Computed Yield Per Hectare

Table 7 shows the computed yield per hectare of the thirteen potato entries. Interestingly, the significantly high computed yield of 387039.15 was 28.32 t/ha, Ganza variety followed with 19.87 t/ha. Both results are within the previous reported 18-30 t/ha yield of Igorota and Granola. The low results obtained from the other entries were due to bad weather condition during the conduct of the study and varietal poor resistance to such conditions.

For better selection, all the entries should also be planted during the dry season to determine the specific performance and pinpoint which entry and variety is best, especially for the farmers in Calasipan, Atok.

Table 7. Computed yield per hectare of thirteen potato entries evaluated

ENTRY	YIELD PER HECTARE (tons/ha)
380579.3	7.93[c]
377852.1	2.65[c]
720071	5.73[c]
387039.15	28.32[a]
28537827	9.58[c]
15.97.8	6.08[c]
381530.1	4.11[c]
G.T	2.93[c]
Alpha	4.04[c]
Dejima	3.70[c]
Ganza	19.87[b]
Granola**	5.26[c]
Igorota**	6.85[c]
CV (%)	24.85

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

Tubers Characteristics

Tuber shape. Variability in the tuber shape of the thirteen potato entries is shown in Table 8. Entries of Alpha, 720071, G.T, 28537827, Ganza, Granola and Igorota have round tuber shape while 380579.3, 37785.1, 387039.15, and 381530.1 have elongated tuber shape. It has been reported that round tubers are preferred for chips and elongated or elliptic ones for fries. However, depending on the slicing machines any large tubers shape could be used.

Skin texture. Table 8 shows that the skin texture of entries. Alpha, 380579.3, 387039.15, G.T, 15.97.8 and Igorota have moderately smooth skin texture, 377852.1, 3815301, Ganza and Granola are smooth in skin texture; 720071 and Dejima have very smooth skin texture; and 285378.27 with rough skin texture. Ideally, smooth to very

smooth skin are preferred both for table and processing purposes. For more fiber, the skin could be left unpeeled.

Depth of eyes. It was observed that four of the thirteen potato entries used in the study have shallow eyes, a criteria preferred by the processors. These are 377852.1, 720071, 285378.27 and Ganza. Shallow eyes gave less trimming loss, shorter time in trimming, and higher volume of materials for chips, thus higher income.

The high yielding 387039.15, together with Dejima and Igorota have moderate by deep eyes. The rest have deep eyes.

Table 8. Tuber characteristics of thirteen potato entries evaluated

ENTRY	TUBERS SHAPE	TUBER SIZE	SKIN TEXTURE	DEPTH OF EYES	SKIN COLOR	TUBER FLESH COLOR
380579.3	Elliptic	Big	Moderately smooth	Deep	Yellow	Yellow
377852.1	Elliptic	Medium	Smooth	Shallow	Yellow	White
720071	Round	Medium	Very smooth	Shallow	Yellow	Yellow
387039.15	Elliptic	Large	Moderately smooth	Moderate	Yellow	Cream
28537827	Round	Big	Rough	Shallow	Violet	Cream
15.97.8	Elliptic	Big	Moderately smooth	Deep	Yellow	White
381530.1	Elongate	Big	Smooth	Deep	Yellow	White
G.T	Round	Medium	Moderately smooth	Deep	Yellow	Cream
Alpha	Round	Medium	Moderately smooth	Deep	Yellow	Yellow
Dejima	Elliptic	Medium	Very smooth	Moderate	Yellow	White
Ganza	Round	Large	Smooth	Shallow	Yellow	Yellow
Granola**	Round	Large	Smooth	Deep	Dark yellow	Cream
Igorota**	Round	Large	Moderately smooth	Moderate	Yellow	Cream

Skin color. Table 8 summarizes the tuber skin color of the thirteen potato entries. As indicated, all the entries have yellow tuber skin color, except for 285378.27 which has violet color. Traditionally, the yellow skin colors are referred both for table and processing. The acceptance of violet skin color may differ on the consumer's acceptance.

Flesh color. Table 8 also shows also the variability in tuber flesh color of the thirteen potato entries. Ganza, 720071, Alpha an 380579.3 have yellow tuber flesh color, 377852.1, 15.97.8, 381530.1 and Dejima with white flesh color; Granola, Igorota, 285378.27, G.T and 387039.15 with cream tuber flesh color. Both yellow and creaming white are accepted for table in processing purposes. For more beta-carotene, colored ones are preferred (Rastovski, 2003).

Storage Characters

Degree of Greening

For food consumption, greening is not accepted due to its glycoalkaloid substance called solanine. To some local consumers in Manila and other areas, greening indicates freshness as in vegetable but should be corrected for food safety.

To select resistant varieties from greening, the 13 entries were stored for two months under diffused light condition. The degree of greening among the tubers of the different entries varied as to the length of storage period.

At 15 days holding, no such greening occurred. However, the greening progress as slightly severely as the storage was prolonged. Among the susceptible entries were the Alpha and Igorota varieties gave the fastest greening development days in diffuse light storage. Those of slight greening at 30 to 45 days were entries of 380579.31, 377852.1

720071, 387039.15, Ganza and Granola. The rest gave sever greening which could be use for planting materials.

Entries with slow greening incidence are of advantage as potatoes are handled from the farmers field to several traders hands without any protection coverings. Moreover, potatoes are retailed in open markets and takes time to be distributed or disposed of. During the sixty days of display all the entries had a rating of 6-10% greened surface area. The tubers of entry 285378.27 had violet skinned which might have masked the greening of tubers. This proves the study of Vandre (2003) that greening in red, violet skin varieties were not easily detected. However, slicing the skin portion could be done to check occurrence of greening with in the flesh portion.

Smith (1977) and Sinden (1992) explained that greening is caused by exposure to ligh during harvesting, handling and marketing. The green color develops in the periderm and in the outer parenchyma cells of the cortex at the same time form a toxic bitter-tasting substance. The green taste is attributed to the formulation of glycoalkaloids. Potato alkaloids comprise mainly two substances; a solanine (solanidine-glucose-rhamnose). The consumption of glycoalkaloid contents my cause serious illness, sometimes leading to death (Jahhax and Salunk, 1975 cited by Sinden, 1992), whether in human or animals. The disease symptoms are those of acute food poisoning and found that a solanine has inhibitions effect or cholisnesterose as demonstrated in studies on rat heart cells.

Table 9. Degree of greening of thirteen potato entries evaluated

ENTRY	15 DAYS	30 DAYS	45 DAYS	60 DAYS
380579.3	1	2	2	3
377852.1	1	2	2	3
720071	1	2	2	3
387039.15	1	2	2	3
28537827	1	1	1	1
15.97.8	1	2	3	3
381530.1	1	2	3	3
G.T	1	2	3	3
Alpha	1	3	3	3
Dejima	1	2	3	3
Ganza	1	2	2	3
Granola**	1	2	2	3
Igorota**	1	3	3	3

Rating Scale: 1 – no greening; 2 – 1-5% greened surface area; 3 – 6-10% greened surface area; 4 – 11% and above greened surface area

Greening formulation is affected by several factors such as entries as shown in the study location, growing conditions, wounding, storage and exposure to light. Gylcoalkaloid content depends on the potato entries and may average to two to ten mg/100g fresh weight for the entire tuber. It is highest in the outermost cells layers hence about 60% is eliminated on peeling. Considering this, potato-breeding programs should include greening as one aspect for evaluation. The effects of growing conditions is primarily observed in potatoes grown during short and cool seasons that promotes production of immature tubers with high glycoalkaloid levels.

(Sinden 1992) further reported that damages and bruises increases the glycoalkaloid content but dependent on the temperature; being slight at low temperature. Storage at low temperature (4 to 8^{o}C), high relative humidity and sprouting doubles the glycoalkaloid content as compared to dry and warm condition (12 to 15^{o}C).

Degree of Decay

Based on the results, all the thirteen potato entries used have no incidence of decay even after four days and half month of display probably due to the low temperature.

Percentage Weight Loss

Table 10 and Fig. 6 indicates that the percentage of weight loss depends on the thirteen entries evaluated and length of storage period. Higher percentage with loss were incurred as storage period was prolonged. Igorota had significantly high percentage weight loss at 10.1% but did not significantly differ with entries 380579.3, 377852.1, and 285378.27. Percentage weight loss were 10.0 kg, 9.7 kg, 9.8 kg and 9.8 kg, respectively. The entries with minimal weight loss were observed from 387039.15 and Alpha. These weight differences among entries were attributed to the genetic characteristics where some entries possess thick skin and cuticles.

Table 10. Percent weight loss of thirteen potato entries evaluated

ENTRY	WEIGHT LOSS (%)
380579.3	10.0[a]
377852.1	9.7[a]
720071	9.8[a]
387039.15	7.7[d]
28537827	9.8[a]
15.97.8	8.7[bc]
381530.1	8.9[bc]
G.T	8.4[cd]
Alpha	7.9[d]
Dejima	9.3[ab]
Ganza	9.4[ab]
Granola**	8.7[bc]
Igorota**	10.1[a]
CV (%)	4.68

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

Other factors that contributed to high percentage weight loss during storage are due to bio chemical change (Rastovski, 1981).

Number of Sprouts

The number of sprouts observed during storage depended on the evaluated entries. Majority of entries produced three sprouts except entry 720071 that produced two sprouts. The dormancy of potato tubers ranged from four to six months for seed purposes, two to three sprouts is ideal for production.

However, for food and processing, sprouting must be prevented as sprouts utilizes the food reserves or nutrients found within the tubers.

Dry Matter Content

The dry matter content is the simplest method of identifying varieties or entries for processing in table purposes. High dry matter content at 21% and the above are ideal for chips and fries. Values below this are good for table uses.

Table 11, the dry matter content significantly differed among the thirteen potato entries. Highly significant differences were observed. Entry 720071 had the highest dry matter content. This was followed by entry 380579.3 with 24%; 3778852.1, 285378.97, 381530.1, Dejima and Ganza with 22%, Alpha, check variety and Igorota with 21%. Those of 20% DMC were from 15.97.8 and G.T. entries. The lowest were obtained from entries 387039.15 with DMC of 17% and Granola with 18%.

Table 11. Dry matter content of thirteen potato entries evaluated

ENTRY	DRY MATTER CONTENT (%)
380579.3	17[f]
377852.1	22[c]
720071	26[a]
387039.15	24[b]
28537827	22[c]
15.97.8	20[d]
381530.1	22[c]
G.T	20[d]
Alpha	21[cd]
Dejima	22[c]
Ganza	22[c]
Granola**	18[e]
Igorota**	21[cd]
CV (%)	2.70

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

The percent dry matter content indicates the solid matter that comprises the tuber which is very important composition of potatoes. It is mainly determined genetically and is dependent on the variety. The findings of NPRCRTC (1985) should that the dry matter content of Igorota and other varieties are variable depending on the planting season, fertilization and maturity among other factors. In this study the differences depend on the, entries characteristics and performance during the unfavorable wet planting season.

Sensory Acceptability of Boiled Potato Tubers

Appearance. The Japanese Dejima varity which was claimed to be good for baked potatoes gave liked moderately rating in visual apperance. Ganza, Igorota, 15.97, 285378.27, 377852.1 and 380579.3 gave liked slightly while the rest gave neither like nor dislike ratings.

Table 12. Sensory acceptability of boiled potatoes from thirteen entries.

ENTRY	APPEARANCE	COLOR	FLAVOR	TEXTURE	GENERAL ACCEPTABILITY
380579.3	Like slightly	Neither Like slightly	Neither Like nor dislike	Like nor dislike	Like slightly
377852.1	Like slightly	Like nor dislike	Like slightly	Like nor dislike	Like slightly
720071	Neither like nor dislike	Like nor dislike	Like nor dislike	Like nor dislike	Like nor dislike
387039.15	Neither like nor dislike	Like slightly	Like slightly	Like slightly	Like slightly
28537827	Like slightly	Like slightly	Like moderately	Like moderately	Like moderately
15.97.8	Like slightly	Like moderately	Like slightly	Like slightly	Like slightly
381530.1	Neither like nor dislike	Like slightly		Like slightly	Like nor dislike
G.T	Neither like nor dislike	Like slightly	Like moderately	Like slightly	Like slightly
Alpha	Like slightly	Like slightly	Like slightly	Like slightly	Like slightly
Dejima	Like moderately	Like slightly	Like slightly	Like slightly	Like moderately
Ganza	Like slightly	Like moderately	Like slightly	Like slightly	Like moderately
Granola	Neither like nor dislike	Like slightly	Like moderately	Like nor dislike	Like slightly
Igorota	Like slightly	Like slightly	Like slightly	Like slightly	Like moderately

Color. In terms of color varity Ganza and entry 15.97.8 gave liked moderately rating. entries 380579.3, Alpha, 387039.15, G.T, 285378.27, 381539.1, Dejima, Granola and Igorota were like slightly. Entries of 720071 and 377852.1 were rated like nor dislike while entries of 15.97.8 and Ganza were rated liked slightly while entries of 720071 and 377852.1 were rated like nor dislike rating.

Flavor. For flavor acceptability entries 380579.3 and 720071 were evaluated like nor dislike while entries G.T, 285378 and Granola gave like moderately rating. The rest

were rated like slightly. Flavor, in this study, describes how they accept and perceive the strong potato flavor.

Texture. In terms of texture, the significant varieties come from Granola, 720071, 377852.1 and 380579.3 with rating of neither like nor dislike. Entries Alpha, high yielding 387039.15, G.T, 15.97.8, 381530.1, Dejima, Ganza and Igorota gave rating liked slightly while 285378.27 was solely liked moderately (Table12).

General Acceptability. For the general acceptability, of the boiled potatoes only for entries or rated like moderately, namely; entry 285378.27, Dejima, Ganza, and Igorota. With slightly liked rating were entries 380579.3, 377852.1, 387039.15, 15.97.8, G.T. Al.pha, and Granola. The rest gave neither like nor dislike rating.

Chipping Quality

Percentage chips recovery. The percent chip recovery varied among the thirteen potato entries shows in (Table 13). The highest 36 percent was obtained from chips of the high yielding 387039.15. varieties Igorota, Ganza, Alpha and intries G.T. 15.97.8 amd 720071, gave 34% while the rest had 31% chip recovery.

Generally, thus of high dry matter content gave the highest chip recovery percentage recovery.

Degree of browning. The potato chips evaluated either had slight, moderate and no browning at all absences of browning was observed in Granola chips. Those of slight browning were entries 380579.3, 720071, 15.97.8, 381530.1, G.T., Alpha, and Igorota the rest have moderate browning.

Browning rating is essential to determine the ideal color for potato chips. The result could be due to the high percentage of dry matter and low and sugar content.

Table 13. Chipping quality of thirteen fried potato entries evaluated

ENTRY	% CHIP RECOVERY	DEGREE OF BROWING	CRISPINESS	OILINESS	FLAVOR ACCEPTA-BILITY	GENERAL ACCEPTA-BILITY
380579.3	31	Slight browning	Slightly crispy	Moderately oily	Strong potato flavor	Like very much
377852.1	31	Moderate browning	Slightly crispy	Slightly oily	Strong potato flavor	Like extremely
720071	34	Slight browning	Slightly crispy	Slightly oily	Strong potato flavor	Like slightly
387039.15	36	Moderate browning	Slightly crispy	Slightly oily	Strong potato flavor	Like slightly
28537827	31	Moderate browning	Slightly crispy	Slightly oily	Strong potato flavor	Like slightly
15.97.8	34	Slight browning	Slightly crispy	Moderately oily	Strong potato flavor	Like extremely
381530.1	31	Slight browning	Slightly crispy	Slightly oily	Strong potato flavor	Like extremely
G.T	34	Slight browning	Slightly crispy	Slightly oily	Strong potato flavor	Like much
Alpha	34	Slight browning	Slightly crispy	Slightly oily	Strong potato flavor	Like very much
Dejima	31	Slight browning	Slightly crispy	Slightly oily	Strong potato flavor	Like very much
Ganza	34	Moderate browning	Slightly crispy	Slightly oily	Strong potato flavor	Like much
Granola	31	No browning	Slightly crispy	Slightly oily	Strong potato flavor	Like much
Igorota	34	Slight browning	Slightly crispy	Slightly oily	Very strong potato flavor	Like extremely

Crispiness. Chips from all the thirteen potato entries were evaluated slightly crispy. It is not clear why all the panelists gave the same rating but could be that the samples taste similarly or they were not properly trained nor they felt satiated with may samples to evaluate.

Oiliness. Slight to moderately oily was obtained from the potato chips evaluated. Those of moderately oily chips were found 380579.3 with 17% DMC and from 15.97.8 with 20% DMC. Literature reviews reported that the dry matter content is correlated with the oiliness of chips. The higher dry matter content, the less oil uptake. Thus, entries

having 21% and more most of the chips with the 21% dry matter obtained from the potato entries gave the rating was slightly oily.

Flavor. Flavor acceptability of the thirteen potato entries is shown in Table 13. All of the chips from the 12 entries gave strong potato flavor, except for Igorota that had a rating of very strong potato flavor. Flavor could be improved by adding seasonings such as salt, pepper, garlic powder, cheese powder and other desired flavoring.

General acceptability. Table 13 presents the general acceptability of the chips for the 13 entries. Results show that chips from Igorota, 381530.1, 15.97.8 and 377852.1 were rated like extremely those chips of like very much were 380579.3, Alpha and Dejima. Granola, Ganza, and G.T gave only liked very much, rating while the rest gave like slightly acceptability. Sensory rating acceptability using appropriate frying machines could better improved the quality of the chips.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The tuberlets of the thirteen potato entries that originated from CIP-Peru, USA, Japan and NPRCRTC were grown during wet season in Calasipan, Atok, Benguet, from May 2005 to September 2006 and stored under Atok condition. This was done to determine and evaluate the growth and agronomic characteristics of potato entries that will be adopted to Calasipan, Atok, Benguet condition.

Results revealed significant differences, in terms of percent survival, plant vigor, reaction to pest and disease, growth performance, agronomic characteristics, postharvest quality, eating and chipping qualities.

In terms of plant growth, nine among 13 potato entries gave highly vigorous, high survival rate of 95 to 98%, and highly resistance to pests rating while four of them had moderately vigorous rating at 30 and 60 days from planting and these are 3778521, G. T., Alpha and Dejima. These entries similarly gave poorer survival rate of 83 to 85%, and a just resistant rating to pest infestation against those highly resistant rating of other entries.

Based on marketable yield parameters, entry 387039.1 exhibited better yield despite typhoon disturbances. The entry produced the highest number and weight of super extra large, extra big, and medium sized tubers, and including the non-marketable tubers that are of small sizes, greened and cracked tubers. The new check variety, Ganza followed similar trend but of significantly lower values. The other processing variety, Igorota gave comparable lower marketable yield values with other entries. The lowest yielders or typhoon-sensitive ones were 377852.1, G. T., Alpha, Dejima, and Granola.

Entry 28537827 is highlighted as excellent producer of medium sized and non-marketable tubers.

As to computed yield per hectare, entry 387039.1 gave 28.32 tons/ha, followed by Ganza with 19.87 tons/ha and the lowest came from 377852.1.

The french fry preferred elongated shape are from the high yielding and large type 387039.15, 380579.3, 377852.1, 15.97.8, 381530.1, and Dejima. The rest are of round to round oval shape that are also good for chips. The drawback, however, of the high yielding and large tuber size 387039.15 was its moderate smooth skin and moderately deep eye that may affect trimming efficiency. Other entries with smooth skin and shallow eyes are 377852.1, 720071, 381530.1, Dejima, Ganza and Granola. The other shallow eyes potato is 28537827. Majority of the entries evaluated are of yellow tuber skin except 28537827 that has violet color. The tuber flesh of the potatoes were of yellow, white and cream.

Greening, during storage was observed at 30 days. Higher degree at 6-9% was observed in a variety Alpha and Igorota while the rest gave 1-5% slight greening. Majority gave progressive greening degree when kept at 60 days. The violet skin color of 28537827 masked the greening incidence but should have been sliced to detect incidence in the flesh.

Percentage weight loss at 60 days ranged from 7.7% to 10.1%. The lowest was obtained from the high yielding and large-sized entry 387039.15.

For the dry matter content, majority gave high values. Based on the recommended 21% and above the processing, these were obtained from 377852.1, 720071, high

yielding 387039.15, 28537827, 381530.1, Alpha, Dejima, Ganza, and Igorota,. The highest was 26% from 720071. The rest gave 20% and below of 17%.

When boiled, it was observed that 28537827, Ganza and Dejima gave like slightly to like moderately acceptability rating on the appearance, color, flavor, texture and general acceptability. The rest gave acceptability specific to one or two sensory attributes.

For chips, majority gave slightly crispy rating. Moderately oily rating was obtained from entries with lower dry matter content such as 38079.3 and 15.97.8. The rest have slightly oily. Perceptible potato flavor were noted in all the entries. The general acceptability ranged from like slightly to like extremely. The latter were obtained from chips of 377852.1, 381530.1, 15.97.8 and Igorota.

With the exception of 387039.15 and Ganza that exhibited good plant growth, high yield, high dry matter content, good eating and processing qualities, other entries should further be evaluated for dry season production and locating trials to determine adaptability. Otherwise, they should be used for biotechnology studies to clone or breed their specific traits and combine to other desired traits to suit industry needs.

Conclusion

Based on the results of the study, it is concluded that entries 387039.15, Ganza, Igorota, 285378.27, 15.97.8, 380579.3, Alpha and Granola have potentials for table potato production and processing. In terms of growth and agronomic characters these entries produced the highest marketable yield and seed tuber size. For table purposes, all the entries are recommended based on their acceptability. For seed tubers, these thirteen entries were considered as they were resistant to leafminer and late blight except for 285378.27 due its violet color which is not accepted common to consumers.

The postharvest characteristics of the different entries stored under diffuse light storeroom may be attributed to their varietal characteristics, for instance skin color made it difficult to detect greening. Potato tubers from entries Alpha, Granola, 285378.27, 377852.1 and 15.97.8 had the lowest percentage weight loss which had a good postharvest characteristics. Decay did not appear on the thirteen potato entries, 387039.15, Alpha, 380579.3, Igorota and Ganza produced sprouts on the fourth months of storage.

Recommendation

Entries 387039.15, 15.97.8, Alpha, 381530.1, 380579.3, Ganza, Igorota and Granola have potentials for postharvest qualities. Hence, it is suggested that these entries could be further evaluated for their growth and yield performance in other potato production areas. If their agronomic performance is stable these entries can be recommended for table potato, seed tuber and for processing production.

Entries Ganza and 387039.15 are highly recommended for rainy season planting in Calasipan, Atok, Benguet as indicated by their good yield and adaptability despite of the bad weather during the experimentation period.

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APPENDICES

Appendix Table 1. Plant vigor at 30 DAP of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	5	5	5	15	5^a
V_2	3	3	2	8	3^b
V_3	3	2	3	8	3^b
V_4	5	5	5	15	5^a
V_5	5	5	5	15	5^a
V_6	5	5	5	15	5^a
V_7	5	5	5	15	5^a
V_8	3	3	2	8	3^b
V_9	3	2	2	7	2^b
V_{10}	3	5	2	10	3^b
V_{11}	5	5	5	15	5^a
V_{12}	5	5	5	15	5^a
V_{13}	5	5	5	15	5^a
TOTAL	55	55	51	51	4.12

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	0.01
Replication	2	1.385	0.692			
Entry	12	46.410	3.868	8.23**	1.82	2.35
Error	24	11.282	0.470			
TOTAL	38					

** - highly significant Coefficient of Variation = 16.51 %

Appendix Table 2. Plant vigor at 60 DAP of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	5	5	2	12	4^{ab}
V_2	2	3	3	8	3^{b}
V_3	2	2	2	6	2^{b}
V_4	5	5	5	15	5^{a}
V_5	5	5	5	15	5^{a}
V_6	4	4	3	11	4^{ab}
V_7	3	5	4	12	4^{ab}
V_8	2	2	3	7	2^{b}
V_9	3	2	2	7	2^{b}
V_{10}	2	2	2	6	2^{b}
V_{11}	5	5	5	15	5^{a}
V_{12}	4	5	5	14	4^{ab}
V_{13}	5	4	4	13	4^{ab}
TOTAL	47	49	45	141	3.61

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.359	0.179			
Entry	12	27.026	2.252	2.58**	1.82	2.35
Error	24	20.974	0.0874			
TOTAL	38	48.359				

** - highly significant Coefficient of Variation = 24.63 %

Appendix Table 3. Plant survival (%) of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	95	97	97	289	96[ab]
V_2	93	95	95	283	94[b]
V_3	83	85	83	251	84[c]
V_4	98	97	98	293	98[a]
V_5	97	95	97	289	96[ab]
V_6	93	97	97	287	96[ab]
V_7	83	83	85	251	84[a]
V_8	98	97	98	293	98[c]
V_9	90	83	85	258	86[c]
V_{10}	83	85	83	251	84[c]
V_{11}	97	98	98	293	98[c]
V_{12}	93	95	95	283	94[b]
V_{13}	97	98	97	292	97[a]
TOTAL	1200	1205	1208	3613	92.64

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	2.513	1.256			
Entry	12	1276.974	106.415	46.03**	1.82	2.35
Error	24	55.487	2.312			
TOTAL	38	1334.974				

** - highly significant Coefficient of Variation = 1.64 %

Appendix Table 4. Pest and disease incidence (leafminer) at 45 DAP of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	1	1	1	3	1^b
V_2	1	2	1	4	1^b
V_3	1	1	2	4	1^b
V_4	1	1	1	3	1^b
V_5	1	1	1	3	1^b
V_6	1	1	1	3	1^b
V_7	1	1	1	3	1^b
V_8	2	2	2	6	2^a
V_9	2	1	2	5	2^a
V_{10}	2	2	2	6	2^a
V_{11}	1	1	1	3	1^b
V_{12}	1	1	1	3	1^b
V_{13}	1	1	1	3	1^b
TOTAL	16	16	17	49	1.26

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	0.01
Replication	2	0.051	0.026			
Entry	12	5.436	0.453	5.58**	1.82	2.35
Error	24	1.949	0.081			
TOTAL	38	7.436				

** - highly significant Coefficient of Variation = 22.68 %

Appendix Table 5. Late blight 45 DAP of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	1	1	1	3	1^b
V_2	2	1	2	5	2^a
V_3	2	2	2	6	2^a
V_4	1	1	1	3	1^b
V_5	1	1	1	3	1^b
V_6	1	1	1	3	1^b
V_7	2	2	2	6	2^b
V_8	1	1	1	3	1^a
V_9	2	2	2	6	2^a
V_{10}	2	2	2	6	2^a
V_{11}	1	1	1	3	1^b
V_{12}	1	1	1	3	1^b
V_{13}	1	1	1	3	1^b
TOTAL	18	17	18	53	1.36

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	0.01
Replication	2	0.043	0.022			
Entry	12	8.464	0.705	26.03**	1.82	2.35
Error	24	0.650	0.027			
TOTAL	38	9.157				

** - highly significant Coefficient of Variation = 12.16 %

Appendix Table 6. Number of SXL tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	10	15	33	58	19[b]
V_2	2	13	6	21	7[b]
V_3	8	9	7	24	8[b]
V_4	100	55	74	229	76[a]
V_5	24	7	24	55	18[b]
V_6	19	10	21	50	17[b]
V_7	11	9	4	24	8[b]
V_8	10	24	14	48	16[b]
V_9	10	7	11	28	9[b]
V_{10}	13	10	3	26	9[b]
V_{11}	44	56	91	191	64[a]
V_{12}	18	14	10	42	14[b]
V_{13}	29	11	18	58	19[b]
TOTAL	298	240	316	854	21.90

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	242.667	121.333			
Entry	12	17398.256	1449.855	11.69**	1.82	2.35
Error	24	2976.667	124.028			
TOTAL	38	20617.590				

** - highly significant Coefficient of Variation = 26.96 %

Appendix Table 7. Number of extra big tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	20	40	31	91	30[b]
V_2	5	15	15	35	12[b]
V_3	20	15	10	45	15[b]
V_4	110	69	97	276	92[a]
V_5	40	20	60	120	40[b]
V_6	25	20	41	86	29[b]
V_7	16	20	10	46	15[b]
V_8	24	20	26	70	23[b]
V_9	14	22	12	48	16[b]
V_{10}	18	13	19	50	17[b]
V_{11}	39	40	140	219	73[a]
V_{12}	24	20	20	64	21[b]
V_{13}	54	23	20	97	32[b]
TOTAL	409	337	501	1247	31.97

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	0.01
Replication	2	1039.590	519			
Entry	12	21057.641	1754.803	4.79**	1.82	2.35
Error	24	8795.744	366.489			
TOTAL	38	30892.974				

** - highly significant Coefficient of Variation = 29.72 %

Appendix Table 8. Number of big tubers (15-25 g) of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	78	119	140	337	112[c]
V_2	28	72	34	134	45[d]
V_3	56	56	78	190	63[cd]
V_4	176	164	232	572	191[b]
V_5	241	224	268	733	244[a]
V_6	70	180	80	330	110[c]
V_7	65	68	86	219	73[cd]
V_8	38	30	23	91	30[d]
V_9	42	58	60	160	53[d]
V_{10}	58	74	56	188	63[cd]
V_{11}	90	119	111	320	107[c]
V_{12}	85	108	10	203	68[cd]
V_{13}	76	76	73	225	75[cd]
TOTAL	1103	1348	1251	3702	94.9

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	2342.000	1171.000			
Entry	12	132734.103	11061.175	14.28**	1.82	2.35
Error	24	18594.667	779.778			
TOTAL	38	1.53670.769				

** - highly significant Coefficient of Variation = 29.32 %

Appendix Table 9. Number of non-marketable tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	120	64	126	310	103[b]
V_2	58	61	66	185	67b[c]
V_3	40	96	34	170	57b[c]
V_4	106	148	203	427	152[a]
V_5	156	130	197	483	161[a]
V_6	56	68	100	224	75b[c]
V_7	32	68	102	202	67b[c]
V_8	31	21	23	75	25[d]
V_9	37	60	98	195	65[bc]
V_{10}	33	84	75	192	64[bc]
V_{11}	50	64	136	250	83[b]
V_{12}	63	88	105	256	85[b]
V_{13}	68	46	57	171	57[bc]
TOTAL	850	998	1322	3170	81.28

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	0.01
Replication	2	8965.744	4482.872			
Entry	12	52380.564	4365.047	6.95**	1.82	2.35
Error	24	15073.590	628.066			
TOTAL	38	76419.892				

** - highly significant Coefficient of Variation = 15.62 %

Appendix Table 10. Weight of SXL tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	0.80	1.10	2.75	4.65	1.55[b]
V_2	0.25	0.90	0.60	1.75	0.58[b]
V_3	0.65	6.20	0.60	7.45	2.48[b]
V_4	11.1	0.90	9.00	21.00	7.00[a]
V_5	1.30	0.80	1.25	3.35	1.12[b]
V_6	1.30	1.00	1.60	3.90	1.30[b]
V_7	0.50	1.35	1.20	3.05	1.02[b]
V_8	0.75	0.80	0.50	2.05	0.68[b]
V_9	0.60	0.75	0.80	2.15	0.72[b]
V_{10}	0.65	0.75	0.40	1.80	0.60[b]
V_{11}	6.65	5.55	8.30	17.50	5.83[b]
V_{12}	0.75	1.25	0.65	2.65	0.88[b]
V_{13}	2.20	0.90	1.50	4.60	1.53[b]
TOTAL	24.50	22.25	29.15	75.90	1.95

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	1.905	0.953			
Entry	12	153.427	12.786	3.33**	1.82	2.35
Error	24	92.120	3.838			
TOTAL	38	247.452				

** - highly significant Coefficient of Variation = 21.83 %

Appendix Table 11. Weight of extra big tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	.85	2.9	1.25	5.00	1.67[b]
V_2	.2	1.2	.6	2.00	0.67[b]
V_3	.9	.65	.4	1.95	0.65[b]
V_4	5.25	4.4	5.0	14.65	4.88[a]
V_5	1.55	1.1	1.9	4.55	1.52[b]
V_6	.8	1.1	1.55	3.45	1.15[b]
V_7	.8	.6	1.0	2.40	0.80[b]
V_8	.55	.8	.3	1.65	0.55[b]
V_9	.45	1.0	.75	2.20	0.73[b]
V_{10}	.6	.6	.75	1.95	0.65[b]
V_{11}	.6	2.9	7.1	10.66	3.53[a]
V_{12}	.65	1.0	.9	2.55	0.85[b]
V_{13}	1.8	.6	1.0	3.40	1.13[b]
TOTAL	15	18.85	22.45	56.35	1.44

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	2.164	1.082			
Entry	12	60.107	5.092	4.94**	1.82	2.35
Error	24	24.728	1.030			
TOTAL	38					

** - highly significant

Coefficient of Variation = 22.97 %

Appendix Table 12. Weight of big tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	.9	3.2	2.75	6.85	2.28^{cd}
V_2	.3	.5	.6	1.40	0.47^{e}
V_3	.9	1.0	.75	2.65	0.88^{e}
V_4	4.5	5.1	5.5	15.10	5.03^{a}
V_5	2.7	4.2	4.85	11.75	3.92^{b}
V_6	1.1	1.95	1.75	4.80	1.60^{cdc}
V_7	.9	1.1	1.2	3.20	1.07^{e}
V_8	.7	.85	.2	1.75	0.58^{e}
V_9	.65	1.5	1.75	3.90	1.30^{dc}
V_{10}	.8	1.4	.75	2.95	0.98^{e}
V_{11}	.6	3.2	3.75	7.55	2.52^{e}
V_{12}	1.1	2.3	.9	4.30	1.43^{dc}
V_{13}	1.3	1.8	1.6	4.70	1.57^{cdc}
TOTAL	16.45	28.1	26.35	70.9	1.82

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	6.072	3.036			
Entry	12	64.379	5.365	15.23**	1.82	2.35
Error	24	8.452	0.352			
TOTAL	38	78.902				

** - highly significant Coefficient of Variation = 24.0%

Appendix Table 13. Weight of non-marketable tubers of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	.55	.5	1.0	2.05	0.68^{abc}
V_2	.3	.2	.3	0.80	0.27^{cd}
V_3	.25	.45	.3	1.00	0.33^{cd}
V_4	.6	1.25	1.0	2.85	0.95^{a}
V_5	.9	.55	1.05	2.50	0.83^{ab}
V_6	.4	.5	.1	1.00	0.33^{cd}
V_7	.1	.3	.6	1.00	0.33^{cd}
V_8	.2	.1	.1	0.40	0.13^{d}
V_9	.35	.5	.35	1.20	0.40^{bcd}
V_{10}	.2	.2	.9	1.30	0.43^{bcd}
V_{11}	.3	.5	1.0	1.80	0.60^{abcd}
V_{12}	.25	1.1	.7	2.05	0.68^{abc}
V_{13}	.5	.3	.3	1.10	0.37^{bcd}
TOTAL	4.9	6.45	7.7	19.05	0.49

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	0.303	0.151			
Entry	12	2.081	0.173	2.90**	1.82	2.35
Error	24	1.434	0.060			
TOTAL	38	3.817				

** - highly significant

Coefficient of Variation = 14.69 %

Appendix Table 14. Computed yield per hectare (tons/ha) of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	3.97	9.87	9.94	23.78	7.93[e]
V_2	1.67	3.59	2.69	7.95	2.65[c]
V_3	4.29	10.26	2.63	17.18	5.73[c]
V_4	41.73	14.94	28.28	84.95	28.32[a]
V_5	8.61	8.53	11.60	28.74	9.58[e]
V_6	6.0	5.83	6.41	18.24	6.08[c]
V_7	2.9	4.29	5.13	12.32	4.11[c]
V_8	2.82	4.55	1.41	8.78	2.93[c]
V_9	2.63	4.81	4.68	12.12	4.04[c]
V_{10}	3.72	3.78	3.59	11.09	3.70[c]
V_{11}	18.21	15.58	25.83	59.62	19.87[b]
V_{12}	4.49	7.24	4.04	15.77	5.26[c]
V_{13}	10.3	4.61	5.64	20.55	6.85[c]
TOTAL	111.34	97.88	111.87	321.09	8.23

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Replication	2	9.671	4.836			
Entry	12	2030.883	169.240	8.05**	1.82	2.35
Error	24	504.580	4.024			
TOTAL	38	2545.134				

** - highly significant

Coefficient of Variation = 24.85 %

Appendix Table 15. Degree of greening 1st week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	1	1	1	3	1.0
V_2	1	1	1	3	1.0
V_3	1	1	1	3	1.0
V_4	2	1	1	4	1.3
V_5	0	0	0	0	0
V_6	1	1	2	4	1.3
V_7	1	2	1	4	1.3
V_8	1	1	1	3	1.0
V_9	1	2	1	4	1.3
V_{10}	1	1	2	4	1.3
V_{11}	1	1	1	3	1.0
V_{12}	1	1	1	3	1.0
V_{13}	1	2		4	1.3
TOTAL	13	15	14	44	1.12

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Treatment	12	1.077	0.090	0.58^{ns}	2.15	2.96
Error	24	4.00	0.154			
TOTAL	28	5.077				

ns – not significant

Coefficient of Variation = 12.92 %

Appendix Table 16. Degree of greening 2nd week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	2	2	2	6	2.0
V_2	2	2	1	5	2.0
V_3	2	2	2	6	2.0
V_4	2	1	2	5	2.0
V_5	0	0	0	0	0
V_6	2	2	3	7	2.0
V_7	2	3	2	7	2.0
V_8	2	3	2	7	2.0
V_9	2	3	3	8	3.0
V_{10}	3	2	2	7	2.0
V_{11}	1	2	2	5	2.0
V_{12}	2	2	1	5	2.0
V_{13}	2	3	3	8	3.0
TOTAL	24	27	25	76	1.9

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	4.667	0.389	1.38^{ns}	2.15	2.96
Error	24	7.333	0.282			
TOTAL	28	12.000				

ns – not significant Coefficient of Variation =26.55 %

Appendix Table 17. Degree of greening 3rd week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	2	2	2	6	2
V_2	2	2	2	6	2
V_3	2	2	2	6	2
V_4	2	3	3	8	3
V_5	0	0	0	0	0
V_6	2	3	3	8	3
V_7	3	2	2	7	2
V_8	2	3	3	8	3
V_9	2	3	3	8	3
V_{10}	3	2	2	7	2
V_{11}	2	3	3	8	3
V_{12}	2	3	3	8	3
V_{13}	3	3	3	9	3
TOTAL	27	31	31	89	2.28

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	7.103	0.175	0.62^{ns}	2.15	2.96
Error	24	7.333	0.282			
TOTAL	28	9.436				

ns – not significant Coefficient of Variation =22.03 %

Appendix Table 18. Degree of greening 4th week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	2	3	3	8	3
V_2	3	3	2	8	3
V_3	3	3	3	9	3
V_4	3	2	3	8	3
V_5	0	0	0	0	0
V_6	3	3	3	9	3
V_7	3	3	3	9	3
V_8	2	3	3	8	3
V_9	3	3	3	9	3
V_{10}	3	3	3	9	3
V_{11}	2	3	2	7	2
V_{12}	3	2	3	8	3
V_{13}	3	3	4	10	3
TOTAL	33	34	35	102	2.61

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	1.590	0.132	0.65^{ns}	2.15	2.96
Error	24	5.333	0.205			
TOTAL	28	6.923				

ns - not significant Coefficient of Variation = 16.36%

Appendix Table 19. Percentage weight loss at first week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	0.1	0.1	0	0.2	0.06
V_2	0	0.1	0	0.1	0.03
V_3	0	0	0.2	0.2	0.06
V_4	0.2	0.1	0	0.3	0.10
V_5	0	0	0.1	0.1	0.03
V_6	0.2	0	0.1	0.3	0.10
V_7	0	0.1	0	0.1	0.03
V_8	0	0	0.2	0.2	0.06
V_9	0	0.1	0.1	0.2	0.06
V_{10}	0	0.1	0	0.1	0.03
V_{11}	0	0.1	0	0.1	0.03
V_{12}	0.1	0	0	0.1	0.03
V_{13}	0.2	0.1	0.1	0.4	0.13
TOTAL	0.8	0.8	0.8	24	0.06

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	0.039	0.003	0.55^{ns}	2.15	2.96
Error	24	0.153	0.056			
TOTAL	28	1.868				

ns - not significant Coefficient of Variation = 7.26 %

Appendix Table 20. Percentage weight loss during 2nd week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	0.1	0.2	0.3	0.6	0.20
V_2	0.1	0.2	0	0.3	0.10
V_3	0.2	0.1	0.5	0.8	0.26
V_4	0.5	0.1	0	0.6	0.20
V_5	0	0.2	0.4	0.6	0.20
V_6	0.1	0	0.4	0.5	0.16
V_7	0.3	0.3	0.1	0.7	0.23
V_8	0.2	0	0.4	0.6	0.20
V_9	0.2	0.4	0.2	0.8	0.26
V_{10}	0.2	0.4	0.2	0.8	0.26
V_{11}	0.2	0.1	0.2	0.5	0.16
V_{12}	0.1	0	0.4	0.5	0.16
V_{13}	0.6	0.2	0.2	1.0	0.33
TOTAL	2.8	2.2	3.3	8.3	0.21

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	0.130	0.011	0.36^{ns}	2.15	2.96
Error	24	0.793	0.031			
TOTAL	28	0.924				

ns - not significant Coefficient of Variation =12.14 %

Appendix Table 21. Percentage weight loss after 3rd week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	5.2	4.7	4.2	14.1	4.7^{b}
V_2	1.9	1.6	1.6	5.1	1.7^{e}
V_3	3.8	1.6	2.0	7.4	2.5^{cdc}
V_4	3.1	2.2	2.7	8.0	2.7^{cdc}
V_5	2.0	2.3	3.5	7.8	2.6^{cdc}
V_6	2.2	2.0	2.5	6.7	2.2^{cdc}
V_7	3.7	2.5	3.2	9.4	3.1^{c}
V_8	2.7	2.6	3.2	8.5	2.8^{cd}
V_9	2.5	3.2	3.2	8.9	3.0^{c}
V_{10}	2.2	3.2	2.1	7.6	2.5^{cdc}
V_{11}	2.0	1.2	1.9	5.1	1.7^{e}
V_{12}	1.7	2.2	1.9	5.8	1.0^{dc}
V_{13}	8.8	7.9	8.3	25.0	8.3^{a}
TOTAL	41.8	37.2	40.3	119.3	3.0

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	111.632	9.303	29.64**	2.15	2.96
Error	24	8.160	0.314			
TOTAL	28	119.792				

** - highly significant Coefficient of Variation =18.30 %

Appendix Table 22.Percentage weight loss after 4th week of display of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	10.2	9.8	10	30.0	10.0[a]
V_2	8.5	7.3	8	23.8	7.9[d]
V_3	10	9.8	9.3	29.1	9.7[a]
V_4	10	9.3	10	29.3	9.8[a]
V_5	7.4	7.9	7.7	23.0	7.7[d]
V_6	8.9	7.9	8.3	25.1	8.4[cd]
V_7	9.5	10	10	29.5	9.8[a]
V_8	10.2	9.7	9.3	29.2	8.7[bc]
V_9	8.9	9.2	8.7	26.8	8.9[bc]
V_{10}	8.7	10	9.1	27.8	9.3[ab]
V_{11}	8.7	9.4	10	28.1	9.4[ab]
V_{12}	9.1	8.6	8.3	26.0	8.7[bc]
V_{13}	10.2	10.1	10	30.3	10.1[a]
TOTAL	120.3	119	118.7	358	9.17

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	23.219	1.935	10.49**	2.15	2.96
Error	24	4.795	0.184			
TOTAL	28	28.014				

** – highly significant Coefficient of Variation = 4.68 %

Appendix Table 23. Number of Sproots per tuber of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	2	3	3	8	3
V_2	2	3	3	8	3
V_3	2	2	3	7	2
V_4	3	3	3	9	3
V_5	3	3	3	9	3
V_6	2	3	3	8	3
V_7	3	3	2	8	3
V_8	3	2	3	8	3
V_9	3	3	2	8	3
V_{10}	3	3	3	9	3
V_{11}	3	3	3	9	3
V_{12}	3	3	3	9	3
V_{13}	3	3	3	9	3
TOTAL	35	37	37	109	2.79

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Treatment	12	11.744	0.979	2.04^{ns}	2.15	2.96
Error	24	10.000	0.285			
TOTAL	28	21.744				

ns - not significant Coefficient of Variation = 17.13 %

Appendix Table 24. Percent dry matter content of thirteen potato entries

ENTRY	REPLICATION			TOTAL	MEAN
	I	II	III		
V_1	17	17	17	51	17^{f}
V_2	22	22	22	66	22^{c}
V_3	26	26	26	78	26^{a}
V_4	23	25	25	73	24^{b}
V_5	22	23	22	67	22^{c}
V_6	20	20	20	60	20^{d}
V_7	22	22	22	66	22^{c}
V_8	20	21	21	62	20^{d}
V_9	21	21	21	63	21^{cd}
V_{10}	22	22	23	67	22^{c}
V_{11}	22	21	22	65	22^{c}
V_{12}	19	17	19	55	18^{e}
V_{13}	20	21	21	62	21^{cd}
TOTAL					

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED Fc	TABULAR F 0.05	TABULAR F 0.01
Entry	12	192.769	16.064	48.19**	2.15	2.96
Error	24	8.667	0.333			
TOTAL	28	201.436				

** – highly significant

Coefficient of Variation =2.70 %