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EVALUATION OF POTATO ENTRIES FOR YIELD AND FRY QUALITY GROWN IN DIFFERENT ELEVATIONS OF BENGUET, PHILIPPINES

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ABSTRACT

Evaluation and screening of a wide range of potato germplasm is necessary to identify cultivars that are adapted to the locality, high yielding, consistently resistant to late blight and have good processing quality. Five potato entries grown and selected from previous trials were evaluated under different ecological zones/elevations from low mountain zone (1350 masl); mid-mountain zone (below 2000 masl) and high mountain zone (2000 and above masl) during the wet season. In summary, entries CIP 380241.17, PHIL 2.21.6.2, CIP 676070 and PHIL 5.19.2.2 significantly out yielded the check varieties Igorota (processing type), Ganza (newly approved variety), and Granola (table type/ farmers variety). Furthermore, PHIL 2.21.6.2 and the check variety Igorota have good fry quality based on high dry matter content and high fry yield. Both entries produced fries which were liked much by the panelists.

Key words: varieties, across locations, germplasm, vigor and canopy cover

INTRODUCTION

Potato (*Solanum tuberosum*) has an important role in the country's economy and effort to attain self-sufficiency in food. It is in fact a high value crop and is widely grown in the Cordillera particularly in Benguet and Mountain Province due to its potential as one of the most profitable crops. It is also grown in the region due to its adaptability to the climatic condition and soil type which are the primary factors favoring the growth and development of the crop (Smith, 1977).

Previous evaluations of potato cultivars resulted to the selection of seven varieties that were officially released to the National Seed Industry Council (NSIC). The varieties are Montaňosa, Dalisay, Solibao, Igorota, Ganza, Gloria and Bengueta Patatas. These varieties are moderately resistant to late blight and are table type potatoes. More specifically, Igorota, Solibao and Gloria were identified to have good chipping quality. However, some of these released varieties were observed to have a decreasing resistance to late blight that ultimately results in low yield. Thus, systematic evaluation of potato genotypes in a multi-location trial is greatly important to be able to select more varieties that are pest resistant, high yielding and adapted to specific locations (Yang, 2002).

Furthermore, due to the growing demand for potato snack food (BuPRE, 2007), the Philippines imported 61,699 mt of a wide range of processed potato products having a value of $ 30.5 M in 2006 (PCARRD, 2008). Potato varieties (e.g. Granola) commonly grown in Benguet are often used for processing but are not suitable for processing. Thus, the country needs immediate action to continuously produce and evaluate potential processing varieties to sufficiently supply the increasing demand for processed potatoes (Balaoing, 2006).

The most significant factor that may influence quality of potatoes for processing is the variety. Varieties for potato fries must have a tuber dry matter content of 21 - 24 % for high fry recovery, less oil uptake, crispy texture and light yellow or light brown sticks (Balaoing, 2006). Potato processors are inclined to pay significant price premiums if such favored varieties are developed (Van der Zaag, 1990). However, Cordillera which produces 75% of potatoes in the Philippines grows a limited number of varieties suitable for processing (PCARRD, 2008). Thus, continuous selection for varieties suitable for processing must be done.

Another factor which may influence fry processing quality is the growing condition. Different growing conditions may enhance processing qualities of these varieties. Therefore, evaluation of the processing varieties grown from different locations is important. The aim of this study is to evaluate the agronomic yield and disease incidence of selected potato entries across locations/zones and seasons, identify the location that produces potato selection with highest yield and best fry quality, determine the most adaptable location for potato production, determine the interaction between locations and potato on fry quality; and recommend to the National Seed Industry Council (NSIC) selected entry/s for official variety released

MATERIALS AND METHODS

The five potato entries evaluated in 2008 during the wet season trial at Loo, Buguias, Bonglo, Atok, and Sagpat, Kibungan were selected for the study. Igorota, Ganza (processing-type) and Granola (table-type) were used as check varieties in all locations and seasons. The planting materials for all entries were subjected to *in vitro* culture and further multiplied under screen house through Rapid Multiplication Technique (RMT).

Field Lay-out and Experiment. All trials in each location were laid out following the randomized complete block design with three replications. Plot size was 1 m x 5 m with 40 tubers per treatment. The recommended rate of inorganic fertilizer for potato (140 – 140 -1 40 kg N – P – K / ha) was applied as side dress and chicken manure at 5 t/ha as basal. Planting was done from 2007 to 2009. Potatoes for the dry season trial were planted from November and harvested Febuary while the wet season trials were planted May and harvested in the month of August. All other cultural management practices like weeding, hilling-up, spraying and irrigation were carried out following the farmers practice..

Processing of Potato Fries. Immediately after harvesting, the tubers were weighed and packed in fish net bags then transported to the processing site. At the processing site, the tubers were washed, peeled, and cut into 7 mm to 12 mm thick sticks (Macmillan, 2000). The sticks were soaked in cold water and pat dried using clean cotton cloth. The dried strips were par-fried for about 2 to 3 minutes in hot vegetable oil. The par-fried strips were packed and quickly frozen within 7 to 9 days. The frozen par-fried sticks were finally fried at about 2-3 minutes. Finally, the fried entries were immediately evaluated by the panelists.

Treatments. The treatments of the study involved two factors namely the location of production and eight potato entries. The potato entries were produced in Loo, Buguias; Bonglo, Atok; Sagpat, Kibungan. The potato entries which came from International Potato Center or Centro Internacional de la Papa (CIP) were 380214.17, 676070, 573275, cv Granola, and cv Ganza. The other potato entries used were 5.19.2.2, 2.21.6.2, and cv Igorota. These entries were selected locally in the Philippines. The monthly average temperature, relative humidity and sunshine duration throughout the study were monitored. Late blight and leafminer incidence were assessed and recorded at 30, 45, 60, and 75 DAP. Plant survival was noted 30 days after planting, plant vigor was observed at 30, 45 and 60 days after planting while canopy cover were measured and recorded at 30, 45, 60 and 75 days after planting using a wooden grid (wooden frame with a dimension of 120cm x 60cm equally divided into

100 squares). Four sample plants were placed at the middle randomly as point of reference in gathering the canopy data of the potato entries.

Tuber yield parameters were classified into marketable (tubers were classified according to sizes measured in terms of weight) and non-marketable (marble-sized, diseased, rat damaged and more than 10% greening were considered non-marketable). Sugar content in Brix was determined by extracting the juice of 20 g potato tubers on a digital refractometer (Atago pocket PAL-1 refractometer #3810-E06). Tuber characteristics were measured through its dry matter content taken by oven drying 50g of sliced potato tubers and computed using the formula:

% dry matter =1 00% - % moisture content

where, % moisture content = $\frac{\text{fresh weight –oven dry weight}}{\text{fresh weight}} \times 100$

Potato fry yield was determined by using the formula:

Potato fry yield = $\frac{\text{weight of unpeeled tubers - weight of sliced tubers}}{\text{weight of unpeeled tubers}} \times 100$

Potato fry color was evaluated using the color chart provided by Stark et. Al. (2001). The presence of fry sugar end was evaluated after final drying by using the following scale: 1-present and 2-absent. The presence of fry sugar end, this is the presence of browning at the end of the potato fries. Sensory evaluation of the fries was done by ten non-smoking panelists, aged 13 and above, evaluated the fries according to crispiness, taste, oil absorption, texture, browning and general acceptability.

The data per entry per locations were statistically analyzed using analysis of variance (ANOVA) for RCBD except for late blight and leaf miner counts. Data across location were analyzed using combined analysis over locations for RCBD (Gomez and Gomez, 1984). Least significant differences (LSD) were used to test significance among treatment means across location and season. The data for tuber characteristics and potato fries were analyzed using analysis of variance for the 3 x 8 factor-factorial in split plot design with three replications in all quantitative data. The significance of differences among treatment means was tested using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Temperature, Relative Humidity and Rainfall

The temperature, relative humidity and rainfall from the different locations were taken from July 2008 to September 2008 (Table 1). Potatoes grow best in temperatures ranging from 17 – 22 □ (HARRDEC, 1996). Loo, Bonglo and Sagpat are within these temperatures which maybe favorable for dry matter production. Relative humidity and rainfall is highest in Bonglo, Atok (95% and 6,733.33 ml respectively). Relative humidity and rainfall might influence the fry quality of the potato tubers by causing changes in the dry matter and sugar content of tubers.

Table 1. Meteorological data in the different locations.

	Low Elevation	Mid-Elevation		High Elevation
	Sagpat	Bonglo	Loo	Madaymen
Temperature (^{o}C)	18.0	18.0	18.0	13.0
Relative humidity (%)	85.0	95.0	77.0	95.0
Rainfall (ml)	1.26	4.55	0.80	11.92

Canopy Cover (%)

Canopy cover assessment at 60 days after planting (DAP) of the eight potato entries across locations showed that Entry 2.21.6.2 had the highest significant mean canopy cover which is comparable with check varieties Ganza and Igorota, with mean canopy of 64 and 63%, respectively (Table 2). Wide canopy of plants may mean high yield. Other entries had canopy covers ranging from 54 and 77% which is significantly higher than the check variety Granola (28%) and comparable with check variety Igorota (63%). Potatoes grown in Sagpat, Kibungan and Loo, Buguias had the highest canopy cover except for Granola (check) which had 98% canopy cover Sagpat, Kibungan and no canopy cover at Loo. Buguias. Low canopy cover of potatoes was observed at Bonglo, Atok however canopy cover of potatoes grown at Madaymen, Kibungan was much lower than that of Bonglo, Atok. The low canopy cover at Bonglo, Atok and Madaymen, Kibungan, Benguet was due to high late blight infection

Table 2. Canopy cover of eight potato entries across locations at 60 DAP grown from August to May, 2009.

Entry	Canopy (%)				
	Low Elevation	Mid-Elevation		High Elevation	
	Sagpat	Bonglo	Loo	Madaymen	Mean
2.21.6.2	100[a]	90[a]	100[a]	32	80[a]
676070	100[a]	67[abc]	100[a]	10	59[ab]
380241.17	100[a]	94[a]	100[a]	13	77[ab]
5.19.2.2	100[a]	97[a]	100[a]	3	75[ab]
573275	100[a]	55[bc]	100[a]	1	54[b]
Granola (check variety)	98[b]	3[d]	0[b]	15	28[c]
Ganza (check variety)	100[a]	75[ab]	100[a]	1	64[ab]
Igorota (check variety)	100[a]	45[bc]	100[a]	6	63[ab]
Mean	100	66[c]	100	8	62
CV (%)	0.54	24.77	0.23	24.31	21.52

Late Blight Incidence

At 60 DAP entries 2.21.6.2, 5.19.2.2 and 382041.17 were found to be resistant to late blight across locations. The late blight resistance of the entries as indicated by their high canopy cover might be attributed to their genetic characteristics. The rest of the entries were moderately resistant to late blight. The potato entries grown at Sagpat (low elevation) were highly resistant to late blight. On the other hand, the potato entries grown at Loo, Buguias and Bonglo, Atok, Benguet (mid-elevation) were moderately resistant while the check variety Granola was susceptible. The potato entries grown at Madaymen, Kibungan, Benguet (high elevation) were susceptible to highly susceptible except for entry 2.21.6.2 (Table 3). The susceptibility of the plants at Madaymen may be attributed to the high relative humidity of the area.

Total Yield (kg per $5m^2$)

Entry 380241.17 significantly outranked the other entries in almost all the locations except at Madaymen where the highest total yield per plot was recorded from entry 2.21.6.2 (Table 4). Entry 573275 had the lowest yield per plot comparable with the check varieties Granola and Igorota. The high yield on some of the entries might be attributed to their resistance to late blight and wide canopy. Based on yield and resistance to late blight, entries 380241.17, 2.21.6.2, 676070 and 5.19.2.2 are highly recommended for potato production under low, mid and high mountain zones during wet and dry season trials. These potato entries will be recommended to the National Seed Industry for official variety release.

Table 3. Late blight incidence at 60 DAP of eight potato entries across locations.

Entry	Late Blight Ratings				Mean
	Low Elevation	Mid-Elevation		High Elevation	
	Sagpat	Bonglo	Loo	Madaymen	
2.21.6.2	1	2	1	3	2
676070	1	3	3	7	4
380241.17	1	3	1	6	3
5.19.2.2	1	2	1	9	3
573275	1	3	2	8	4
Granola	1	7	8	9	6
Ganza	1	4	2	9	4
Igorota	1	4	2	7	4
Mean	1	4	3	7	

Late blight rating and description: 1 – highly resistant; 2 – resistant; 3-4 – moderately resistant; 5 – susceptible; 6 – 7 – moderately susceptible; 8 – 9 – highly susceptible (CIP rating scale).

Table 4. Total yield kg per $5m^2$ across locations.

Entry	Total Yield (kg per $5m^2$)				Mean
	Low Elevation	Mid-Elevation		High Elevation	
	Sagpat	Bonglo	Loo	Madaymen	
2.21.6.2	13.52^{bc}	11.38^{b}	14.37^{bc}	3.60^{a}	10.72^{bc}
676070	15.18^{abc}	8.88^{bc}	11.10^{cd}	1.49^{bc}	9.17^{b}
380241.17	17.83^{a}	19.20^{a}	19.75^{a}	2.20^{b}	14.75^{a}
5.19.2.2	13.47^{bc}	13.45^{b}	6.23^{e}	0.60^{cd}	8.48^{bc}
573275	11.30^{c}	7.57^{bc}	16.35^{ab}	0.83^{cd}	9.01^{b}
Granola (check variety)	15.77^{ab}	5.01^{c}	8.02^{de}	0.83^{cd}	7.24^{bc}
Ganza (check variety)	15.87^{ab}	8.33^{bc}	16.62^{ab}	0.02^{d}	10.21^{b}
Igorota (check variety)	6.02^{d}	4.95^{c}	8.65^{de}	1.31^{bc}	5.23^{c}
Mean	13.62	11.08	14.22	1.36	8.70
CV (%)	24.52	19.20	20.78	15.76	22.13

Computed Yield

Entry 380241.17 significantly out yielded the check varieties Granola, Ganza and Igorota (Table 5). The second highest yielder was noted from entry 2.21.6.2 significantly outyielding Igorota (check) and was comparable with the check varieties Granola and Ganza. The high yield of the two entries might be attributed to its resistance to late blight and wide canopy. It was observed that entries with wide canopy produce high yield. Potato entries grown at Loo, Buguias and Sagpat, Kibungan, Benguet produced the highest marketable yield which might indicate favorable conditions for potato production. As cited by Tad-awan et al. (2008), yield is usually attributed to soil quality, weather, and management in the farm. Thus, the environmental conditions in the farm coupled with the practices of the farmer may contribute to the high yield of potato in the two farms.

Dry matter content

Highly significant differences were observed on dry matter content of the tubers harvested from the different locations. Tubers harvested from Loo gave the highest dry matter (Table 6) which may be due to the low relative humidity and rainfall of the site. High rainfall or excessive water will result to low dry matter content in the potato tubers (Kellock, 1995). All the tubers harvested from the different locations are suitable for processing due to their high dry matter content.

Table 5. Computed yield (T ha^{-1}).

Entry	Yield (T ha^{-1})				
	Low Elevation	Mid-Elevation		High Elevation	Mean
	Sagpat	Bonglo	Loo	Madaymen	
2.21.6.2	25.57^{c}	21.33^{bc}	27.93^{bc}	7.19^{a}	20.51^{ab}
676070	28.02^{ab}	16.00^{cd}	22.47^{cd}	2.99^{bc}	17.37^{bc}
380241.17	33.90^{a}	34.07^{a}	39.30^{a}	4.41^{b}	27.92^{a}
5.19.2.2	19.43^{bcd}	21.87^{b}	12.37^{e}	1.19^{cd}	13.72^{bc}
573275	21.07^{bc}	12.63^{de}	32.37^{ab}	1.67^{cd}	16.94^{bc}
Granola	26.70^{ab}	8.58^{e}	14.97^{de}	1.67^{cd}	12.98^{bc}
Ganza	27.73^{ab}	13.67^{de}	32.57^{ab}	0.05^{d}	18.51^{bc}
Igorota	10.90^{d}	7.87^{e}	16.57^{de}	2.62^{bc}	9.49^{c}
Mean	22.92	17.00	24.81	2.72	17.18
CV (%)	24.92	19.84	20.78	2.99	27.05

The tuber dry matter content of the different entries ranged from 18 to 20% (Table 6). The highest dry matter content of 20% was obtained from 380214.17, 5.19.2.2, 573275, 2.21.6.2 and Igorota (check). All the entries may be used for fry processing since all had 18% and above dry matter content. Tubers with less than 18% dry matter are seldom used for frozen processing because of poor texture in processing (Mosley, 2005). The dry matter content of the different entries might be attributed to genetic characteristics specifically the maturity of the crops. Entries that mature early generally have higher dry matter content (Kellock, 1995). A highly significant interaction was observed between locations and entries on the tuber dry matter content. Entries 380214.17 and 573275 planted in Loo gained the highest tuber dry matter content . Dry matter content is affected by genetic characteristics but maybe influenced by water uptake, temperature, photoperiod and others (Rastovski et al., 1981). Thus, both entries and location must be considered in selecting potato entries for processing in terms of dry matter content.

Sugar content (^{o}Brix)

Highly significant differences were observed in the sugar content of the potato tubers harvested from the different locations (Table 7). Potato tubers harvested from Sagpat, Kibungan gave the highest sugar content while potato tubers from Bonglo, Atok gave the lowest sugar content. Sugar content is a varietal characteristic that may be influenced by environmental factors in a location (Peet, 2007). Thus, the different sugar contents exhibited by the entries might be attributed to the environmental conditions in each location.

The potato entries significantly differed in terms of tuber sugar content. The lowest sugar content was obtained from 380214.17 and 573275 but is not significantly different from the rest of the entries except Granola (check) and 676070. Sugar content of the tubers might be attributed to the growing season, cultivar, fertilizer practices, diseases and other management practices during the growing stage of the plants. Low tuber sugar content is preferred for processing since it usually results in light colored fries.

There was no interaction between the locations and entries. However, lowest sugar content was exhibited by 5.19.2.2 harvested in Bonglo, Atok, Benguet.

Table 6. Dry matter content (%) of potato entries harvested across locations.

Treatment	Percentage
Location (L)	
Loo	20[a]
Bonglo	19[b]
Sagpat	19[b]
Potato Entries (PE)	
380214.17	20[a]
5.19.2.2	20[a]
676070	19[b]
573275	20[a]
2.21.6.2	20[a]
Granola	18[c]
Ganza	19[b]
Igorota	20[a]
L x PE	**
CV (a) %	10.59
CV (b) %	15.09

Means followed by common letters are not significantly different at 5% level of DMRT.

Table 7. Sugar content of potato entries harvested across locations.

Treatment	Sugar Content
Location (L)	
Loo	3.7[b]
Bonglo	2.5[c]
Sagpat	4.4[a]
Potato Entries (PE)	
380214.17	3.2[b]
5.19.2.2	3.4[b]
676070	3.7[a]
573275	3.2[b]
2.21.6.2	4.1[b]
Granola	3.7[a]
Ganza	3.4[b]
Igorota	3.3[b]
L x PE	Ns
CV (a) %	15.71
CV (b) %	17.80

Means followed by common letters are not significantly different at 5% level of DMRT.

Potato fry yield

No significant differences are observed in the fry yield of potato tubers in each location (Table 8). Potato tubers harvested from Loo gave the highest fry yield. The tuber fry yield of the different entries was not significantly different from each other. However, the highest fry yield was obtained from 573275, 2.21.6.2 and Igorota (check). CIP 2.21.6.2 and Igorota may therefore be recommended for potato fry processing because of their high fry yield, high dry matter content and acceptability. No significant interaction exists between the locations and entries. The highest fry yield was observed in entries harvested from Loo, Buguias, Benguet.

Table 8. Fry yield of potato entries harvested across locations.

Treatment	Fry Yield (g)
Location (L)	
Loo	35
Bonglo	33
Sagpat	31
Potato Entries (PE)	
380214.17	33
5.19.2.2	28
676070	32
573275	35
2.21.6.2	35
Granola (check)	32
Ganza (check)	32
Igorota (check)	35
L x PE	Ns
CV (a) %	21.40
CV (b) %	35.60

Means followed by common letters are not significantly different at 5% level of DMRT.

Potato fry color

The color of the potato fries from each location showed no significant differences (Table 9). Potatoes harvested at Loo, Buguias and Sagpat, Kibungan, Benguet produced fries that were moderately light yellow in color. Significant differences were observed in the color of the fries processed from the different entries. Entry 5.19.2.2, 2.21.6.2 and Igorota (check) produced light yellow fries while Ganza (check) produced slightly yellow fries. The color of the potato fries maybe due to the low sugar content of the tubers. Low tuber sugar content results in light colored fries while high reducing sugar causes undesirable dark fry color (Mosley, 2005). A highly significant difference existed between the locations and entries. Potatoes from Sagpat, Kibungan, Benguet produced slightly dark fries as exhibited by Ganza (check) while potatoes from Bonglo, Atok, Benguet produced slightly yellow fries as exhibited by 2.21.6.2 (Table 9). Both entries and location are important factors in selecting potatoes with light yellow to yellow fries.

Sensory Evaluation

The potato fries that were produced from the tubers harvested from the different locations were moderately perceptible, moderately oily, and slightly firm (Table 10). Dry matter content influenced the crispiness, oiliness and texture of the potato fries produced. If the dry matter content is too low, the potato fry will be soft or too wet; however, if the dry matter content is too high, the potato fries will be too hard and dry. A relatively high dry matter content concentration results in a lower fat content (NIVAP, 2007). The tubers from the three locations produced potato fries which were liked moderately by the panelists. The fries that were produced from the tubers harvested in Bonglo were liked much by the panelist while the fries from the tubers harvested in Loo and Sagpat were moderately liked by the panelists.

The potato fries that were produced from the tubers of the different entries had moderately perceptible taste and were slightly brown. The sugar content of the tubers may affect the browning pattern and the taste of the entries. The sugar content of the entries ranging from 3.2-4.1^{0}Brix all produced slightly brown fries with moderately perceptible taste. Entries 573275, 2.21.2.2 and Igorota (check) produced slightly crispy fries while the other entries produced moderately crispy fries. The crispiness maybe affected by tuber dry matter and time of final frying (Sanz et.al., 2007). The fries

produced were moderately oily except fries processed from entries 5.19.2.2 and 676070 which were slightly oily. Varieties with high dry matter content concentration result in low fat content (NIVAP, 2007). Fries of variety Igorota (check) were moderately firm while the other entries produced slightly firm fries. Tubers with low tuber dry matter are seldom used for fry processing because of poor texture (Mosley, 2005). The entries produced fries which were liked moderately by the panelists. However, fries from entries 2.21.6.2 and Igorota (check) were liked much by the panelist. The acceptability of the fries may be influenced by the sugar content of the tubers and color of the fries.

Table 9. Fry color of potato entries harvested across locations.

Treatment	Fry Color
Location (L)	
Loo	3
Bonglo	2
Sagpat	3
Potato Entries (PE)	
380214.17	3[b]
5.19.2.2	2[c]
676070	3[b]
573275	3[b]
2.21.6.2	2[c]
Granola	3[b]
Ganza	4[a]
Igorota	2[c]
L x PE	**
CV (a) %	19.12
CV (b) %	20.19

Means followed by common letters are not significantly different at 5% level of DMRT.

Table 10. Sensory evaluation of the potato fries harvested across locations grown from May to August, 2009

Locations	Crispiness[1]	Taste[2]	Oiliness[3]	Texture[4]	Browning[5]	General Acceptability
Loo	3	3	3	3	4	3
Bonglo	3	3	3	3	4	2
Sagpat	3	3	3	3	4	3
Entries						
380214.17	3	3	3	3	4	3
5.19.2.2	3	3	2	3	4	3
676070	3	3	2	3	4	3
573275	4	3	3	3	4	3
2.21.6.2	4	3	3	3	4	2
Granola	3	3	3	3	4	3
Ganza	4	3	3	3	4	3
Igorota	3	3	3	3	4	2

[1]1-very crispy, 2-crispy, 3-moderately crispy, 4-slightly crispy, 5- not crispy

[2]1-very perceptible, 2-perceptible, 3-moderately perceptible, 4-slightly perceptible, 5-not perceptible

[3]1-not oily, 2-slightly oily, 3-moderately oily, 4-oily, 5-very oily

[4]1- firm, 2-moderately firm, 3-slightly firm, 4- not firm

[5] 1-severe browning, 2- moderately browning, 3-light browning, 4-no browning

[6]1-like very much, 2-like much, 3-like moderately, 4-like slightly, 5-dislike or not like

CONCLUSION

Entries 380241.17, 5.19.2.2, 573275, 2.21.6.2 and Igorota had the highest dry matter content which resulted in high fry yield. Highest sugar content which was exhibited by 2.21.6.2, Granola, 380241.17 and 573275 resulted in sugar end on fries. All the entries were rated acceptable in taste tests conducted.

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