

Determination of quality of native cultivars of yellow potato (*Solanum phureja* Juz et Buck) in northern Peru

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Abstract

In the countryside of Llama, department of Cajamarca, located at 6°22.280' of Latitude South, at 78°51.709' of West Longitude and at an altitude of 2900 masl, the research work was carried out "Determination of quality of native potato cultivars (Solanum phureja Juz et Buck) in northern Peru, "18 native cultivars of the yellow diploid series, Solanum phureja Juz et Buck, are selected for their scientific, biological and nutritional value. These are cultivated and preserved in areas very localized by small farmers in the high Andean areas, at an altitude of 2000 to 3000 masl, besides being the basis of their food, they are consumed in the form of mashed potatoes, spicy potatoes with guinea pig, green broth and other traditional dishes. The design of Complete Blocks Random (BCA), with 18 treatments and three replicates, was used to determine the plant height, number of tubers per plant, yield, specific gravity, dry matter and color of frying, for comparison of Native cultivars of their different characteristics studied, in addition was used the test of significance of Tukey to the level of 0.05 of probabilities. Cultivation Cutervina-Cu de Cutervo yellow yielded 39,410 t/ha with 62.56% of commercial tubers, 36.74 tubers/plant, with 21.97% of dry matter and 2.5 frying color and the cultivar Amarilla Espolonuda with 33,082 t/ha, 63.25% of commercial tubers, 37.84 tubers / plant, 23.10% dry matter had 2.0 frying color, both skin and yellow pulp, slightly oval tubers, surface eyes, meet characteristics required by the processing industry. The cultivar Tortolita of round shape, cream skin and cream pulp with 32.217 t/ha and 62.24 tub/plant, 22.93% of dry matter and 1.5 of color of frying, has very significant characteristics for processing and progenitor; The cultivar Chanchilomita-Ba of round shape, red skin and yellow pulp, had 26,022 t/ha, 25.85 tub/plant, 28.70% of dry matter and 1.5 of frying color is the one with the highest percentage of total solids, presenting the Higher values of dry matter, whose characteristics are for the processing industry and parent.

Keywords: Native Cultivation, Diploid, Quality

Introduction

In northern Peru, native potatoes with diploid pulp $2n = 2X = 24$, species (*Solanum phureja* Juz et Buck), have a great scientific, biological and nutritional value, are cultivated and preserved in areas very localized by Small farmers of high Andean areas, at an altitude of 2000 to 3500 masl, besides being the basis of their food, are consumed in the form of mashed potatoes, spicy potato with guinea pig, green broth and other traditional dishes; Peru is the center with the greatest diversity of native potatoes, more than 2 800 cultivars of the 3 900 in the world (Bonierbale, 2004, Amorós *et al.*, 2008). Native potatoes not only have a high diversity of colorful shapes and colors, but also provide important amounts of nutrients and polyfunctional compounds, which beneficially affect one or more functions of the organism, beyond a proper nutritional effect (Villacrés *et al.*, 2007). Also, native potatoes have different colors of skin and pulp, many of them are yellow and may also have purple, red, blue, black, white, cream and bicolor. Yellow pulp cultivars have a high content of vitamin C and natural antioxidant, antibacterial, antiviral, anti-inflammatory, anti-cancer properties that have potential health benefits and red or purple pigmented pulp cultivars contain anthocyanins and flavonoids, substances with antioxidant effects And anticancer agents (Smith, 1975; Landrum *et al.*, 2001; CIP 2003; Pascual *et al.*, 2008). Among the antioxidants we have three large groups of compounds: vitamins, polyphenolic compounds and carotenoids. Pigments of pigmented pulp rich in polyphenolic compounds (Anthocyanins, Phenols, Flava-3-oles and Capac Antioxidant) with antioxidant properties beneficial to health; These polyphenolic compounds are regulated at the transcriptional level (Koes *et al.*, 2005) are correlated with metabolite levels, to co-regulate with structural genes (André *et al.*, 2009).

The quality of this species of potato, for purposes of industrial processing in the form of strips and flakes, and other types of processed, requires other characteristics that are not required for fresh consumption, such as depth of eyes, color of the Skin and pulp, shape, size, dry matter content and reducing sugars, which can be determined with a rigorous selection of the genetic stability of these ecotypes. This work constitutes a great contribution in the knowledge of the best native cultivars in performance, phonological characteristics, quality for commercial and industrial purposes, identification and selection of parents, being the objectives, the evaluation of the performance, determination of the specific gravity, color of Frying and agronomic characteristics of 18 native cultivars of yellow pulp diploid potatoes.

Materials and methods

The present research work was carried out in the Llama District of Chota province of the Cajamarca region, geographically located at 6°22.280' South Latitude, at 78°51.709' West Longitude and at an altitude of 2 914 masl.

Materials

We evaluated 18 treatments consisting of native cultivars of yellow potato that were collected from the northern mountain range of Peru, as follows:

Table 1. Diploid native cultivars (*Solanum phureja* Juz et Buck), from northern Peru.

Native Cultivars	Skin color	Pulp color
1. Amarilla Lanchina-Cu. 301C	Yellow	Yellow
2. Amarilla Espolonuda-Cu. 301D	Yellow	Yellow
3. Cutervina Ojo Rojo-Cu. 302	Yellow	Yellow
4. Chaucha Redonda-Cu 307	Red	Yellow
5. Cutervina Larga-Cu. 308	Yellow	Yellow
6. Amarilla Cutervina-Cu. 309	Yellow	Yellow
7. Amarilla Larga-Cu.311	Yellow	Yellow
8. Chaucha Colorada-Cu. 313	Guinda	Yellow
9. Tortolita-Ch. P-01	Violet eyes cream	Cream
10. Amarilla Peruanita-Ba.102	Yellow	Yellow
11. Chaucha Potocha-Ch. 103	Yellow with violet	Yellow
12. Chaucha Peruanita.Ba. 104	Yellow	Yellow
13. Chanchilomita- Ba. 105	Red	Yellow
14. Amarilla Llaucana-Hu. 101	Yellow	Yellow
15. Perlamayina-Hu. 102	Yellow	Yellow
16. Amarilla Tambina-Hu.103	Yellow	Yellow
17. Amarilla Redonda-Ca. 101	Yellow	Yellow
18. Chaucha Negra-Ca. 302	Black	Cream And violet jasper

Source: Made by myself

Where: Cu = Cutervo, Ch = Chota, Ba = Bambamarca, Hu = Hualgayoc, Ca = Cajamarca.

Harvest

Observations during the experiment

Plant height

This evaluation was performed at 30 and 60 dds, measuring from the soil surface to the apex of the plant; And at the time of harvest the length of the main stem was measured from the neck of the plant to the apex.

Observations during the harvest of the experiment

This characteristic was realized at the moment of the harvest counting the number of main stems of each one of the plants of the treatments.

Total yield of tubers

The tubers of each of the plants harvested from the treatments were weighed, then converted to t/ha.

Yield of commercial tubers per plant

To determine this characteristic was related by its diameter of tubers, which were more than 3 cm and then the weight was adjusted to t/ha.

Total number of tubers per plant

All tubers were counted from each of the treatment plants.

Observations during the laboratory phase

The determination of the characteristics of this phase was carried out in the Laboratory of the Genetic Improvement Department of the International Potato Center (CIP) Lima.

Determination of dry matter of tubers

For this, 200 to 205g fresh tubers per treatment, placed in a stove for 72 hours (3days) at a temperature of 80°C, then re-weigh and determine the percentage of dry matter.

Determination of the color of frying

They were cut into flakes, placed in a metal basket to boil with hot oil; at a temperature of 180°C, for 2.5 minutes. The color of potato chips, on the subjective scale of colors, was assigned to the International Potato Center.

Statistic analysis

In the present work the design of Complete Blocks Random (BCA) was used, with 18 treatments and three repetitions. For the comparison of the native cultivars of their different characteristics studied, Tukey's significance test was used at the 0.05 level of probabilities. For the study of association and dependence of the different vegetative characteristics with the commercial yield the study of the regressions and correlations was done.

Results and discussion

For the total yield of tubers was found high statistical significance for treatments, the cultivar Amarilla Cutervina-Cu Cutervo skin and yellow pulp had a yield of 39,410 t/ha with 62.56% of commercial tubers, 36.74 tub./plant, with 21.97% Dry matter and 2.5 color of fry; The cultivar Amarilla Espolonuda of skin and yellow pulp with 33.082 t/ha with 63.25% of commercial tubers, 37.84 tub./plant, 23.10% of dry matter had 2.0 color of frying, both cultivars of slightly oval form and superficial eyes considered apt for prosecution. The cultivar Tortolita cream skin and cream pulp with 32,217 t/ha and 62.24 tub./plant, 22.93% dry matter and 1.5 color of frying; The cultivar Chanchilomita-Ba red skin and yellow pulp had 26,022 t/ha, 25.85 tub./plant, 28.70% dry matter and 1.5 color frying, which are very significant characteristics for the processing industry and as a parent.

Table 2. Tukey significance tests (0.05) for yield, number of tubers, plant height, dry matter, fry color, in the quality determination of 18 native cultivars of yellow potato (*Solanum phureja* Juz et Buck) in the North of Peru.

Ecotypes	Yield	Yield Comm.		N° tub/plant	Plant height	Dry matter	Fry color
	(kg/plta)	Kg/pta	%				
Amarilla Cutervina - Cu	39.410 a	24.655	62.56	36.74 abc	1.33 ab	21.97 hi	2.5
Cutervina Larga - Cu	38.275 ab	26.490	69.21	42.64 abc	1.30 bc	24.00 defgh	3
Chaucha Potocha - Ba	35.710 ab	23.876	66.86	52.76 ab	1.03 gh	22.03 ghi	4.5
Perlamayina - Hu	34.925 ab	24.643	70.56	42.31 abc	1.10 f	20.73 i	3.5
Amarilla Espolonuda -Cu	33.082 ab	20.924	63.25	37.84 abc	1.23 cd	23.10 efgh	2
Amarilla Lanchina - Cu	32.947 ab	20.510	62.25	38.16 abc	1.13 f	23.50 defgh	3
Tortolita - Ch	32.217 ab	11.614	36.05	62.24 a	1.00 h	22.93 fgh	1.5
Cutervina Ojo Rojo - Cu	30.902 ab	20.392	65.99	52.76 abc	0.98 h	25.17 cde	3
Chaucha Negra - Ca	30.150 ab	18.789	62.32	28.29 bc	1.37 a	21.93 hi	1.5
Amarilla Redonda - Ca	30.015 ab	20.113	67.01	41.63 abc	1.02 gh	24.40 c	3.5
Amarilla Larga - Cu	28.423 ab	19.396	68.24	34.74 bc	0.97 h	23.20 defgh	2
Amarilla Tambina - Hu	28.204 ab	18.313	64.93	37.44 abc	1.20 de	24.80 cdef	2.5
Amarilla Peruanita - Ba	27.816 ab	19.196	69.01	40.52 abc	1.02 gh	24.07 defg	2.5
Chaucha Colorada - Ba	26.659 ab	17.515	65.70	32.90 bc	1.19 de	29.67 a	2.5
Chanchilomita - Ba	26.022 ab	16.948	65.13	25.85 c	1.11 f	28.70 ab	1.5
Amarilla Llaucana - Hu	25.605 ab	16.600	64.83	40.72 abc	1.21 d	26.70 bc	3
Chaucha Redonda - Cu	20.505 ab	13.884	67.71	20.43 c	1.24 cd	26.43 c	2
Chaucha Pintada - Ba	17.417 b	11.655	66.92	23.82 c	1.09 fg	25.27 cd	4
	X=32.825			X= 38.034	X=113.912	X =24.478	
	DLS0.05=			DLS 0.05 =	DLS 0.05 =	DLS 0.05 =	
	21.220			25.620	7.087	2.083	
				CV.=7.54%	CV.=2.01%		

Source: Made by myself

Where: Cu = Cutervo, Ch = Chota, Ba = Bambamarca, Hu = Hualgayoc, Ca = Cajamarca.

* Significant; ** Highly Significant; N.: Not significant

1 The means with a common letter are not significantly different ($p \leq 0.05$) according to the Tukey test
Subjective color scale of frit from the International Potato Center:

1 = creamy yellow, 2 = creamy yellow with low presence of dark spots, 3 = creamy yellow with regular presence of dark spots, 4 = creamy yellow with high presence of dark spots, 5 = totally dark.

Graph 1. Yield (kg/plant), dry matter (%), fry color (CIP Color Scale) of native yellow potato cultivars (*Solanum phureja* Juz et Buck) in northern Peru.

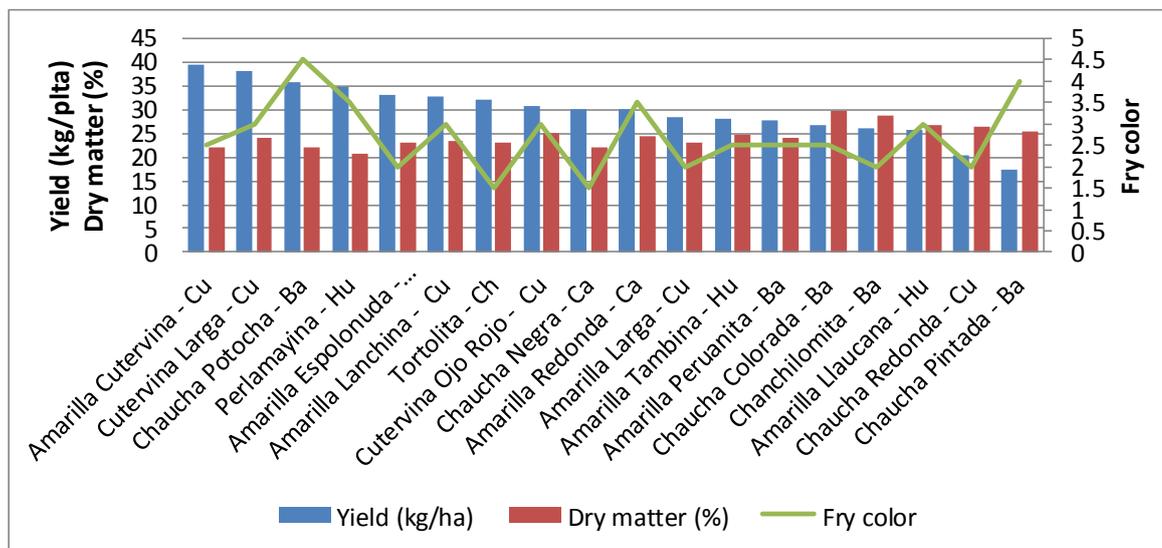


Figure 1. Photo of tubers and chips of native cultivars: Yellow Cutervina (Cu 309), Yellow Spolonuda (Cu 301D), Tortolite (Ch-P-01), Chanchilomite (Ba 105).



Conclusion

Cultivation Cutervina-Cu de Cutervo showed the highest yield reaching 39,410 t/ha with 62.56% of commercial tubers, 36.74 tub/plant, with 21.97% of dry matter and 2.5 of frying color, followed by cultivar Amarilla Espolonuda with 33.082 t/ha with 63.25% of commercial tubers, 37.84 tub/plant, 23.10% dry matter had 2.0 frying color, both skin and yellow pulp, with slightly superficial eyes, shaped slightly oval tubers, gather Characteristics required by the processing industry. As well as the cultivar Tortolita of round form, cream skin and cream pulp with 32.217 t/ha and 62.24 tub/plant, 22.93% of dry matter and 1.5 of color of frying, very significant characters of this cultivar for processing and progenitor; The cultivar Chanchilomita-Ba of round shape, red skin and yellow pulp, had 26,022 t/ha, 25.85 tub./plant, 28.70% of dry matter and 1.5 of frying color is the one with the highest percentage of total solids, presenting the Higher values of dry matter, whose characteristics are for the processing industry and parent.

References

- Amorós W., Bonierbale, M. & Manrique K. 2008. Mejoramiento genético de la papa para uso gourmet. Centro Internacional de la Papa CIP. (Lima).
- Bonierbale M., Amorós W. & Espinoza J. 2004. Estrategias y desafíos para el mejoramiento de papa para procesamiento. Agricultura & Agri-Food, New Brunswick- Canada, Centro Internacional de la Papa (Lima), 12p.
- Centro Internacional de la Papa. 2003. Hojuelas de papa de colores. Conservando la biodiversidad ancestral con nuevas formas de consumo. Lima, CIP Perú. 2p.
- Koes R., Verweij W. & Quattrocchio F. 2005. Flavonoids: a colorful model for the regulation and evolution of biochemical pathways. *Trends Plant Sci* 10:236-242.
- Landrum J. & Bone R. 2001. Lutein, zeaxanthin and macular pigment. *Archives of Biochemistry and Biophysics*. 385: 28-40.
- Pascual T. & Sanchez B. 2008. Anthocyanins: from plant to health. *Phytochem* 7: 281-299.
- Smith O. 1975. Potato Chips. In *Potato Processing*. Eds. W.F. Talburt O. Smith. Westport, CT, The Avi Publishing Company, Inc., 305-402.
- Villacrés E., Monteros C., Reinoso I. & Quilca N. 2007. El aporte de la papa nativa a la nutrición, la alimentación, salud y seguridad alimentaria de la población ecuatoriana. Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP).