Evolution of the potato (*Solanum tuberosum* L.) market in Argentina

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Abstract

Potato is the main horticultural crop commercialised in Argentina; along with just a handful of other vegetables, namely tomato, onion, squash and carrot, it represents 70% of total vegetable commercialisation and consumption in the country. The aim of the current work is to analyze the evolution of the potato market in Argentina, based upon the volume received by the Buenos Aires Central Market. For this end, the following aspects were assessed for the period 1999-2016: the percent variation in the incoming volume and the tendency of the total incoming volumes (TV); and, in 2016, the volume per month and per cultivar (VM and VC), province of origin and average price evolution over the year (EP). From the comparative analysis between the early years and the end of the study, an increase of 19% was observed, mainly in the months of May (20%), February (13%), January (12%), October (10%), April (7%) and July (6%). The mean TV commercialised over 1999 to 2016 was 333,254 t, with a mean VM of 27,774 t month^{-1}. The following months exceeded this mean: November (29509a), August (29235a), October (29200a), July (28997ab), June (28553ab), December (28117ab) and May (27970ab); while in 2016, the mean VM was 27772, where the following exceeded the mean: October: 32789a, May: 30286ab and August: 28715ab. Potatoes are grown in 12 provinces: Buenos Aires (75.86%), Córdoba (12.07%), Tucumán (7%), San Luis (2.02%), Mendoza (1.97%), Jujuy (0.55%) and Santa Fe (0.34%), with the remaining 2% in San Juan, Rio Negro, Catamarca, Corrientes and Santa Cruz. The cultivars under commercialisation are: 'Spunta' (95%), 'Innovator' (0.27%), 'Daisy' (0.15%), 'Asterix' (0.10%), 'Kennebec' (0.034%), 'Atlantic' (0.022%), 'Ballenera' (0.06%) and unidentified (3.92%). For EP, the average monthly price was 0.27 US$ kg^{-1}, and higher than average prices were observed in July 0.35, September 0.34, June 0.322, August 0.31, October 0.29 and December 0.28 US$ kg^{-1}, respectively. These results indicate an annual increase of 1%, and the need to expand the production and consumption of cultivars of higher nutritional quality and increase the production in those provinces that, although possessing favorable agroclimatic conditions, show low market participation.

Keywords: provinces, cultivars, prices, commercial volumes

INTRODUCTION

Potato is globally the most important horticultural crop and the most consumed in Argentina. It is on the market through every month of the year, being produced in diverse Argentinean provinces and in many cases stored for various months (Castagnino et al., 2009).

Potato (*Solanum tuberosum*) comprises one of the greatest contributions of the American continent to humanity, given that its origin is located on the high plane of the Peruvian Andes. It is estimated that it has been grown by the inhabitants of this region for more than 8,000 years and introduced to Europe by the conquerors in the mid-16th century, from where it began to expand throughout the world. Its consumption has been constantly increasing to become one of the world's principal foods.

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With a consumption of 60 kg capita^{-1} year^{-1}, potato is the main horticultural crop commercialised in Argentina; it, and just a handful of other vegetables, namely tomato, onion, squash and carrot, represent 70% of total vegetable commercialisation and consumption in the country.

It is currently the fourth food crop in order of importance, after wheat, rice and maize, and together with these cereals is of huge relevance in the world's diet. It is found among the ten most important foods produced in developing countries (Martín Martín and Jerez Mompie, 2017).

The world potato sector is going through enormous changes. Until the beginning of the 1990s, almost all potatoes were produced and consumed in Europe, North America and the countries of the ex-USSR. Since then, there has been a dramatic increase in production and demand in Asia, Africa and Latin America, where, according to the United Nations Food and Agriculture Organisation (FAO), production has increased from less than 30 million t at the beginning of the 1960s to more than 165 million t in 2007 (FAO, 2008). Globally, nearly 20 million ha are sown, with a mean annual yield of 20 t ha^{-1}. In 2014, world production was 385 million t.

The potato grown in the main producing regions of Argentina belong to the species *Solanum tuberosum* ssp. *tuberosum* (L.), given that this can produce tubers with longer photoperiods. Additionally, in the Andes region, the species *S. tuberosum* ssp. *andigena* ("papas andinas" or "papas criollas") and *S. phureja* are grown, among others.

It concerns a horticultural crop principally orientated to covering the internal market, in both fresh form and that arising from Category III. Exportations are sporadic and respond to occasional demands from neighboring countries when these suffer climatic problems. According to Larocca (2014), total annual export is from 0.3 to 1.5% of total annual production. In particular, Brazil has been known to receive 74% of the total annual volume exported, with the rest distributed between the remaining neighboring countries (Larocca, 2014).

This situation indicates the need for research and technology organisms to propitiate an increased diversity in the vegetable diet in general, and, in the specific case of potato, the need for more detailed study of the varietal diversity available, in order to promote the consumption of those cultivars possessing higher culinary and functional quality. The aim of the current work is to analyze the commercial situation of the potato market in Argentina, based upon the volume received by the Buenos Aires Central Market (Mercado Central de Buenos Aires), the country's principal point of reference, where 17% of national production is commercialised.

The main producing countries are China, Russia and India, plus those of highest technological development, such as the USA, Canada and the European Union. In Latin America, Argentina stands out for its high yields per unit area (35 t ha^{-1} on average), "seed" quality and the percentage of production destined for industrial processing (around 25%) (Huarte, 2014).

The first commercial cultivars in Argentina were established toward the end of the 19th century, in the horticultural región 7 (Litoral) in the Province of Santa Fé on the outskirts of the city of Rosario. Currently around 80,000 to 85,000 ha are under cultivation, and production is classified according to its arrival at the market (Huarte, 2014):

- I) Early production (in the provinces of Tucumán, Salta, Jujuy, Corrientes and Misiones) that presents elevated risk of frost and high temperatures at harvest, which interferes with field storage;
- II) Semi-early production (Buenos Aires, Córdoba, Mendoza, Santa Fe, and Tucumán), generally carried out in the same lots as later production; together with the latter, this comprises the so-called "white potato", denomination derived from the color the tuber skin takes when it forms in sandy soils;
- III) Semi-late production (Buenos Aires, Mendoza, Río Negro, Chubut), obtained in the main potato production zone, principally in the south-east of the Province of Buenos Aires corresponding to the zone of highest yield in the country, where yields of up to 50 t ha^{-1} can be obtained. Here the production comprises "black

potato" due to the coloration of the skin taken in soils with high organic matter;

- IV) Late production (Córdoba, Mendoza, Santa Fe) that together with semi-early meets the requirements of the internal market throughout almost the entire year.

Potato breeding has been an important activity for institutions such as INTA (Instituto Nacional de Tecnología Agropecuaria - National Institute of Agricultural Technology) since the 1940s, and new cultivars are continually being produced for the national market, such as 'Newen-INTA' released in 2010. Furthermore, Argentinean researchers (Martín Carboni, Juan Martín D'Ambrosio and Sergio Feingold, of the Agro-biotechnological Laboratory of the Experimental Station in Balcarce) participated in the Potato Genome Sequencing Consortium, an international research group involving 14 countries that obtained and analyzed the genome sequence, permitting advances in improvements in productivity, quality, nutritional value and resistance to different pathogens.

This situation indicates the need for research and technology organisms to propitiate an increased diversity in the vegetable diet in general, and, in the specific case of potato, the need for more detailed study of the varietal diversity available, in order to promote the consumption of those cultivars possessing higher culinary and functional quality.

MATERIALS AND METHODS

The aim of the current work was to analyze the commercial situation of the potato market in Argentina, based upon the volume received by the Buenos Aires Central Market (Mercado Central de Buenos Aires, MCBA), the country's principal point of reference, where 17% of national production is commercialised.

Data were processed by analysis of variance, based upon information obtained from the producers' Fruti-horticulture Guides.

For this end, the following aspects were assessed for the period 1999-2016: the percent variation in the incoming volume and the tendency of the total incoming volumes (TV); and, in 2016, the volume per month and per cultivar (VM and VC), province of origin and average price evolution over the year (EP).

RESULTS

Potato was commercialised in the internal Argentinean market throughout the 12 months of the year, originating from 12 provinces with a mean monthly production of nearly 28,000 t, with details given below.

Total commercialised volume

From the comparative analysis between the early years and the end of the study, an increase of 19% was observed, mainly in the months of May (20%), February (13%), January (12%), October (10%), April (7%) and July (6%).

The months of least commercialisation and consumption were January and February (b), while the highest consumption was observed in October (a) (Figure 1).

The mean TV commercialised over 1999 to 2016 was 333254 t, with a mean VM of 27774 t month^{-1}. The following months exceeded this mean: November (29509^{a}), August (29235^{a}), October (29200^{a}), July (28997^{ab}), June (28553^{ab}), December (28117^{ab}) and May (27970^{ab}); while in 2016, the mean VM was 27772, where the following exceeded the mean: October: 32789^{a}, May: 30286^{ab} and August: 28715^{ab}.

Regarding the tendency over 1999-2016, the period 2004-2006 stood out from the rest (Figure 2).

Average monthly price

The average monthly price was 0.27 US$ kg^{-1}, and higher than average prices were observed in July 0.35, September 0.34, June 0.322, August 0.31, October 0.29 and December 0.28 US$ kg^{-1}, coinciding with the final month of autumn, winter and spring (Figure 3).

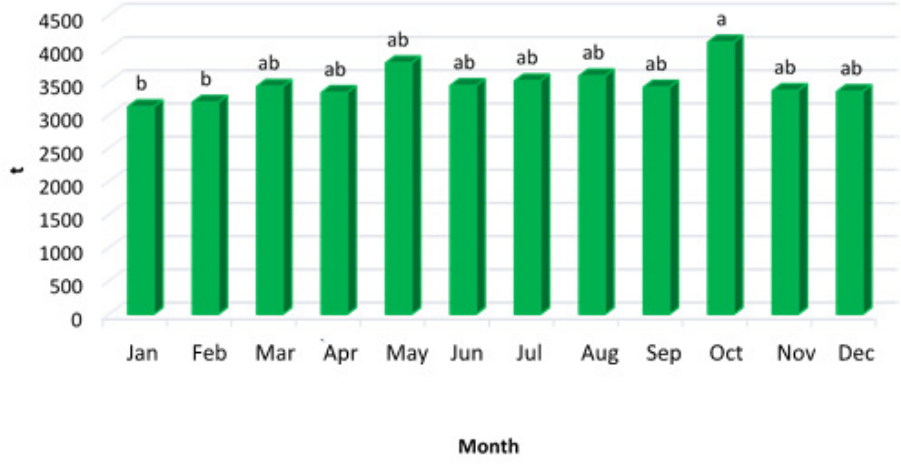

Figure 1. Evolution of mean potato commercialisation in the principal concentrating market (MCBA) throughout the year for the period 1999-2016.

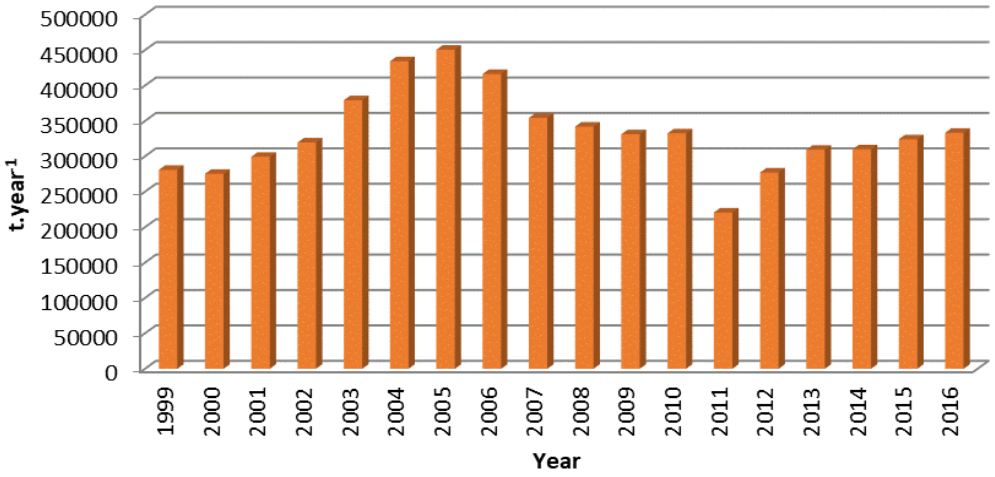

Figure 2. Tendency in the annual potato commercialisation in the principal concentrating Argentinean market (MCBA) over the period 1999-2016.

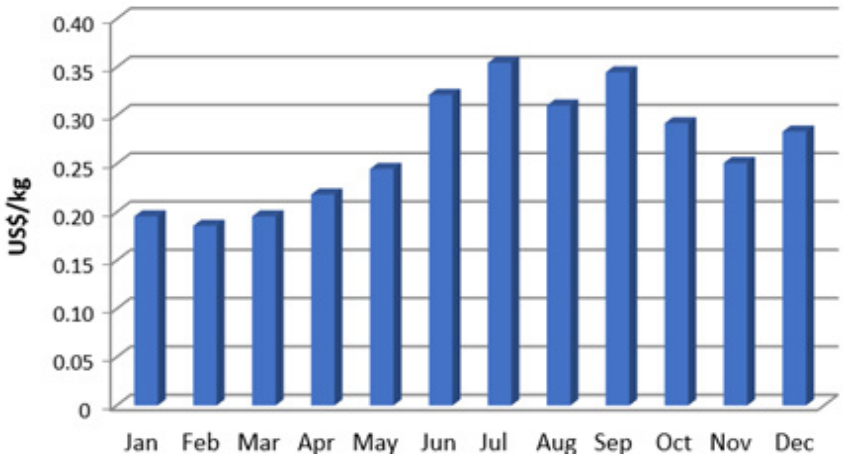

Figure 3. Evolution of potato price in the principal concentrating market (MCBA) throughout 2016.

Price seasonality was considerable, coinciding with Larocca (2014), who mentioned that the seasonality continues to be important in spite of the stabilizing effect of the industry (Figure 4).

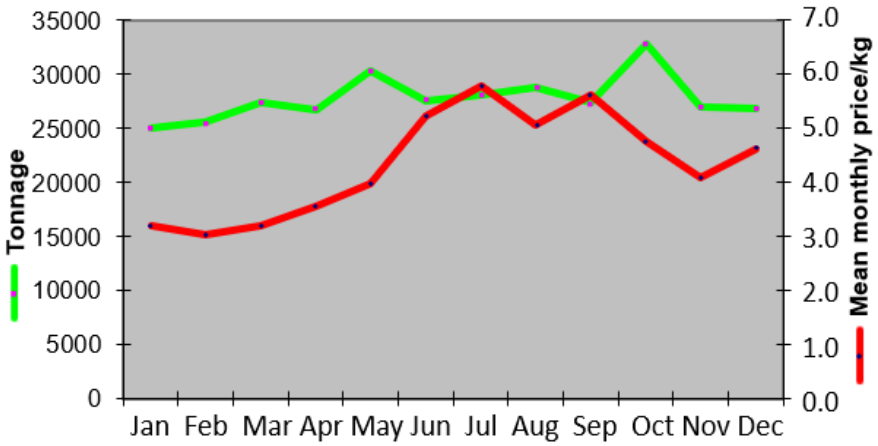

Figure 4. Relative stability in volume per month juxtaposed with price evolution over 2016.

According to Larocca (2014), not only are price variations observed through the year, but also between regions, the prices being highest in potato from Córdoba and Mendoza compared to that from the south-east of the Province of Buenos Aires.

Distribution of national production

Potatoes are grown in 12 provinces, with by far the most being produced in the Province of Buenos Aires with 252830 t annually (75.86%), followed by Córdoba (12.07%), Tucumán (7%), San Luis (2.02%), Mendoza (1.97%), Jujuy (0.55%) and Santa Fe (0.34%), with the remaining 2% in San Juan, Rio Negro, Catamarca, Corrientes and Santa Cruz (Figures 5 and 6).

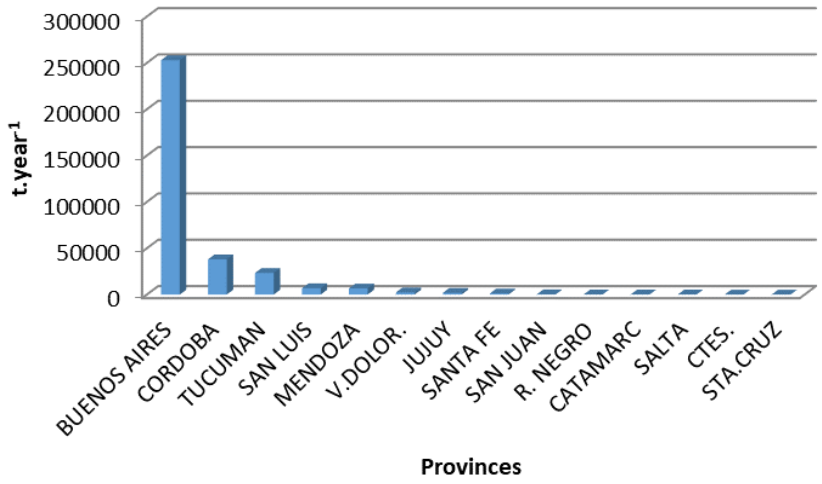

Figure 5. Potato production in 2016 in the distinct producing provinces.

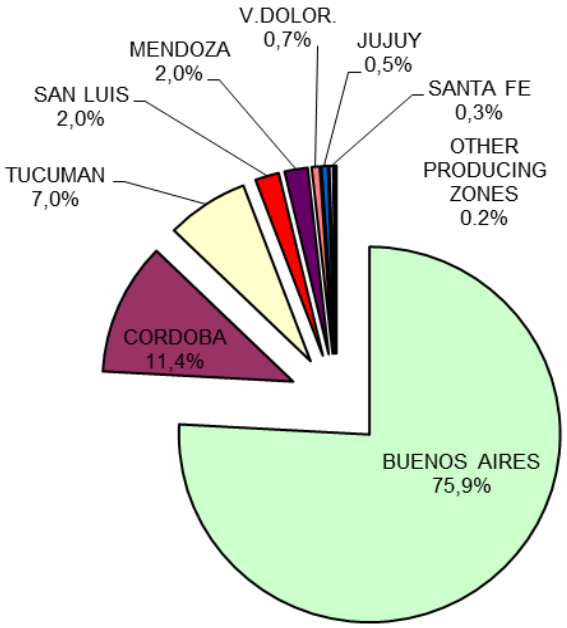

Figure 6. Percentage distribution of total potato production commercialised in 2016 in the principal concentrating Argentinean market (MCBA).

Varietal panorama

The most widely grown potato cultivar in Argentina is 'Spunta' (95%) from The Netherlands, which has an intermediate maturation period and is characterized as giving elongated smooth-skinned tubers of pale yellow flesh that, although giving high yield, possesses low dry matter and is very susceptible to disease (Castagnino et al., 2009).

The remaining cultivars under commercialisation are:

- 'Innovator' (0.27%), from The Netherlands, that gives large elongated and oblong tubers with rough white-yellow skin, cream-colored flesh, shallow well-distributed eyes, of high tuber size and yield;
- 'Daisy' (0.15%), characterized as giving good dry matter content, yellow flesh and an oval elongated form;
- 'Asterix' (0.10%) from Holland, of good dry matter content and conservation quality, with oval elongated red-skinned tubers of yellow flesh and shallow eyes, giving high yields, semi-late maturity and moderate resistance to mechanical damaging and to *Phytophthora infestans*;
- 'Kennebec' (0.034%) from North-America, possessing oval rounded tubers with white flesh, white smooth skin, and shallow and scarce eyes. It is of good culinary quality and used for various purposes (sticks, dehydrated mash and slices) (Castagnino et al., 2009);
- 'Atlantic' (0.022%) from the USA (1978), whose characteristics are high dry matter, very good agro-industrial properties for the elaboration of chips, low storage capacity, with rounded tubers, white flesh, good calibre, intermediate yield, early maturity and medium resistance to common scab.
- 'Ballenera' with a minimal proportion (0.06%), followed by unidentified cultivars (3.92%).

For industrial purposes, cultivars are permanently introduced and evaluated, basically with rounded medium or large tubers (Huarte and Capezio, 2015). Among national cultivars with specific end uses, the following are noteworthy: 'Frital-INTA' for "papine" production, smooth skin and cream-colored flesh; 'Pampeana-INTA' (rounded white-fleshed tubers) for dehydrated mash elaboration due to its high dry matter content; and 'Calén-INTA', with elongated tubers, being similar to 'Spunta', but of better sanitary performance and culinary

quality, among other properties (Huarte and Capezio, 2015).

Some cultivars of INTA have shown outstanding performance in other countries, such as 'Achirana-INTA' and 'Serrana-INTA' (Huarte and Capezio, 2015), and some foreign cultivars of red skin that have occupied certain niches in the fresh Argentinean market are 'Chieftain', 'Asterix', 'Cherie' and, in the past, 'Red Pontiac' (Huarte and Capezio, 2015).

Currently, new tendencies are being observed in the Argentinean market and healthier, more nutritional, product categories are being disseminated, such as baked potatoes (of Category II), which are being accepted by consumers concerned for a healthy and natural diet (Castagnino et al., 2009).

CONCLUSIONS

These results indicate the need to expand the production and consumption of cultivars of higher nutritional quality and increase the production in those provinces that, although possessing favorable agro-climatic conditions, show low market participation.

The Argentinean potato sector needs to meet the challenge of optimising its competitively for both the fresh market and the agro-industry, while at the same time optimising its position in external markets. Furthermore, it is essential for public and private institutions and organisms to carry out work directed toward the consumer, aiming to create awareness of the necessity to value the quality and diversity of the cultivars consumed.

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