

Development, characteristics, and trends for beef cattle production in Argentina



Hugo M. Arelovich,*†‡ Rodrigo D. Bravo,*† and Marcela F. Martínez*

*Departamento de Agronomía, Universidad Nacional del Sur, 8000 Bahía Blanca, Argentina;

†Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, 1900 La Plata, Buenos Aires, Argentina; and

‡Centro de Recursos Naturales Renovables de la Zona Semiárida, 8000 Bahía Blanca, Argentina

Implications

- The production of agricultural commodities has historically been linked to the development and traditions of a country. Argentina has traditionally produced beef, and the country maintains one of the largest consumptions of beef per capita worldwide. However, the absence of clear long-term policies and strategies to stimulate beef cattle production; characteristics of commercial procedures; the interests of export companies and domestic markets; environmental constraints, such as prolonged unpredicted droughts; and the availability versus potential adoption of technological tools have affected producer management decisions and profitability, as well as the overall beef cattle business.
- The main challenge the Argentinean beef cattle industry will face in the coming years is its recovery from a severe reduction in inventory. This can be overcome by improvements in reproductive performance and the calf crop, and by limiting the number of heifers and cows slaughtered. In our view, these actions should be supported by an aggressive export policy and by encouraging long-term beef cattle production programs by region.
- Although scientists and some policy makers in Argentina are aware of the relevance of sustainability criteria (having a safe food supply; maintaining biodiversity, clean water, and air by minimizing emissions and contamination), sustainability is focused mainly on the preservation of natural resources, that is, diminishing the impact of erosion and recovering degraded soils and rangelands. Unfortunately, most of what is known about the preservation of natural resources is still declamatory, and concrete action to apply sustainability criteria to beef cattle systems remains within the academic and policy planning arenas.
- Argentina has succeeded in reaching an animal health status that has benefited beef quality and exports. However, concrete action on sustainability, animal welfare, and describable beef quality for grass-fed and feedlot-finished cattle would help expand future markets, both domestic and export, and provide the world with the high-quality product for which Argentina is recognized.

Key words: beef cattle, beef quality, breed, production system, sustainability, trade

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doi:10.2527/af.2011-0021

Introduction

Raising cattle for beef is related to the cultural, social, and economic history of Argentina. Early grazing practices were conducted by indigenous groups. European cattle and sheep were first introduced and released in the Pampeana region by the Spanish colonizer Juan de Garay in the 16th century. After cattle were introduced, they reproduced there and spread freely. At that time, leather, rather than beef, added value to cattle, increasing demand and establishing a particular, although not necessarily friendly, commercial relationship among all social parties involved: natives, the legendary *gaucho*, and Spanish descendents. The struggle for free commerce was born, and cattle trading influenced the economics of the region. Although many other factors contributed, the development of the contemporary beef cattle production system in Argentina is the result of historic events. Many aspects that influenced livestock development in Argentina are described by Giberti (1974), who reviewed and discussed the growth of the economy, the culture, and the parallel development of Argentinean society and beef cattle production.

Changes in beef production in Argentina within the last 30 years are the result of cattle competing with other agriculture commodities for land resources, severe climatic constraints, natural resource deterioration, dramatic changes in the production systems, the slow adoption of technology, changes in the interests and profitability of producers, and the inability to generate a set of useful policies to sustain and improve productivity, as well as a healthy development of the industry.

This paper describes some of the particularities of beef cattle production in Argentina, despite its diversity by region and the dynamic processes changing production conditions. In addition, valuable information has been reported by several sources, which have emphasized different aspects of the industry, and have made predictions and offered proposals to stimulate productivity and sustainability (e.g., Miñón et al., 2009; Rearte, 2010). International resources were consulted when the required information was not found or when making comparisons with other countries; otherwise, Argentinean authors and domestic sources for statistics were preferred. Official records for different aspects of the industry sometimes appear to disagree in absolute values, but not in trends.

Current Status of Beef Cattle in Argentina

Global and Regional Scenario

Globally, the consumption of various products of animal origin continues to grow, and this pattern is expected to continue for the immediate future. Despite a decrease in total animal numbers, some countries, such as the United States, produce approximately the same amount of beef, prob-

Table 1. Evolution of beef cattle numbers in inventory for the last 4 years¹

Year	Cows	Heifers	Steers	Yearling steers	Male calves	Female calves	Bulls	Oxen	Total	Variation, %
2008	23,712,136	8,203,242	4,804,549	5,312,143	7,139,558	7,144,966	1,255,957	10,571	57,583,122	
2009	22,486,186	7,875,848	4,663,256	5,064,301	6,506,136	6,629,495	1,196,437	10,465	54,432,124	-5.5
2010	20,540,972	7,209,738	4,138,245	4,470,793	5,678,652	5,802,958	1,096,852	11,533	48,949,743	-10.1
2011	20,060,138	7,303,025	3,649,056	4,114,646	5,795,376	6,008,279	1,029,460	12,681	47,972,661	-2.0

¹Source: adapted from Antuña et al. (2010) and SENASA (2011).

ably because of an increase in production efficiency. Global exports (total amounts) have remained at similar levels over the past 5 years. Worldwide beef consumption has tended to decline slightly, paralleling beef production trends (USDA-FAS, 2011). These figures may indicate that consumption is expandable and that an unsatisfied international demand for beef remains (Arelovich, 2011). The evolution of beef cattle numbers in Argentina by animal type [Antuña et al., 2010; National Service of Animal Health and Agri-food Quality (SENASA), 2011] illustrates a recent decrease from 57.58 million (2008) to 47.97 million animals (through April 2011). This indicates a 17% decline in cattle inventory, which has differentially affected the proportions of sexes within the cattle herd in the country (Table 1). The main effect has been on the cow-calf sector by reducing the availability of breeding females. This decrease in inventory can be attributed to multiple circumstances, such as an intense drought affecting cow-calf-producing areas, low cattle prices (through November 2010), misleading political decisions affecting exports as well as domestic trade, and strong stimuli to cultivate high-priced grain and oilseed crops, which have allowed less grazing land to be available for cattle.

Territorial Distribution of Beef Cattle

Continental Argentina is 2,791,810 km², with large areas recognized as naturally suitable for extensive beef production. Beef cattle are produced in all of continental Argentina (latitudes 21°48' to 50°01' S) through very diverse ecological regions with huge differences in climate, soils, and vegetation. The biogeographical regions are so diverse that they include subtropical rain forests; central temperate, fertile mollisol soils in the Humid Pampas; extensive western arid and semi-arid regions bordering the Andes; and cold sub-Antarctic zones in the south of the country. However, approximately two-thirds of continental Argentina is associated with arid and semi-arid rangeland ecosystems: the arid zone is 170 × 10⁶ ha and the semi-arid zone is 48 × 10⁶ ha, constituting 60 and 15%, respectively, of the continental territory (Fernández and Busso, 1999).

These different environments determine production objectives, breed choices, stocking rates, management procedures, and management styles for the different regions. The five agroecological regions of Argentina, depicted together with the boundaries of different provinces, are shown in parallel with a map including the more complex biogeographical features of the country (Figure 1). These regions are the Argentinean North West (NOA), the Argentinean North East (NEA), the Semi-arid, Pampeana, and Patagonia. Still, within each region great variability in the climate, soil, and topography can be observed.

A detailed description of the climate at different locations in Argentina has been provided by the National Institute of Agricultural Technology (INTA, 2011). In general, precipitation decreases from east to west and from north to south along the country, with the highest temperatures

occurring in the northern regions and the lowest occurring in the south. However, the pre-Cordillera and Cordillera de los Andes across the Semi-arid and Arid regions could be very cold from north to south. Most beef cattle are found in the Pampeana region (64% of total cattle inventory), which is also the most relevant area for grain and oilseed production.

Throughout the 20th and 21st centuries, inappropriate land use (e.g., inadequate cropping practices, deforestation, and overgrazing) as well as droughts contributed to erosion and the deterioration of natural resources, particularly in the most labile semi-arid areas. Argentina also faces the challenge of recovering large deforested subtropical regions, but these areas have been mainly assigned to oilseeds and grain crops. Beef cattle could play a very important role in the recovery of these areas, if they are progressively transformed into pasture lands.

Beef Cattle Breeds

From a historic perspective, the Criollo should be mentioned as one of the most antique breeds in the Americas and in the world. They were brought to the New World by Spanish colonizers. Natural selection allowed for the development of aptitudes such as an extraordinary reproductive efficiency under intense nutritional constraints. Other characteristics of Criollos are their meekness, docility, hardiness, and longevity. Studies on Criollo crosses with British cattle have shown improvements in growth rate and beef attributes, although they are not one of the most popular breeds. The Asociación Argentina de Criadores de Ganado Bovino (Criollo breed association), is quite recent (1984) compared with others. The goal of this association is both to disseminate information on the attributes of this breed, as well as to incorporate them through crossbreeding, which is presently being considered by some producers in the central-northern areas.

However, British breeds began to be imported as early as 1823, with the arrival of the first Shorthorn bull. Aberdeen Angus and Hereford were brought in the late 1800s and quickly expanded throughout the entire country. By the beginning of the 20th century, other breeds introduced were Polled Hereford, Charolais, Limousin, and Fleckvieh Simmental, which have exhibited good performance in the Pampeana region. Others, such as the Limangus, Piedmontese, and Brahman crosses, are more recent.

As discussed previously, beef production covers a range of climatic zones, from subtropical through Mediterranean to temperate to very cold areas, which affect animal health and the productive response. Overlapping this climatic variability are differences in pasture quality and quantity. Because there is a large variety of breeds from which to choose, they are present in each region according to the preference of the producer and the background of the farm, but with the rationale that the chosen breed will be the most suitable for the conditions in the area.

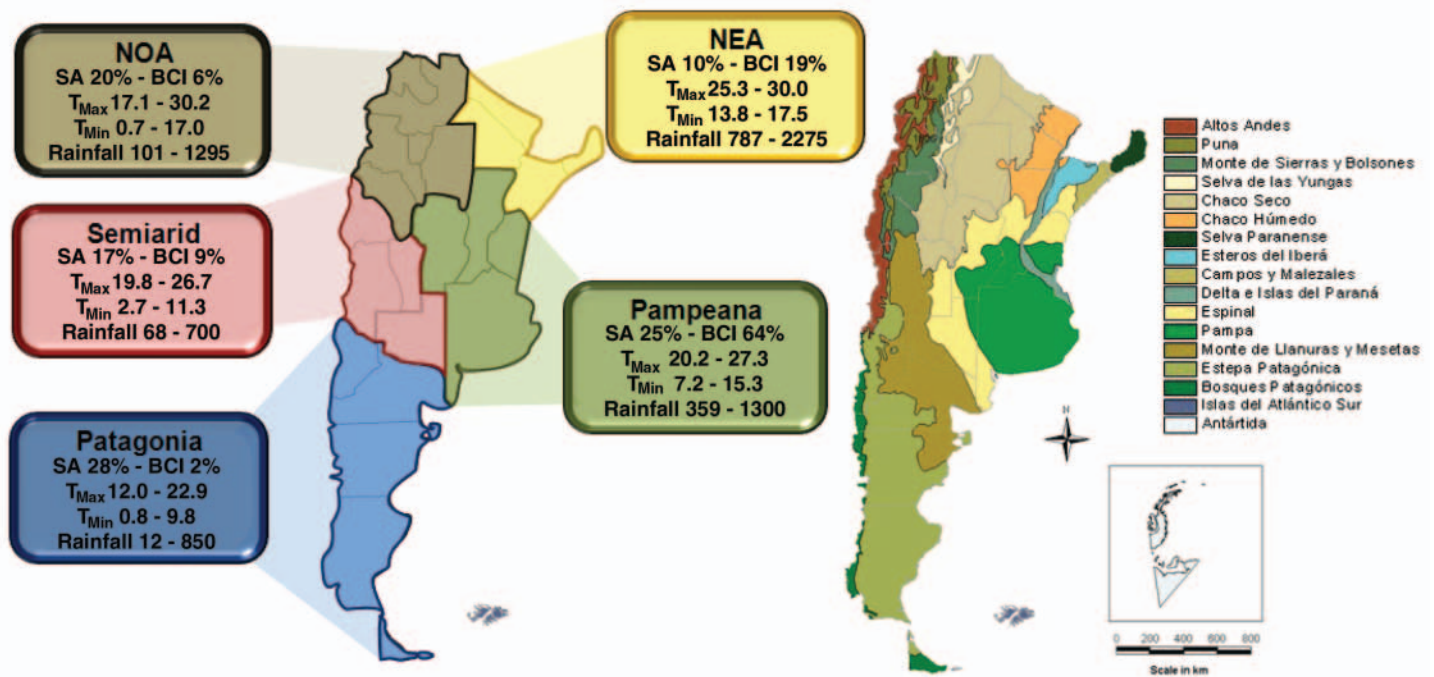


Figure 1. Biogeographic distribution of beef cattle in Argentina by region (source: adapted from Government of Argentina, 2011; INTA, 2011; SENASA, 2011). NOA = Argentinean North West region, NEA = Argentinean North East region; SA = surface area; BCI = beef cattle inventory; T_{Max} and T_{Min} = annual average maximum and minimum temperatures (°C). Rainfall is shown in millimeters per year.

Crossbreeding with *Bos indicus* is now extensively used to increase the productivity of cattle in subtropical areas as well as in some temperate areas. *Bos indicus* crosses have been largely integrated into the North West, North East, and northern Pampeana regions because they have adapted better than the pure British crosses to those particular environments.

Currently, most breeds are represented by their respective breed associations. The Sociedad Rural Argentina (SRA) keeps an *Official Record* of these associations. A total of 57 breeds of beef and dairy cattle and buffalo are registered in the *Official Genealogical Records* of the SRA (2011). Annually at a major event, SRA awards prizes to the winners of competing breeds. Generally, livestock exhibitions, as well as the SRA Annual Exhibit in Argentina, are very important for identifying elite seedstock and establishing genetic trends for beef cattle. These shows are replicated at many sites in the country, but on a smaller scale. Many producers and companies are involved in the business of cattle exhibits in Argentina, and these exhibits continue to be important for different reasons (e.g., tradition, education, and business development). Although the economic value of animals prepared for exhibits is very high, they should not be the main tool or a unique tool considered for genetic progress.

Production Systems

Modern beef cattle enterprises in Argentina compete for land with grain and oilseed crops. Compared with the United States or Canada, beef production in Argentina has never been such a highly specialized industry. In many cases, beef in Argentina is produced as a by-product of the cash crop business. Traditionally, beef production was divided into cow-calf, stocker, and finishing segments. Until a few years ago, different areas of the country were easily associated with one of these activities. A

detailed description of typical beef cattle production systems can be found in Rearte (2007).

However, all three segments might be found integrated in one farm, particularly in areas where the soil and climate were suitable for a large availability of forage. Because of the constraints of marginal regions and rangelands, mostly cow-calf operations were developed in these areas, excluding the Patagonia region, which was mainly sheep country. Extensive cow-calf operations are found in the semi-arid and arid rangelands, and within the area known as Cuenca del Río Salado (east-central Humid Pampeana region), where no other agricultural activity can be performed successfully. Because of the limiting soil characteristics, the Cuenca del Río Salado is recognized as a leading area for cow-calf production, exhibiting the best calf crop performance (more than 65%), compared with the 55% calf crop average for the entire national cow herd (SENASA, 2011). In marginal areas, the major problem is the poor reproductive performance and small calf crop, technically because of overstocking, inappropriate pasture planting and use, poor replacement feeding practices, and rangeland degradation.

Cuestas Acosta and Lotti (2011) reported that the apparent beef production for cow-calf systems in 6 subregions of the country averaged 39 kg of beef/ha, with a minimum of 13 and a maximum of 72 kg of beef/ha. The same authors reported that for grass-fed finishing programs that included large amounts of small grains and perennial pastures for the Buenos Aires, Entre Rios, and Santa Fe provinces, productivity varied from 278 to 571 kg of beef/ha in the top farms. Nevertheless, beef production peaked when sound supplementation programs were included. However, in rangelands or systems in which native grasses are 80 to 100% of the vegetation, cattle production ranged from 61 to 81 kg of beef/ha. Regard-

ing the availability of scientific knowledge and technology developed in the country for use in cattle production, it would be possible to have a positive influence on productivity in the cow-calf segment and in ecologically marginal areas.

Until the 1990s, 100% of beef cattle were finished on grass, with occasional grain supplementation. There were no restrictions on slaughtering weights, and tender beef supplies from very young animals were available for domestic consumption. Toward the end of the 1980s, confined cattle operations became more frequent in the beef cattle industry. Today, the future of feedlots is a matter of discussion by the different stakeholders involved in production, packing, trade, and, to a lesser extent, domestic consumption. The number of confined cattle operations began to grow during those years, driven by the increase in soybean planting, which substantially reduced the use of grazing land for beef as well as dairy cattle. A few enterprises were commercial feedlots receiving animals from third parties, most of which were and still remain differently sized operations integrated within farms. Many farmers include the feedlot as an alternative step in their agricultural programs.

Nonetheless, extensive beef cattle production is a distinctive feature in Argentina. Beef production is generally based on grazing native and cultivated pastures. Brizuela and Cangiano (2011) recently published a review of the evolution of cultivated forage species. An estimate of the surface area with cultivated pastures mainly in the temperate areas of the country was estimated at more than 15 million ha; however, to maximize profitability, the yield and use efficiency of cultivated pastures must be improved by integrating grain and oilseed crop agriculture within farms

(Bertin, 2006). A summary of the main cultivated forage species used by region in Argentina (adapted from Brizuela and Cangiano, 2011) is presented in Table 2.

An indicator of the evolution in forage use is the pasture seed market in Argentina. This market exhibited a large increase from the period 2000–2001 to the period 2009–2010, reaching a total of 51,577 metric tons. Preference was given to a larger proportion of perennial temperate grasses and legumes, small grains, and summer pastures (Cuestas Acosta and Lotti, 2011). Annual summer pastures, particularly of corn and sorghum, contributed the most to this growth, likely related to the increase in silage feeding in the country.

Hay, silages, coarse and small grains (as concentrates), and, to a much lesser extent, industrial feeds or by-products are provided for short periods, particularly when pasture availability, quality, or both do not meet animal consumption needs or nutrient requirements. The degree to which this general description fits into production systems varies among regions and from farm to farm. Complementary feeding from fiber sources and programs supplementing grazed pastures have progressively increased in use in the last few years.

Current stratification estimates by production systems are as follows: cow-calf only, 17%; predominantly cow-calf, 28%; stocker and finishing, 17%; predominantly finishing, 19%; finishing only, 4%; and all segments, 15% (Cuestas Acosta and Lotti, 2011). This stratification is for production units (PU) that range from small farms to the largest estancias. At least theoretically, there is a critical PU size within each ecological region; below this threshold, beef cattle production would become unprofitable

Table 2. Cultivated pasture distribution by region¹

Pasture	NOA ²	NEA ²	Semi-arid	Pampeana
Small grain			<i>Secale cereale</i> <i>Triticale</i> <i>Avena</i> spp.	<i>Avena</i> spp. <i>Lolium multiflorum</i> <i>Triticale</i> <i>Secale cereale</i>
Summer	<i>Sorghum</i> spp. <i>Zea mays</i>	<i>Sorghum</i> spp. <i>Zea mays</i>	<i>Sorghum</i> spp. <i>Zea mays</i>	<i>Zea mays</i> <i>Sorghum</i> spp. <i>Setaria italica</i> <i>Panicum miliaceum</i>
Perennial grasses	<i>Chloris gayana</i> <i>Cenchrus ciliaris</i> <i>Panicum maximum</i> <i>Panicum coloratum</i> <i>Digitaria eriantha</i>	<i>Brachiaria</i> spp. <i>Cynodon plectostachyus</i> <i>Cynodon dactylon</i> <i>Digitaria decumbens</i> <i>Digitaria eriantha</i> <i>Setaria sphacelata</i> <i>Panicum maximum</i> <i>Panicum coloratum</i> <i>Paspalum</i> spp. <i>Pennisetum purpureum</i>	<i>Eragrostis</i> spp. <i>Panicum coloratum</i> <i>Digitaria eriantha</i>	<i>Thinopyrum ponticum</i> <i>Festuca arundinacea</i> <i>Lolium perenne</i> <i>Dactylis glomerata</i> <i>Bromus catharticus</i> <i>Phalaris aquatica</i>
Legumes	<i>Medicago sativa</i> <i>Melilotus albus</i> <i>Melilotus officinalis</i>	<i>Leucaena leucocephala</i>	<i>Medicago sativa</i> <i>Melilotus albus</i> <i>Melilotus officinalis</i>	<i>Trifolium repens</i> <i>Trifolium pratense</i> <i>Medicago sativa</i> <i>Lotus tenuis</i> <i>Lotus corniculatus</i>

¹Source: adapted from Brizuela and Cangiano (2011).

²NOA = Argentinean North West region; NEA = Argentinean North East region.

in the long term under average year economic circumstances. The main factors interacting with critical PU size are likely carrying capacity, strategic planning, technological approaches and decisions, environmental constraints for the area, and back-and-forth freights to the site.

A general distribution of cattle in PU of different sizes is presented in Figure 2. Only 16.11% of the PU hold 61.24% of the cattle inventory, with a range of 501 to 5,000 animals. The vast majority of PU (83.57%) have fewer than 500 animals, but these account for only 30.93% of the cattle inventory. Almost 8% of the total number of beef cattle in the country are accounted for by the largest size PU (more than 5,000 animals), which represent only 0.32% of the total PU. In some areas of Argentina, production systems are undergoing a process of intensification involving changes in the production and utilization of seeded and native pastures; eventually, grazed forage will remain a key component of the cattle diet (Rearte, 2011).

In other sites, such as the semi-arid south, where a desertification process is underway, the technological input and conversion of old systems into new ones presents a real challenge. Modern and appropriate policies that all parties involved are in agreement with, as well as the parties' active participation in practices for recovery, are a priority; however, there is potential for beef cattle intensification as well (Arelovich, 2010, 2011).

Compared with the United States or Canada, the feedlot sector in Argentina faces additional challenges. The future of the feedlot sector depends mainly on the relationship between the prices of concentrate feeds and the price of beef, as well as cattle purchase and selling prices. Sudden changes in any of these variables occur in Argentina quite frequently. When these variables are stable and favor beef cattle production, then the use of mechanization or management tools, such as scientific knowledge in ration formulation, feed conversion optimization, and implants or special additives, could make the difference in animal performance and profit.

In 2006, the estimate of total numbers in confined operations reached 1.5 million animals, with a total beef cattle inventory of 58.5 million

(Rearte, 2010). In March 2010, there were 2,278 feedlots with a total of 1.6 million cattle, averaging 700 animals per feedlot. Most of them were concentrated in the province of Buenos Aires (mostly humid and subhumid areas of the Pampeana region), with 686,696 animals within 947 feedlots and an average of 725 animals per feedlot (Cuestas Acosta and Lotti, 2011). The cattle inventory in 2010 was 48.9 million animals (Table 1). These data show that feedlot cattle were 2.56% of the inventory in 2006, which was increased to 3.27% in 2010 despite the decline in total numbers.

Even though beef prices were low for years and did not improve until the final months of 2010, more animals entered confined systems, encouraged by government subsidies for feedlots. Land use was preferred for oil-seed and grain crops, and intensive droughts in marginal regions also did not favor extensive cattle production. Furthermore, drought forced many cow-calf operators to liquidate their herds. Now subsidies are no longer available but beef prices have increased, making feeding confined cattle more profitable. Profitability is also influenced by seasonal variability in prices. In general, the best return is achieved when cattle are bought in winter and sold in spring. Again, rapidly changing circumstances may not favor a very accurate prediction of feedlot development in the near future.

Animal Health Status

Argentina has been fighting successfully to control diseases such as foot-and-mouth disease (FMD), brucellosis, and tuberculosis. A key step in this story was the action of SENASA. Many veterinarians are professionally involved in the development of health programs and vaccination protocols. The health care of beef cattle herds has been one of the most widely adopted technological tools. Low reproductive or productive performance of beef cattle, or both, can be mostly attributed to undernutrition or starvation, rather than to a poor sanitary status because of disease.

Regarding diseases of concern that may affect international trade, the OIE (World Organization for Animal Health, 2011) has recognized the following health status for beef cattle in Argentina:

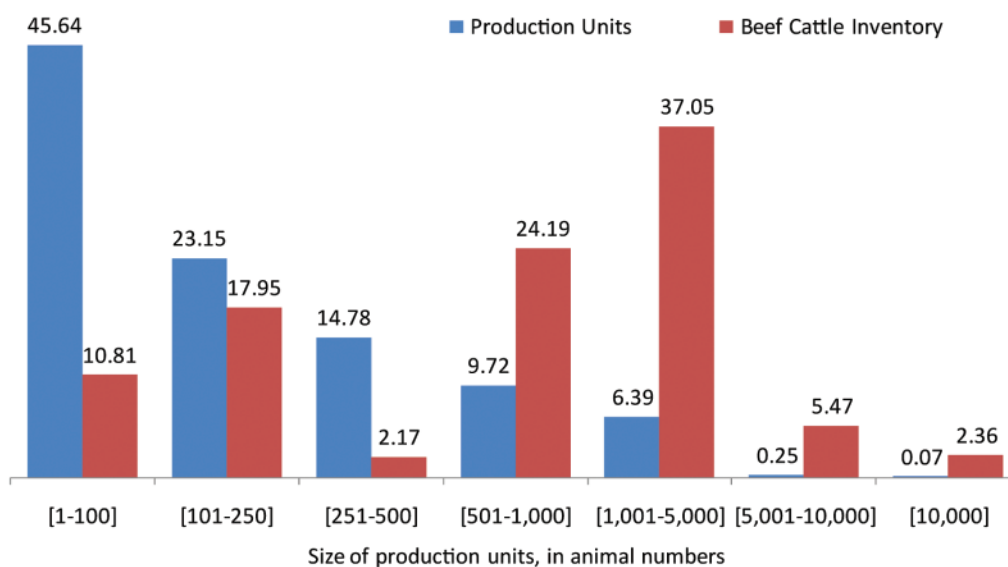


Figure 2. Stratification by farm unit size (source: adapted from SENASA, 2011). Production units and beef cattle inventory are shown as percentages for each size level.

- FMD: two free zones from the Río Negro to the south without vaccination, and to the north with compulsory vaccination.
- Bovine spongiform encephalopathy: negligible risk status.
- Bovine tuberculosis: national program to control and eradicate tuberculosis.
- Bovine brucellosis program: strategic vaccination throughout the country progressively consolidating the status of brucellosis-free areas.

In September 2007, SENASA introduced a traceability program. Resolution 754/2006 established that calves born on each farm be identified individually by tags in both ears. Each tag has a unique number, one of which is the Unique Key for Livestock Identification and the other being the National Health Record for Agricultural Producers. Additional documentation, an electronic document called a DT-e, is required to transport animals from one site to another. The DT-e allows SENASA to keep records of the farms that have cattle with health programs, outbreak of diseases, and animal movements. This new system allows a detailed record of each individual herd for multiple purposes. The system was developed to guarantee effective action against any health risk at any step of the beef business value chain.

Beef Cattle Trade

For beef cattle, both domestic and export markets have historically been meaningful to the economy. Beef represented a larger portion of Argentinean exports, which have been demoted by the increasing production of grains and oilseeds, among other constraints.

Beef marketing from the farm to slaughtering plants is carried out through different channels. However, more than 50% of beef is sold directly on the farm, and only about 12% is sold at trade fairs (Cuestas Acosta and Lotti, 2011). In Argentina, the main cattle trade fair is the Liniers Market, in the city of Buenos Aires. Despite geographical distances, selling prices at Liniers influence the beef price in the whole country. This market also presents a stable monthly trade of about 110,000 animals, with a 10% variation (Mercado de Liniers, 2011).

To control slaughter weights, the Ministry of Agriculture, Livestock and Fisheries (MAGyP) established minimum slaughter weights at 280 kg for live animals and 165 kg for bone-in carcasses, with Resolutions 13/2010 and 88/2010, respectively. The average slaughter weight for 2010 in all cases exceeded 400 kg, of which steers and cows exhibited the greatest average weight, at 450 kg, and export steers weighed an average of 505 kg (Cuestas Acosta and Lotti, 2011).

In 2010, a total of 11.8 million animals were slaughtered in Argentina. The lawful slaughter and marketing of beef in Argentina must be carried out at meat processing plants. In 2010, a total of 456 active meat processing plants were reported. Only 40% of these plants were authorized by SENASA, but just 21% of them were involved in beef exports.

Figure 3 illustrates the evolution of slaughtered animals by sex in the period 2001 to 2010, excluding the information on bulls, male calves, and female calves (adapted from Oficina Nacional de Control y Comercio Agropecuario data, as cited by Cuestas Acosta and Lotti, 2011). That the slaughter of cows and heifers has increased since 2006, peaking in 2009, is indicative of a progressive liquidation of the reproductive herd. Beginning in 2005, the slaughter weight began to decrease, with fewer steers and more yearlings being sent to the beef market. The sudden decline in all sexes slaughtered in 2010 was due to the decreased total inventory, but

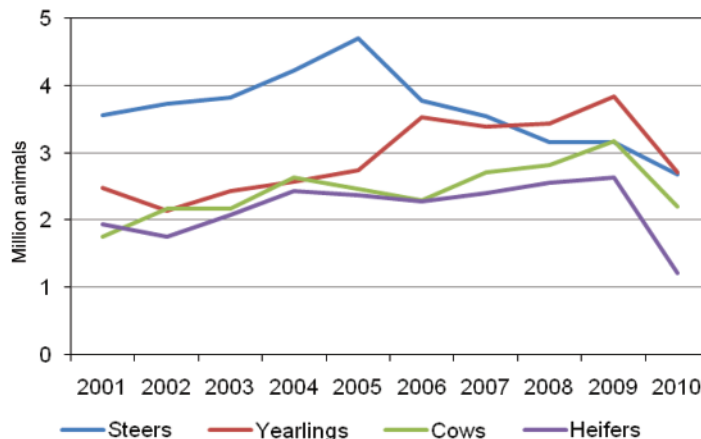


Figure 3. Evolution of slaughtered beef cattle numbers by sex in the last 10-year period (source: adapted from Cuestas Acosta and Lotti, 2011).

it also showed some retention of female cattle because of increased prices and an increased demand for calves in the production chain.

Historically, Argentina and Uruguay, which are neighboring countries with similar production systems, have shared a taste for beef and have exhibited the largest consumption levels in the world. In 2008, Uruguay substantially decreased beef consumption to 50.6 kg per capita/year to favor exports, but consumption has increased again in Uruguay, reaching 62.1 kg in 2010 (USDA-FAS, 2011). Conversely, Argentinean beef consumption has decreased, from 69.2 kg in 2007 to 56 kg in 2010 (USDA-FAS, 2011), and it is expected to decrease to 48 kg in 2011 (MAGyP, 2011). For Argentina, increased exports were not the cause of the decline because they did not increase. Instead, different reasons, such as higher retail prices, a greater scarcity of beef because of reduced animal numbers, and other factors discussed previously, have contributed to this decrease in consumption. Figure 4 compares the seven largest producers of beef cattle in the world with Argentina in terms of total beef production, beef exports, and human consumption of beef.

Although most of the beef is produced to satisfy domestic demand, growth is expected in commodities as well as processed and differentiated products within the international market. As mentioned, the global demand for beef is expanding, and in 2010, the export balances suggested insufficient beef to meet the global demand (Arelovich, 2011). Having a country free of FMD

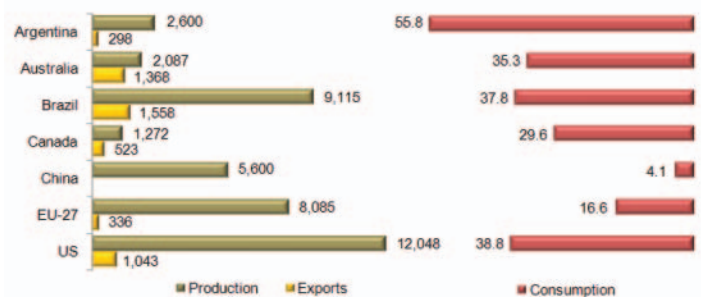


Figure 4. Argentinean beef production, beef exports, and human consumption of beef contrasted with those of the largest beef producers in the world (source: adapted from USDA-FAS, 2011). Production and exports \times 1,000 metric tons. Human consumption of beef is shown in kilograms per capita/year.

and bovine spongiform encephalopathy, with production know-how and with production potential, presents opportunities unique to Argentina.

A brief analysis of the export market scenario showed that in 2005, for a total of 3.15 million metric tons of beef carcass produced, Argentina exported 771,427 metric tons to the world, at a value of US\$1.3 billion (US\$1,679 per metric ton). Because of the factors mentioned above, production and trade have decreased. In 2010, of the total of 2.6 million metric tons of beef carcasses produced, the country exported only 309,874 metric tons, at a value of US\$921.6 million (at US\$2,974 per metric ton) according to the data reported by MAGyP (2011). The price of beef per metric ton increased by 77%, and exports were reduced by almost 60% in this period. When contrasted with the same level of production and exports reached in 2005, the loss in Argentinean beef exports was approximately US\$ 1.3 billion in 2010. This problem requires serious review and consideration if there is any intention to get back on track.

In 1979, an agreement with the European Union established a quota for exporting high-quality boneless beef. Argentina holds one-half of this quota, which is equivalent to 28,000 metric tons/year. It was named the Hilton Quota because the beef was supplied to the distribution chain of the Hilton Hotels Corporation. The price range for these special beef cuts is US\$9,000 to 14,000/metric ton (IPCVA, 2011). The main consumers of the Hilton beef cuts are Germany (56%), followed by the Netherlands, Italy, the United Kingdom, Belgium, and Spain (MAGyP, 2011). However, Argentina is facing problems meeting this quota. Thus, in 2009 and 2010, Hilton cuts were only 22,437 and 25,639 metric tons/year, respectively, or 5.9 and 15.4% of the total beef exported. Because beef exports decreased in 2010 but Hilton cuts were priced higher, the quota represented 14.3 and 31% of the economic value of total beef exports, a much larger proportion in monetary value than standard cuts. An agreement was achieved to expand the Hilton beef exports to 30,000 metric tons for 2011–2012. However, recent news has indicated that the 28,000 metric ton amount was not fulfilled for 2011. It remains to be seen whether this special benefit for exports can be fully met in 2012.

Regarding concerns for animal welfare, there are regulations governing aspects of animal protection, animal hauling, and slaughtering procedures, with controls in processing plants (SENASA, 2011). For a food of animal origin to reach the status of an organic food, it should fulfill the required standards for animal welfare. These standards include the size of the herd, outdoor access, and grazing. All these practices are monitored by SENASA in coordination with other international organizations (SENASA, 2011).

Some Facts for Beef Cattle Science and Technology

Research Information

It is very difficult to summarize and discuss the research done in the country that is applied to the different aspects of beef cattle production. The interest in pastures, ruminant nutrition, and production systems leads the list, followed by genetics and animal health.

Animal science and technology information is concentrated in the *Revista Argentina de Producción Animal*, published by the Asociación Argentina de Producción Animal and a few other peer-reviewed periodical publications, mostly from universities. The INTA has its own system of reporting valuable research data through a large diversity of publications and websites. Many of them are specific to beef cattle production. Information from INTA is of a more practical nature and is in much easier reach

of the producer through the organization's powerful extension service. The vast majority of the research conducted is applied research.

Other organizations that promote experimentation on beef cattle topics are the Asociación Argentina de Consorcios Regionales de Experimentación Agrícola (AACREA) and, more recently, the Instituto de Promoción de la Carne Vacuna Argentina. The AACREA, a highly developed private organization, is a consortium of producers and professionals that frequently generates and uses its own data. In addition, researchers from the Argentinian scientific technological system (universities, institutes, and government agencies) participate in using the developments of AACREA. The Instituto de Promoción de la Carne Vacuna Argentina has scholarships and financial aid for research more focused on the product and the consumer. International scientific information could be of practical use if, in any way, it is adapted to solve any production situation. If any drugs or other patented agricultural inputs are used, they have to be approved by SENASA before being imported or reproduced in the country.

Most professionals agree that a huge gap exists between available knowledge and the adoption of technology, even when it is a matter of common sense and zero cost. This is more relevant to beef cattle production in some areas but is not a common feature for other agricultural activities. It is very difficult to quantify in economic value how much is lost within this gap. However, Rearte (2010) indicated that some studies estimate this gap as being larger than 60% for cow-calf operations and 54% for finishing cattle operations.

Three-fourths of the continental territory is arid or semi-arid (Fernandez and Busso, 1999); thus, cow-calf producers in these areas are a target for improving reproductive efficiency. Many research papers, in Argentina or other regions of the world, stress the benefit of protein supplementation to improve reproductive performance for low forage quality and availability (Arelovich, 2010, 2011). Argentina produces large amounts of plant protein concentrates; however, protein supplementation is still not included within feeding programs, even when the relationship to calf price justifies supplementary feeding. Alternatively, more expensive grains are used because perhaps they were produced within the farm. This is a clear example of the gap between the adoption of technology and production.

Beef Quality

Argentina has traditionally produced beef, exhibiting one of the largest beef consumption levels in the world. Beef is embedded in the popular culture to such an extent that every single individual would proudly mention "our beef" with a sense of ownership. Argentinean beef is also believed to be of superior quality, and this belief extends beyond Argentina. However, scientific measurements of quality, with objective standards beginning to be researched over the last 15 years, have not reached the consumer and are not influencing either production systems or the cattle trade.

A special issue of *Meat Science* edited by Descalzo and Sanchez (2008) gathered 25 articles on diverse aspects related to Argentinean beef quality. In this issue, Schor et al. (2008) reviewed physical, chemical, and sensory attributes researched in Argentina by different authors. Because of the variability in studies produced in different beef production systems, feeding systems, and environments and with different breeds, including evaluation methodologies, preslaughter treatments, and postslaughter treatments, it seems difficult to define descriptors of quality scientifically for Argentinean beef. One of the most evaluated physical variables has been tenderness, with experiments reporting highly variable shear force values for the different feeding systems (finishing on pastures versus in feedlots). The lowest

values were reached by animals finished on grain; however, when animals were slaughtered at the same level of finishing, shear force values were similar in feedlots or on pasture with supplementation.

During the last several years, great effort has been expended by Argentinean researchers to understand and improve the nutritional quality of beef produced in domestic systems. As in other countries, after the potential benefits of conjugated linoleic acid (CLA) were discovered, different authors reported greater concentrations of CLA in grass-fed animals compared with animals receiving high-concentrate diets (Schor et al., 2008).

Most studies relating CLA to grain feeding are with diets including corn. Some studies showed that incremental levels of oats fed to steers grazing winter oats over a 130-day period increased intramuscular fat without affecting the CLA content (Marinissen et al., 2006). Moreover, a recent preliminary study showed that when whole oats were compared with whole corn in diets fed to confined animals, animals fed oats produced a larger ribeye area than those fed corn, although subcutaneous fat deposition was greater for those fed the corn diet (Forgue et al., 2010)

Finishing beef on pastures produces leaner beef cuts with less cholesterol, a smaller n-6:n-3 ratio, a greater PUFA content, and similar marbling if the animals are slaughtered at similar degrees of finishing (Schindler et al., 2004; Schor et al., 2008). Argentina has production characteristics that allow cattle finishing on pasture to reach an adequate finishing grade in an acceptable period of time with all the advantages for the market from a grass-fed system.

For Argentinean beef exports and their reputation, there is a real need to correlate the quality of the beef with its geographical origin because inferior products disguised as Pampean beef have appeared on the international market (Champredonde, 2008). Currently, the Argentine legal system allows a corporate or Geographical Indication to differentiate an agricultural from an agroalimentary product. This is important because the strategy used to differentiate a product such as beef must be supported in the legal system and in the perception of quality by different consumers. Although the validation of quality by origin labels is limited to a few regions, these constitute an effective mechanism to protect a product and differentiate its image from other products (Champredonde, 2008).

Relevance of Sustainability for Beef Cattle in Argentina

For beef cattle systems, sustainability cannot be considered independently from other agricultural activities, except for those areas where cropping is limited by soil and climate. The nature of the agricultural structure has led the world to favor larger farm sizes, specialized production, crop monocultures, and mechanization. The resulting lack of rotation and diversification removes key mechanisms of self-regulation, turning monocultures into highly vulnerable agroecosystems dependent on high chemical inputs (Altieri, 2000). This is true for Argentina in areas where valuable cash crops were rotated with pastures for grazing only a few years ago. Before monoculture cropping, the concept of alternating cropping with grazing was a much more widespread tradition, which is believed to sustain better soil conditions and survival of biodiversity.

As in many other worldwide situations, the environmental standards are recognized but adopted voluntarily. More developed countries help companies and corporations understand and fulfill environmental requirements as they try to generate applicable legislation. Different forums within the country discuss the need to create new policies and generate

action to make all agricultural ecosystems sustainable. Sustainability concepts are already a concern of government planning bodies (for the coordination of environmental management Resolution MAGyP 395/2010). These concepts are also present in mottos, in development, and as a topic of concern at scientific meetings. However, practical actions to be carried out and accepted by most players in the production chain toward the sustainability of agricultural systems are still a matter of debate. Today, the most important aspect of sustainability related to beef cattle production is related to stopping the desertification and degradation processes in rangelands and the recovery of large deforested areas.

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About the Authors



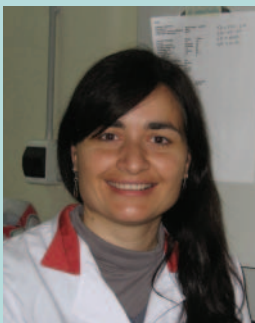
Hugo M. Arelovich is a full professor of animal nutrition at the Departamento de Agronomía, Universidad Nacional del Sur, Argentina. He also serves as researcher at Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CIC), Argentina. He completed studies at Universidad Nacional del Sur (Ingeniero Agrónomo) and Oklahoma State University (MSc and PhD). Presently, he teaches graduate and undergraduate courses, and shares responsibility for various other academic activities in his department. His research interest is in ruminant nutrition, and he has been involved in

protein nutrition, the improvement of low-quality forage use, the manipulation of rumen fermentation, and forage and grain oats quality and their impact on animal performance and beef quality. Currently, he is president of the Asociación Argentina de Producción Animal (AAPA), which, after agreements with the American Society of Animal Sciences, is developing the 1st Joint Meeting of ASAS-AAPA, 2011, at Mar del Plata, Argentina.

Correspondence: hugoarel@criba.edu.ar



Rodrigo D. Bravo is presently a teaching and research assistant at the Departamento de Agronomía, Universidad Nacional del Sur, Argentina. His undergraduate studies were at the same university where he received his Ingeniero Agrónomo diploma in 2007. He is presently finishing his master's degree in "Evaluation of the nutritional quality of dual-purpose wheat in response to N-S fertilization." Bravo's background, as the son of a farm producer, adds a very valuable feature to his research views and interpretations. He is involved in academic administration activities.



Marcela F. Martínez is a teaching and research assistant of animal nutrition at the Departamento de Agronomía, Universidad Nacional del Sur, Argentina. Her undergraduate and graduate studies were at the Universidad Nacional del Sur, where she received a diploma on biochemistry and a doctorate in agronomy. Her thesis research on the quality of grain and forage for different oat genotypes deserved regional appreciation, and the value of this work gained recognition through an international publication. In addition to her involvement in teaching and research programs, she coordinates activities and is the manager of the Nutrition Laboratory. She is also involved in academic administration activities.

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