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Sustainable sheep production and consumer preference trends: Compatibilities, contradictions, and unresolved dilemmas

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ABSTRACT

There are increasing concerns of society towards the consumption of animal products which have been produced and transformed in a sustainable manner. This trend influences consumer purchasing decision making, particularly in developed countries. On the other hand, in the next years, the pressure to increase the volume and efficiency of meat production will be much higher to cope with the expected unsatisfied demand. At least in part, current and future technologies could contribute to solve this challenge. However, the use of some of these innovations could have a negative effect on consumer preferences. There is no consensus in our society about this dilemma. The objective of this paper is to review the scientific evidence related to these topics and to analyze and discuss the effect of some of the extrinsic and intrinsic factors linked with the sheep industry which could affect the acceptability of lamb meat by consumers.

1. Introduction

By the year 2050, the agriculture sector has the challenge to increase production over 60% to feed the world (Food and Agriculture Organization of the United Nations (FAO), 2012). In this scenario, meat consumption, as a strategic source of protein in human diet, is expected to grow substantially. The projected demand shows that the leading position will be taken by poultry and pig meats, followed by bovine and sheep meats, respectively. World meat exports will grow by 19% in 2021, primarily driven by poultry and beef, where supply and demand will come mainly from North/South America and Asia/Latin America/oil exporting countries, respectively. In particular, expected growth in sheep meat for production and consumption (22% in volume; 4% in price in real terms) between 2009–11 and 2021, will be driven mostly by developing countries.

After the reduction in global supplies of sheep worldwide during the last decades, Rowe (2010) highlighted that sheep meat market share will be recovered, associated with price incentives in comparison with other meats. The traditional importing markets (e.g. EU and USA) will be expanded by increasing demand from developing countries with growth in income such as China, Saudi Arabia, Jordan, United Arab Emirates, India, Turkey and Qatar (Food and Agriculture Organization of the United Nations (FAO), 2012).

Food and Agriculture Organization of the United Nations (FAO) (2012) mentioned that in some countries, this expand in demand could promote increases in productivity through the use of better genetics and finish lambs on grain. New Zealand and Australia are two potential candidates to take advantage of this market opportunity. However, in both countries, production orientation is dominated by pastoral production systems (Bray & Gonzalez-Macuer, 2010; Cottle, 2010), and the use of feedlotting is restricted to Australia (only 14% of total lamb slaughtered comes from feedlots) to supply mainly the niche of the USA's lamb market. Rowe (2010) posed that sheep meat cannot compete with poultry or pig meat in volume or price, therefore, the alternative way is to focus more on differentiation based on quality and consistency.

In the next 50 years, there is no doubt that research and innovation will play a key role in increasing food productivity in more than 100%. So, essentially, it looks that the sheep industry will have to face two main challenges at the same time: a) to increase production and efficiency, contemplating product differentiation, adding-value and consistency and b) to increase the speed of the technology achievements and adoption in order to compete successfully in the market with the other alternative meats. This is not an easy competition given the size and type of business and capital investment of poultry, pig meat and beef industries. Moreover, this will have to be done without decreasing the sensory quality of sheep meat.

From the consumer side, there is an increasing concern about the sustainability of the intensification of animal industries and its potential damages on the environment, human health, and animal welfare. In

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some segments of consumers, extrinsic factors (e.g. product origin, general production practices, animal welfare, social and religious values, climate change, water and air pollution, and human health) appear to be important clues in consumer purchasing decisions (Font i Furnols et al., 2006, 2009; Garnier, Klont, & Platow, 2003; Grunert, 2006; Saunders, Guenther, & Driver, 2010; Tilman, Cassman, Matson, Naylor, & Polasky, 2002; Troy & Kerry, 2010).

The need for more global sustainable agricultural was strongly addressed in the pass, but it has to be applied specifically to local values and constraints (Tilman et al., 2002).

The debate is open about the sustainability of the intensification of animal production systems and consumer perceptions related to this issue. In this article, the potential compatibilities, contradictions and unresolved problems associated with this dilemma will be addressed and discussed, and in particular applied to sheep meat.

2. Sheep meat production systems: intensification, research technologies, innovations, and trends

2.1. Automatization

Since 1990, in most of the leading sheep production and exporting countries like New Zealand, Australia and Uruguay, it is possible to see several structural changes in the sheep industries, such us: a) reductions of total sheep numbers, b) reduction or conversion of sheep farms, particularly the smaller ones, c) more specialization in wool and/or meat production, d) intensification and increases in productivity, e) sheep production systems concentrated on more marginal soils, f) aging of farmers, and g) less labor force available (and less qualified) to work in sheep farming (Montossi et al., 2011; Morris, Cronin, & Bush, 2012).

Under these social, economical and environment limitations, sheep farming has to be adapted to be more efficient with less resources, particularly those associated with environmental and labor force constraints. The use of new precise and accurate technologies that can increase productivity and efficiency with less labor unit/sheep heads and less time consuming are called to play an important place in future sheep farming. The move to automatization and use of more precise technology tools in sheep farming is an interesting and positive response in this direction.

The implementation of the concept of precision livestock farming is a relatively new concept applied to beef and sheep production systems. Precision livestock farming has been defined and applied for different situations and conditions (Berckmans, 2004; Laca, 2009a,b; Pomar, López, & Pomar, 2011; Rowe, 2006). In this sense, targeting several areas of science and livestock production and industries situations, some definitions are quoted in the literature as follows: a) "precision livestock farming is an innovative production system approach which is based on intensive and integrated use of advances in animal sciences and in the new technology of information and communication" (Pomar et al., 2011), b) "Precision livestock production is the augmentation of precision agriculture concepts to include all the component of agroecosystems, particularly animals and plant–animal interactions" (Laca, 2009b), and c) "Precision Sheep Management (PSM) describes a system whereby animals are managed as individuals or small groups rather than as a (whole) flock" (Morris et al., 2012).

These approaches about livestock precision management have different degrees of application to commercial situation, where the proposal of PSM of the Australian Sheep Industry Cooperative Research Centres (CRC) is very well advanced and currently implicated in Australian sheep farming situations (Cooperative Research Centre—CRC, 2013a, 2013b).

Rowe and Atkins (2006) stated that approximately 20% of the total flock contributes little to sheep farmer productivity and profitability, therefore measuring, monitoring, and processing animal performance to select the most productive individual is a key issue to keep competitive the enterprise.

Morris et al. (2012) reviewed and analyzed the application of PSM for Australian conditions. This system management is based on the combinatory use of (i) radio frequency identification technology (e.g. in ear tags), (ii) remote and automatic measuring and monitoring equipments (e.g. "walk-over-weighing" scale powered by solar panels, Pedigree Matchmaker, remote drafting systems applied for selective supplementation technologies), and software specially designed for processing and analyzing the performance information recorded in general or specialized sheep enterprises (e.g. in stud breeders). A list of different devises, equipments, and software which are currently utilized by farmers are listed by Cooperative Research Centre—CRC (2013a, 2013b).

In addition, the Spanish farmer cooperative "Los Pastores" is using an integrated information system in its lamb classification and fattening centers. These centers gather, process, and analyze information to improve productivity and consistency of the products offered to the market. This process has been evaluated also in relation to the stress generated by the logistics implemented as well as the effects on meat quality (Miranda de la Lama et al., 2009).

The productive and/or economical benefits of the application of PSM (based on individual recording) were demonstrated to: a) save labor costs and use more efficiently farmers' working time (Cooperative Research Centre—CRC, 2013a); b) improve sheep genetic progress (Atkins, 2010), c) apply remote drafting technology for setting sheep individual performance through supplementation under grazing conditions (Bowen, Pepper, McPhie, & Winter, 2009), and d) improve individual performance which can drive positively the productivity and profitability of the whole enterprise (Haigh, 2010).

In addition, Haigh (2010) mentioned that these technologies can also reduce animal's stress by minimizing animal movements and confinement in yards; therefore they can improve animal welfare. This effect is particularly important in the context of the claims made by animal welfare organizations (e.g. People for the Ethical Treatment of Animals) about the ethical and moral obligation of farmers to provide close monitoring of animals and proper animal husbandry practices to ensure animal health and welfare.

Morris et al. (2012) concluded that PSM technologies contribute with enhancing productivity, profitability and reduce animal welfare concerns for Australian sheep industry associated with low monitoring and recording frequency performed by stockmen. The same authors also mentioned that the major limiting factors to increase the adoption of the PSM are: a) the initial investment needed (see cost ranges for different options at Cooperative Research Centre—CRC (2013b) for small scale producers and b) the age restrictions and informatics skills of farmers to be motivated and encouraged to use these novel and more sophisticated technologies.

2.2. Genetics

Sheep farmers around the world are generally characterized by their extensive systems, making use mainly of grasslands, often located in marginal areas, to produce meat, wool and milk. As world population rises, production of food and fibers from marginal lands will become increasingly important. Therefore, sheep industry is likely to have an opportunity to this increased demand (Macfarlane & Simm, 2007; Mueller, 2008). For example, in 2006, according to FAOSTAT (2007), there were around 1.1 billion sheep in the world producing approximately 13 million tons of sheep meat.

During the past half century, the less industrialized countries experienced rapid increases in animal production through both large-scale confinement systems and traditional small-scale systems. These countries now produce the majority of the world's meat (Fraser, 2008).

Increase productivity and efficiency of lamb meat production is a key factor to augment the competitiveness of the meat sheep industry. Reproduction rate, lamb growth and carcass quality have a major influence on producer returns. All of these traits of economical interest can be improved through different nutritional and husbandry practices.