FOOD AND PERSPECTIVES ON PIG PRODUCTION SYSTEM IN COLOMBIA

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Abstract

The pig production is an activity capable of generating a huge amount of data. The characteristics of intensive production, is determined for the convenient collect records, and in fact is a practice on intensive farms, which registered the main technical parameters (food and health) production indicator; They have influence pork production costs. A questionnaire-based survey will conducted in fattening pigs farms in Antioquia the main region producer of Colombia. The diagnosis will allow in an objective form identify the critical factors of food sources and their relationship with nutritional disorders, which affect the performance of pig production systems in Colombia. This information's will provide a basis for developing strategies with the purpose of have an efficient production, quality and safety product and decrease production costs, thus respond effectively and efficiently to the productive sector.

Key words: swine, feeding, nutritional disorders

INTRODUCTION

The world's tendency to increase pig production as a protein source of high quality has been promoted more in developing countries, which is necessitated by factors such as animal welfare, low environmental impact and sustainability (González, 2005). For instance in Colombia, this sector is not well represented because of lack of two basic requirements for increased productivity; a strong internal market and insufficient raw materials for animal feeding (Estrada, 2005). However, in recent years, pig production has shown an increase, reflected by the dynamic steady growth, from 10.29% growth in 2001, 9.18% in 2002 and 10.98% in 2003 (DANE, 2004). As a result of this growth, there have been economically sustainable development programs in the pig production in Colombia. It has been established that the food factor impacts more on the production costs and that the possibilities to take advantage of the vast amount of resources in tropical production systems is limited by scarce information on the techno-economic factors specifically feeding and its relation with nutritional disorders.

Pig production in the world

The main producers of pork in the world in 2005 is China with 51.202 million Metric Tons, which represented 50% of the world total, followed by the European Union with 21.200 million Metric Tons of which Germany and Spain produced 4 409 and 3 130 Metric Tons respectively and the United States producing 9.4 million Metric Tons (FAOSTAT/FAO's Statistics, 2007). In Latin America, the three key pork producing countries are Brazil, Chile and Mexico (Ormel, 2001). Brazil contributed, as a major producer of pigs, occupying fourth place globally with 3.10% of the total, with 3.14 million Metric Tons, followed by Mexico with a production of 1.102 million Metric Tons (FAOSTAT/FAO's Statistics, 2007). The Colombian participation is not represented in the regional statistics, although the national production of pork has increased from 94 000 Metric Tons in 1998 to 97 000 Metric Tons in 2001 (FAO, 1998). The year 2005 registered a production of 128 000 Metric Tons. This production is low even though Colombia occupies a modest sixth place among producers in Latin America (FAOSTAT/FAO's Statistics, 2007).

Pig production in Colombia

During the last 15 years, the pig sector has made tremendous efforts to increase production in the pig industry and to improve its competitiveness by strengthening participation on the national market and creating opportunities on the international market of animal protein (Posada et al., 2006).
This effort **is** reflected in the modernization of pig farms and the improvement of production parameters, hence products of excellent quality: pig meat with a high proportion of lean and other nutrients (Estrada, 2005). The first census of pig commercial farms in Colombia in 2002 helped to outline the reality pig production and the participation of different regions of the country in pig farming. These statistics are depicted in Table 1.

Per capita consumption of pork meat

Tejo et al. (2001), per capita consumption is higher in developed countries than in developing countries 1.

Tab.1.: Departments with pig commercial production in different Regions of Colombia

Region	Departments
Antioquia	Antioquia
Central	Bogotá, Cundinamarca, Boyacá, Meta y Tolima
Costa Atlántica	Atlántico, Sucre, Bolívar, Cesar, Córdoba, La Guajira y Magdalena
West	Quindío, Risaralda, Caldas y Valle del Cauca
Eastern	Norte de Santander, Santander, Arauca y Casanare
South	Cauca, Nariño, Huila y Caquetá

Source: Estrada. 2005 adapted from DANE – ASOPORCICULTORES – FNP

(28.6 kg/person/year vs. 11.7 kg/person/year, respectively). However, in China, per capita consumption has increased from a low base in 1980 of 12.0 kg to 34.2 kg in 2002 (Steinfeld et al., 2006). The world average consumption has been increasing significantly at a rate of 2 kg for each 10 years. In 2005, it reached 15.9 kg/person/year. In Latin America, Chile has the highest per capita consumption (19.3 kg). Brazil follows with per capita consumption of around 13.2 kg. In Colombia, the situation is totally different because consumption has always been far below the world average. The per capita consumption in the year 2006 was 6 kg/person/year (FAOSTAT/FAO's Statistics, 2007). This deterioration is mainly due to continuing population growth and diminishing purchasing power of the population

Strategies to strengthen pork production

Liberalization of trade worldwide has resulted in a significant increase in global trade of pork. It has become increasingly essential to be competitive on the global market, as this will prove profitable to a country's primary pork producers. To be competitive on the export market will require (Orr, 2006): low cost of production, efficient production, reliability of supply, quality and safety of products.

This limits Colombia to make it to the front in pig production and thus encouraging the cultivation of yellow corn, soybean and cassava, achieving an increase of 92 000 hectares of maize in 2002 to 135 000 as of 2003. In industrial cassava, the National Program also consolidated the goal of production from 11 500 hectares in 2002 to 18 200 in 2003 with an active involvement of the private sector and the agreements MADR, CIAT and CLAYUCA. Unfortunately soybean could not meet the goals. However, despite the drawbacks in 2003 with respect to 2002, a growth of approximately 8 000 hectares was achieved which represented 50% of the set goal, responding in part to the expectations of the network and the high domestic demand for the grain (Gottre et al., 2006).

The development of new strategies for pork production is key, which must initiate a change in paradigm that until that moment has been established, and given orientation to a new scheme where priority is efficient production with few infrastructures, functional and economic conditions and with ecological schemes, which achieves low environmental impact and proper the welfare of an animal, achieves a sustainability system (Arey, 2006). For this goal, the use of outdoor pig production systems and maximum incorporation of local raw materials with agro-ecological requirements compete with grains and soybeans (Gonzalez, 2005).

Pig production systems

Intensive system can be defined as the set of facilities and practices that are aimed at the production of pigs using the smallest area possible in system of absolute confinement. A high level of intensity and management control generally characterizes pig production systems in the industrialized world (Sørensen et al., 2006). This system requires a sophisticated infrastructure such as cages and corrals that should ensure the comfort and security, adequate ventilation and easy access to food and water (González, 2005). The accommodations are very important in maternity because the animals in those stages of development are most vulnerable. The birth and growing of piglets with their mother is one of the most important stages in the pig farms (Pinheiro, 2000).

In Colombia, for swine production, the highest proportion is in specialized systems (intensive and alternative 70%).The Intensive system began with the importation of breeding stock races Landrace, Yorkshire, Duroc, Jersey, Hampshire, Large White and Pietrain, among others, and commercial lines trihybrids and tetrahybrids as PIC and Dekalb. Commercial development of this sector was fostered by a small number of feed processing companies which provided piglets, animal feeds, drugs, veterinary services and farm management expertise to contracted pig producers (Minagricultura, 2003).

Alternative production system in many European countries and to a lesser extent in North America, alternative, less intensive systems of production may be adopted. These include deep litter, bedded indoor systems or outdoor production systems for both sows and growing pigs. Indoor bedded systems are often combined with cheaper building structures, such as un-insulated sheds

in Northern Europe, or hoop (tent-like) structures in North America, camping in France and Spain, in Argentina Sistemas al Aire Libre (SAL), Venezuela it is called sistema de producción a campo, SISCAL in Brazil, Sistema Intensivo de cría a Campo (SIAC) in Uruguay (Honeyman, Gonzalez, 2005; Arey, 2006; Pinheiro, 2000; Petrocelli, 1997) and Colombia is sistema semiintensivo o alternativo (Minagricultura, 2003).

Outdoor systems can have economic advantages too, requiring much less capital to set up (Honeyman, 2005). As a result, more than 30% of UK sows are now housed outdoors. There are also niche markets for outdoor reared and organic pork in a range of countries, as well as for specific slow growing breeds such as the Iberian pigs of Spain, the Mangalicas of Hungary or Creole pig in Latin America (Arey, 2006; Barba, 1998, Benítez, 2001).

Extensive system of rearing is traditionally used in Africa, Asia and some parts of Latin America It is characterized by the low level of technology, the pigs are confined only at night, behind simple fences or in small huts, to avoid thefts or damage to the crops of the neighbourhoods (Leterme et al., 2007). The free animals pick up food where and when they can. They receive unbalanced agricultural by-products, kitchen wastes, unconventional feeds such as tree leaves, maize stalks, local plants and tubers and occasionally a balanced ration (Pérez, 1997; Ocampo et al., 2005) Natality and prolificidad low rates (6 to 7 piglets by birth) and finishing pigs and less weight because they employ crossings with Creole pig and commercial races (Minagricultura, 2003). However, whilst the precocity and prolificity of some local breeds are high, the mortality of piglets is high due to diarrhoea, overlying, worms and different diseases (myasis, pneumonia, etc.). After weaning, mortality rates generally decrease, except when an epidemic arises. Growing performances highly depend on the adult weight of the breed and nutritional conditions. Nevertheless, in this system, the productivity is usually low and very variable such as presented in Table 2 (Leterme et al., 2007).

Tab. 2: Performans of pigs reared on different systems in the tropics

Parameters	Extensive1	Alternative2	Intensive3
Reproduction			
Age at puberty (m)	7.5 –12	5–6	7–9
Number of litters/year	1–2.1	1.1–2.2	2.1–2.4
Conception rate	60–65	60–80	80–90
Total number of born piglets	3.0–12	7.0–12	9–11
Number of weaned piglets	0–8	6.0–8.0	7– 9
Mortality (% piglets born)	15–100	20–35	10– 25
Number of weaned piglets/sow/year	6–14	13–18	14–21
Growth			
Age at weaning (d)	60–120	35–45	21–35
Piglet weaght at weaning (kg)	7.5–15	7–10	6–8
Average daily gain after weaning (g/d)	120–160	410–510	480–630
Feed conversion ratio	>5	3.3–5.5	2.9–4.3

Source: Leterme et al. (2007) adapted from 1. Local breeds of Africa and South America: Buldgen et al. (1994); d'Orgeval (1996); Ocampo et al. (2005). 2. Creole, Large White, Landrace: Serres (1998); Mota et al. (2002); Santos Recalde and Lean (2002); Rinaldo et al. (2000; 2003); Alonso-Spilsbury et al. (2004). 3. Large White and Landrace: Egbunike (1986); Holness (1996); Payne and Wilson (1999); Kunavongkrit and Heard (2000); Rinaldo et al. (2003).

Systems of feeding

In intensive systems, feeding depends exclusively on diets based on grains and soybeans. Unfortunately, are also consumed by humans. The availability and supply of grains and protein foodstuffs is likely to become more limited (Amaefule et al., 2006; Close, 1993). In order to encourage pig production, there is need to source alternative foodstuffs or unconventional feeds for which there is no competition with humans, and which are relatively cheap for pig feeding (Amaefule et al., 2006).

There are two traditional feeding systems used in Latin America: the balanced feed and the use of high humidity food with protein supplements. In intensive farms the 100% of the pigs are fed with balanced food; while small and medium farms, the animals are given by-products and low-protein crops such as cassava or banana and smallholders cannot afford the production of protein-rich crops such as Soya bean or sunflower. In countries like Colombia, they are also limited by environmental conditions, since part of the land is dominated by mountainous topography (Leterme et al., 2006).

Agro forestry seems to be a promising approach to combine production and environmental rehabilitation (Leterme et al., 2006). Indigenous trees are integrated in the farming systems and provide, at the same time, valuable products (fruits, leaves, wood) and environmental services (erosion control, water conservation, nutrient recycling). Tree leaf meals (TLM) should be used primarily to feed sows because they better digest and transform raw foodstuffs and forages than smaller pigs (Le Goff and Noblet, 2001). Feeding with fibrous diet reduced the incidence of non feeding oral behaviors. These high-fiber diets can reduce apparent feeding motivation of pregnant sows and, thus, improve the welfare of sows subjected to feed restriction (Ramonet et al., 1999). However, other criteria should be considered, such as fiber degradability or bulking properties and anti-nutritional factors.

Essential knowledge of pig feed products, such as hazard profiles of animal feeds in Colombia may change the administrative tendencies for national food systems and may be integrated to control risk system in means of feeding and the potential for risks to pig health.

Means of feeding and nutritional disorders

Most pig diseases in Latin America arise from nutrition problems. This means that, in almost all Countries, the animals are of low growth and low reproductive activity (Benítez, 2001).

The proportion of a nutrient in the food influences the proportion in which a raw material will be included in the diet. There are also nutritional limitations derived from the use of greater or lesser proportion of the ingredient in

Tab. 3: Anti-nutritional factors in the leaves of tree and shrubs documented as being used in livestock feeding (Kumar, 1992)

Anti-nutritional substances (Species)	Effect ANFs in no ruminant
Non-protein Amino acids	
Mimosine (*Leucaena leucocephala*) and Indospecine (*Indigofera spicta*)	Causes poor growth, alopecia, eye cataracts and reproductive problems (Kumar, 1992); reduced feed intake (Leterme et al., 2007)
Glycosides	
(A) Cyanogens (*Acacia giraffae; A. Cunninghamii; A. Sieberiana; Barteria fistulosa; Manihot esculenta*)	Cause goitrogenic effects; Poor animal performance; teratogenic effects (Kumar, 1992).
(B) Saponins (Albizia stipulata Bassia latifolia; Sesbania sesban). Exp. Alfalfa	Retardation of growth rate; Haemolysis red blood stipulation-specific interaction wit membrane proteins; severe physiological disorders such as haemolysis, gastro-enteritis, paralysis and death (Leterme et al., 2007).
Phytohemagglutinins	
Bauhinia purpurea	The biological effects of lectins probably result from their affinity for sugars. They may bind to the carbohydrate moieties of cells of the intestinal wall and cause a non-specific interference with nutrient absorption (Liener, 1985)
Beans (*Phaseolus vulgaris L.*).	Which have been reported to cause poisoning in all class of livestock. Has been reported to cause symptoms of anorexia, lassitude, weakness (Van der Poel et al., 1990).
Polyphenolic compounds	
Tannins and Lignins (All vascular plants)	Deterioration of the conversion (Kumar, 1992)
Alkaloids	
Datura stramonium, Lolium perenne	Have dramatic physiological and neurological activities (Leterme et al., 2007).
Oxalate (*Acacia aneura*)	
Spinacea oleracea, *Oxalis tuberos*, Niper grass, rice straw	The complexing of phytic acid with nutritionally essential elements and possibility of interference with proteolytic digestion (Leterme et al., 2007).

pig diet, resulting in deficiency in the nature of the ingredient, the proportion in which an ingredient can be included in a diet is affected by some nutritional restrictions on food. These restrictions may be of tw o types, chemical and / or physical (Kumar, D'Mello, 1992):

Chemical restrictions are based on excesses or deficiencies of the chemical composition of a particular nutrient or by the presence of toxic substances. The antinutritional factors (ANFs) may be defined as those substances generated in natural food stuffs by the normal metabolism of species and by different mechanisms (e.g., inactivation of some nutrients, diminution of the digestive process or metabolic utilization of feed) which exert effects contrary to optimum nutrition (Kumar, 1992). These ANFs may include certain oligosaccharides (raffinose and stachyose), alkaloids and saponins (Ferguson, 2003). ANFs may be regarded as a class of these compounds, which are generally not lethal. They diminish animal productivity but may also cause toxicity during periods of scarcity or confinement when the feed rich in these substances is consumed by animals in large quantities (Kumar, 1992).

The ANFs which have been implicated in limiting the utilization of shrub and tree forages include non-protein amino acids, glycosides, phytohemagglutinins, polyphenolics, alkaloids, triterpenes and oxalic acid (Table 3).

CONCLUSION

Colombia facing the challenge of production, globalization and being competitive with the international market, is necessary reduce production costs specially in the feeding, because this factor is more of 50% of the total costs. One of the ways to reduce the cost is through the use of raw materials which are locally produced. Unfortunately, information on the nutritive effect of raw material (Forages) in pigs and economic impact in pig farms is scarce and generally limited. The knowledge inputs to food production, such as hazard profiles of animal feeds in Colombia may change rapidly the administrative tendencies for national food systems and may be integrated a control risk system in means of feeding and the potential for risks to pig health.

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