

The brazilian pig industry can adopt european welfare standards: a critical analysis

A suinocultura brasileira pode adotar padrões europeus de bem-estar: uma análise crítica

Cleandro Pazinato Dias^I Caio Abércio da Silva^{II} Xavier Manteca^{III}

– REVIEW –

ABSTRACT

Animal welfare is an issue of growing concern worldwide. Since the 1960s, Europe has led the discussions on this subject, developing the supporting science and the necessary standards. Currently, European welfare standards on pig farms set the global standards and may represent a potential marketing barrier for commercial pork production. Brazil is one of the largest producers and exporters of pork and has intensified efforts to adapt to the new standards. The objective of this paper is to assess the feasibility of applying European welfare standards to Brazilian industrial pig farming. The complexity of the required changes and the potential advantages to Brazil are discussed, and it is concluded that Brazil has the resources to meet the majority of the requirements.

Key words: animal production, Brazil, European standards, pigs.

RESUMO

O bem-estar animal é um tema de crescente preocupação mundial. A partir da década de 1960, a Europa centralizou as discussões sobre a questão, provocou o nascimento desta ciência e promoveu o desenvolvimento de normas relacionadas. Atualmente, os padrões europeus de bem-estar na criação de suínos constituem-se referências mundiais, podendo representar futuramente potenciais barreiras mercadológicas para a comercialização da carne suína. O Brasil é um dos maiores produtores e exportadores desta proteína animal, e intensificou suas ações com objetivo de se adequar a este novo cenário. O objetivo deste documento é avaliar a viabilidade da suinocultura industrial brasileira em aplicar os padrões europeus de bem-estar em seu atual sistema produtivo. Os níveis de complexidade estruturais e de manejo e as vantagens potenciais do Brasil neste contexto são discutidas, e um cenário a priori positivo mostra que

o país tem várias facilidades para a adequação da maioria das exigências praticadas.

Palavras-chave: Brasil, diretivas europeias, produção animal, suínos.

INTRODUCTION

Animal welfare was formerly linked primarily to ethical issues, which have given rise to a new science, as society demands that the problems should be addressed scientifically. The European Union has edited numerous regulations in recent decades to set the minimum acceptable welfare standards for farm animals.

In 1964, in England, the publication of the book *Animal Machines, The New Factory Farming Industry* (HARRISON, 1964) marked the beginning of a new phase for animal welfare. Ethical concerns regarding animals gained intensity in Europe after the demand for food, housing and employment was reduced in the post-war period. The condemnation of customary husbandry practices, such as mutilation and excessive confinement, and the comparison of animal production units to industries that prioritize profit at any cost contributed the most for these changes. In response, in 1965, the British government established the Brambell Committee, a group of experts that published a report recommending that certain production practices should be condemned and

^IPrograma de Pós-graduação em Ciência Animal, Departamento de Medicina Veterinária Preventiva (DMVP), Centro de Ciências Agrárias (CCA), Universidade Estadual de Londrina (UEL), CP 10011, 86057-970, Londrina, PR, Brasil. E-mail: cleandropazinato@uol.com.br. Corresponding author.

^{II}Departamento de Zootecnia, CCA, UEL, Londrina, PR, Brasil.

^{III}Departamento de Ciencia Animal y de los Alimentos, la Universidad Autónoma de Barcelona (UAB), Barcelona, España.

demanded scientific studies (BRAMBELL, 1965). The Brambell Committee was thus responsible for establishing the basis of animal-welfare legislation in England, with subsequent impacts in Europe and other countries (RUSHEN, 2008).

New approaches on the subject have been conducted by two advisory and independent agencies of the British government (FARM ANIMAL WELFARE COUNCIL, 2009): the Farm Animal Welfare Advisory Committee (FAWAC), established in 1968, and the Farm Animal Welfare Council (FAWC), which succeeded them in 1979. The objectives of these entities included the continuous review of animal welfare on farms and during trade, transportation and slaughter as well as the promotion of new proposals to the government and other entities related to welfare. The FAWC published over 40 reports. In 2011, that organization formed the Department for Food and Rural Affairs in England (DEFRA), which had different strategies but similar goals (FARM ANIMAL WELFARE COUNCIL, 2011).

The FAWC proposed a set of minimum standards to ensure proper animal welfare, which became known as the five freedoms (FARM ANIMAL WELFARE COUNCIL, 1979). Subsequently, these five principles were updated to be more understandable and reissued (FARM ANIMAL WELFARE COUNCIL, 1992). The standards state that the animals should be free from hunger and thirst; free from discomfort; free from pain, injury and disease; free to express normal behaviors and free from fear and distress. The recognition, acceptance and adoption of these principles in the production, transportation and slaughter of farm animals represented an extremely important practical advance in animal welfare (MANTECA & GASA, 2008).

In turn, public action on the subject expanded when the European Union, via the Treaty of Amsterdam, recognized that animals are "sentient beings", incorporating their welfare as a primary concept in legislation (THE TREATY OF AMSTERDAM, 1997). On the global stage, animal welfare was incorporated into the strategic plans of the World Organization for Animal Health which developed recommendations and standards for best practices (OIE, 2009).

One major source of investment was the European Commission of the Welfare Quality® project, which involved experts from 44 institutes and universities in 13 European countries and four Latin American countries. The Welfare Quality® project recognized that consumers' perception of the quality of food of animal origin is not only determined by the

absence of chemical or microbiological contaminants but also by the welfare of the animals (BLOKHUIS, 2008). The basic principles of the Welfare Quality® protocols were based on a modified version of the five freedoms, which were envisioned as four principles: good food, good housing, good health and appropriate behavior (BOTREAU et al., 2007).

Animal welfare as well as food security and the environment have strong appeal. The belief that animals should not suffer leads to the requirement that they were created to, and should be transported and slaughtered humanely (VELARDE & DALMAU, 2012).

Scientific knowledge is now being used to establish new standards and recommendations of welfare. Thus, one of the basic strategies of the European Union regarding animal protection and welfare for 2012-2015 involves the inclusion of scientific indicators in legislation (EUROPEAN COMMISSION, 2012).

The first Community Union legislation on animal welfare was adopted in 1974 and established the practice of mandatory stunning before slaughter for mammals (CONSELHO DAS COMUNIDADES EUROPEIAS, 1974). Subsequently, standards were established involving all elements of production, transport, slaughter and experimentation. At present, the general rule that sets minimum requirements for animal production is Directive 98/58/EC (COUNCIL OF THE EUROPEAN UNION, 1998), which is not applied exclusively to swine. Directive 2008/120/EC (COUNCIL OF THE EUROPEAN UNION, 2008) applies specifically to intensively farmed pigs in the European Union and places pigs at the forefront of animal protection (MAGRAMA, 2012).

The theme has been ongoing worldwide, most notably in Western societies and those strongly influenced by Western culture. Thus, supported by European initiatives, Australia, New Zealand and Canada have generated legislation specific to the subject through, respectively, the Primary Industries Standing Committee (PRIMARY INDUSTRIES STANDING COMMITTEE, 2008), National Animal Welfare Advisory Committee (NATIONAL ANIMAL WELFARE ADVISORY COMMITTEE, 2010) and the National Farm Animal Care Council (NATIONAL FARM ANIMAL CARE COUNCIL, 2014).

Europe has generated the leading studies on the subject, establishing tradition of public policy on the subject, which is one of the major players in the pork market becoming their norms references for many countries. For these reasons, Europe provides the best model of study for Brazil.

In the pork market, Brazil ranks third in production and fourth in exports worldwide; between 2009 and 2012, Brazil exported 16.8% of the volume produced, and the current domestic consumption is 15.1kg per capita per year (ASSOCIAÇÃO BRASILEIRA DA INDÚSTRIA PRODUTORA E EXPORTADORA DA CARNE SUÍNA, 2013). Productivity and technization of Brazilian herds are high; 525, 000 sows on 833 farms yielded an average of 26.31 weaned piglets/sow/year, with a pre-weaning mortality rate of 8.01% (AGRINESS, 2013).

The Brazilian pig industry has shown interest in animal welfare, discussing the issue at local technical events and specialized international and national conferences. There has also been research interest in this area, with the formation of research groups on the subject.

Government initiatives to help Brazil adapt to the demands of the international market include two major acts of the Ministério da Agricultura Pecuária e Abastecimento (MAPA): Instrução Normativa N. 56 (BRASIL, 2008), which established best-practice recommendations for livestock welfare and economic interests (REBEM) and the Comissão Técnica Permanente de Bem-estar Animal - CTBEA (BRASIL, 2011), with attribution to propose technical standards for animal welfare.

Brazil has applied new welfare standards to pig farming without the support of specific regulations; however, under pressure from Brazilian society and the requirements of importers, the Brazilian pig industry is ready to adopt legally mandated animal-welfare practices that meet market demands and support economic sustainability.

In the opinion of Pedro Camargo Neto, president of the Brazilian Association of Producers and Exporters of Pork (ABIPECS), in the medium term, the industry must be prepared to invest in animal welfare, because originally this measure does not have much to do with the Brazilian production (referring to Directive 2008/120/EC), but gradually it passes to be a requirement of international market itself, which Brazil will have to adapt. Although the rules were not included in the WTO, overtime, they come to be barriers to importers (CAMARGO NETO, 2012).

Given that Brazil has surplus pork production and must export a significant amount, recognition of the welfare requirements of importers would help to bring Brazil into greater harmony with the international market. Brazil must meet the standards of its European competitors.

The objective of this analysis is to review European legislation regarding animal welfare in production, assessing the potential of

these standards for the Brazilian industrial pig farming through a discussion of factors that favor or hinder their application.

DEVELOPMENT

The evaluation of the possibility to adopt the European welfare standards for intensive pig farming in Brazil demands a critical analysis of its strengths and difficulties. The critical points and competitive advantages of its application will also be demonstrated.

Herefore, based on the practices of the Brazilian pig industry and considering European Directives 98/58/EC and 2008/120/EC (COUNCIL OF THE EUROPEAN UNION, 1998, 2008), some key questions of this discussion are o:

- Does Brazil have the resources needed to follow the European model of welfare?
- What are the advantages and disadvantages of implementing these models in Brazil?
- What are the most significant changes to adapt Brazilian production to the standards of European welfare, and what impacts would they have on production?

The physical structural and management aspects of industrial pig farms may indicate the difficulties that industrial pig farms would need to undergo to implement these changes (Table 1). The housing of pregnant sows and modifications of the floors in different sectors of the farm exemplify structural changes. In terms of management, the need for a minimum weaning age and changes in procedures (mutilations) performed on newborns is also required. The table outlines structural and management changes with "greater impact", where the levels of complexity for implementation in Brazil, can be represented by four status: ↓ (Reduced): Those situations where the natural Brazilian advantage due to climate, space or availability of human resources and raw materials for food, giving to Brazil a clear advantage; + (Mild): Those situations where there is minor changes to management and/or low investment; ++ (Moderate): Those situations where there is moderate changes to management and/or moderate investment; +++ (High): Those situations where there is major changes to management and/or high investment.

The analysis of important elements for successful pig industry reveal specific potential advantages for Brazil in terms of grain production, natural resources, human talent and climate.

Brazil is self-sufficient in corn and soybeans, which are the two main raw materials

Table 1 - Theoretical level of complexity of implementing European Union directives in each area of production (2008/120/EC, 98/58/EC) in the Brazilian pig industry.

Requirements of animal welfare	Level
Unobstructed floor area available to each weaner or rearing pig in a group (m ² /animal)	+
Total unobstructed floor area available to each gilt and sow kept in a group after service (m ² /animal)	+
Minimum area of continuous solid floor in a gestation group (m ² /animal)	+
Maximum width of the openings and minimum slat width when concrete slatted floors are used for pigs kept in groups	+++
Freedom of movement: gilts and sows, tethered	↓
Freedom of movement: housing pregnant sows in a group	+++
Access to manipulable material to build a nest during the week before the expected farrowing time	+++
Permanent access to sufficient stimulation and enrichment activities for all pigs	+++
Supply of wholesome food appropriate to their age and in sufficient quantity	↓
Conception and use of feeders and drinkers to reduce the risk of contamination and negative effects of competition between animals	+
Use high-fiber materials in the diet of gestation sows	++
All pigs fed at least once a day	↓
Simultaneous access to feed for all pigs fed in groups and not fed <i>ad libitum</i>	+
Fresh water for all pigs over two weeks of age	↓
Segregation of sick animals (hospital pens) with immediate and appropriate treatment	↓
Appropriate euthanasia procedures when necessary to prevent needless suffering	++
Sufficient number of trained people to take care of the animals	↓
Staff training (training courses/certificates)	↓
Low level of continuous noise (<85 dBA), constant or sudden noise shall be avoided	↓
Light with an intensity of at least 40 lux during a minimum period of 8 h/day	↓
Lying area: physically and thermally comfortable, drained, clean and with space for all animals to lie down at the same time	++
Floors smooth, not slippery, and stable	+
Air circulation, dust level, temperature, relative air humidity and gas concentrations within limits not harmful to animals	↓
Daily inspection of equipment essential to animal health and welfare and correction of damage	↓
Provide emergency and alarm systems, when animal health and welfare depend on artificial ventilation systems	+
Procedures with piglets: avoid routine reduction of corner teeth	+
Procedures with piglets: avoid routine tail docking	++
Procedures with piglets: castration of males until 7 days (without anesthesia and analgesia)	+
Procedures with boars: reduce the length of the tusks	↓
Housing of boars in pens (minimum 6 m ²)	++
Farrowing pens should allow free movement of females and protection for piglets (farrowing rails). The area behind of the farrowing pen should allow natural or assisted farrow	++
Facilities for piglets: allow all piglets to lie down at the same time, floor solid or covered with bedding	++
Weaning at age 28 days or 21 days (nursery: all in/all out, separated from sows)	+
Minimum possible mixing of pigs in the nursery and growing and finishing	++
Daily inspection of animals	↓
Maintain records of veterinary treatments and mortality rates for at least 3 years	+

Levels of complexity for implementation in Brazil:

↓ (Reduced): Natural Brazilian advantage due to climate, space or availability of human resources and raw materials for food.

+ (Mild): Minor changes to management and/or low investment.

++ (Moderate) Moderate changes to management and/or moderate investment.

+++ (High): Major changes to management and/or high investment.

Source: COUNCIL OF THE EUROPEAN UNION (1998, 2008).

used in feed production. In 2011, Brazilian pigs consumed 15.44 million tons of feed, 23.9% of the total feed produced in the country. The demands for corn and soybean meal for all animal production were, respectively, 36.6 million tons and 12.3 million tons (SINDIRAÇÕES, 2012). During the 2010/2011

harvest, 57.4 million tons of corn and 75.3 million tons of soybeans were produced (COMPANHIA NACIONAL DE ABASTECIMENTO, 2013).

The agriculture occupies only 7% of Brazilian land, with pasture at 23%, urban land at 4% and natural vegetation covering the remaining 65%

(REDEAGRO, 2012). The vast geographical area and great availability of water resources favor the adaptation of pig farms in accordance with European standards of welfare or expansion of new farms.

Brazil has 190.7 million inhabitants, 63.9% of whom live in the south, southeast and midwest of the country (IBGE, 2010). This macro-region is home of almost 100% of Brazilian industrial pig farming (ASSOCIAÇÃO BRASILEIRA DA INDÚSTRIA PRODUTORA E EXPORTADORA DA CARNE SUÍNA, 2013). Thus, the country has a labor force with sufficient technical skills and training in both the traditional pig-farming regions and the more newly developed areas.

Analyzing the possibility of Brazil and Europe to implement production systems of excellence in animal welfare, climate conditions and the territorial extent are some of the factors that make Brazil a region with higher potential to achieve this benefit (MOLENTO, 2013). The Brazilian climatic conditions, such as facility to ventilate the farms, high incidence of natural light, abundant fresh water, and the availability of land for the use of manure and expansion units, the low density of pigs per area and the low cost of labor are elements that favor the Brazilian industry (HECK, 2011a), and these conditions can also facilitate the adoption of European welfare standards.

Specific requirements of different phases of production Maternity phase

At this stage, the most significant structural changes are related to the adequacy of the floors of the stalls and the installation of protective devices for piglets in farrowing pens (Brazil already uses several models) and in other spaces used exclusively for piglets. Concrete slatted floors for the piglets housed in groups must meet strict standards; the maximum width of the openings and the minimum slat width should be 11mm and 50mm, respectively.

An important consideration regarding the floor for piglets in maternity pens is the need for sufficient space for all pigs to lie down at the same time and a solid or coated floor. Investments are needed to improve the floors or even purchase special floors.

The most significant changes in the industry are concentrated in management. The first is related to the minimum age of weaning, which should be performed at 28 days; however, piglets may be weaned at 21 days, provided that the nursery will allow all piglets to be housed in groups with the same age after cleaning and disinfection of stalls, keeping them out from contact with sows after this segregation. In practice, most producers can meet

these standards without changing the work routine. In intensive systems in Brazil, weekly deliveries result in empty maternity and nursery rooms, prioritizing the formation of groups of animals of the same gestational age (sows) or chronological age (weaners). Many Brazilian farms wean at 28 days of age, a policy that gained adherents approximately 12 years ago, after the first outbreaks of porcine circovirus.

In the European Union, castration is allowed if it is conducted until the seventh day of life by means that do not tear the tissues. The procedure must be performed by a veterinarian or by a trained individual. After this period, the procedure can be performed only with anesthesia, prolonged analgesia and by veterinarians. In the minority of Brazilian farms that castrate piglets late (after the seventh day of life), an adjustment to these rules will involve the training of staff. Immunocastration is an alternative to surgical castration that has been practiced by many companies in Brazil since 2007 (BRASIL, 2007). The successful adoption of immunocastration provided a rapid expansion of the use of this new technology favorable to the welfare of pigs by large Brazilian companies (HECK, 2011b). The slaughter of intact males, as practiced in some European countries, is not permitted in Brazil.

The prohibition of routine tail docking, teeth clipping and grinding would reduce the need for procedures in the maternity pens, making easy to adapt the norm. However, European legislation allows these practices when there is evidence that other animals are suffering from aggression caused by bites or cannibalism despite efforts to prevent these behaviors.

Material must be provided to allow sows to express nest-building behaviors before farrowing. This requirement will require complex changes in Brazil, considering the characteristics of the facilities, the cost and logistics of transporting the material, and the expense of manual labor to manage and remove the maternal after use.

This requirement, however, is not mandatory if its omission is technically justified through, for instance, by a slatted floor or by the potential for problems in waste disposal; however, failure to implement this practice could affect the welfare of the females by preventing them from expressing an important behavior.

Nursery phase

In the nursery phase, no significant structural change is needed, except in units with concrete slatted floors that do not meet the standard (the maximum width of the openings and minimum

width slat width, 14mm and 50mm, respectively); however, if the unit uses floors made of another material, such as plastic or iron slatted floors, there is no specific requirements. Many farms in Brazil have floors made of iron or plastics.

One of the main concerns is the maintenance of stable groups of animals, minimizing mixing and preferably restricting it to the maternity pens or to within one week after weaning. This section restricts but does not prohibit common practices such as sexing and separation of animals by size or genetic lines, such as segregations (followed by mixing) which can be performed during weaning or shortly after. This plan corresponds to current practices on most Brazilian farms, so changes would not adversely affect routine practices or costs.

Growing/finishing phase

In the growing/finishing phase, no significant structural change is required, with the exception of floors if a concrete slatted floor is used. The maximum width of the openings and minimum width slat width, 18mm and 80mm, respectively, might require some adaptation of units and consequently some investment.

The maximum density allowed in the final stage (pre-slaughter) is 1m² for animals over 110kg of live weight (DIRECTIVE 2008/120/EC). This requirement would not pose any major difficulties in adaptation because such densities are already common in Brazil, and farms that still do not operate with this density should increase the area of fattening.

Weaning to estrus

In this short period between weaning and estrus, there is no requirement for immediate investment because females at this stage may remain in individual stalls, as it is the standard in most production units. There are also no specifications regarding the size of the stalls or the characteristics of the floors.

Gestation phase

The most significant structural adaptations from the Directive 2008/120/EC (COUNCIL OF THE EUROPEAN UNION, 2008) are required in this phase from 28 days of gestation. Changes can be required in management regarding the feeding system and in static or dynamic gestation groups, mainly in the formation of groups ensuring adequate feed intake by females.

Structural changes may be required if the unit has concrete slatted floors with a maximum opening width and minimum width slat width of 20mm and 80mm, respectively.

Sows kept in groups require an unobstructed floor area. The unobstructed floor area or surface available to each animal must be free of obstacles to movement, allowing them to stand up, lie down and rest freely without restriction. Elements that can pose obstacles may include feeders and structures used to separate animals (fences, dividers, stalls, free-access stalls, half stalls, etc.). These latter structures are designed to provide privacy to animals and ease hierarchical disputes in the pen (BABOT et al., 2012). The space occupied by the continuous feeders can be counted as unobstructed floor area if they are less than 25cm deep and the surface can be used by the animal. The inner part of the free-access stalls or the inner surface of the half-stalls of pregnant females may also count as unobstructed floor area (ANPROGAPOR, 2012). Similar to the inner surface of the feeding stations, these may only be counted as unobstructed floor area when the entry and exit of animals are not compromised. Otherwise, where entry is restricted or when the feeder does not operate 24 hours a day, this area should not be considered unobstructed. Then all these technical issues should be considered by Brazilian producers.

A part of the area of the floor must be continuous and solid, with a maximum of 15% reserved for drainage openings. Independent of the size of the group of pregnant sows, there should be at least 1.3m² of continuous solid floor/sow and 0.95m² gilt. This requirement can be achieved by two means: i) an entirely solid floor (no drainage openings); ii) a combination of solid and slatted floor (maximum width of the openings and minimum width slat width, 20mm and 80mm, respectively). The entirely solid floor has the disadvantage of hampering the drainage of manure and wastewater; however, this model best fits the use of manipulable materials such as straw, without the risk of obstructing manure drainage.

Boar studs

Pens for boars must be at least 6m² and constructed so that the boars can move without restrictions; the boars should hear, smell and see other pigs. A significant structural change may be required for farms using individual housing like stalls. This set of requirements provides no guidelines regarding the floors.

General measures

Widespread measures, regardless of the stage, include environmental-enrichment materials for all pigs, such as straw, is one of the more complex points of care. Considering the tropical climate, this condition may compromise temperature management.

Furthermore, such enrichment is not a usual practice in the country and thus will require the development of new technologies and practices. To meet this demand, Brazil needs to develop research involving producers, Embrapa (Brazilian Agricultural Research Corporation) and Brazilian universities.

The training of farm workers is also shaped by European rules regarding animal care. Farm workers must receive training courses focused on welfare; however, the regulations do not specify the minimum number of training hours and the frequency thereof. A technical report by the National Pork Producers Association of Spain suggests that a minimum one course of 20 hours is needed to ensure that employees receive appropriate training (ANPROGAPOR, 2012). Moreover, in practice, only one person per farm is required to undergo formal training. That person is responsible for passing on this information as an internal welfare consultant. In Brazil, implementation of these measures would not be complex; it can be done through government policies.

CONCLUSION

Brazilian industrial pig farms are fully capable of meeting the standards of European welfare laws. Brazil has some potential advantages related to the availability of natural resources.

The implementation of European welfare standards in Brazilian industrial pig farming could increase the value of the pork produced in Brazil and its competitiveness in international markets.

Brazil already meets some of the welfare requirements. The time needed to meet legal standards to participate in international markets may be equivalent was needed in Europe (moratorium <10 years); however, Brazil should develop technologies adapted to the climate and structure of Brazilian farms.

REFERENCES

- AGRINESS. **Melhores da suinocultura**: resultados oficiais da 6ª edição. Florianópolis: Agriness, 2013. 8p.
- ANPROGAPOR. **Guía explicativa para la aplicación del RD 1135/2002**, de 31 de octubre, relativo a las normas mínimas de protección de los cerdos. Madrid: Ministerio de Agricultura, Alimentación y Medio Ambiente, 2012. 44p.
- ASSOCIAÇÃO BRASILEIRA DA INDÚSTRIA PRODUTORA E EXPORTADORA DA CARNE SUÍNA (ABIPECS). **Relatório 2012-2013**. Available from: <<http://www.abipecs.org.br>>. Accessed: Sept. 18, 2013.
- BABOT, D.G. et al. **Observatori del porcí**. Informe anual. Informe del sector porcino ejercicio 2011. Generalitat de Catalunya. Lleida: Departament d'Agricultura, Ramaderia, Pesca, Alimentació i Medi Natural, 2012. 230p.
- BLOKHUIS, H.J. International cooperation in animal welfare: the Welfare Quality® project. **Acta Veterinaria Scandinavica**, Copenhagen, v.50, Suppl.1, n.S10, p.1-5, 2008.
- BOTREAU, R. et al. Aggregation of measures to produce an overall assessment of animal welfare. Part 2: analysis of constraints. **Animal**, Cambridge, v.1, n.8, p.1188-1197, 2007.
- BRAMBELL, F.W.R. **Report of the technical committee to enquire into the welfare of animals kept under intensive husbandry systems**. London: Her Majesty's Stationary Office, 1965. (Cmd 2836).
- BRASIL. Instrução Normativa n. 56, de 6 de novembro de 2008. Estabelece os procedimentos gerais de Recomendações de Boas Práticas de Bem-Estar para Animais de Produção e de Interesse Econômico - REBEM, abrangendo os sistemas de produção e o transporte. **Diário Oficial da União**, Brasília, 7 nov. 2008, Seção 1, p.5.
- _____. Ministério da Agricultura Pecuária e Abastecimento. **Ofício Circular n. 001/2007/DICS/CGI/DIPOA**. Autorização para o abate de suínos imunocastados por meio de vacina. Brasília, 2007. 4p.
- _____. Ministério da Agricultura, Pecuária e Abastecimento. Portaria n. 524, de 21 de junho de 2011. Instituir a Comissão Técnica Permanente de Bem-Estar Animal - CTBEA. **Diário Oficial da União**, Brasília, 22 jun. 2011.
- CAMARGO NETO, P. **Bem-estar de suínos virá com custo no setor no médio prazo**. Available from: <<http://www.suinculturaindustrial.com.br>>. Accessed: Oct. 2012.
- COMPANHIA NACIONAL DE ABASTECIMENTO (CONAB). **Série histórica de produção safras 1976/77 a 2012/13**. Available from: <<http://www.conab.gov.br>>. Accessed: Sept. 18, 2013.
- CONSELHO DAS COMUNIDADES EUROPEIAS. **Directiva 74/577/CEE** do Conselho, de 18 de Novembro de 1974. Relativa ao atordoamento dos animais antes do seu abate. Edição especial portuguesa. Bruxelas, 1974. Cap. 3, p.258.
- COUNCIL OF THE EUROPEAN UNION. Council Directive 2008/120/EC of 18 December 2008 laying down minimum standards for the protection of pigs (Codified version). **Official Journal of the European Union**, n.L 47, 18 fev. 2009. p.5.
- _____. Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes. **Official Journal of the European Union**, n.L 221, 8 ago. 1998. 23p.
- EUROPEAN COMMISSION. **Communication from the commission to the European parliament**. Brussels: The council and the European economic and social committee on the European Union Strategy for the Protection and Welfare of Animals, 2012-2015. 2012. COM (2012).
- FARM ANIMAL WELFARE COUNCIL. **Farm animal welfare in Great Britain**: Past, present and future. 2009. p.1-59. Available from: <<http://www.fawc.org.uk>>. Accessed: Apr. 5, 2012.
- _____. FAWC updates the five freedoms. **Veterinary Records**, London, v.17, p.357, 1992.

- _____. **Final report**, 2011. p.1-14. Available from: <<http://www.fawc.org.uk>>. Accessed: Apr. 5, 2012.
- _____. **Press statement**. Hook Rise South, 1979. 2p.
- HARRISON, R. **Animal machines**: the new factory farming industry. London: Vincent Stuart Publishers, 1964. 215p.
- HECK, A. A revolution in pork production. In: LONDON SWINE CONFERENCE - Exploring the future, 11., 2011, Ontario. **Proceedings...** Ontario: London Swine Conference. 2011a. p.19-26.
- HECK, A. Imunocastração in swine: a practical approach. In: LONDON SWINE CONFERENCE - Exploring the future, 11., 2011, Ontario. **Proceedings...** Ontario: London Swine Conference, 2011b. p.135-142.
- IBGE. **Sinopse do censo demográfico 2010**. Available from: <<http://www.ibge.gov.br>>. Accessed: Sept. 18, 2013.
- MAGRAMA. **Eurostat y estadísticas del magrama**. Sacrificio de cerdos en Europa 2011. Available from: <<http://www.3tres3.com>>. Accessed: Nov. 5, 2012.
- MANTECA, X.; GASA, J. **Bienestar en el ganado porcino**. Barcelona: Boehringer Ingelheim, 2008. 118p.
- MOLENTO, C.F.M. Bem-estar animal na europa, é viável implementar no Brasil. In: SIMPÓSIO BRASIL SUL DE SUINOCULTURA, 6., 2013, Chapecó, Brasil. **Anais...** Chapecó: Simpósio Brasil Sul de Suinocultura, 2013. p.121-122.
- NATIONAL ANIMAL WELFARE ADVISORY COMMITTEE (NAWAC). **Animal welfare (pigs) code of welfare 2010**. New Zealand: MAF Biosecurity, 2010. 44p.
- NATIONAL FARM ANIMAL CARE COUNCIL. **Code of practice for the care and handling of pigs**. Ottawa, 2014. 75p.
- OIE. World Organisation for Animal Health. **Terrestrial animal health code**. 18.ed. Paris, 2009. V.1.
- PRIMARY INDUSTRIES STANDING COMMITTEE (PISC). **Model code of practice for the welfare of animals**: pigs. 3.ed. Victoria: CSIRO Publishing, 2008. 32p.
- REDEAGRO (REDE DE CONHECIMENTO DO AGRO BRASILEIRO). **Uso da terra no Brasil**. 2012. Available from: <<http://www.redeagro.org.br>>. Accessed: Sept. 18, 2013.
- RUSHEN, J. Farm animal welfare since the Brambell report. **Applied Animal Behaviour Science**, Amsterdam, v.113, p.277-278, 2008.
- SINDIRAÇÕES. **Setor de alimentação animal**. 2012. Available from: <<http://www.sindiracoes.org.br>>. Accessed: Sept. 18, 2013.
- THE TREATY OF AMSTERDAM. Protocol on Protection and Welfare of Animals. **Official Journal C 340**, 10 nov. 1997.
- VELARDE, A.; DALMAU, A. Animal welfare assessment at slaughter in Europe: moving from inputs to outputs. **Meat Science**, Barking, v.92, p.244-251, 2012.