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## Correlation sow, piglet and personnel responsible at the design of a farrowing crate for sow.

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### ABSTRACT

In housing for sows in a farrowing pen must meet the environmental requirements of the sow, the piglet and personnel responsible. Their daily activities require compliance with thermal, physical and social factors that are closely related to their welfare. Evaluation of 200 models used in the main pig producing countries to define world trends farrowing, their technical and economic arguments that fundamental. Coexistence sow, piglet and human, required to provide a temperature distribution that meets the biological requirements of every living entity and generate comfort, technical argument that explains why traditional farrowing crates that restrict the movement of the sow to protect the piglets are by discontinuing use. This work show the design of a farrowing crate as a commercial alternative to Mexico, which meets the 30 parameters defined, privileges the senses of touch, taste, smell, sight and hearing of the sow as generators of comfort, the footprint of his hooves and their points of contact with floors and express their respect by natural movements, when lie down, get up, eat and exercise. The five met manufactured prototypes expected in each of the four test runs expectations. With litter average 12 piglets, the average mortality rate in the twenty test scores is 5.3% after 3 days and 4.8% after 15 days old piglets. Swine farmers made following recommendations to help reduce the mortality rate. 1 show the economic benefits involved stress reduction in the sow. 2. Attend the timely and individual to each sow in childbirth. 3. Promote environmental enrichment variables that must be implemented in the Farrowing crate. 4. Provide the necessary room temperature for piglets and sows.

**Keywords:** Design, sow, comfort, farrowing crate.

### 1 Introduction

In housing for sows in a farrowing pen must meet the environmental requirements of the sow, the piglet and personnel responsible. Their daily activities require compliance with thermal, physical and social factors that are closely related to their welfare. In practice, producers developing indoor free-farrowing systems need to consider key aspects of design and management to maximize piglet survival and enhance the welfare of sows and piglets. These include: provision of sufficient space, solid floors with long straw bedding in the nest area, optimal physical and thermal environment to maximize maternal behavior, key design elements highlighted here and importantly an attitudinal shift to the operation of the system, (Baxter, 2009). Production in pigs, attendance at delivery is limited mainly by the costs of the individual attention of sows, plus childbirth often occurs at night time. Due to various physiological parameters, the body of the sow before farrowing has temperature changes, Suzanne (Held, 2011). Round 50% of the postnatal death in piglets is caused by crushing or overlying by the domestic sow when they are kept loose in a farrowing pen. To solve some of these problems, much research attention has been directed towards the farrowing environment, (Andersen, 2005). Sow at liberty days before childbirth tends to be outside the group to se-

lect the nest site and will be even far from the area daily. The day or the hours before childbirth makes an oval nest excavated a piece of ground and standing around branches, straw or any material easy to get cover protects and litter, preventing dispersal, (Baxter, 2010). At farms with system intensive, the sow trying to build a nest. Operations kicking, digging and hauling materials are common. Nest building ceases four hours before childbirth coinciding with the increased level of oxytocin and uterine contractions. Today modality is to motivate the natural maternal behavior to help the survival of piglets. Enriching the environment of childbirth and minimize the modified maternal behavior, (Blackshaw, 2013). In commercial farms, females are taken to farrowing crates without bed but relatively comfortable, with the objective of reducing the area per female, have proper control and limit losses piglet crushing. The sow should be allowed: Senior visual contact with pigs. Provide training material for a nest to help improve maternal behavior and reduce losses by crushing. Provide it with straw, strings, wood or other objects to help you reduce stress and stereotypies. Have room to move longitudinally and take positions, movements and convenient natural behaviors. Distinguish between defecation areas and nest. Moving and nuzzle to warn piglets will lie. To reduce injuries, the floor area of the sow should be non-slip. Consider developing movement while changing position to get up and down to set the type of floor, (Lewis and Boyle, 2005).

## 2 Materials and methods

This is part of the research "Design and construction of a maternity room for pigs," whose purpose is to prioritize the implementation of the concepts of animal welfare, to promote their application in the livestock sector in Mexico. The line of research defines design parameters that must fulfill a maternity room in five dimensions: 1. Environmental conditions that demand the sow the piglet and the staff. The thermo neutral zone, air quality, humidity, noise, light intensity, photoperiod, vital space and space intolerance, coefficient of resistance to passage of heat. 2. Welfare animal. 3. Production system. 4. the housing Design. 5. Economic variables. At this stage animal welfare concepts relate to daily and productive life of the sow. By identifying and conceptualizing the problem, generates and analyzes a variety of materials; videos, photographs and printed material, which illustrates the behavior of the sow from arriving at the maternity room, before, during and up to two weeks after childbirth, and staff, the space necessary for the work in childbirth. Afterwards the functionality and versatility of 200 farrowing crate models used in the main pig producing countries analyzed. This step allowed us to identify the principles of solution applied to the geometries of the cages that create comfort and motivates the expression of natural behavior of animals, trends, building materials and manufacturing processes. Three alternative solutions were evaluated using the following indicators: 1 Floors. Coefficient of friction, thermal insulation, durability, interchangeable parts, ease of installation, pins problems, ease of cleaning, material accessible on the market. 2. To define the future innovations designed cage, were invited to a product in each test to externalize some qualitative arguments of its operation. structure. Dimensions, dimensional adjustment systems, strength, rigidity, manufacturing process, interchangeability of parts, thermal insulation, durability, physical damage to the animal and personnel, allow natural movement of the animal. 3. The wall. Rigidity, durability, thermal insulation, installation, cleaning, color and piglet protection. 4. Pen. Space, light intensity, motivated natural behavior, enrichment, comfort. A partial evaluation of 5 prototypes manufactured with four deliveries each and mortality in the first 3 days of life and 2 weeks after birth, as the only reference variable measures the crushing of piglets. To define the future innovations designed To define the future innovations designed cage, were invited to a product in each test to externalize some qualitative arguments of its operation, were invited to a product in each test to externalize some qualitative arguments of its operation.

## 3. Results

The design parameters that must be met in the design of a maternity ward for pigs are a function of: 1. Environmental conditions that demand the sow and piglet. The thermo neutral, air quality, humidity, noise level, photoperiod area have light intensity, living space and intolerance, coefficient of heat flow resistance of the housing, and their senses of touch, taste, smell, vision and hearing. Also provide appropriate working environment for the staff in

charge. 2. Welfare animal. Prioritize compliance with the principles and criteria of animal welfare defined by Welfare Quality Assessment Protocol for Pigs, 2009, to provide comfort and motivate individual and social natural behavior of the sow and piglet. 3. The related to the production system. 4 Housing: Understand global trends in maternity wards, farrowing crates and piglets pen in the main pig producing countries, identifying engineering principles applied, such as resistance, stiffness, heat transfer phenomena, ventilation, heating, thermal and mechanical properties of materials and construction processes. 5. Economic sustainability of the production unit. This promotes the design of a farrowing crate for sows that prioritize animal welfare concepts and promotes its application in the livestock sector in Mexico.

This principle complies with 30 design parameters tested and agreed with pig farmers. The farrowing crate designed has the following design features: The farrowing pen: With dimensions of 3400mm by 2500mm. This only works with the farrowing crate 2400mm by 2500mm. See Figure 1. It has three areas: 1 Farrowing crate. Recreate the natural conditions that searches the sow before farrowing, an argument that provides confidence to the sow and reduce the stress of labor. With a cover color, dark green and litterfall, offered to sow security against possible predators, regulate light intensity and improve the visual isolation. A container with stubble leading to formation of the nest and suspended objects accessible to the sow and sweet flavor make an environmental enrichment. 2. Area exercise of the sow. Playground that allows the sow release stress after crucial hours in antepartum and postpartum where it can drink water, eat and do various movements, without risking the piglets. 3. Pen for piglets.

Floors: Tables made from recycled polyethylene 20 mm thick by 100 mm wide, straw colored, arranged longitudinally on the pen, provides the sow and piglet confidence moving. Tables with static friction coefficient of 0.2, average surface imperfections 3 mm depth, 5 mm wide, 10 mm long and malleable the passage of the animal's hoof. Tables that form a uniform continuous plate, where rest the piglets and the sow, with separations of 10 mm to 20mm for piglet and sow area of debris. This arrangement of tables in the pen form five areas of floors; rest, exercise, waste and protect the front legs of the sow when lying down or up in the cage. In the area of contact with the floor piglets, straw is used to improve the thermal condition.

Walls: Incorporating recycled polyethylene tables of 8 mm thick, 500 mm wide and green and litterfall color. The greater heat exchange of the piglet inside the Farrowing pen occurs in the contact you have with the various surfaces. To help the thermoregulation system of piglets, the walls are sprinkled with thermal paint, which creates a thermal conductivity of surface, 0.018Wm-1k-1. According to paint manufacturer has useful life of 15 years, high flexibility and does not retain odors. The wall objects hanging have easy access to invite piglets develop their qualities of rooting, detect and recognize different textures, away from the sow.

Farrowing crate structure: Two pieces of steel 1150mm high and 2200 mm length, 800mm spaced form the Farrowing structure that defines the area of the sow. Zone whose geometry and dimensions are designed with the philosophy, "Limiting movement, allowing movement." The structure is can move and rotate, complete or individual parts within the pen. With longitudinal and transverse systems adjustment the Farrowing to give versatility and can adapt to different sizes of animals. The versatile design of the structure favors its strength, rigidity, easy manufacturing process and interchangeability of parts, as arguments to increase its life. In addition to allowing the natural movement of the sow and avoid that harmful for piglets. The structure is sprayed with yellow paint thermal contrast with the color of pen and acts as indicator for the sow lies down safely and minimize the crushing of piglets. The paint on the structure minimizes Thermal sensation of the sow when in contact with steel.

The five met manufactured prototypes expected in each of the four test runs expectations. With litter average 12 piglets, the average mortality rate in the twenty test scores is 5.3% after 3 days and 4.8% after 15 days old piglets.

Swine farmers made following recommendations to help reduce the mortality rate. 1 show the economic benefits involved stress reduction in the sow. 2. Attend the timely and individual to each sow in childbirth. 3. Promote environmental enrichment variables that must be implemented in the Farrowing crate. 4. Provide the necessary room temperature for piglets and sows.

#### **4. Conclusions**

Pig production units in Mexico have no technology to minimize mortality of piglets. Therefore, it is important to continue the development of animal welfare concepts and their application in the design of their facilities. Motivate the expression of natural behavior, provide comfort conditions and finally the welfare of animals, the indicator is more important in the design of housing and livestock equipment. Since, in Mexico initial financial investment, is the strongest argument for the adoption of new technologies, Farrowing crate for sows promoted is priced 40% less than existing commercial cage.

To achieve the goals outlined in the research "Design and construction of a maternity ward for swine" and have an impact livestock sector in Mexico, it is recommended to work on the following topics: 1. Establish a testing methodology to indicate the degree stress generated by the sow's designed Farrowing crate. 2. Designing a monitoring system via remote, temperature and heart rate of a sow to predict childbirth reduce the mortality rate of piglets and improve individual care and welfare of the sow and piglet. 3. Knowing the environmental enrichment variables that must be implemented in a housing and farrowing crates.

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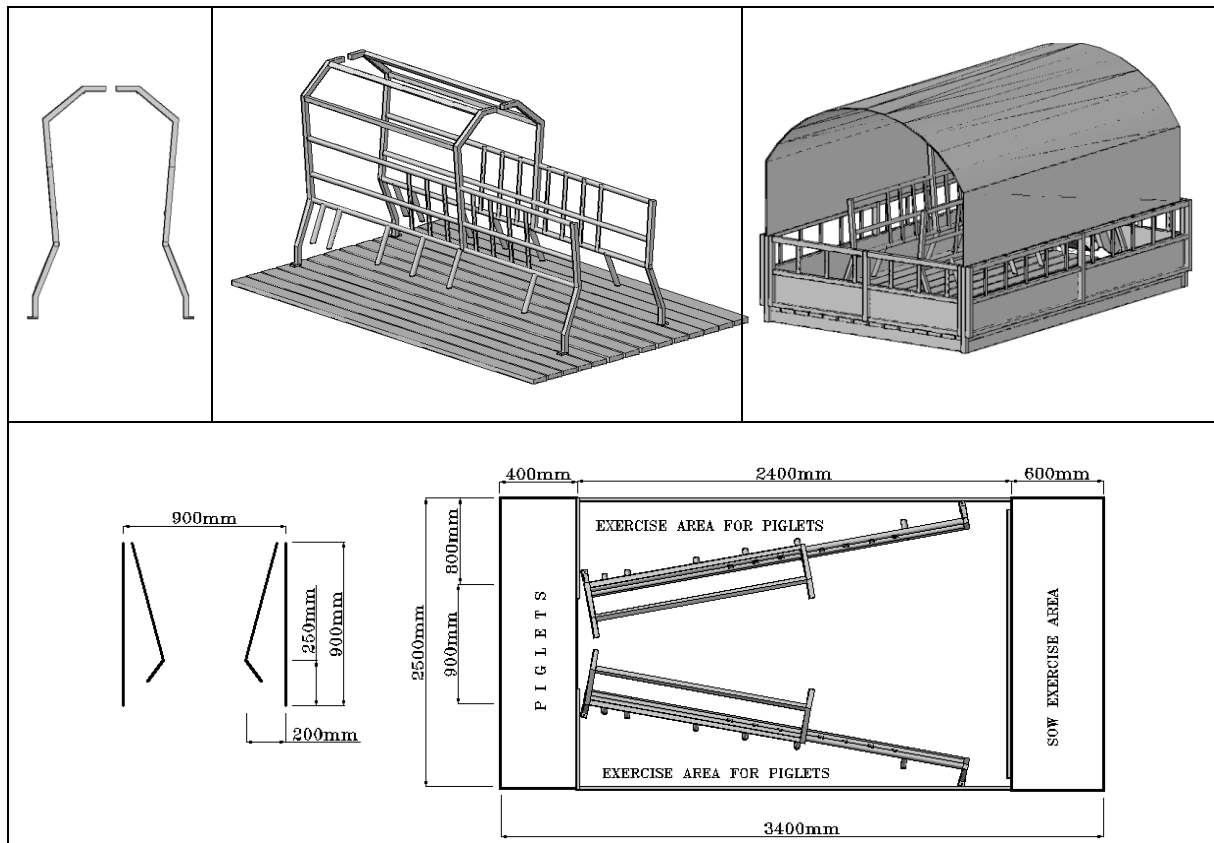


Figure1. Dimensions and geometry farrowing crates sows.