MINIATURE PIGS FACILITIES AND MANAGEMENT AT THE INRA

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ABSTRACT

In 2005, the INRA decided to create its own breeding facilities for miniature swine. The current facilities and management for Pitman-Moore and Yucatan breeds are described. Animals are housed in a newly transformed closed building block that was used in the past for larger commercial pigs. The herd size is about 50 sows and 12 boars, and their litters are kept until around 6 months old. Animals are housed in small groups of 6 to 10 animals, in slatted-floor pens with controlled air circulation. Sows are unrestrained in space inside farrowing pens and mating boars are housed alone. Sows are raised on a 7-week batch farrowing system with natural mating within a closed herd. Piglets are weaned at 4 weeks. They stay in their pen until they are 3 months old and then moved to the growing unit. Feeds are in accordance with the physiological stage. All animals are restrained in food to limit obesity so that growth and body weight are controlled. Weight is around 700 g at birth, 4 kg at weaning, 18 kg at 6 months of age, 37 kg at 1 year, and between 60 and 70 kg for adults. Animal cares are quite similar to larger pig production.

Key words: Breeding, Facilities, Growth, Miniature pigs

INTRODUCTION

In 2005, the miniature pig project started at the INRA. Three years later, work began. facilities for a minipig herd were created on the site of Saint-Gilles (Brittany, France) in a newly transformed closed building block that was used in the past for larger commercial pigs. Breeding stock was introduced in June 2008 (Vietnamese and Pitman-Moore breeds) and in June 2010 (Yucatan breed).

Although miniature pigs are bred for more than 60 years for biomedical research around the world, poor literature deals with management and description of facilities for this kind of pigs. At the beginning, most of them were maintained in pasture with a shelter. Mc Clellan *et al.* (1966) are quite specific in their description of facilities and management used in the Battelle Memorial Institute. In Europe, the Göttingen miniature swine breeding facilities located in Denmark are operational since many years but it is a private company and access to it is very limited. Furthermore, no usual commercial supplies are available for these pigs in Europe. In general, facilities were designed on the basis of knowledge for larger domestic pigs.

Likewise, minipig reproductive traits were compared to larger domestic pigs. Miniature and larger pigs seem close, except for sexual maturity, which is earlier, and litter size, which

is lower in miniature swine (Bouchard. *et al.*, 1995; Ellendorff *et al.*, 1977; Panepinto *et al.*, 1978; Thong, 1974; Weaver, *et al.*, 1965). About males, a few data are available on semen but on different breeds, and management of the herd is not really reported (Evans *et al.*, 1990; Lipetz *et al.*, 1989; Pinkert *et al.*, 1993; Schimatsu *et al.*, 2002). Dealing with nutrition, for a long time it was generally accepted that miniature pigs needs were the same as the needs for pigs' production (Bollen *et al*, 2000). Bollen *et al.* (2006) concluded that needs in protein and metabolism energy are different. Lynda Panepinto (personal communication) agrees with this and insists on level of micronutrients in the formula, especially when ration is strongly restricted.

According to these different elements, obtained from several breeds of miniature pigs, knowledge on commercial pigs and thanks to a visit of the Göttingen miniature pigs breeding facilities or talk with Lynda Panepinto, the facilities and management at the INRA were designed.

FACILITIES

The minipig facilities are composed of one building of 1,000 m². All the pens have slatted floor and the rooms are controlled for temperature by hot water heaters, and for air circulation by electric exhaust fans. Rooms are distributed over 3 main areas: a farrowing/weaning block, a growing block and a breeding block.

The farrowing area is composed of 3 rooms with 12 farrowing pens each (fig. 1). At the beginning, a removable wall was imagined to limit the area during farrowing, thinking that crushed piglets would be a major problem, which was not observed. Removable walls are not used now and increasing the pen's area even improves the farrowing environment. In addition, a rubber mat is introduced in the pen during the first days after birth, in particular for the smallest piglets of which the legs can go through the slatted floor. The nest is separated from the rest of the pen by a slide gate allowing access to piglets only. At weaning, the slide gate is closed to keep the piglets in the main area with the aim of preventing any escape from the nest where the outside wall is 0.5 m high (*vs.* 1 m for the other walls of the pen).

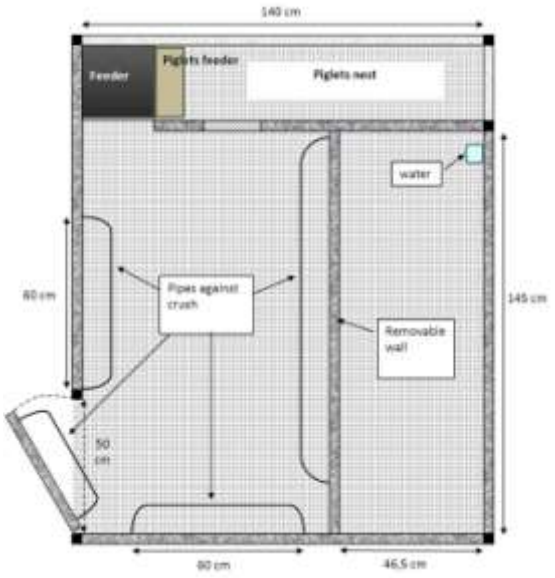

Fig. 1. Schematic plan of a farrowing pen.

The growing area is composed of 6 rooms with 6 pens (7.5 m² each). Two feeders are installed in each pen to let all animals eat at the same time. Each pen has removable plastic slats on their front and back parts to allow access to a concrete tank, which is cleaned between each batch of pigs. The rest of the floor is composed of concrete slats. Twelve young animals are housed per pen and older pigs or adults are also housed in groups with 1.25 m² of space per animal.

The breeding area is composed of 2 rooms. The first one is dedicated to pregnant sows housed in groups (Fig. 3) It is not still working because sows will be

fed with self-feeders (prototypes) which are not yet working because of still in development. For the moment, sows are housed in growing pens in group of 6. The second one is dedicated to boars and mated sows housed in distinct pens (Fig 4)..

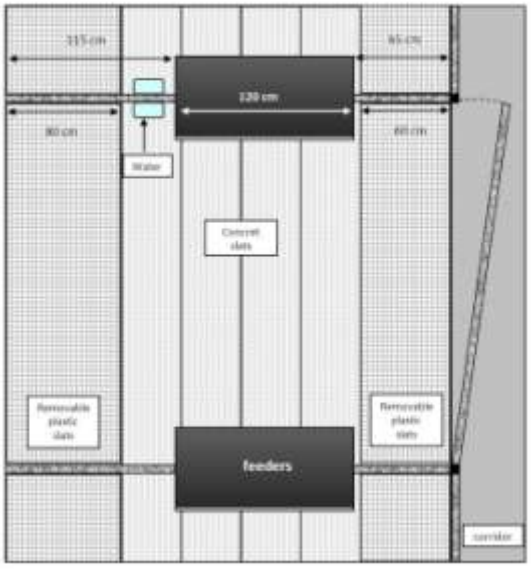

Fig. 2. Schematic plan of a growing pen.

The room for boars and mated sows is composed of 12 individual pens for boars, of 2 m² of space each, and 3 pens for sows and gilts in groups for mating (one of 6 places and 2 of 3 places) with 1.2 m² of space per animal (Fig. 4). All pens have a concrete slatted floor.

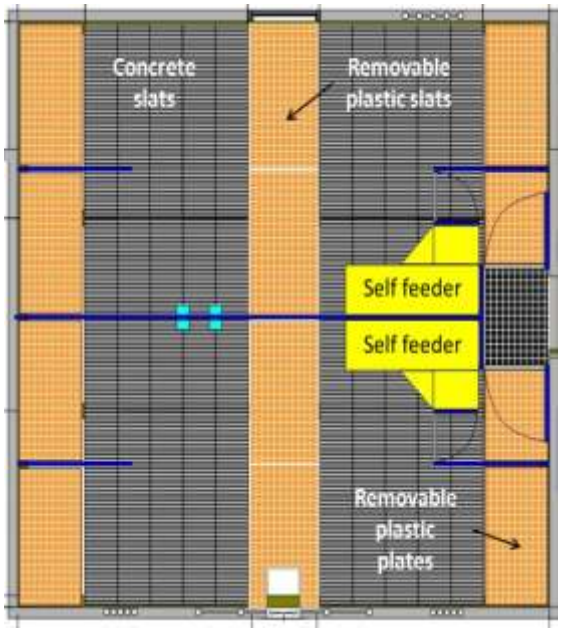

Fig. 3. Pregnant sows room.

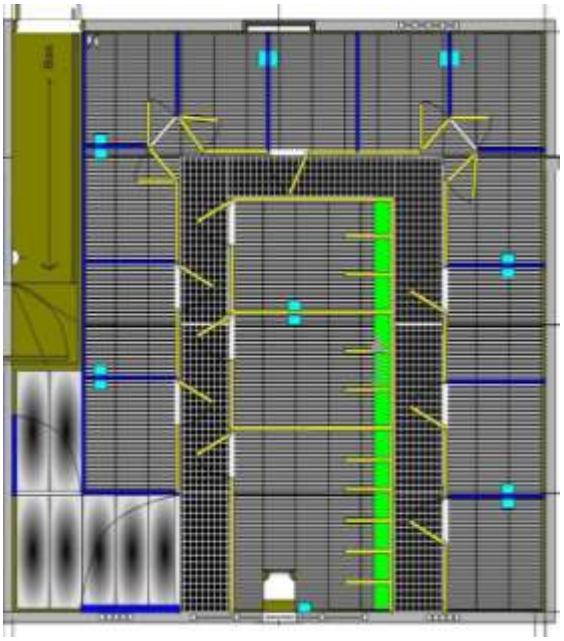

Fig. 4. Boars and mated sows room.

A sick room is also available. This room has the particularity to be composed of several pens adapted for different physiological stages of the animals. Fortunately, the occurrence of having sick animals in our facilities has been low since the start of the breeding program, so this room is often used to prepare experimental animals or before a shipment. Two experimental rooms of 60 m² are also available in the building. They are open spaces with concrete floor and slopes to eliminate waste and to wash easily. Currently, they are mainly used for behavioral studies.

MANAGEMENT

Technical workers being limited in number, this element was a strong factor to design the breeding facilities and management system. Sows are raised on a 7-week batch farrowing system and piglets weaned at 4 weeks of age. For each batch, sows are matted at the same time with the objective of having 12 sows at farrowing simultaneously. Gilts are introduced only to replace original sows with troubles; otherwise, sows are kept as long as possible. Housing pregnant sows in groups and restricted feed supply is not without problems. Pregnant sows are moved to farrowing pens between 2 to 3 weeks before the expected farrowing date, so daily intake is individually supplied and levels adapted to body weight. With self-feeders for pregnant sows, daily intake can be controlled all along pregnancy and thus the sows could be introduced later in farrowing pens.

Table 1. Main specifications of feeds supplied to miniature pigs.

	Starter	**Piglet**	**« sows »**	**mini pigs**	**lactating sows**
Proximate analysis, %					
Ash	7.0	5.4	5.8	6.8	6.1
Crude protein	19.0	18.0	13.3	15.0	16.4
Crude fat	6.7	2.8	4.3	2.4	4.2
Crude fiber	3.0	3.6	5.1	14.1	4.1
Starch	24.5	43.5	40.5	29.1	39.0
Nutritional values					
Net Energy, Mcal/kg	2.54	2.31	2.21	1.74	2.25
Digestible Lysine, g/kg	12.8	11.4	4.6	5.0	8.4
Digestible Phosphorus, g/kg	4.1	3.9	2.4	2.2	3.5
Calcium, g/kg	12.5	9.5	11.5	9.8	11.0

During lactation, to prevent obesity, daily intake is limited to 4 % of body weight for gilts and 5% for sows. In general, all animals are weighed at least once a month to check growth, and at food transition, with the aim of adjusting feed intake to maintain a homogenous herd as far as possible. Five different feeds are used (Tab. 1). The “starter” one is supplied *ad libitum* during 2 weeks before weaning and at 3.7 % of body weight one week after. The “piglet” food is supplied during 3 weeks at 3.0 % of body weight, followed by the “sows” feed (corresponding to the feed usually delivered to larger commercial sows) supplied at 2.8 % of body weight during 2 months. The last feed supplied is the “minipig” feed, provided at 2.25 % of body weight during 2 months. Thereafter, the daily ration slowly decreases until 1.20 % of body weight for older adults. The “minipig” feed is the result of a work (unpublished) on energy needs of Göttingen miniature pigs in which 6-month-old animals were housed in calorimetric chambers. As animals are restrained in food intake, growth is controlled too but not stopped. As reported in Fig. 5 and 6., body length (from the root of the tail to the end of the snout) and body weight evolve together. At 30 months of age, the body length curve stops increasing whereas body weight continues to increase slightly, suggesting that skeletal growth has ended but potentially not body weight. So increasing food intake in mature animals would likely lead to obesity.

Animal cares are quite similar to larger commercial pigs. Pigs' hooves are trimmed at farrowing. A particular attention must be paid to this procedure, otherwise locomotion disorders quickly appear. Piglets receive iron injection at birth. Males and females are separated and housed in pens of same sex around 3 to 4 months of age because of early puberty.

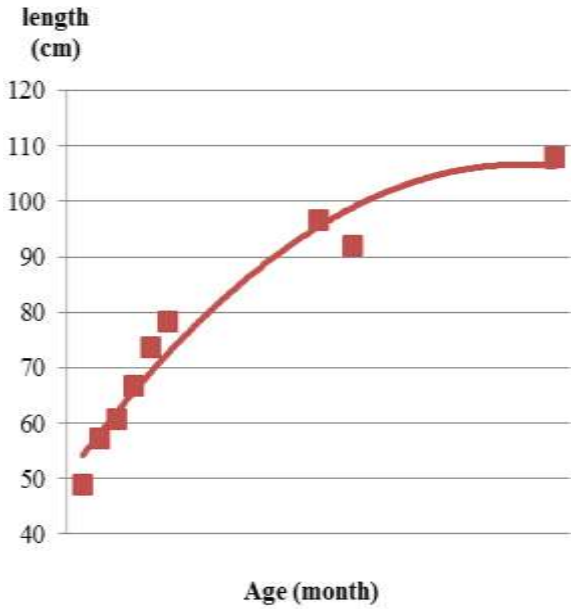

Fig 5. Body length of the Yucatan miniature pig in relation to age.

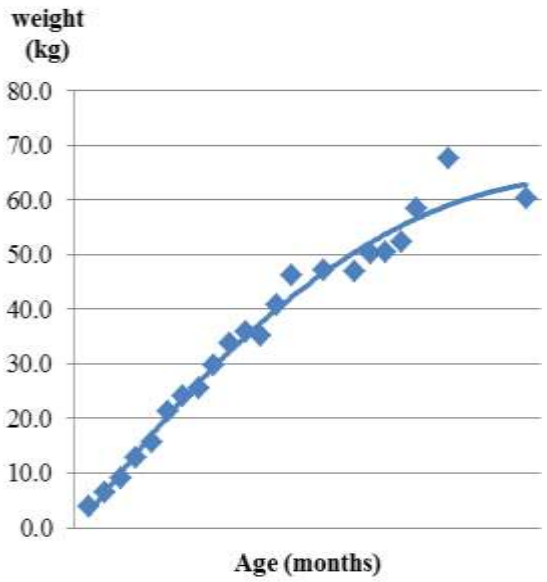

Fig. 6. Body weight of the Yucatan miniature pig in relation to age.

CONCLUSION

Pigs used for meat production are often used like “control” in comparison to miniature pigs. It must not be forgotten that genetic selection (natural or controlled by the human) created two types of divergent animals that are used with different purposes (production *vs.* biomedical research). At the INRA of Saint-Gilles, knowledge on miniature pigs improves day after day, benefiting from past and shared experiences. In our case, one of the most important challenges was to design, find and build suitable breeding facilities for miniature pigs. Applying technics used for larger commercial pigs, such as the 7-week batch farrowing system, appears to be quite adapted to miniature pig breeding. Today we can consider that we have a basic breeding system that is working well to supply animals in good conditions. Nevertheless, animal needs and scientific objectives are breed-specific, meaning that knowledge on the first question must still be improved to increase the relevance of scientific research. With the implementation of self-feeders for pregnant sows, we are on progress to improve facilities for both mini-pig production and research. Similarly, conducting parallel studies on nutritional needs at different physiological stages would provide a valuable knowledge for the management of miniature pigs.

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