

Influence of the housing systems on the welfare of sows during pregnancy

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ABSTRACT

In a first phase of research, data from 88 reproductive Italian pig breeding farms were analysed. In this investigation 4 main housing systems were identified: 1) collective pen for the entire pregnancy phase; 2) individual stall for the entire pregnancy phase; 3) individual stall for a first period of less than 35 days, followed by collective pen; 4) individual stall for a first period of more than 35 days, followed by collective pen. For each one of these solutions 10 representative farms were then selected and in these ones a more detailed investigation was carried on considering single animals. In order to evaluate the welfare conditions of the sows, a number of indicators of health, behaviour and reproductive performance were determined for a sample group of animals per farm, the number of animals being in proportion to the size of the farm. In particular the indicators regard: A) reproductive performances; B) physical integrity; C) behaviour; D) management (environmental conditions, type of feeding ratio during pregnancy and farrowing, fat thickness and body condition score); E) sanitary conditions; F) work times and costs of production. The research will continue for two farrowing cycles and is now half completed; as a result, only the intermediate results will be presented.

INTRODUCTION

In the last few years in Europe, specific laws on animal welfare have been issued. After the European Council Directive on minimum standards for the protection of pigs (91/630/EEC), several European countries have adopted more restrictive rules. Generally, the new pig welfare rules confirm that gilts and sows without piglets are to be housed in groups.

A new European directive is currently being drawn up which will integrate and modify the current directive in force. One of the aspects with which political and scientific debate is most concerned regards the use of systems of individual housing (in particular the individual stall), during the sows' pregnancy period.

The individual housing system in the gestation period is still widely used in Italian farms. Besides with the obvious organizational advantages, farmers often claim better production yields and a healthier condition of the sows.

In a recent study carried out in 71 Italian pig breeding farms, Barbari (2000) analyzed the reproductive performances of dry sows kept in different housing systems: the number of pigs born alive or total born, the number of weaned, the farrowing rate, the number of returns, etc.. The analysis showed that the performances vary according to the different housing systems used and, in particular, that the individual stall used in the whole pregnancy phase gives quite

good results, on average better than the results obtained in group housing systems or in mixed systems.

The main problem with collective pens concerns the method of feed distribution. Individual rationing is possible, but not generally practised; therefore at feeding time aggressive behaviour among the sows can occur, with negative repercussions on the reproductive performances.

In a study carried out in France (Vieuille *et al.*, 1996), a clear correlation between housing systems and body injuries found on the animals was particularly evident.

It was therefore considered appropriate to carry out a more thorough investigation into the question in order to verify the effective influence of different housing systems on the welfare of sows in the specific Italian situation.

MATERIALS AND METHODS

The activity carried out within the sphere of the project was arranged into different phases, which in total were planned to extend over 3 years.

The first phase of the work consisted in a fact-finding survey on housing structures and on the management of the sows in the farrowing and insemination/pregnancy phases, in two specialized pig-breeding areas in the provinces of Reggio Emilia and Modena (northern Italy). Information was taken from 52 farms in the first province, and 36 farms in the second. Overall therefore, the farms involved in the first phase of the study numbered 88.

The characteristics recorded were as follows:

- type of confinement in the pregnancy phase (individual stall, collective pen, a combination of the two);
- type of farrowing pen;
- type of flooring and removal of dejections;
- type of environmental conditioning;
- type of feeding and method of feed distribution;
- organization of the reproduction phase (time displacement between groups of sows, no. of stalls, no. and type of farrowing pens per room, the possibility and potential of empty pen cleaning, duration of suckling period, type of insemination and control of pregnancy);
- genetics used;
- productive performances.

At the end of the survey it was possible to produce an archive of data on the housing conditions. The results of this first phase are described in the subsequent paragraphs.

The main housing methods on which the execution of the experimental part of the project was concentrated were:

- collective pen for the entire pregnancy phase
- individual stall for the entire pregnancy phase
- individual stall for the first phase of pregnancy and collective pen in the second, with period in the individual stall of less than 35 days;
- individual stall for the first phase of pregnancy and collective pen in the second, with period in the individual stall of more than 35 days.

10 farms were selected for each of the above types of housing, distributed in equal measure between the two aforementioned provinces, in which animals were followed on an individual basis for two successive productive cycles, the number equal to the consistency of a weekly period (in general about 5% of the sows in production). It was decided to exceed this limit only for modest size farms (less than 100 sows), maintaining the objective of not falling under a minimum of 10 sows per farm (keeping two subsequent periods under control).

An experimental protocol was then established which provided for a number of inspections variable from a minimum of 7 to a maximum of 10 in the space of two productive cycles, according to the management methods adopted in each farm. By way of example Fig. 1 shows a scheme of the measurements expected to be taken in a farm with sows kept in a single pen throughout the entire pregnancy phase. From the diagram it can be seen that the average duration of the surveys is equal to about 280 days.

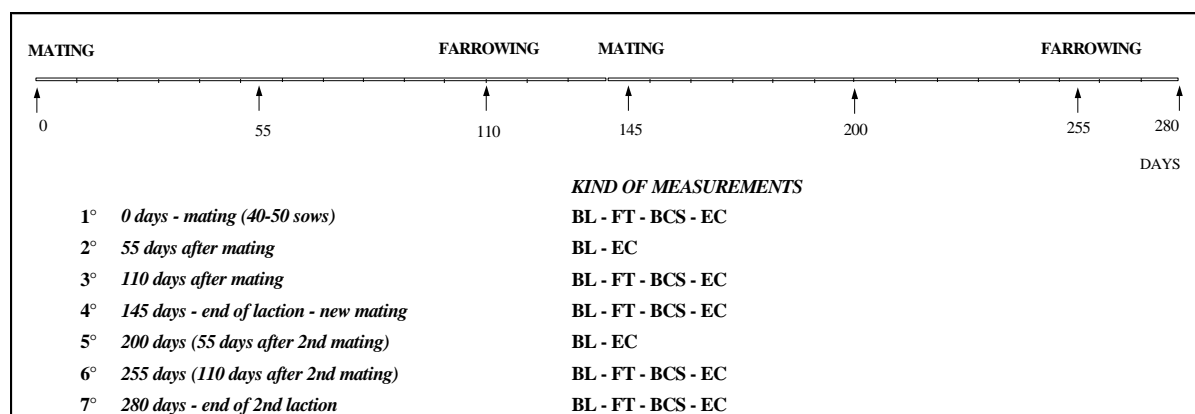


Fig. 1. Scheme of the experimental protocol for a farm of more than 800 sows with individual stall housing for the whole gestation period (BL: body lesions; FT: fat thickness; BCS: body condition score; EC: environmental conditions).

During the course of the inspections various “indicators” of welfare were taken, as specified below.

- **Productive performances**

The number of: empty sows, returns of heat, abortions, deliveries, live born piglets, total born piglets, deaths in the farrowing pen, weaned piglets per sow, suckling days; interval between deliveries, and weaning-useful cover interval; deliveries per sow/year; live born per sow/year; weaned piglets per sow/year.

The aforementioned data was collected mainly from the technical management programmes existing in the farm.

- **Physical condition of the animals**

Incidences of lameness; injuries to mammae, tails and vulvae; scabs, desquamations, scars, oedemae, sores, abscesses, scratches, etc..

- **Behavioural indices**

Daily rhythm of activity and rest; frequency of change in position and posture; permanence in the different functional zones (feeding, defecation, rest); methods used in rising and lying down; aggressive attacks, non feeding oral activity (stereotypies).

Closed-circuit telecameras were used to collect the behavioural data, with a “Time-Lapse” video recorder, installed in 8 sample-breeding farms. In this way it was possible to examine the 4 housing types in two different farms (one for each province).

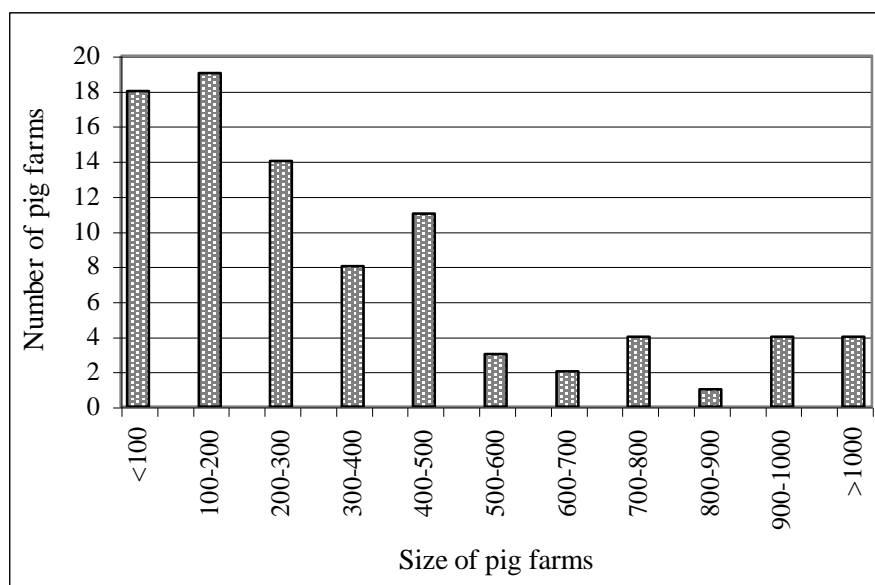


Fig. 2: Number of pig farms according to the size of farms.

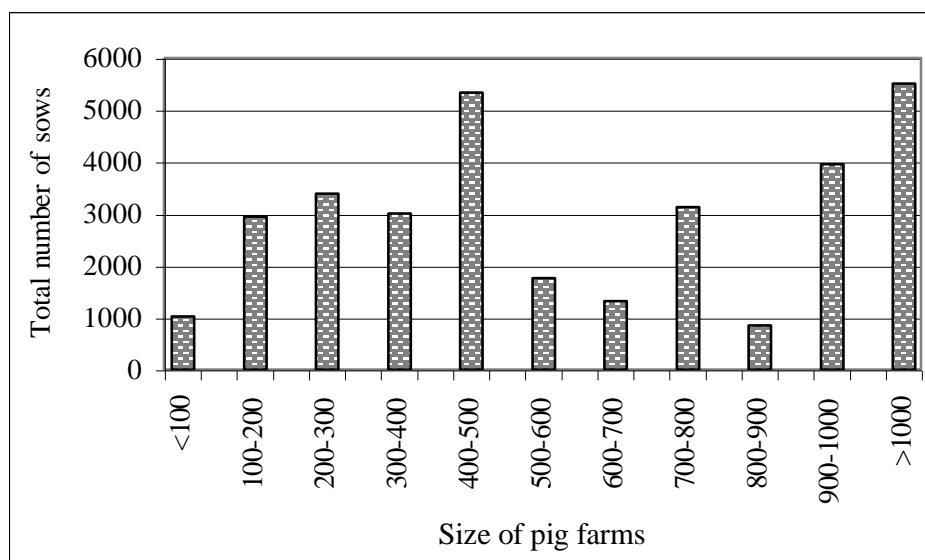


Fig. 3: Number of sows according to the size of pig farms.

In addition, specific *reactivity tests* were planned, carried out with different methods in the two different situations: single pen and collective pen.

For the sows in the individual pen, the researcher reached out his hand during feeding to touch the sow's head and check the animal's reaction (if it continued eating, if it retreated and returned to eat within 1', or stayed away for more than 1').

In the case of collective pens, one researcher entered the pen and positioned himself at its long side, remaining immobile, while a second researcher remained outside the pen and recorded,

in a period of three minutes the number of animals which entered within a radius of 0.5 metres of the first researcher and how many animals had contact with the man.

- ***Zootechnical, environmental and economic aspects***

Other measurements related to:

- *Internal environmental conditions* (temperature, humidity, ammonia concentration)
- *Type of rationing carried out in pregnancy and suckling periods*
- *Thickness of back fat at entry to, and exit from farrowing pen* (measured with the Renco Lean Meater ultra-sound instrument)
- *Body Condition Score (BCS)* (score from 1 to 6 on the basis of observation of the animal's back, the region between the thighs and the appearance of the skin)
- *Sanitary condition* (vaccinations, administration of medicines, therapeutic treatments)
- *Work times and the professionalism of the people working on the farm; management costs*

RESULTS AND DISCUSSION

Analysis of the different types of farms

1 – Farm dimension

The investigation involved a total of 32,213 sows in cycle. The variation in farm sizes was found to be very high, varying from less than 100 to more than 1000 sows in cycle.

The main aspects characterising farm sizes are summarised as follows (Fig.2, Fig.3):

- about 60% of the farms can be classed as small-size, being included in the first three classes (up to 300 sows). These farms however, have a low proportion of sows bred, representing only 23% of the total number of sows in cycle;
- the large-size farms (more than 700 sows), while representing only 15% of the total, contain 43% of the sows, in compliance with the strong tendency towards the concentration of pig-breeding farming in the area. Moreover, these farms, more precisely those with more than 750 sows, will be held to comply with the provisions of Legislative Decree 372/98 which assimilates the European IPPC Directive and will therefore be obliged to adopt the “Best Available Techniques” for the prevention and/or reduction of polluting emissions into the environment.
- among the farms of medium dimensions, the most representative are those in the 400-500 class which constitute 13% of the farms and breed almost 17% of total sows.

2 - Housing

The classification of farms according to the four main types of housing is shown in Tab.1 e Tab. 2

For 8 farms it was not possible to make a precise classification since a mixture of types of housing is used at the same time.

Individual stall for the whole of the pregnancy period is practised in 20% of the farms and is found particularly in the small-size farms. In total the sows kept in a single stall for the whole pregnancy period represent only 16.5% of the total, and this figure contradicts the widely held view that this type of housing is extensively used. As a matter of fact many farmers seem to

favour this system for its advantages in terms of the reduction in work time and the greater possibility of controlling the animal, objecting strongly to the widely-aired European regulation on animal welfare which would prohibit this practice when extending over the whole pregnancy period. In actual facts however, different methods prevail, limiting the adoption of the single stall to the initial phase, thereby approaching the impending regulation on animal welfare.

Support for adoption of the individual stall is in any case also confirmed by the widespread use of the mixed system with prolonged periods in the single stall (more than 36 days), with transfer to collective pens only at a very late stage when, due to the advanced state of pregnancy, the sows tend to reduce their aggression and number of conflicts. In fact, as many as 13 farms (15% of the total) adopt this management method and constitute, for the number of sows involved, the most predominant class type with 28% of all the animals included in the study.

The combined system of single stall and collective pen is also present in the version with short permanence in the single pen. This category includes cases in which permanence in the single pen is 3 weeks (6 cases), 4 weeks (5 cases) and 5 weeks (5 cases). This method involves the formation of groups of sows and their transfer into multiple pens immediately after ascertaining pregnancy. This type of housing is well represented in all size classes as regards the number of animals, whilst with regards to the farms it is more widely represented in the group of small farms where about half of the farm units adopt this solution.

Tab. 1: Number of farms according to housing solution and size of farms.

<i>Housing solution</i>	<i>Size of pig farms</i>											<i>total</i>
	<100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	>1000	
Individual stalls	5	4	6	2	3		1	1			1	23
Collective pens	13	5	2	1	1						1	23
Collective pens (first 30 days) and individual stalls		1	1	1								3
Collective pens (more than 30 days) and individual stalls		1				1						2
Individual stalls (first 21 days) and collective pens		3				1		1		1		6
Individual stalls (first 22-28 days) and collective pens		1	1	1						1	1	5
Individual stalls (first 29-35 days) and collective pens		2			2		1					5
Individual stalls (more than 36 days) and collective pens			3		3	1		2	1	2	1	13
Mixed solutions		2	1	3	2							8
	18	19	14	8	11	3	2	4	1	4	4	88

Tab.2: Number of sows according to housing solution and size of farms.

<i>Housing solution</i>	<i>Size of pig farms</i>											<i>total</i>
	<100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	>1000	
Individual stalls	337	750	480	350	430		700	800			1300	5147
Collective pens	682	575	1445	800	1450						1550	6502
Collective pens (first 30 days) and individual stalls		180	210	400								790
Collective pens (more than 30 days) and individual stalls		155				600						755
Individual stalls (first 21 days) and collective pens		440				558		750		1000		2748
Individual stalls (first 22-28 days) and collective pens		170	225	380						1000	1200	2975
Individual stalls (first 29-35 days) and collective pens		380			1000		620					2000
Individual stalls (more than 36 days) and collective pens			765		1500	600		1580	850	1950	1456	8701
Mixed solutions		300	265	1080	950							2595
	1019	2950	3390	3010	5330	1758	1320	3130	850	3950	5506	32213

The type class involving housing in collective pen for the whole pregnancy period is the predominant type for the number of farms: 29 farms, representing more than a third of the total. It is however more common in the small-size classes, probably owing to the extra work deriving from the greater time required for individual control. In the small farms however this problem is less strongly felt, with small numbers being more easily controllable. The lower inclination of small farmers to make relatively significant investments required for installing individual pens also certainly plays a role.

The type class consisting in housing in the collective pen in the first phase of pregnancy and then the transfer to an individual stall in the second phase has been found to be completely incidental. It is in fact limited to three small-size and two medium-size farms. This is a system which seems unlikely to catch on if we take into account that it is precisely the first phase in which conditions of maximum tranquillity are necessary for the animal for the purposes of an effective start to the pregnancy (nidation of the embryos), and therefore a more restricted confinement. It is therefore considered that this solution can only produce good results in the case of farmers with a high degree of experience and professionalism.

3 – Housing method in the phase awaiting insemination

From the data collected it stands out that two management methods are practised in equal measure in the weaning-heat waiting phase: individual stall and collective pens.

The first solution, chosen to avoid incidences of aggression and conflict which occur between animals when weaned and grouped in collective pens, is adopted by 53% of the total of farms.

The solution in collective pens is found to be quite varied in size, in terms of the number of animals per box. Cases with numbers from 6 to 10 are the most common, involving 17 farms (24% of the total).

Groups with more than 15-20 animals are on the other hand used to a very small degree. It is nevertheless interesting that such numbers are mostly found in the larger size farms.

4- Type of flooring and space assigned per sow

The figures shown in Tables 3 and 4 and in Fig.4 give a picture of the technological status of the farms visited, in view of the future application of the regulations on the environment and on animal welfare.

The figures in Tab. 3, which refer only to farms with collective pens, show how, despite the fact that all types of flooring are well-represented, the traditional type with full floor inside the building and slatted floor in the outside dunging passage, is clearly prevalent in the survey area (44% of cases). This passage often extends in width as far as two metres, constituting a sort of yard, generally open, with slatted floor in whole or in part, where the sows have extensive opportunity for movement and deambulation.

When there is no external passage, the internal flooring is divided into a full area, reserved for rest, and a slatted area reserved for defecation. This solution is reasonably in line with the new Directive proposal on animal welfare and is well represented in the studied area with 30% of cases.

There are still farms with old full floorings (18% of cases), certainly appreciated by the sows, especially when made of brick, but not suitable for the rational management of dejections, due to the large quantity of cleaning water required.

Tab.3: Number of farms with sows in collective pens according to the floor type and the number of sows per pen..

<i>Floor solution</i>	<i>Number of sows / pen</i>					
	0-5	6-10	11-15	16-20	> 20	<i>total</i>
Full floor	4	5	1	1		11
Partially slatted floor		12	6	1		19
Full floor and outside dunging passage		9	13	6	1	29
Totally slatted floor	2	3				5
	6	29	20	8	1	64

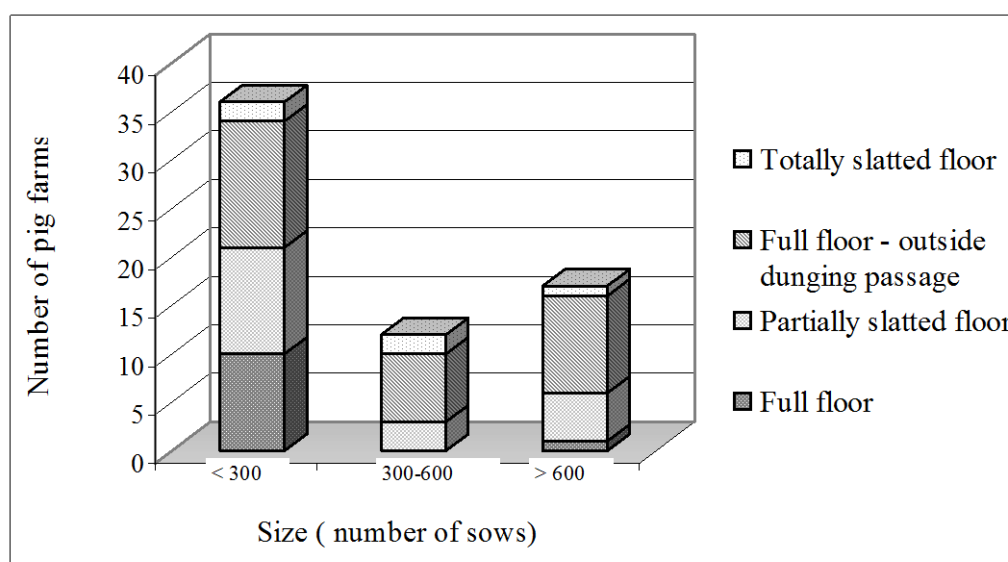


Fig. 4: Number of farms by type of flooring and dimension of farm.

The totally slatted flooring, finally, is present in a minority of cases, as shown by the unwillingness of farmers to keep sows in a group on a surface which creates some difficulties for deambulation.

With regards to the space assigned per animal (Tab. 4), the ranges of variation differ according to the type of flooring, showing a justified tendency to assign less surface area in the case of a totally slatted floor, increasing the space in the case of full flooring and still more for a partially slatted floor. The absence of clear tendencies occurs only in the presence of an external passage, with areas varying from a minimum of 1.3 m²/animal to more than 3 m²/head.

Tab. 4: Number of farms with sows in collective pens according to the space per animal and the type of flooring.

Floor solution	Surface / sow (m ²)							total
	0-1,3	1,3-1,5	1,5-1,8	1,8-2,1	2,1-2,4	2,4-2,7	> 3	
Full floor			3	3	1	2	2	11
Partially slatted floor	1	2	4	2	1	1	8	19
Full floor and outside dunging passage	6	2	4	6	2	1	6	27
Totally slatted floor		3	1	1				5
	7	7	12	12	4	4	16	62

The values appear moreover to be extremely diversified, with peaks very distant from recommended values. If on the one hand an abundance of space is not in any case a negative fact from the point of view of animal well-being, on the other hand there are unacceptable minimum values under this aspect, being within parameters deemed as recommendable (1.35 m² for totally fissured, 1.6 for partially slatted and 1.5 for full flooring excluding the external

passage). There is also the aggravating fact that these values are sometimes associated with high numbers in the group.

5 - Type of flooring and number of sows per pen

From Table 3 it can be noted how in pens with full flooring and in those with slatted flooring, the number of animals is limited to a large extent, while in pens with partially slatted flooring and still more, in those with full pavement and external passage there is a certain frequency of more numerous groups, more than 10 and 15, and as many as 20 animals.

6- Types of delivery pen

In the 88 farms surveyed there are 5,035 places for the farrowing phase. The more traditional type of pen, with the sow placed longitudinally is still prevalent with respect to the more recent method with the sow placed diagonally (74 farms against 14), even though the latter type is proportionately more common in the medium-large-size farms. Once again dimensions vary considerably. It is not possible however to make in this case any judgement on the matter due to the varied nature of the solutions found inside each of the two types.

7 – Duration of suckling

The picture which emerges from the analysis of the data reveals a net prevalence of traditional practices and a limited adoption of the new emerging trends, for example, in American pig breeding.

In fact only two farms, moreover small-size, opt for weaning relatively early at 3 weeks. Most of the farms (42%) wean instead at 4 weeks, followed by a group, consisting mostly of large-size farms, which weans at between 21 and 24 days.

Perfectly in line with the regulatory proposals on animal well-being under discussion by the European Community, is a group of 21 farms, almost all small-size, which extend the suckling period beyond 4 weeks.

Combining the figure for the number of sows present as a whole in all the farms, with the number of spaces available in the farrowing pens, a certain undersizing in these spaces seems to emerge. In fact forecasting 2.2 deliveries/year, with 5,035 delivery pens, this would give an overall average length of time in the delivery pen of around 26 days; taking account of the suckling times declared by the farmers, this would lead to significantly reduced periods of empty pen cleaning.

8 - Type of feeding

Dry feeding is the prevailing type, being present in around 60% of the farms. A computerized performance control procedure is present in 54% of the farms in Modena, while it is less widespread in the Reggio Emilia farms, present only in 25% of them.

Survey on the conditions of the animals

At present complete data is available for only 19 farms and relates to the first production cycle.

It is not therefore possible to furnish valid scientific results at this stage of the research.

An initial brief examination of the data collected reveals that the transfer into collective pens has a significant influence on the physical condition of the animals (especially in terms of

scratches on various parts of the body). This phenomenon is less notable when the animals are held in the collective pens for the whole pregnancy period and appear on the other hand to be more evident when grouping occurs after a period held in the single stall. In this second case it appears that the worst conditions occur when the length of stay in the single stall is of a shorter duration.

These effects tend moreover to disappear towards the end of the cycle. Vice-versa, in the individual stalls, where the phenomenon of scratches and injuries appear to be negligible, there are cases, though very limited, of limb diseases and sores, very probably caused by this particular system of containment. Furthermore, the conditions seem to worsen, not insignificantly, towards the end of the cycle.

We will therefore defer a more detailed analysis of the results of this phase of the research to the illustration of the work within a conference setting.

CONCLUSIONS

In brief we can say that the sample of farms surveyed appears to be largely representative of all the different current management methods in intensive pig farming. It emerges from this picture however, as indicated in point 2, that there is a modest incidence, especially in terms of number of animals, of farms which practise the whole pregnancy phase in a single pen; such practice would infringe the new regulations. This fact possibly makes it appropriate to concentrate attention above all on farms which adopt the mixed system (individual stall plus collective pen), already in line with the new regulations, where the determining factor to find a compromise between animal welfare and productivity is the time to be spent in the single stall. It therefore seems useful in our opinion to examine in particular the effects of this variable, also to ascertain if the extension of the period in the single stall over 28 days proposed by the regulation (e.g. up to 35 days) may be, at least in the Italian situation, a valid objective to pursue, considering the fact that, in the summer period, a high level of conflict associated with the state of stress caused by the high temperatures, may produce much more serious consequences.

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