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Litter Performance of Large White Yorkshire Sows Raised in Different Farrowing House Systems in Tropical Climate

D. Magesh Ram[1*], A. Kannan[1], George Sherin K.[2], Muhammad Aslam M.K.[2] and Sabin George[1]

[1]Department of Livestock Production Management, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala, INDIA

[2]Base Farm, Kerala Veterinary and Animal Sciences University, Kolahalamedu, Idukki, Kerala, INDIA

**Corresponding author: DM Ram; E-mail: vetmagesh@gmail.com*

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ABSTRACT

Preweaning piglet mortality, mainly due to crushing is an important concern in pig production systems adversely affecting the profit from the farm and welfare of the animals. The present study compared three different systems of farrowing houses viz. conventional farrowing house with guard rail and one-third slated floor (T_1), farrowing house with guard rail and floor level ventilation (T_2), and farrowing houses with farrowing crates (T_3) to identify the best system to minimize the farrowing house stress and mortality. There were no changes in average daily feed intake, serum cortisol levels and maternal behaviour of the sows in different groups. The litter size and litter weight at birth were more or less similar in all treatment groups, whereas litter size and litter weight at weaning was higher ($P < 0.05$) in T_3 compared to other groups. There was significant reduction in piglet mortality in houses with farrowing crates (T_3) compared to other two groups ($P < 0.05$). Cost of production per kilogram live weight of piglets on housing cost basis was also observed to be lower in system with farrowing crates. The payback period required to meet the housing cost for T_3, T_2 and T_1were calculated as 1.63, 2.94 and 3.11 years, respectively. The results of present study identified that farrowing houses with farrowing crates significantly reduced piglet mortality, thereby increasing the profitability of swine husbandry without any adverse effect on the performance of sows.

Keywords: Farrowing crate, Swine husbandry, Farm economics

Swine husbandry is an important livelihood activity of small and marginal farmers in many developing countries of the world. Though the demand for quality piglets is ever increasing, farmers are reluctant to maintain breeding stock due to requirement of individual housing system for farrowing. The profitability from pig farms dependents mainly on controlling preweaning piglet mortality, which accounts for 75 per cent of the total mortality in pig farms. Crushing of piglets by dam is the single major cause (47.9%) of pre-weaning mortality during the first three days of piglet's life (Andersen *et al.,* 2008; Rangstrup-Christensen, 2018). Improvements in swine production can therefore be made by adopting appropriate housing management to reduce the mortality of young piglets.

There are multifactorial reasons behind the increased incidence of crushing, such as older sows (Rolandweber *et al.,* 2009), sows in higher parity number (Lensink *et al.,* 2009), increased litter size (Lensink *et al.,* 2009), outdoor housing (Roehe *et al.,* 2009), cold climate (Weber *et al.,* 2009) etc. The weak and last piglets are often more vulnerable for crushing due to incoordination and reduced movements due to lack of feed. Runt piglets produce stressors than in normal sized littermates in preweaning period. (Ramsay *et al.,* 2010). When the ambient temperature is below the critical temperature of new born piglets, they try to survive through physiological or behavioral adaptation methods like shivering, huddling or stay near to the dam to keep warm (Mainau *et al.,* 2015). Elevated ambient temperature keeps piglets away from dam, leading to reduction in suckling time thereby creating weak and undernourished piglets.

It is imperative to have managemental measures such

as installation of farrowing crates, proper lighting and ventilation to reduce piglets being crushed by the dam. Ethical concerns regarding the quality of life of farm animals demand more serious attention to animal's psychological needs and social tendencies. Morally acceptable housing systems are expected to assure adequate harmony between the genetic predisposition of farm animals and their overall environment. Hence the present study was conducted to compare the litter performance of large white Yorkshire pigs raised in three different farrowing house systems in subtropical climate and their cost effectiveness.

MATERIALS AND METHODS

The study was conducted in the Centre for Pig Production and Research, Mannuthy under Kerala Veterinary and Animal Sciences University with the approval of institutional animal ethics committee. Average annual rainfall reported in the region is 3042.8 mm. The mean monthly maximum temperature ranges from 28.6 ºC in July to 35.7 ºC in March, whereas monthly minimum temperature varies between 21.8 ºC in July to 24.5 ºC in April/May. Average maximum monthly humidity ranges between 77% (February) and 95% (July/August). Mean monthly minimum humidity varied from 37% in March and 84% in July (Nameer *et al*., 2000). The area is at an elevation of 22.5 m above sea level and has tropical climate (Ningaraju and Joseph 2014).

Thirty Large White Yorkshire sows in last quarter of pregnancy were selected and 10 animals were housed in each of the 3 housing systems viz. conventional farrowing house with guard rail and one-third slatted floor (T_{1}); farrowing house with guard rail with floor level ventilation (T_2) and farrowing house with farrowing crates (T_3), as given in Fig. 1. These animals were maintained in the housing systems from last quarter of pregnancy until weaning of piglets at forty-five days after farrowing. The sows were fed with standard concentrate ration (18% CP), offered twice a day. Monthly deworming, spraying of ecto-parasiticides and other management procedures as per standard farm protocols were practiced.

Maternal behavior of the sows was studied in the first three days after farrowing based on the method described by Mathew (1997). Litter size and weight at birth, fourth week and weaning were recorded till weaning at 45 days of age. The weight loss during lactation in sows and piglet mortality during the study period were also recorded. Stress level in different groups of pigs included in the study was assessed by estimating serum cortisol level using ELISA at the beginning, and end of the experiment.

The data collected on various parameters were statistically analyzed by Completely Randomized Design (CRD) as per the methods of Snedecor and Cochran (1994). The maternal behavioral pattern was statistically analyzed by Kruskal Walis test and the means of different experimental groups were tested by using Duncan's Multiple Range Test (DMRT). The whole data were analyzed using computerized software program SPSS (Ver. 20.0; IBM, United States). The cost of production of litter was calculated based on various economical parameters.

RESULTS AND DISCUSSION

Physiological parameters and body condition of sows

Observations on rectal temperature, respiration rate, average daily feed intake, weight loss and maternal

Fig. 1: Various farrowing housing modifications experimented. A - Conventional farrowing house with guard rail and one-third slatted floor (T1); B - Farrowing house with guard rail and floor level ventilation (T2); C - Farrowing house with farrowing crates (T3)

behavior score were analysed statistically and the results are presented in Table 1. Significantly higher (P<0.01) rectal temperature and respiratory rate were observed among sows in farrowing house with farrowing crates (T_3). Sows in T_3 group had significantly higher lactational weight loss (P<0.05). Significant difference was not observed between treatment groups with respect to average daily feed intake and maternal behavior of sows. Serum cortisol level (ng/ml) of sows estimated on first and last day of the study period did not differ significantly. The results are presented in Table 2.

Table 1: Mean physiological and other parameters of sows in different treatments

S. No.	Particulars	Treatment		
		T1	T2	T3
1	Rectal temperature	38.55^{a} ± 0.01**	38.59^{a} ± 0.01**	38.70^{b} ± 0.016**
2	Respiration rate	28.09^{a} ± 0.11**	28.80^{a} ± 0.11**	29.86^{b} ± 0.12**
3	Average daily feed intake	5.42 ± 0.05	5.55 ± 0.09	5.68±0.08
4	Weight loss	18.30 ± 0.36*	17.80 ± 0.29*	23.32±.042*
5	Maternal behavior score	4.5±0.34	3.8±0.32	3.7±0.23

* P <0.05, ** P<0.01; Values bearing different superscripts differ between the columns.

Table 2: Serum cortisol level (ng/ml) of sows in different treatments

S. No.	T1		T2		T3	
1	Initial	Final	Initial	Final	Initial	Final
2	35.11 ± 0.17	34.38 ± 0.22	34.44 ± 0.25	35.06 ± 0.28	35.47 ± 0.16	35.08 ± 0.27

The elevated rectal temperature and respiratory rates in sows maintained at houses with farrowing houses as observed in present study not agree with earlier reports by (Baxter *et al.,* 2012). Higher ambient temperature and body temperature did not affect average daily feed intake in sows maintained at houses with crates (T3), though they suffered significantly higher weight loss during lactation. This may be the reflection of higher nutrient drain through milk for raising larger litters and higher weaning weight of piglets in T3 group. Anyway this is not agreed with Baxter *et al.* (2012). There were no significant differences in their farrowing housing systems. Likewise, it was observed that the maternal behaviour of sows in different treatment groups was observed to be more or less similar during the study period. Analysis of serum cortisol level revealed that sows in T3 group were not exposed to additional stress factors (P > 0.05) due to reduction in floor space and ventilation. These results dissimilar with Ramell *et al.* (2011).

Litter performance of sows

The litter size and litter weight at birth were more or less similar in all the treatment groups. Litter size and litter weight at fourth week and at weaning (45 days) were significantly higher (P<0.05) among sows in farrowing house with farrowing crates (T_3). The results are presented in Table 3. Significantly higher litter weight at weaning (P > 0.05) was noticed in treatment group T3, which varied in the order T3>T2>T1. It may be due to higher opportunity of suckling compared to other treatments, and increased livability of the piglets. Similar results were reported by Baxter *et al.* (2010).

Table 3: Litter performance of sows in different treatments

S. No.	Particulars	T1	T2	T3
1	Litter size at birth (No)	8.8 ± 0.38	7.6 ± 0.65	8.8 ± 0.29
2	Litter weight at birth (Kg)	11.03^{ab} ± 0.31	9.77^{a} ± 0.69	11.31^{b} ± 0.26
3	Litter size at 4^{th} week (No)	5.6^{a} ± 0.33*	6.2^{a} ± 0.46*	7.6^{b} ± 0.40*
4	Litter size at weaning (No)	5.6^{a} ± 0.33*	6.2^{a} ± 0.46*	7.6^{b} ± 0.40*
5	Litter weight at weaning (Kg)	50.01^{a} ± 2.32*	52.92^{a} ± 3.48*	64.10^{b} ± 2.96*

* P <0.05, ** P<0.01; Values bearing different superscripts differ between the columns.

Mortality pattern of piglets

Piglet mortality was significantly lower (P<0.05) in T_3 group during fourth week and at the time of weaning. Livability was higher (P<0.05) in T_3 group during fourth

week and at the time of weaning. Results on piglet mortality and livability are presented in Table 4 and Table 5 respectively. Despite mortality being similar in the first two days after birth in the three systems, livability improved considerably in house with farrowing crates with time. This proves that the system with farrowing crates is superior in reducing the preweaning mortality of piglets due to crushing. The results agree with reports by Mondal *et al*. (2012) and Ramesh *et al*. (2014).

Table 4: Livability of piglets

S. No.	Characters	T1	T2	T3
1	Livability at fourth week	$63.80^{a} \pm 3.19$*	$83.79^{b} \pm 5.62$*	$86.55^{b} \pm 3.9$*
2	Livability at weaning	$63.80^{a} \pm 3.19$*	$83.79^{b} \pm 5.62$*	$86.55^{b} \pm 3.9$*

* P <0.05, ** P<0.01; Values bearing different superscripts differ between the columns.

Table 5: Mortality occurrence of piglets in different treatments

Age (in days)	T1	T2	T3
0-3	20	10	8
3-45	12	4	4
Total	32	14	12

Economics of litter production

Economics of litter production in terms of Indian rupees (INR) calculated for the treatment groups are presented in Table 6. Total production cost and feed cost were higher in the housing system with farrowing crates (T_3). However total receipts/year/sow (₹) was higher and the time required to pay back the housing cost was lowest for T_3 group.

Table 6: Cost benefit analysis of different farrowing housing systems

S. No.	Particulars	Treatments		
		T1	T2	T3
1	Floor space requirement / pregnant sow (sq.ft)	100	100	50
2	Housing cost per sow (INR)	70000	70000	47000
3	Number of batches per year	6	6	6
4	Average litter size at birth/ sow (No.)	8.8	7.6	8.8
5	Average litter size at weaning/ sow (No.)	5.6	6.2	7.6
6	Mortality of piglets / sow (No.)	3.2	1.4	1.2
7	Weaning weight @ 45 days of age (kg)	8.93	8.54	8.43
8	Sale price of piglet at weaning (INR 250 / kg)	12502	13237	16017
9	Total Loss in INR due to piglet death/sow (INR)	7144	2989	2529
10	Total receipts /year/sow (INR)	75012	79422	96102
11	Total losses due to mortality/ sow (INR)	42864	17934	15174
12	Total cost of production per piglet (INR)	2232.5	2135	2107.5
13	Total feed cost (INR)	52508.4	55595.4	67271.4
14	Total production cost other than feed cost (INR)	22503.6	23826.6	28830.6
15	Time required to pay back housing cost (years)	3.11	2.94	1.63

Cost of production is considered to be the basic measure of economic efficiency in swine industry. Based on the assumptions and comparison, it was observed that the cost of litter production was higher in conventional farrowing houses with guard rail and one-third slatted floor (T1), followed by farrowing house with guard rail with floor level ventilation (T2). The lowest cost of production and highest net profit was obtained in farrowing house with farrowing crates (T3) among the three different farrowing systems. The period required to pay back the housing cost was also the lowest in system with farrowing crates (T3). This agrees with Ahmadi *et al*. (2011) who had taken crates, pens and designed pens housing system for production of weaners.

Farrowing house with farrowing crate significantly improved the litter performance of sows in terms of litter size and weight at weaning and reduced piglet mortality. Farrowing crate system turned out to be the most economical and profitable housing method which can be adopted to tropical wet climate. The system enhances profitability of swine enterprises by reducing mortality and improving weight of weaned piglets.

REFERENCES

Ahmadi, B.V., Stott, A.W., Baxter, E.M., Lawrence, A.B. and Edwards, S.A. 2011. Animal welfare and economic optimization of farrowing systems. *Anim. Welf.,* **20:** 57-67.

Andersen, I.L., Hauvik, I.A. and Boe, K.E. 2009. Drying and warming immediately after birth may reduce piglet mortality in loose housed sows. *Animal,* **3**(4): 592-597.

Baxter, E.M., Lawrence, A.B. and Edwards, S.A. 2012. Alternative farrowing accomdation: welfare and economic aspects of existing farrowing and lactation systems for pigs. *Animal,* **6**(1): 96-117.

Lensink, B.J., Leruste, H. and De Bretagne, T. 2009. Sow behaviour towards humans during standard management procedures and their relationship to piglet survival. *Appl. Anim. Beh. Sci.,* **199**: 151-157.

Mainau, E., Temple, D. and Manteca, X. 2015. Pre-weaning mortality in piglets. Farm Animal Welfare Education Centre, Spain

Mondal, S.K., De, U.K., Das, G.K., Powde, A.M. and Verma, A.K. 2012. Pattern of mortality of crossbred pigs in an organized swine production farm. *J. Livest. Sci.,* **3**: 37-44.

Ningaraju, G.K. and Joseph. 2014. Effect of drip fertigation on growth and yield of oriental pickling melon (*Cucumismelo var. conomon* (L.) Makino) under high density planting. *Int. J. Sci. Res. Pub.,* **4**(6): 1-5.

Ramell, A.M., Pato, R., Pena, R., Saco, Y., Mantena, X., Torre, J.L.R. and Bassols, A. 2011. Identification of serum stress biomarkers in pigs housed at different stocking densities. *The Vet. J.,* **190**(2): e66-e71.

Ramesh, V., Vasanthakumar, S. and Edwi, S.C. 2014. Multifactorial approach to mortality of piglets in semi-arid region of Tamil Nadu. *Indian J. Field Vet.,* **19**(1-4)*:* 11-15.

Ramsay, T.G., Stoll, M.J. and Caperna, T.J. 2010. Adipokine gene transcription level in adipose tissue of runt piglets. *Biochemist. Mol. Biol.,* **155**: 97-105.

Rangstrup-Christensen, L., Krogh, M.A., Pedersen, L.J. and Sørensen, J.T. 2018. Sow level risk factors for early piglet mortality and crushing in organic outdoor production. *Animal,* **12**(4): 810-818.

Roehe, R., Shrestha, N.P., Mekkawy, W., Baxter, E.M., Knap, P.W., Smurthwaite, K.M., Jarvis, S., Lawrence, A B. and Edwards, S.A. 2009. Genetic analyses of piglet survival and individual birth weight on first generation data of an experiment for piglet survival under outdoor conditions. *Livest. Sci.,* **121**: 173-181.

Snedecor, G.W., and Cochran, W.G. 1994. *Statistical Methods*. 8th Edn. The Iowa State University Press, Ames, I. A.

Weber, R., Keil, N.M., Fehr, M. and Horat, R. 2009. Factors affecting piglet mortality in loose farrowing systems on commercial farms. *Livest. Sci.,* **124**: 216-222.