Sow and Litter Performance for Two Genotypes in Crated and Group Gestation Systems

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Summary and Implications

The sow and litter performance for two sow genotypes housed in crated and group-housed gestation systems was compared for two parities. The study was conducted at the Iowa State University L. Christian Swine Research and Demonstration Farm, Atlantic, IA. The gestation housing systems were individual crates in a mechanically ventilated confinement building (CRATE) and, group-housed sows in a modified-open front building (MOF) or a bedded hoop structure (HOOP). All sows were fed individually. The group-housed sows were fed with either feeding stalls (FS) or electronic feeders (EF). The two sow genotypes were Yorkshire x Landrace (WHITE sows) and Hampshire x Yorkshire x Landrace (COLOR sows). The Yorkshire and Landrace breeding was similar in both genotypes. Duroc terminal boars were hand mated to all sows. The data analyzed were for litters born from April through December 1998. The trial was terminated because of a pseudorabies outbreak and subsequent depopulation of the farm. Therefore, the results of this study are only partial and should be interpreted carefully. The WHITE sows demonstrated superior litter traits compared with the COLOR sows. The WHITE sows when housed in gestation crates, had larger litters at birth and weaning than the COLOR sows and the group-housed WHITE sows. The dynamic groups, which means sows were added and removed each week, depressed the litter performance of the WHITE sows compared with the WHITE sows housed in individual gestation crates, but there was no similar effect for the COLOR sows. The type of feeding system (FS or EF) did not affect sow reproductive performance in the group housing settings. The bedded hoop structures did not differ from the modified open-front partially slatted floor group housing for housing gestating sows, when sow and litter performance was used as the comparison.

Methods

The effects of swine gestation housing on sow and litter performance of two genotypes were evaluated at the Iowa State University Lauren Christian Swine Research and Demonstration Farm near Atlantic, IA. The gestation housing systems were 1) individual gestation crates in a mechanically ventilated, partially slatted floor, manure flush confinement building (CRATE); 2) group pens in a naturally ventilated, curtain-sided, partially slatted floor, modified-open front building with no bedding and a deep manure pit (MOF); and 3) group pens in deep-bedded, naturally ventilated hoop structures (HOOP). The group-housed gilts were individually fed with either individual feed stalls (FS) or computerized electronic feeders (EF). Sows fed with the electronic feeders were given an initial training period the week after breeding during which time they learned to use the feeders. The two sow genotypes were Yorkshire x Landrace (WHITE sows) and 1/4 Hampshire x 1/2 Yorkshire x 1/4 Landrace (COLOR sows). The Yorkshire and Landrace breeding was similar in both genotypes. Duroc terminal boars were mated to all sows. Farrowing occurred weekly throughout the year. Cross fostering occurred across all sows.

Sows were naturally mated in a centralized, slatted floor confinement breeding barn. Three to 7 days after breeding, the sows were randomly assigned to one of the gestation systems. The sows returned to the same assigned gestation housing system after breeding for the second parity. The groups of sows consisted of 40 to 60 sows. Sows were added weekly to the groups from the breeding barn and sows were removed weekly from the groups for transfer to the farrowing rooms. Three to five sows were added or removed each week. Thus, the group housed sows were in dynamic groups, i.e., the composition of the group changed weekly. All breeding stock tested PRRS negative.

The records analyzed were for farrowings that occurred from April 1998 through December 1998. In early 1999, pseudorabies virus (PRV) was diagnosed and the farm was depopulated and later repopulated. The records of the herd were not analyzed following the PRV diagnosis and for approximately 30 days prior to the diagnosis. A total of 585 litters was included in the analysis. This included first parity litters (n=409) and second parity litters (n=176). There were 322 litters from COLOR sows and 263 litters from WHITE sows.

The gilts were purchased as market weight replacement gilts and were generally cycling on arrival. After a 60-day isolation period the gilts were eligible for breeding. Breeding was delayed slightly to allow for construction at the farm to be completed. Therefore, the gilts were bred no earlier than three estrous cycles after puberty.

The sows were weighed and scanned for tenth rib backfat prior to farrowing (approximately 110 days of gestation) and at weaning. Sow lactation feed intake also was recorded. During gestation all sows were fed 4.5 lb/day of a corn–soy diet. During the last trimester the gestation feed allowance was increased to 6 lb/day.

At farrowing the number of pigs born alive, stillborn pigs, and mummified pigs was recorded. The birth weight of the

live pigs also was recorded. At weaning, the litter was counted and weighed. Weaning occurred at 17–19 days of age. Pig gain per day during lactation was calculated.

The sowed litter data were analyzed with SAS by using General Linear Model. The model used sow genotype (2), parity (2), and housing system (5) as the variables. The sow/litter was the experimental unit. Orthogonal contrasts were used for mean comparisons. Least squares means are shown in the tables.

Results and Discussion

Note. Because of the short time period (April to December), the variability of many of the parameters measured and the few number of parities in this data set, conclusions drawn from these data should be limited and regarded as preliminary. In addition, the second parity was cut short by the disease outbreak. After repopulation a similar experiment will be initiated without the challenges of new construction, multiple sow breed lines, and management of a new farm.

A simple comparison of the two sow genotypes for litter data and sow data is shown in Tables 1 and 2, respectively. Parities (1 and 2) and housing system types (five) were merged in the analysis. The WHITE sows had more pigs born alive (7.5%), more stillborns, heavier pigs at birth (9.5%), more pigs weaned (8.2%), and heavier litter weaning weights (5.7%) at 18.5 days of age than the COLOR sows (Table 1). If the number of live pigs and stillborn pigs are combined, the WHITE sows gave birth to more than an additional pig per litter than the COLOR sows. Also, the pigs from WHITE sows grew slightly faster (4.4%) from birth to weaning (Table 1). The WHITE sows were heavier and had more backfat before farrowing, and were heavier at weaning (Table 2). There was no difference in backfat at weaning. The WHITE sows consumed more feed per day during lactation.

Parity and genotype

An analysis of the two sow genotypes by both parities for litter and sow data is shown in Tables 3 and 4. As expected, sow performance in the second parity was improved for both genotypes over the first parity for most items measured.

Genotype and housing systems

The analysis of sow genotype by gestation housing system is shown in Table 5 for the litter data and in Table 6 for the sow data. For the COLOR sows, there was no difference in pigs born live per litter (NBA), stillborn (SB), mummified pigs (MM), pig birth weight (BW), pig gain (ADG), or weaning weight (WW) across housing systems. The number of pigs weaned (NW) was greater for the COLOR sows in crates than the COLOR sows housed in groups with electronic feeder (MOF/EF or HOOP/EF) ($P<.05$) (Table 5). For the WHITE sows housed in crates, the number of pigs born live per litter (NBA) and number of pigs weaned (NW) was greater than for the WHITE group housed sows ($P<.05$). The number of stillborn pigs for the WHITE sows housed in a modified open front with electronic feeder and hoop with feeding stalls was greater than the other housing systems, except for the modified open-front with electronic feeder ($P<.05$). For the WHITE sows there were no differences for mummified pigs, pig birth weight, weaning weight, or pig gain (Table 5).

The COLOR sows housed in crates were heavier and had more backfat prefarrowing than the COLOR sows in other housing systems ($P<.05$) (Table 6). The COLOR crated sows were also heavier ($P<.05$) and had numerically more backfat at weaning (Table 6). The WHITE sows in hoops with electronic feeders weighed less than the other sows ($P<.05$). There were no other differences in WHITE sow weights or backfat by housing type.

In examining the performance of all the sows (COLOR and WHITE) for the five housing types, the WHITE sows gestated in crates gave birth to more pigs and weaned more pigs per litter than any other housing group ($P<.05$) (Table 5). The number of stillborn pigs was highest for the WHITE sows from modified open-front with an electronic feeder and from the hoop with feeding stalls, although the later did not differ from the modified open-front with feeding stalls. The WHITE sows had numerically heavier pigs at birth and at weaning.

In general, the sows in crates were heavier at prefarrowing and at weaning than the group-housed sows. The WHITE sows had numerically more backfat than the COLOR sows at both prefarrowing and at weaning. In aggregate there is some evidence that the group housed sows, particularly those fed with the electronic feeders, may have not received adequate feed. This may be due to the stress of the dynamic sow groups, the colder group housing systems or inexperience in managing the electronic feeders.

Conclusions

Although this was a shortened trial due to the depopulation, and the sows were young (first and second parity), the results suggest that 1) the WHITE genotype sows demonstrated superior litter traits than the COLOR sows; 2) the dynamic groups and more rigorous environment of the hoop and modified open-front facilities during gestation reduced the litter performance of the WHITE sows; 3) the group-housed sows in cold housing probably required additional feed to match the weight of the crated sows; 4) mixing the sows in dynamic groups likely reduced litter performance; 5) the COLOR sows may be better able to adapt to the group housing; 6) there was no apparent advantage in litter performance using the electronic feeders compared to feeding stalls; and 7) the bedded hoop structures were no different than the modified open-front partially slatted floor confinement as a group housing for gestating sows when using litter and sow performance as the comparison.

Acknowledgments

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Table 1. Litter performance of two sow genotypes.

	Sow Genotype				
	COLOR		WHITE		
Litters	322		263		
Item	mean	sem	mean	sem	
NBA	9.39	0.16	10.16	0.18	*
SB	0.65	0.07	1.06	0.08	***
MM	0.16	0.03	0.14	0.03	
BW	3.34	0.03	3.66	0.03	***
NW	8.16	0.14	8.83	0.16	**
WW	11.8	0.1	12.4	0.1	***
WA	18.4	0.2	18.5	0.2	
ADG	0.45	0.005	0.47	-.006	*

*Means in the same row with different superscripts differ P<.05.
**Means in the same row with different superscripts differ P<.01.
***Means in the same row with different superscripts differ P<.001.

Item abbreviations
NBA = born alive, pigs/litter
SB = stillborn, pigs/litter
MM = mummified, pigs/litter
BW = birth wt., lb (average)
NW = weaned, pigs/litter
WW = wean wt., lb/pig
WA = wean age, days
ADG = average daily gain, lb/day

Sow Genotype abbreviations
COLOR = Hampshire x Yorkshire x Landrace
WHITE = Yorkshire x Landrace

Table 2. Sow weights, backfat thickness, and lactation feed intake for two sow genotypes.

	Sow Genotype				
	COLOR		WHITE		
Litters	322		263		
Item	mean	sem	mean	sem	
PFW	424	3	436	3	**
PFBF	13.2	0.2	14.3	0.2	***
SWW	378	4	389	4	*
SWBF	12.6	0.2	13.0	0.2	
ADFI	10.43	0.17	11.06	0.18	*

*Means in the same row with different superscripts differ P<.05.
**Means in the same row with different superscripts differ P<.01.
***Means in the same row with different superscripts differ P<.001.

Item abbreviations
PFW = prefarrow wt., lb
PFBF = prefarrow backfat, in.
SWW = sow wean wt., lb
SWBF = sow wean backfat, in.
ADFI = average daily feed intake (lactation), lb/day

Sow Genotype abbreviations
COLOR = Hampshire x Yorkshire x Landrace
WHITE – Yorkshire x Landrace

Table 3. Litter performance of two genotypes of sows for two parities.

Genotype	COLOR				WHITE			
Parity	1		2		1		2	
Litters	233		89		176		87	
Item	mean	sem	mean	sem	mean	sem	mean	sem
NBA	9.3[e]	0.2	9.7[de]	0.3	10.1[d]	0.2	10.3[d]	0.3
SB	.66[g]	0.09	.60[g]	0.14	1.29[h]	0.10	.60[g]	0.14
MM	0.17	0.03	0.11	0.05	0.15	0.04	0.14	0.05
BW	3.32[f]	0.04	3.39[f]	0.06	3.58[e]	0.04	3.82[d]	0.06
NW	7.91[e]	0.17	8.80[d]	0.27	8.64[d]	0.19	9.22[d]	0.27
WW	11.01[i]	0.13	13.56[g]	0.20	11.89[h]	0.15	13.47[g]	0.20
WA	18.0[b]	0.2	19.4[a]	0.3	18.2[b]	0.2	19.1[a]	0.3
ADG	.42[f]	0.01	.53[d]	0.01	.45[e]	0.01	.51[d]	0.01

[abc]Means in the same row with different superscripts differ P<.05.
[def]Means in the same row with different superscripts differ P<.01.
[ghi]Means in the same row with different superscripts differ P<.001.

Item abbreviations
NBA = born alive, pigs/litter
SB = stillborn, pigs/litter
MM = mummified, pigs/litter
BW = birth wt., lb (average)
NW = weaned, pigs/litter
WW = wean wt., lb/pig
WA = wean age, days
ADG = average daily gain, lb/day

Sow Genotype abbreviations
COLOR = Hampshire x Yorkshire x Landrace
WHITE = Yorkshire x Landrace

Table 4. Sow weights, backfat thickness and lactation feed intake for two genotypes of sows for two parities.

Genotype	COLOR				WHITE			
Parity	1		2		1		2	
Litters	233		89		176		87	
Item	mean	sem	mean	sem	mean	sem	mean	sem
PFW	413[c]	3	456[a]	5	423[b]	4	463[a]	5
PFBF	13.0[c]	0.2	13.6[bc]	0.3	14.0[ab]	0.3	14.7[a]	0.3
SWW	352[h]	3	433[g]	5	361[h]	4	430[g]	5
SWBF	12.4	0.2	13.1	0.3	12.8	0.3	13.3	0.4
ADFI	9.18[f]	0.16	13.18[d]	0.24	9.90[e]	0.18	13.03[d]	0.24

[abc]Means in the same row with different superscripts differ P<.05.
[def]Means in the same row with different superscripts differ P<.01.
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COLOR = Hampshire x Yorkshire x Landrace
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Table 5. Litter performance of two sow genotypes and five gestation housing systems.

Genotype	COLOR					WHITE				
Housing System	C	MOF/EF	MOF/FS	HP/EF	HP/FS	C	MOF/EF	MOF/FS	HP/EF	HP/FS
Litters	112	53	47	46	64	120	25	47	29	42
Item	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean
NBA	9.5^{b}	9.2^{b}	9.2^{b}	9.3^{b}	9.6^{b}	11.0^{a}	9.4^{b}	9.5^{b}	9.4^{b}	9.5^{b}
SB	0.73^{ab}	0.58^{ab}	0.72^{ab}	0.37^{a}	0.69^{ab}	0.79^{ab}	1.96^{d}	1.09^{bc}	0.76^{ab}	1.48^{cd}
MM	0.17	0.26	0.09	0.15	0.09	0.14	0.04	0.15	0.34	0.07
BW	3.30^{e}	3.41^{ce}	3.39^{de}	3.27^{e}	3.36^{e}	3.59^{bc}	3.64^{abcd}	3.79^{a}	3.69^{ab}	3.70^{ab}
NW	8.6^{b}	7.8^{c}	8.2^{bc}	7.6^{c}	8.0^{bc}	9.8^{a}	7.8^{bc}	8.4^{bc}	7.9^{bc}	7.9^{bc}
WW	11.9^{bc}	11.7^{bc}	11.6^{c}	11.6^{c}	11.9^{bc}	12.4^{ab}	13.0^{a}	12.1^{abc}	12.3^{abc}	12.8^{a}
WA	18.5	17.8	17.9	18.1	19.3	18.9	18.2	18.4	18.3	17.8
ADG	0.46	0.45	0.45	0.45	0.44	0.46	0.50	0.46	0.47	0.48

^{abcde}Means in the same row with different superscripts differ P<0.05.

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Housing system abbreviations
CRATE = individual crate
MOF/EF = modified-open front/electronic feeder
MOF/FS = modified-open front/feeding stalls
HP/EF = hoop structure, bedded/electronic feeder
HP/FS = hoop structure bedded/feeding stalls

Table 6. Sow weights, backfat thickness and lactation feed intake for two sow genotypes and five housing gestation systems.

Genotype	COLOR					WHITE				
Housing System	C	MOF/EF	MOF/FS	HP/EF	HP/FS	C	MOF/EF	MOF/FS	HP/EF	HP/FS
Litters	112	53	47	46	64	120	25	47	29	42
Item	mean	mean	mean	mean	mean	mean	mean	mean	mean	mean
PFW	443^{a}	422^{bcd}	411de	397^{e}	425^{bcd}	422^{a}	444^{ab}	438^{ac}	414de	428^{acd}
PFBF	13.8^{abd}	13.6^{bde}	12.4^{ef}	11.9^{f}	13.0^{cdef}	14.2^{ab}	14.2^{abc}	14.1^{abc}	15.0^{a}	14.3^{abc}
SWW	393^{ab}	362^{c}	370^{c}	365^{c}	381^{bc}	404^{a}	375^{bc}	386^{abc}	378^{bc}	381^{abc}
SWBF	13.5^{a}	12.6^{ab}	11.9^{b}	12.1^{b}	12.0^{b}	13.1^{ab}	12.4^{ab}	13.0^{ab}	13.5^{a}	12.6^{ab}
ADFI	10.8^{b}	9.2^{c}	10.3^{bc}	10.8^{ab}	10.8^{ab}	11.0^{ab}	10.0^{bc}	11.0^{ab}	12.1^{a}	11.1^{ab}

^{abcde}Means in the same row with different superscripts differ P<0.05.

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