A Reduction in Litter Size on an Ontario Swine Farm

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Abstract

In a 200 sow herd, the litter size fell from an average of 10.5 pigs born alive per litter from January to June, to an average of 9.2 for the remainder of the year. Management changes during the first part of the year resulted in half the sows weaning litters at three weeks of age and half the sows weaning at four weeks of age instead of at six weeks as was previously done. The subsequent litter size was 9.3 pigs born alive per litter for three-week weaned sows compared to 10.0 for four-week weaning. The management of gilt breeding was also altered by the necessity to breed groups of 12 gilts in one-week periods of time and therefore a higher proportion of gilts may have been mated on their first estrus instead of their second or third estrus as had been the case. The difference in litter size of first parity sows between the first six months and the second six months was 1.1 pigs. Parvovirus infection may have been a factor contributing to the reduction in litter size amongst first parity sows; two groups of first parity sows experienced an increase in mummified piglets, a reduced farrowing rate, and smaller litter size. However, no attempt was made at diagnosing an infectious agent. Parity distribution remained relatively unchanged during the year and was not associated with the drop in litter size.

Key words: Swine, litter size, weaning age, parity.

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Résumé

Diminution du nombre de porcelets par portée, dans une porcherie de l'Ontario

Cette étude s'étalait sur une période d'un an et elle portait sur un troupeau de 200 truies où le nombre de porcelets vivants par portée passa d'une moyenne de 10,5, de janvier à juin, à 9,2, pour le restant de l'année. Les changements apportés à la régie par l'éleveur, au cours de la première partie de l'année, l'amenèrent à sevrer les porcelets de la moitié de ses truies, dès l'âge de trois semaines, et ceux de l'autre moitié, à l'âge de quatre semaines, plutôt qu'à l'âge de six semaines, comme auparavant. Après ces changements, le nombre de porcelets vivants par portée s'établit à 9,3 chez les truies dont on sevrait les porcelets à l'âge de trois semaines, comparativement à dix chez celles dont on les sevrait à l'âge de quatre semaines. L'éleveur changea aussi sa façon de planifier les accouplements et fit saillir hebdomadairement 12 truies; par conséquent un plus grand nombre furent probablement saillies à leur premier oestrus plutôt qu'à leur deuxième ou troisième, comme cela se faisait auparavant. La différence dans le nombre de porcelets par portée des truies primipares, entre les premiers et deuxièmes six mois de l'expérience, fut de 1,1 porcelet. L'infection due au parvovirus pourrait avoir contribué à réduire le nombre de porcelets par portée, chez les primipares. Deux groupes de ces dernières donnèrent plus de porcelets momifiés, moins de parturitions et des portées moins nombreuses. On ne tenta toutefois pas d'isoler d'agent infectieux. La distribution des parturitions demeura toutefois sensiblement la même, au cours de cette année, et sans rapport avec la diminution du nombre de porcelets par portée.

Mots clés: porcs, nombre de porcelets par portée, âge au sevrage, parturition.

Introduction

The monitoring of productivity parameters to determine whether or not target goals are being realized is a major component of a swine health management program. The number of liveborn pigs per litter is an essential variable to record, in that litter size is directly related to sow productivity (1). A reduction in liveborn piglets per litter will result in a reduction in pigs weaned per sow per year, and therefore a possible reduction in herd profitability.

Small litter size has been associated with infectious diseases such as porcine parvovirus and leptospirosis (2), and with management procedures such as single mating, the breeding of gilts at first estrus, early weaning, and the feeding of nutritionally inadequate diets (3). Litter size may be affected by seasonal influences, particularly breeding during hot summer months (4). Certain breeds such as Durocs and Hampshires tend to have smaller litters than Yorkshire and Landrace. Crossbred Yorkshire-Landrace sows produce larger litters than purebreds.

Litter size is affected by many factors and the analysis of a herd problem associated with this parameter requires a thorough herd history and careful analysis of production records.

TABLE I
Monthly Summary of Litter Size and Other Productivity Variables

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Number of litters	14	21	31	8	28	25	25	31	20	28	36	42
Born alive per litter	11.4	10.2	10.6	9.9	10.4	10.2	8.7	9.0	9.8	8.9	10.3	8.5
Born dead per litter	0.4	0.9	0.8	0.1	0.6	0.9	0.6	0.5	0.5	0.7	1.2	0.9
Litters of <8 pigs (%)	7	14	10	12	7	20	36	26	25	29	11	31
Litters with one or more mummified fetuses (%)	0	5	3	12	4	8	24	16	0	14	14	10
Litters from parity 1 sows (%)	50	24	52	37	32	28	24	32	10	46	19	38
Litters from parity 2 sows (%)	30	30	9	37	18	28	32	29	40	14	11	14

History

The herdsman of a large swine operation in southern Ontario observed a reduction in litter size from July to December 1985 and sought advice regarding steps to improve this area of production.

The herd was a closed 200-sow farrowing operation which had undertaken an expansion and intensification program in January of 1985 in order to increase the number of pigs produced. At the beginning of 1985 the herd was farrowing groups of 24 sows every three weeks. The farrowing area consisted of three all-in/all-out rooms of 24 farrowing crates. Pigs were weaned at six weeks of age. One litter of pigs was farrowed per crate every nine weeks, resulting in less than six farrowings per farrowing crate per year.

The decision was made in January to modify the farrowing area into five rooms of 12 farrowing crates, eliminating half of one farrowing room (12 crates) and using this space for constructing a nursery to handle four week old piglets. The goal of farrowing 24 sows every three weeks was therefore changed to a goal of farrowing 12 sows every week; increasing the yearly potential farrowing capacity of the herd from approximately 416 litters to 624 litters.

Beginning in late January 1985 the herdsman began to regroup the sows and gilts in order to achieve the new goal of 12 farrowings per week. Eight groups of 24 sows farrowed and in each case, approximately 12 litters were weaned at three weeks and 12 litters were weaned at four weeks of age. Thus the existing eight groups were divided into 16 groups of 12 sows. It would have been necessary to breed five groups of 12 gilts to fill the farrowing schedule of 12 farrowings per week. During the period January to July, three groups of gilts were bred leaving two weeks with no farrowings.

TABLE II
Parity and Litter Size for Each Six Month Period in 1985

	January to June		July to December	
Parity	% of Farrowings	Average Number Born Alive	% of Farrowings	Average Number Born Alive
1	34	9.7	30	8.6
2	20	10.2	21	8.6
3	16	11.6	16	9.5
4	15	10.9	9	10.2
5	6	9.7	11	9.4
≥6	9	11.7	13	10.3

The herdsman attempted to breed gilts on the second or third estrus. However, when it was necessary to breed 12 gilts in one week, the majority of the animals were bred on their first heat.

Otherwise, breeding management and feeding practices were left unchanged throughout the year. The number of mature boars varied from 10 to 12. Sows were fed a corn-based lactation ration and a corn-barley gestation ration. The herd was vaccinated for leptospirosis and erysipelas but not for porcine parvovirus. All sows and gilts were hand-mated twice at 24-hour intervals. Sows were housed in individual stalls through the breeding and gestation period. Most of the breedings were between first generation crossbred Landrace and Yorkshire females with Hampshire-Duroc males.

Records were kept by hand, using litter cards and a weekly summary book. Unfortunately litter cards of culled sows were discarded when the sows left the herd. Therefore, a retrospective examination of the herd productivity with respect to individual sow performance, was limited to the sows remaining in the herd at the time of the study.

Results of the Analysis of Farm Records

Based on the records of sows still present in the herd (a total of 309 farrowings) the average number of pigs born alive per litter during the first half of 1985 (January to June) was 10.5 compared to an average litter size of 9.2 for the second half of the year. Stillbirths remained constant throughout the year, however the percentage of litters with at least one mummified piglet increased from 5% of litters to 13% of litters after June. The monthly herd performance illustrating the decrease in litter size during the second half of the year is presented in Table I.

The monthly average number of pigs born alive per litter was not related to the number of stillbirths per litter ($r = 0.07$, $p > 0.1$) nor was it related to the percentage of first ($r = 0.18$, $p > 0.1$) or second ($r = 0.02$, $p > 0.1$) parity sows farrowing per month. However, monthly litter size was negatively correlated ($r = -0.91$, $p < 0.001$) with litter scatter (% of litters of <8 live born pigs) and was negatively associated ($r = -0.71$,

$p < 0.01$) with the percentage of litters with one or more mummified fetuses. Correlation coefficients (r) between variables were obtained using standard methods (5).

The proportion of small litters (<8 pigs born alive) was much higher in the July to December period (48 of 182 litters) compared to the January to June time interval (16 of 127 litters). The relative risk for a small litter being born in the second half of the year was 2.25 to 1. Smaller litter size appeared to be independent of parity (see Table II) in that the average number born alive for each parity was lower in the second half of the year, and the proportion of farrowings per parity remained relatively constant.

In the first half of the year, farrowings were from groups of 24 sows farrowing every three weeks. In July, the sows from three-week and four-week weaning and the all-gilt groups began to farrow. The subsequent litter size of sows that weaned litters at three weeks was lower than the subsequent litter size of sows that weaned litters at four weeks (Table III).

The increased number of mummified fetuses observed in the second half of the year was associated with older sows. Twenty-five percent of litters born to older sows (≥5 litters) contained mummified fetuses compared to 10% of litters from first and second parity sows. However, the weekly summaries (Table IV) show that at least two groups consisting of all first parity sows experienced reduced farrowing rates, small litter size, and a high percentage of mummified fetuses suggestive of porcine parvovirus infection.

There did not appear to be a difference in litter size between sows that were bred to a single boar or to two different boars. In the period from July to December, 38% of the litters of sows bred to one boar were small (≤8 pigs born alive) compared to 36% of the litters from sows bred to two different boars. Of the litters associated with single boar matings, only one boar appeared to sire a higher proportion of small litters than the herd average of 35 to 40%. Boar 120, a purebred Hampshire, bred ten sows of which seven farrowed litters of eight pigs or less and only three farrowed litters of nine or more live pigs.

TABLE III
The Subsequent Litter Size of Sows Weaning Piglets at Three and Four Weeks of Age

	Three-week weaning		Four-week weaning	
Parity	Number of Farrowings	Born Alive per Litter	Number of Farrowings	Born Alive per Litter
2	9	7.9	17	9.8
3	9	10.3	9	7.9
4	9	10.1	9	10.1
5	11	7.4	2	11.0
6	3	10.0	2	11.0
>6	4	10.0	7	12.1
Total	45		46	
Mean ± std. dev.		9.3 ± 3.0		10.0 ± 2.8
Average parity	4.4		3.8	
Total pigs born Mean ± std. dev.	10.9 ± 3.4		11.7 ± 4.0	

TABLE IV
Productivity of Groups of Gilts Introduced to the Herd between January and July 1985

Number Bred	Week Farrowed	Number Farrowed	Born Alive	Born Dead	Mummies	Born Alive per Sow
13	July 14-21	8	41	5	15	5.1
12	Aug. 4-10	8	58	2	7	7.2
11	Oct. 20-27	10	82	5	0	8.2

Discussion

The reduction in litter size coincided with changes associated with the herd being converted to a weekly farrowing cycle. The parity distribution of a herd has a major effect on litter size (4), and at a time of herd expansion one would expect litter size to be lower as a result of a high proportion of gilt farrowings. An examination of the percentage of farrowings according to parity was an important first step in the investigation of this problem and demonstrated that a change in parity distribution had not occurred. Furthermore, litter size was lower for all parities in the second half of the year. This suggested that the factors responsible for decreased litter size in this herd affected older as well as younger sows.

Porcine parvovirus in an endemically-infected herd is associated with small litter size, increased numbers of mummified piglets, and an increased return-to-service rate amongst zero and first parity sows. Parvovirus infection may have caused the increased number of mummies and small litter size (average 5.1 pigs born alive) in one group of first parity sows farrowing from July 14 to 21. Unfortunately, mummified piglets were not submitted for fluorescent antibody testing at the time and therefore one can only speculate as to the cause of this sporadic increase in mummified piglets from a group of young sows.

Likely a more important factor associated with the reduced litter size in the parity one sows was the change in management with respect to breeding gilts. The majority of gilts in the second half of the year were bred on the first observed heat. One would expect a difference of one pig per litter between gilts bred on their first estrus compared to their second or third heat (6).

The most important factor associated with the reduction in litter size of the older sows (greater than first parity) was the change in the lactation period of the sows.

English *et al* (7) suggest that one can expect an increase of 0.2 piglet for each delay of five days when weaning between two and five weeks of age. The difference in litter size between the three-week-weaned sows and the four-week-weaned sows of 0.7 of a piglet per litter in this herd was similar to the findings of Clark and Leman (8). This depression in litter size with earlier weaning is caused not by reduced ovulation rate but by increased losses of embryos suggesting that the uterus requires a certain amount of time to fully recover from the previous pregnancy (7).

The data comparing three-week-weaning and four-week-weaning in this herd suggest that four-week-weaning would be more profitable even though one would expect almost 0.1 litters per sow per year more with three-week-weaning.

Nutritional factors affecting litter size such as energy, mycotoxins, and biotin levels were not measured. However, in the case of zearalenone toxicity one would have expected other signs of hyperestrogenism to have been evident such as swollen vulvas of young growing gilts, prolapsed rectums, and anestrus problems. Likewise, a biotin deficiency may have been accompanied by a noticeable increase in hoof cracks and lameness. The incidence of these clinical problems did not appear to change during the year.

Brooks and Cole (9) suggest that the energy intake during lactation and during the weaning to breeding interval is a critical factor affecting subsequent litter size, particularly for first parity sows.

In a controlled feeding trial, the difference in subsequent litter size of sows fed 2.7 kg per day and sows fed 3.6 kg per day between weaning and breeding was 1.5 pigs born alive (9). The possibility of increasing the feed intake during the lactation and weaning-to-breeding period was discussed with the herdsman.

In summary, it was anticipated that the litter size would improve once the farrowing routine was established, thus eliminating the need to breed whole groups of gilts and to wean litters younger than four weeks of age. It was recommended that gilts be selected early, vaccinated against porcine parvovirus, and not bred until their second heat. The goal for litter size of parity one sows was set at ten live born piglets. Careful monitoring of the parity distribution and the litter size according to parity was encouraged.

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