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Culling of sows and the profitability of piglet production[1]

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Abstract

The effect of culling rate on herd productivity is illustrated.

The effects of rearing intensity, age at first mating and at first farrowing, lactation length, and remating and pregnancy diagnosis on culling and sow productivity are discussed.

The use of a sow productivity index as a culling aid is mentioned.

Introduction

The number of piglets weaned per sow per year in a herd is the product of the number of litters produced per sow per year and the number of piglets weaned per litter. The number of litters produced per sow per year (farrowing index) is calculated as the total number of litters farrowed in a year divided by the average number of sows in the herd. Most of the increase in the number of piglets weaned per sow per year during the past 10-15 years has been achieved by a higher farrowing index as a result of reduced lactation length. At any lactation length, the number of piglets weaned per sow per year will be enhanced by sows which are producing high numbers of weaned piglets at regular intervals. After the first litter the farrowing interval is usually longer than after subsequent litters. The number of piglets born per litter is lowest in the first and the second litter. It increases to a maximum at around the fourth litter and decreases gradually in later parities. The third, the fourth and the fifth litter are yielding the highest number of piglets weaned per litter (Legault et al., 1975b; Noguera et al., 1983; van der Steen, 1984). A high culling rate will result in a high percentage of first and second litters produced in a herd. Today, an average culling rate of 40-50 % per year is a generally accepted figure. In this contribution some aspects with respect to culling and sow productivity are discussed.

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Table. 1. Results of Dutch pig farms in 1983 (ranking in order of replacement rate).

	Results at a replacement rate of			
	<30 %	30-35 %	35-45 %	45-55 %
Number of farms	51	59	159	121
Average replacement rate (%)	25	33	40	50
Litters per sow per year	2.06	2.12	2.09	2.07
Piglets born alive per litter	10.4	10.3	10.2	10.2
Piglet mortality rate (%)	14.4	14.6	14.7	15.7
Piglets raised per litter	8.9	8.8	8.7	8.6
Piglets raised per sow per year	18.4	18.7	18.2	17.0
Age at weaning (days)	34	32	32	32

From Baltussen (1985).

Culling rate and herd productivity

In Table 1 the relationship between culling rate and herd productivity is illustrated for Dutch pig farms in 1983. The farms are ranked in order of replacement rate (per year), which is the reflection of culling. The highest number of piglets raised (to about 23 kg) per sow per year was found on farms with a replacement rate of 30-35 %. With 2.12 litters per sow per year this means a replacement rate of approximately 15.5 % per reproductive cycle. Piglet mortality was high on farms with a replacement rate of 45-55 %. Both the high replacement rate and the high piglet mortality rate are indicating management problems on these farms.

In France, Dagorn & Aumaitre (1979) ranked farms in order of number of litters weaned per culled sow. The relationship with herd productivity is shown in Table 2. In that table, the number of piglets weaned per sow per year is expressed per sow per year of productive life and per sow per year of presence on the farm respectively (Legault et al., 1975a; Legault, 1978). These estimations are not in agreement with

Table 2. Relationship between number of litters per culled sow and herd productivity.

	Litters per culled sow				
	<3	3-3.99	4-4.99	5-5.99	≧6
Number of farms	154	247	281	211	156
Lactation length (days)	31.1	32.6	32.2	32.6	32.0
Piglets born (total) per litter	10.17	10.58	10.58	10.69	10.79
Piglets weaned per litter	8.25	8.53	8.51	8.61	8.71
Piglets weaned					
per productive sow per year	18.1	18.7	18.8	19.0	19.4
per sow present per year*	15.5	16.5	16.7	17.1	17.6

* The sow was considered as present from 210 days of age until discarding.
From Dagorn & Aumaitre (1979).

the definition of annual productivity given earlier. According to Table 2 an increased number of litters per culled sow is associated with a higher herd productivity.

Effect of rearing intensity

Den Hartog (1984) assigned gilts to one of four energy levels during rearing: 3 M ('ad libitum'), 2.5 M, 2.1 M and 1.8 M (M is metabolizable energy required for maintenance). The four energy levels were applied from 12 to 38 weeks of age. Gilts were inseminated between 35 and 41 weeks of age. The reproductive performance of the gilts at the four energy levels up to the first litter is summarized in Table 3. In a portion of the animals the effect of the level of energy intake during rearing on lifetime performance was studied (Table 4). Up to the first litter 43 % of

Table 3. Effect of level of energy intake during rearing on reproductive performance in gilts.

	Energy level			
	3 M	2.5 M	2.1 M	1.8 M
Number of gilts at 12 weeks of age	172	168	168	172
Number of gilts at 38 weeks of age	156	155	164	164
Percentage of gilts with a (spontaneous) pubertal oestrus	69	75	71	68
— Age at puberty (days)	234	237	237	244
— Weight at puberty (kg)	139	131	118	109
Number of piglets born alive in the first litter per 100 gilts present at the start				
— pregnant after a spontaneous oestrus	386	399	437	438
— pregnant after spontaneous and induced oestrus	485	486	599	579

From den Hartog (1984).

Table 4. Effect of level of energy intake during rearing on lifetime reproductive performance.

	Energy level			
	3 M	2.5 M	2.1 M	1.8 M
Number of gilts at 12 weeks of age	52	45	50	49
Number of first litters	24	23	31	34
Number of second litters	17	10	24	24
Number of seventh litters	4	1	7	9
Total number of litters (1st-7th litter)	78	53	107	136
Number of litters per gilt present at the start	1.50	1.18	2.14	2.78
Number of litters per first parity sow	3.25	2.30	3.45	4.00

From Jongbloed et al. (1984).

all gilts were culled; at the two higher levels of energy intake 54 and 49 % of the gilts had to be removed. The main reason for culling was reproductive disorder (no oestrus, no conception, abortion). Culling because of leg weakness was important before the first litter at the energy level of 3 M during rearing and after the first litter at 2.5 M during rearing. At any parity the number of piglets born per litter did not differ significantly among the four energy levels. The best lifetime performance was observed for gilts reared at 1.8 M. Levels of energy intake during rearing higher than 2.1 M were considered as detrimental to lifetime performance. These results are largely supported by those found in a Danish (Nielsen & Danielsen, 1984) and a West German study (Kirchgessner et al., 1984). In experiments at the Regional Pig Research Farms in the Netherlands the number of gilts culled during rearing was also increased at a high feeding level (ca. 2.8 M). But gilts not culled produced more litters than gilts with a low feed intake during rearing. In an experiment carried out by van de Kerk & de Witte (1983) the number of litters produced per first parity sow was only slightly higher for animals with a high feed intake during rearing (ca. 3 M).

Effects of age at first mating and age at first farrowing

Mating gilts at puberty (first oestrus) usually results in a reduced size of the first litter as compared to mating gilts at the second or the third oestrus. After 3 parities, no effect was observed (MacPherson et al., 1977) or a small difference still was found (Young & King, 1981).

Brooks & Smit (1980) studied the effect of age at mating in gilts mated at the second oestrus. Gilts were mated at a mean age of 198 or 237 days. The number of piglets born per litter did not differ significantly in any of five parities. Only in the first litter the mean number of piglets weaned was significantly lower for the early-mated gilts. The interval from weaning to conception was not affected by mating age. Reasons for removal of animals were unrelated to mating age. For animals completing five parities the total output of piglets born or weaned was almost identical for both mating ages.

Nearly all retrospective studies concerning the effects of age at first mating and age at first farrowing, which are cited below, are restricted to sows that have farrowed at least once. Information is lacking about mated gilts that do not farrow. Bereskin & Frobish (1981) reported that the number of piglets born or weaned in the first litter was not significantly affected by age at mating (217 to 312 days). Kozma (1985) could not demonstrate any effect of mating age (< 210 to > 340 days) on the number of piglets born or weaned per litter in first and later parities. However, gilts mated before 210 days of age and also those mated after 320 days of age were culled at a higher rate. In a study by Schneider et al. (1980) not only in the first litter but also in the second one litter size at birth increased with age at (successful) mating ($\leqq 190$ to 400 days). No effect was observed with respect to the interval between weaning and conception and the longevity of sows. Bouwman (1985) found a lower number of piglets born in the first litter when gilts were mated rather young (< 230 to > 290 days). Gilts mated at an older age produced more litters. Conception rate

Table 5. Relationship between age at first farrowing and lifetime productivity.

	Age (days) at first farrowing						
	290-309	310-329	330-349	350-369	370-389	390-409	410-429
Number of animals	1566	3107	3237	2532	1058	612	320
Piglets born* in 1st litter	9.4	9.8	10.1	10.1	10.2	10.2	10.4
Piglets weaned in 1st litter	8.0	8.3	8.4	8.4	8.4	8.4	8.4
Piglets born*/sow	43.8	42.6	40.3	37.0	37.6	36.6	35.6
Piglets weaned/sow	35.4	34.6	32.6	29.9	30.7	30.1	28.7
Litters/sow	4.02	3.90	3.69	3.41	3.44	3.36	3.29

* Total born.
From Noguera & Gueblez (1984).

was not influenced by age at first mating.

In a study by Chapman et al. (1978) no effect of age at first farrowing (≦ 319 to ≧ 471 days) on the number of piglets born or weaned per litter in first and later parities was shown. Also the average farrowing interval and the number of litters produced per sow were not affected. The number of litters produced per sow was not significantly influenced by the size of the first litter. Mean litter size at birth in subsequent litters was higher for sows with 9 or more piglets (total) born in the first litter. However, mean litter size at weaning did not reflect the same trend. Legault & Dagorn (1973) reported a small increase in the number of piglets born or weaned per sow (total number in all litters produced) with age at first farrowing (260 to 540 days), as well as a slightly prolonged average farrowing interval. The number of litters produced per sow was unaffected. The results of a recent French study (Noguera & Gueblez, 1984) are presented in Table 5. The number of piglets born or weaned in the first litter increased with age at first farrowing (290 to 430 days). In the second litter, litter size at birth was slightly reduced when the first litter was farrowed between 290 and 310 days of age. Contrary to the observations of Chapman et al. (1978) and Legault & Dagorn (1973), the number of piglets born or weaned per sow decreased with age at first farrowing, with most of the decrease between the ages of 310 and 370 days. This decrease was attributable to a decreased number of litters per sow. The number of litters produced per sow was not affected by the size of the first litter, unless the number of piglets (total) born in the first litter was less than 7, when fewer litters resulted. The number of piglets born or weaned per sow was positively related to the size of the first litter. Thus, in favour of a high lifetime performance an age at first farrowing of about 300 days should be envisaged.

Effect of age at weaning (lactation length)

Reducing lactation length to about 3 weeks is known to improve herd productivity (Aumaitre, 1978; te Brake, 1978). A higher reproductive rhythm because of a re-

duced lactation length might result in a higher annual culling rate. However, differences in replacement rate among farms were not associated with age at weaning (Table 1). This is in agreement with the findings of Dagorn & Aumaitre (1979) in that there was no relationship between weaning age and the number of litters per sow at culling (Table 2). A lower annual culling rate on farms weaning the piglets at an early age (mean age 17 days) as compared to farms weaning the piglets rather late (mean age 46 days) was reported by van der Heyde & Lievens (1976).

Effects of repeat matings and pregnancy diagnosis

The effect of repeat matings (at subsequent oestruses) on sow productivity is difficult to assess because of lack of data. In Table 6 conception rates to first and subsequent matings in gilts and sows found in a study by Bisperink (1979) are given. The numbers of extra days required per reproductive cycle (considered from first mating to first mating for the next litter) in remated gilts and sows are also included in that table. After the first remating the conception rate was lowered by 14 to 22 %. About half of the gilts and sows remated twice conceived. After the first remating the reproductive cycle was increased by 44 to 59 days. In gilts and sows remated twice the number of extra days required per reproductive cycle was about equal to or exceeded the duration of a normal pregnancy. On the whole, differences in litter size at birth between first and subsequent matings were rather small. In gilts an increase in litter size up to the second remating was observed, but at the second remating this increase was solely due to a higher number of still-born piglets. Especially in animals remated twice the reproductive performance in the next cycle was below average.

More information is needed with respect to what is happening in a group of mated (or inseminated) females to those animals that fail to farrow. Based on the available literature the following assessment was made by Arts (1981):
— 35 % of the animals which do not farrow return to oestrus at about 3 weeks after mating (on average at 21.5 days);
— 17 % return to oestrus at 4-6 weeks after mating (on average at 35.3 days);

Table 6. Conception rates to first and subsequent matings and numbers of extra days per reproductive cycle required by remating.

Parity	Conception rate (%)			Extra days per reproductive cycle*	
	1st mating	1st remating	2nd remating	1st remating	2nd remating
0 (gilts)	82	65	50-55	56	108
1	81	67		44	136
2-4	84	66		57	149
≧5	84	62		59	128

* Considered from first mating to first mating for the next litter.
From Bisperink (1979).

— 19 % return to oestrus between 45 and 115 days after mating (on average at 70 days);
— 29 % do not show any heat symptoms after mating. The few animals that abort or that carry mummified foetuses are included in the last category.

At a farrowing rate of 80 % the total number of days lost because of non-pregnancy was estimated at 1070 days per 100 mated animals. In non-pregnant animals not seen in heat by 6 weeks after mating the number of unproductive days amounted to 810 days per 100 mated animals. Therefore, detection of pregnancy would allow an early elimination of these non-pregnant animals. Ultrasonic instruments are usually applied at 4 to 6 weeks after mating. Depending on the apparatus used, according to Arts & te Brake (1979) 50 to 92 % of the non-pregnant animals were identified correctly. Van de Wiel (1984) reported that pregnancy as well as non-pregnancy was diagnosed very accurately by a test for oestrone sulphate (in blood plasma) applied at about 28 days after mating.

Use of a sow productivity index

At the Department of Animal Breeding of the Wageningen Agricultural University a project has been started to develop a sow productivity index. The sow productivity index is meant only as an aid in culling of sows on the basis of their expected productivity and should not be confused with a breeding value estimate. The productivity index predicts the future value of a sow and is estimated from already realized production. If the expected productivity of a sow in the next litter(s) is lower than the expected value of an average replacement gilt, then she should be culled. The expected value of an average replacement gilt is the value of an average sow up to the time of culling. Van der Steen (1984) reported that litter size at birth (total born), fraction of piglets weaned and interval from weaning to mating were the most important traits to be included in the productivity index. However, low correlations (ca. 0.2) were found between predicted and true values for these traits. Further work is in progress.

Conclusions

Herd productivity is adversely affected by a high culling rate. A culling policy should be aimed at achieving a high herd productivity. Such a policy has to start with introducing gilts in the herd which are able to produce many litters. It is indicated that a high rearing intensity, i.e. a high level of feed or energy intake during rearing, is detrimental to lifetime performance.

In favour of a high lifetime performance mating gilts at about 6 months of age, in order to farrow at about 300 days of age, has to be taken into consideration. Further studies, more prospective in nature, are needed to clarify this. Reducing lactation length to about 3 weeks will increase herd productivity. Culling of sows is not influenced by weaning age.

More information is needed with respect to time of returning to oestrus of gilts and sows not becoming pregnant after first mating. Remating animals which have

returned twice is not recommended. Pregnancy diagnosis is especially of interest in eliminating non-pregnant animals which are returning late to oestrus or are not showing any heat symptoms after mating.

A sow productivity index is meant as a culling aid. Its application has to await results of further work.

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