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Sow nutrition for productivity and longevity: Any new ideas?

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Introduction

Achieving good breeding females with high longevity and lifetime production in swine production is challenging. Sow longevity can be defined in many ways, such as the following:

- Number of litters per lifetime
- Pigs weaned per lifetime
- Average herd parity
- Percent sows removed by a given parity
- Sow's age at death or culling

Based on these definitions, sows are prematurely removed from the breeding herd for the following reasons:

- Reproductive problems (repeat services, fail to conceive, fail to farrow)
- Poor performance (reduced litter size, lactation failure, disease)
- Locomotion problems (foot lesions, injuries, structural problems)

The two major factors affecting longevity are culling rate and sow mortality. The survey data in **Table 1** summarizes factors influencing sow longevity and lifetime performance.

Sow longevity as measured by number of years in the herd can be calculated as follows:

Sow longevity, years = # litters/lifetime / # litters / sow/ year

Thus, from the data in **Table 1**, average sow longevity is 1.9 years (4.3 ÷ 2.25). The replacement rate in this herd can be calculated as 100 ÷ number of years in the herd. For the average herd this would be 100 ÷ 1.91 = 52.4% and 100 ÷ 2.27 = 44% for the upper 10%. For a 500 sow unit, the upper 10% herd will require 42 fewer sows for replacements. Can this reduction in culling rate be achieved by nutrition?

Sow nutrition, productivity, and longevity

A greater understanding of the sow nutrient requirements and feeding strategies to prolong her life in the breeding phase will be required to answer this question. However, all phases of the sow's life—gilt development, gestation, lactation, and wean-to-service interval—are important.

The objective of the gilt nutrition program is to allow the gilt to express its genetic potential for age at puberty and subsequent lifetime performance. The modern gilt is very lean, has a greater capacity for lean tissue deposition, and is, on average, 50 kg heavier at an equivalent stage of maturity compared to its predecessors (**Table 2**).

Table 1: Survey data and target values for factors influencing sow longevity and lifetime performance (Pigchamp, 1999).

	Average	Upper 10%	Lower 10%	Targets
Pigs weaned/mated female/yr	21.5	24.4	18.8	24
Pigs weaned /sow/lifetime	40	55	25	50
No. litters/lifetime	4.3	5.45	2.94	5
No. litters/female/year	2.25	2.4	2.1	2.4
Average parity	3.0	3.8	2.2	3.0
No. years in herd	1.91	2.27	1.40	2.1
Replacement rate, %	52.4	44.0	71.4	45
Culling rate, %	49.6	42.3	63.5	40
Sow mortality	4.4	1.7	7.5	<5.0

Table 2: Changes in growth and body composition of gilts.

Criteria	1975	2000
% Lean Carcass	45	55-60
% Fat	27	15-18
P2 at first service (mm)	30-35	18-20
Daily lean tissue growth rate (g/d)	200	340
Live-weight at third parity (kg)	195	250

Adapted from Boyd, 1999.

Gilts have lower appetites and lower growth rates than barrows and, therefore, have different nutrient requirements than barrows at similar live-weights. Thus, split-sex feeding is now a common practice and allows the opportunity to feed and manage gilts differently than barrows. This practice allows the use of weaner gilts to be fed to an optimum live-weight and age-at-first-service and also allows the gilts to acclimatize and develop immunity to the particular disease challenges on the unit. The nutrient requirements of any population of gilts will depend on its lean tissue growth rates; the composition of the diets fed should be based on an estimate of lean tissue growth rate and average daily feed intake.

Gilts that are

- Moved from the finishing barn and placed in isolation units at 75-80 kg live-weight
- Provided with at least 12 sq. feet per gilt
- Fed appropriate diets
- Exposed to mature boars as early as 140-150 days of age

should reach puberty at an earlier age and have better lifetime performance. The appropriate diet should be either a moderate lysine diet (0.6%) with high energy (3.5 Mcal/kg) corn-soybean meal fed moderately or a high lysine diet (1.31%) with moderate energy (3.2 Mcal/kg) fed restrictively. A suggested feeding program is given in **Table 3**.

For replacement gilts selected at a market weight of approximately 115 kg, the feeding strategy should be based on the age and backfat level at selection. Gilts that are 145 days of age or more and have greater than 14 mm P2 backfat at time of selection can be fed a gilt developer diet shown in **Table 3**. The premix in this diet should be similar to that used for grower pigs of 25 to 59 kg and should ensure a higher intake of calcium, phosphorus, copper, iron, zinc, selenium, folic acid, biotin, choline, pyridoxine, and riboflavin than that supplied to finisher hogs. This increased intake will enhance body reserves which may used during future reproduction and may reduce culling rate due to locomotion problems.

Gilts that are less than 140-150 days of age at a time of selection (115 kg) and have less than 14 mm P2 backfat, should be fed a diet similar to the "fat enhancing" diet shown in **Table 4**. This diet should reduce growth rate slightly and should allow ad libitum-fed gilts to gain 1.5 to 2 mm P2 backfat per week. Therefore, these gilts should weigh about 125 kg and have 19-22 mm P2 backfat at breeding at their second estrus.

Nutritional effects on sow reproductive performance are mediated by changes in sow body composition, metabolic, or endocrine factors. Sow nutrition during each stage of the reproductive cycle will influence nutrient requirements and performance in subsequent stages. Nutrition during pre-breeding and gestation is associated with ovulation rate, embryo survival, and fetal growth. Gestation feeding should be targeted to provide sufficient nutrients for development of the fetal load, including the increase in uterine tissue, development of the mammary gland, and a modest maternal gain. The demand for nutrients is not as high during these fetal and tissue development stages compared to the lactation phase. When feeding to condition, it is critical not to overfeed sows during the dry period. It

Table 3: Suggested feeding program for replacement gilts to 115 kg live-weight.

Weight (kg)	Feed/d (kg)	Protein (%)	Lysine (%)	Calcium (%)	Phosphorus (%)	Mcal DE (kg)
25 – 50	1.7	19.5	1.05	0.80	0.7	3.35
50 – 75	2.5	17	0.85	0.75	0.65	3.25
75 – 90	2.75	15.5	0.75	0.65	0.55	3.25
90 – 115	2.9	14	0.65	0.60	0.50	3.25

Table 4: Gilt developer diets fed from selection to time of breeding.

	Gilt developer > 145 days	Fat enhancing < 145 days
Backfat (P2)	>14 mm	<14 mm
Mcal DE/kg	3.25	3.45
Protein, %	14.5	13.5
Lysine, %	0.65	0.55
Calcium, %	0.80	0.85
Phosphorus, %	0.70	0.75

is well established that increase feed intake of pregnant sows and the associated large increases in sow body weight will depress feed intake of lactating sows. The latter results in poor condition at weaning, requiring increased levels of feed to be given during subsequent pregnancy to restore the lost body condition. This, in turn, depresses lactation intake in the subsequent parity and so a vicious downward spiral begins.

Target maternal gains during gestation should be 25 to 40 kg during the first parity, 25 to 30 kg during the second parity, 25 kg for parities three and four and 20 kg during parity five to avoid the downward spiral of feed intake. These targets can be achieved if sows are fed according to the live body weight and backfat measurements or a good estimate of body condition based on determined backfat measurement. This practice would control underfeeding or overfeeding sows during pregnancy. Gestation diets based on corn-soybean meal provide high energy diets to gestating sows. Severe feed restriction (60-70% of recommended energy intake) during gestation will decrease the sow's longevity in the breeding herd due to her inability to meet her target weight gains and withstand repeated reproductive cycles. A method of restricting energy intake and controlling weight gain during gestation is to increase dietary fiber level. In addition to controlling energy intake, dietary fiber may confer some added benefits by increasing litter size, improving voluntary feed intake, and improving manure characteristics by decreasing pollution potential by reducing nitrogen output in urine. The type of fiber fed would depend on the parity of the sow. Multi-parous sows have been shown to demonstrate greater ability to digest fibrous diets than first parity sows.

Excessive energy intake in late gestation (day 75-100) may be detrimental to subsequent milk production. Studies at Michigan State University suggests that energy intakes of 10.5 Mcal ME (3.3kg corn-SBM diet) per day during late gestation reduces the amount of milk-secreting tissue in the mammary gland compared with gilts fed 5.75 Mcal ME (1.8 kg corn-SBM diet). Gilts that were fat were found to have fewer milk-secreting cells in their mammary glands than did lean gilts.

In the last fifteen days prior to farrowing (day 100-115), fetal demand is greatest and extra protein and energy will be required to satisfy the sow's nutrient requirements. If insufficient nutrients are available from her dietary intake at this stage, then the sow will mobilize protein and fat reserves to supply the nutrient requirements of the developing fetuses, which will cause her to be catabolic prior to farrowing.

The main aim of lactation feeding is to maximize energy and nutrient intake of the sow. This high nutrient intake is necessary to satisfy the demand for milk production, maintenance, and growth. A high protein, high energy diet should be fed. Insufficient nutrients to meet the requirement for milk production and maintenance will enhance the breakdown of body tissues to meet the demands of the piglets. Excessive mobilization of body tissues results in low milk production, delayed wean-to-service intervals, and potentially reduced litter size. This situation will reduce sow longevity within the breeding herd.

Sows in good condition at weaning will also require less feed to restore and maintain condition during pregnancy, which, in turn, improves feed intake in the subsequent lactation. During lactation, feed intake should be increased gradually from the first day after farrowing, aiming to reach a maximum as soon as the sow will be able to tolerate full feed. This approach is important in herds that have demonstrated frequent occurrence of a transient decline in feed intake.

The objective during the weaning-to-service interval should be to mate the sow and have her conceive within 5-7 days after weaning. The condition of the sow at mating has a marked effect on the weaning-to-estrus interval and the aim is to avoid any more loss of body weight or body condition during the period. The loss of both body fat and body lean has been implicated as being responsible for reproductive failure post-weaning. The sow at weaning normally consumes less feed due to the removal of her piglets. However, her appetite returns after 24-48 hours, and it is important that she is fed a lactation diet to either appetite or at least 3.5 kg per day based on body condition until mating.

Summary

The move to highly productive, lean-type genotypes and the more intensive and more productive production systems has resulted in increased sow mortality rates and higher culling rates. The longevity of lean genotypes may be improved by feeding low protein (14%), high energy (3.0 Mcal ME/day) diets from selection to breeding and the longevity of the average genotypes may improved by feeding low energy diets from selection to breeding (2.5-2.6 Mcal ME/day). Gestational weight gain should be controlled by phase feeding during the various phases of pregnancy and using fibrous feedstuffs to reduce energy density. Feed fresh, palatable, and nutritious feed during lactation. Feed several times per day to appetite. Ensure adequate feed intake during wean-to-service interval based on body condition.

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