KEEPING SOWS HEALTHY AND PRODUCING WELL

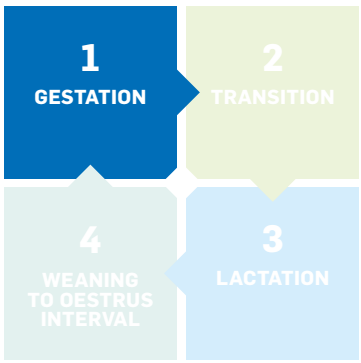
THE DE HEUS **FOUR PHASES APPROACH**

Keeping sows healthy and producing well can be challenging. Finetuning every detail has a positive effect on the animal itself, on the health and number of piglets and ultimately on the technical and financial performance of the farm.

SOW PRODUCTION CYCLE

The reproductive cycle of the sow can be divided into 4 distinct physiological phases: gestation, transition, lactation and weaning to oestrus interval (Figure 1). Each phase has its own characteristics and therefore needs its own specific management and has its own nutritional requirements. This paper describes the physiology and importance of all 4 phases.

Figure 1: Four phases of the reproductive cycle of the sow

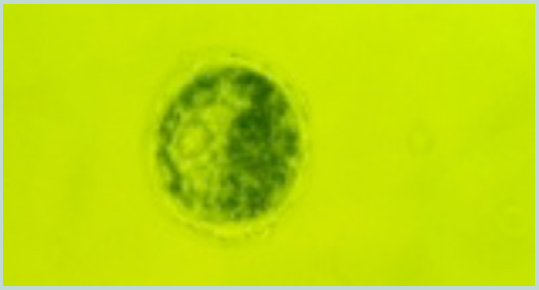


GESTATION PERIOD

Aim: *Recovery from previous lactation, development and growth of the new litter. During gestation, sows need to recover losses from the previous lactation and a uniform and healthy litter needs to be formed and grown.*

Gestation can roughly be divided into three different stages: early gestation (d0-42), mid-gestation (d43-85) and late gestation (d86-110).

Day 5 embryo



Day 19 embryo

Day 35 embryo

Figure 2: Embryonic deveopment on day 5, 19 and 35 of gestation (source: Wageningen University)

During early gestation, sows should recover from losses suffered to their condition, either backfat or muscle, during lactation. In this period, nutritional demands for litter growth are relatively low and body reserve recovery is relatively efficient. Based on the targeted body composition at next farrowing, combined with the losses in lactation, a feeding strategy should be defined. This means that body condition should be measured. Preferably by weighing and backfat measurements, but otherwise by only measuring the back fat of sows when entering and leaving the lactation room.

Besides body condition recovery, the litter develops from fertilised oocytes into miniature piglets of about 4 grams in early gestation (day 35). As shown in Figure 2, the embryo undergoes rapid changes in the first 35 days after fertilisation.

The period around day 5-7 is particularly important, because this is when the embryo starts to settle in the uterus (i.e. implants in the uterine horn). Next, the period around day 15-18 is important, as maternal recognition of pregnancy takes place. During maternal recognition of pregnancy, embryos give out a signal which tells the sow she is pregnant. For the signal to be strong enough, a minimum of 2 embryos per uterine horn is needed. As you can imagine, to optimally support embryonic development, calmness and rest is key during this phase.

During mid-gestation, nutrient demand is relatively low. Sow recovery should be finalised and feeding to maintenance should be sufficient to meet nutritional requirements. The placenta develops further up to day 60 but this has relatively low nutrient requirements. During this phase, you should take care not to feed below maintenance and ensure that sows feel satiated. Satiated sows are quieter, which is beneficial for reproductive results.

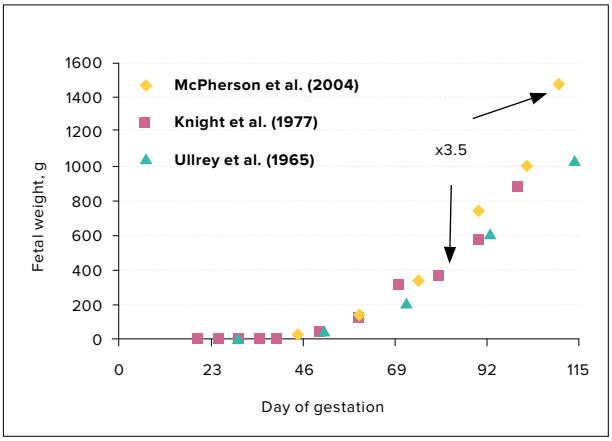


Figure 3: Fetal weight development during gestation (Source: Kim 2010)

In late gestation, piglet weight increases dramatically. From different literature sources, Kim et al (2010) modelled a weight increase of 1 kg between day 85 and 115 (Figure 3). This means a 3.5x increase in piglet body weight! Nutrition should support this. Because piglet growth is mainly muscle (protein) growth, the sow's need for protein will rise during late gestation. Energy requirements, on the other hand, remain relatively stable, so the ratio lysin to energy in the feed should change.

Looking at requirements, a so-called high-low-high (H-L-H) feeding schedule is advised by De Heus. High in early gestation to support body recovery from lactation, low in mid-gestation to prevent animals from getting too fat and to reduce feed costs and high during late gestation to support piglet growth. If possible, a two phase gestation feed, varying in lysine to energy ratios, is recommended. We would advise a lower lysine to energy ratio in early and mid gestation and a higher lysine: energy during end gestation.

TRANSITION PERIOD

Aim: *Give birth to litter, produce colostrum, start-up milk production. During transition, sows need to give birth to piglets, which they then have to supply with colostrum and thereafter milk. At De Heus, the transition period is defined from about 5 days before until 4 days after farrowing.*

During the transition period, sows undergo significant hormonal and metabolic changes. If any of these changes does not go well, sow and piglet performance during transition and during lactation is negatively affected. Furthermore, this period is also crucial for piglet vitality.

Just before farrowing, several hormonal changes take place which initiate the farrowing process and are important for the start-up of colostrum production (Figure 4). These hormonal changes are initiated by signals from the piglets, when they are ready to be born.Farrowing is one of the most important processes in the sow's reproductive cycle. Normal farrowing takes about 3-6 hours, with a 15 minute interval between the birth of piglets. Piglets that are born dead are often suffocated during the birth process. This happens when the placenta detaches from the uterus too early in the birth process or when farrowing takes too long. Dead born piglets lengthen the interval between piglets to 45-60 minutes, increasing the farrowing duration and thus increasing the risk of more dead born piglets. In addition, a long farrowing can also reduce piglet vitality, which in turn increases pre-weaning mortality.

Colostrum production is initiated at about the same time that farrowing starts, probably a little before, and is independent of stimulation of the piglets. Colostrum contains a valuable source of energy for young piglets, with low amount of fat

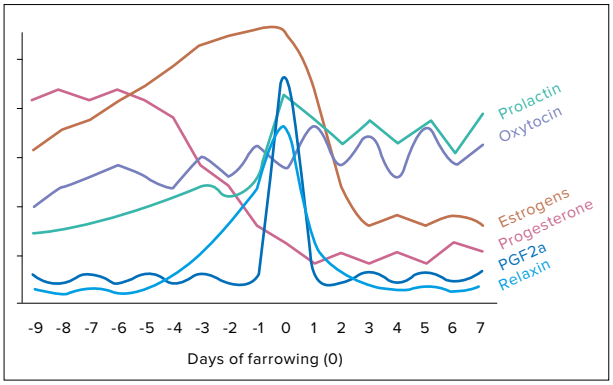


Figure 4: Hormonal changes around farrowing

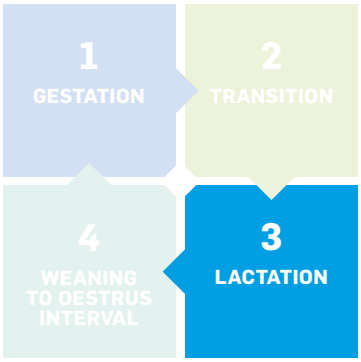
Table 1: Composition of colostrum and milk (Theil et al 2014b)

CONTENTS OF LIPID, PROTEIN, LACTOSE, DRY MATTER AND ENERGY IN COLOSTROM, TRANSIENT MILK AND MATURE MILK							
	Colostrum			Transient milk		Mature milk	
	Early	Mid	Late				
Time pospartum	0 h	12 h	24 h	36 h	3 d	17 d	SEM
Chemical composition[2] (g/100 g)							
Lipid	5.1^{c}	5.3^{c}	6.9^{bc}	9.1^{a}	9.8^{a}	8.2^{b}	0.5
Protein	17.7^{a}	12.2^{b}	8.6^{c}	7.3^{cd}	6.1^{d}	4.7^{e}	0.5
Lactose	3.5^{d}	4.0^{c}	4.4^{bc}	4.6^{b}	4.8^{ab}	5.1^{a}	0.1
Dry matter	27.3^{a}	22.4^{b}	20.6^{b}	21.4^{b}	21.2^{b}	18.9^{c}	0.6
Energy (kj/100 g)[1]	260^{d}	276^{d}	346^{c}	435^{ab}	468^{a}	409^{b}	21

[1] Calculated energy derived from lactose and fat contents (energy in protein not included because the roles of proteins differ in colostrum (immunity) and milk (growth) and hence are not normally being oxidised to great extent.
[2] Values in rows without a common superscript differ (P<0.05).

reserves, and immunoglobulins to provide the piglet with immunity. Sows produce colostrum up to 24-36 hours after the birth of the first piglet. After this period, milk composition changes and after about 15 days milk composition is stable. Because colostrum production is also mainly steered by hormones, many of the factors influencing the farrowing also influence colostrum production. Studies show that influencing clostrum production with nutrition is hardly possible.

After 36 hours, colostrum is called milk and has changed in composition quite a bit (see table 1). From this time onwards, stimulation by piglets starts to influence milk production. More vigorous stimulation by a higher number of or heavier piglets increases the milk yield. It is therefore important that piglets are vital and actively looking for the udder. Furthermore, the udder should not be too full of milk around this time, as piglets are not yet able to empty the udder. If the udder is full but not emptied, milk production reduces and maximum milk production will not be reached.One important issue during the transition phase is constipation. Constipation has negative effects on the farrowing process, production of colostrum and the start-up of milk production. Inherent to modern husbandry, a certain degree of constipation is inevitable. Firstly, sows are moved from group housing, where they can walk around freely, to a pen where they are not able to move as much. This increases the risk of constipation, particularly when combined with low feeding levels, which is common practice in sow husbandry. In addition, lactation feed often contains lower fibre levels than gestation feed which also increases the risk of constipation. Preventing constipation, for example by giving more feed or extra fibre during the transition phase, will positively affect the farrowing duration as well as colostrum and milk production.



LACTATION

Aim: *Grow piglets as heavy as possible The main aim in lactation is to grow the litter as heavy as possible with acceptable body condition losses of the sow.*

Sow's milk supplies the majority of the nutrients for suckling piglets. Sow milk production is therefore directly related to the growth of the piglets.

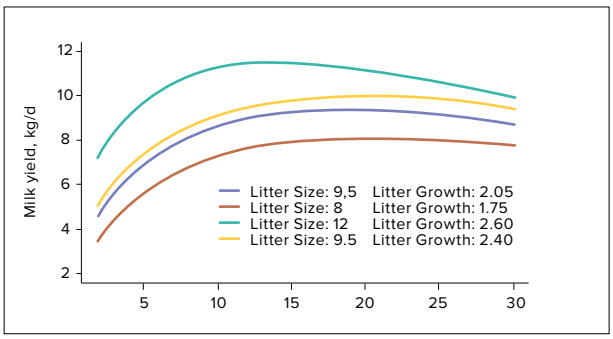
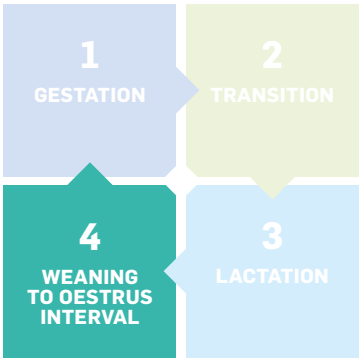


Figure 5: Effect of number of piglets suckling (8, 9.5 or 12) or litter growth (2.05 or 2.40 kg/day for 9.5 piglets) on milk production. Hansen et al 2012.

The amount of milk a sow produces is determined by a so called push and pull effect. Milk yield can be stimulated by feeding the sow a high amount of nutrients which positively affects milk yield (Push). However, suckling more or heavier piglets can also stimulate the milk yield of the sow (Pull) as is shown in Figure 5. Figure 5 shows that milk yield is highest for sows suckling 12 piglets and lowest for sows suckling 8 piglets. In addition, for sows suckling 9.5 piglets with a litter growth of 2.05 vs 2.6 kg/day, milk production was highest for sows with the heavier piglets. As mentioned before, from about 36 hours after farrowing, milk yield is determined by stimulation by piglets. It is therefore important to have vital piglets around this time. This means we should aim for a fast farrowing process, piglets with a good birth weight and with a good colostrum intake.

A certain degree of body condition loss is inevitable as the amount of nutrients excreted with milk is so high that it cannot be compensated by nutrient uptake. However, nutrient supply to the sow should match nutrient requirements as closely as possible, to minimise, or at least control, body condition loss. In general, weight losses up to 10% (excluding litter) are acceptable, but exact limits depend on sow genetics as well as farm characteristics. Ask our specialists how to optimise the feed intake of sows during lactation.



WEANING TO OESTRUS INTERVAL

Aim: *Get pregnant, basis of new litter. During weaning to oestrus interval, the sow needs to become pregnant with a healthy litter as soon as possible.*

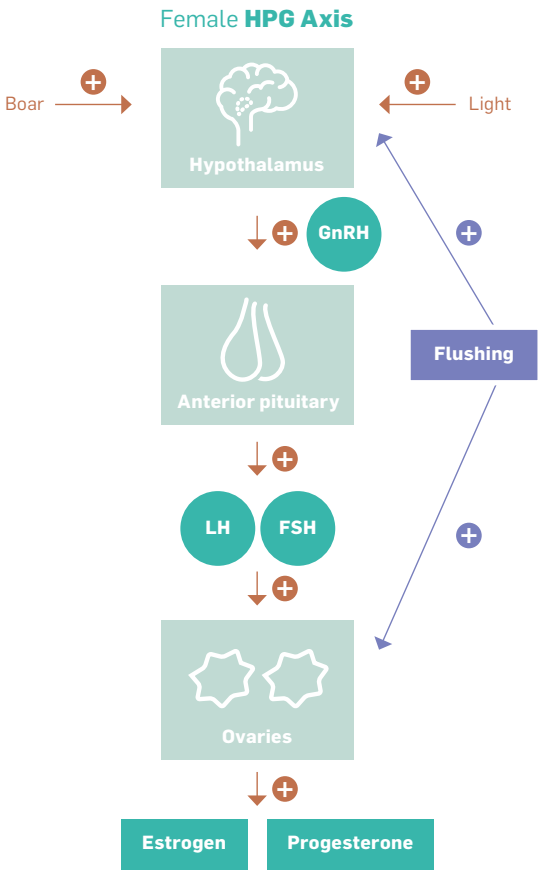


Figure 7: Overview of hormonal stimulation as well as ways to influence hormonal situation

The average length of the period between weaning and insemination, i.e. weaning to oestrus interval (WEI), is about 5 days. After weaning, the suckling stimulus ceases and, in response, several hormones are released within and from the brain. These hormones, e.g. Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH), stimulate follicular growth on the ovaries.

Follicles contain the oocytes (eggs) from which embryos develop. Larger follicles therefore also mean larger oocytes and better quality piglets. Besides housing oocytes, follicles also produce a hormone called oestradiol. Oestradiol initiates the oestrus expression of sows and more oestradiol therefore means a better oestrus expression. So if follicles are larger, through better stimulation of FSH and LH, piglet quality is better but oestrus expression will also be clearer. The latter makes it easier to inseminate the sow at the right time, thus increasing the chance of pregnancy.

FSH and LH production can be stimulated in several ways. Exposure to light and a sexually active boar stimulate the brain to produce a hormone called Gonadotrophin Releasing Hormone (GnRH, Figure 7). GnRH in turn stimulates the production of FSH and LH which stimulates follicular growth.

Nutritionally we can stimulate follicle development by stimulating insulin secretion. Insulin stimulates the brain to release GnRH, but also directly stimulates follicular growth on the ovaries. Its effects can add to light and boar stimulation. Insulin is produced in the body in response to rising glucose concentrations in the blood. So if we stimulate glucose concentration in the blood, also called flushing, we can stimulate insulin concentration in the blood. This in turn can stimulate follicle development on the ovaries. Feeding a flush-feed or top-dress, designed to stimulate blood glucose, is therefore advised during the weaning to oestrus interval. Figure 7 shows the hormonal stimulation of the ovaries as well as possibilities to stimulate the hormone production.

CONCLUSION

To improve your farm's technical performance and to keep sows healthy in a natural way, it is important to optimize management and nutrition of your sows at every stage of the reproduction cycle. In this white paper, we have given you the background about what you can work on at all stages.

De Heus has numerous tools for measuring your sows' vitality and reproduction results and to help you improve them. Ask your specialist for an in-depth analysis of your sows' vitality and to discuss the items you would like to improve on.

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