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Beteenden hos suggan som påverkar smågrisarnas överlevnad och tillväxt

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Sammanfattning

Det är viktigt för bondens ekonomi och ur djurskyddssynpunkt att många smågrisar överlever. Det finns många olika faktorer som påverkar smågrisarnas överlevnad och tillväxt och de olika faktorerna påverkar även varandra. Syftet med detta arbete är att beskriva hur saggans beteende påverkar smågrisarnas överlevnad och tillväxt samt vad saggans beteende kan bero på. Saggor i intensiva produktionssystem har andra förutsättningar än saggor som lever under naturliga förhållanden. Bland annat har de mindre utrymme, färre valmöjligheter och är beroende av att människan förser dem med resurser. Ett stort problem inom smågrisproduktionen är att saggan lägger sig på sina smågrisar. Detta leder till att smågrisarna krossas till döds eller kvävs ihjäl. Saggans beteende när hon lägger sig eller när hon har lagt sig på en smågris påverkar dödligheten och risken för skador. Även saggans beteende under grisningen kan vara mer eller mindre riskfyllt för smågrisarna. Det finns skillnader i digivningsmönster mellan saggor. Variationen i maternellt beteende mellan saggor kan därför vara av betydelse för att minska smågrisdödligheten och öka tillväxten, då vissa saggor uppvisar ett lämpligare beteende än andra.

Summary

Piglet survival is of importance because it affects the farmer's economy and the welfare of the pigs. There are several factors affecting piglet survival and they are often linked to each other. This paper will focus on how the behaviour of the sow can affect the growth and survival of the piglets and also possible causations of differences in maternal behaviour. Sows in intensive production systems have different possibilities to express their maternal behaviour than free ranging sows. They often live in small pens or crates, have fewer choices because of the restricted environment and are depended on human provided resources. One of the major problems in piglet production is that piglets are crushed by the sow and then dies from traumatic injury or suffocation. Sow behaviour when she lies down or when she has a piglet under her body affects the mortality and the risk of injures on piglets. Also, sow behaviour during farrowing can affect piglet survival in a positive or negative way. There are differences in nursing patterns between sows. The variation in maternal behaviour between sows can therefore be of interest, in order to find a way to reduce piglet mortality and increase growth.

Introduction

Piglet survival is a matter of great importance. It is highly affecting the farmer's economy and is also an issue of pig welfare. Number of piglets produced per sow per year is the most important trait affecting the financial results (Palmø, 1999). Because of that many pig-breeding programmes focus on increasing number of born piglets. However there are more factors involved that contributes to the final result. Large litters at birth do not guarantee large litters at weaning. The litter could be reduced during the pre-weaning period due to a number of factors. Pre-weaning mortality is influenced by litter size at birth but also by many other things such as birth weight, duration of farrowing, dystocia, birth order, thermal environment, nutritional status, disease, sow and piglet behaviour, sex and genetics. This paper will focus on the sow's impact, how her behaviour influences the growth and survival of the piglets.

Maternal behaviour under free-ranging conditions

The domestic pig originates from the wild boar. There are several sub species of wild boars and they are found in Europe, Africa and Asia. Domestic pigs give birth to larger litters than

wild boars. This is an effect of genetic selection for high productivity. The average litter size for a wild boar is 3-5 (Harris et al., 2001) compared to 12-13 for ordinary production sows in Sweden (Quality genetics, 2010). Pigs living in their natural habitat live together in small maternal groups consisting of 3-4 females and their offspring. Adult boars join the groups when the sows are in heat season.

When a sow is about to farrow she leaves the group and search for a suitable nesting site. Sows tend to place the nest outside their normal home ranges (Jensen, 1986; Jensen 1989). She probably do this because she need time alone with the piglets so they can learn to recognize each other and to avoid cross-suckling (Jensen, 1986). The sow then builds her nest using branches, twigs and sprigs as nesting material. When it is time to farrow the sow lay down in her nest. She seldom leaves the nest during farrowing. However she often gets up at least one time between the births of the individual piglets, especially in the beginning of the farrowing. When the sow stands she turns around and nose at her newborn piglets (Petersen, 1990).

The first two days after farrowing the sow spend most of her time in the nest. After the first couple of days the time spent outside the nest gradually increase. She also performs nest building after parturition, repairing her nest. If her old nest becomes unsuitable for some reason, for example gets soaking wet, she can build a completely new one and move her piglets (Stangel & Jensen, 1991). After approximately seven days the piglets leaves the nest and start to follow their mother. They are then gradually introduced to the family group and live together with the other sows with litters the rest of the time (Strangel & Jensen, 1986).

Causes of pre-weaning piglet mortality

There are several reasons for piglet mortality in modern piglet production during the pre-weaning period and many of the underlying causes are interlinked. One of the most common causes of death during the pre-weaning period is crushing, meaning that the sow lies down or roll over in a way so that she crushes the piglet with her body (Marchant et al., 2001). However, crushing cannot in all cases be blamed on the sow alone. Piglet mortality is the outcome of interactions between sow, piglet and environment. Weakened piglets are less responsive and are therefore more easily crushed (Weary et al. 1996). The piglets' conditions are depending on several factors such as the physiology and body condition of the sow, availability and quality of feed, diseases and injuries etc. Most losses due to crushing occur during the first 3days of the piglets' life (Marchant et al., 2001). According to a study by Gardner et al. (1989) the survival rate for the first seven days of life was 32% for piglets weighing less than 0.8 kg, compared to 97% for piglets weighing more than 2.0 kg, meaning that the piglets' birth weight affects its chances for survival. This makes physiological factors during gestation a matter of importance because they influence the birth weight and viability of the piglet afterbirth. For example, it has been demonstrated that there is a relationship between uterine blood flow and litter weight. High uterine blood flow has a positive effect on piglet size (Pere & Etienne, 2000). Afterbirth the availability of milk affects the piglets' condition. The availability of milk is affected by physiology but also by sow behaviour. Sows ability to produce milk varies between individuals (Thompson & Fraser, 1988). The motivation of sows to nurse is also of importance. In pigs very few antibodies are transferred through the plasenta to the piglet so it is extremely important that the piglets get milk (Nelson, 1932).

Dystocia (difficult labour) can also decrease the piglets' pre-weaning survival. The resulting hypoxia (oxygen deprivation), caused by the decreased blood flow to fetus, reduce post natal viability. Hypoxia of course cause stillbirths but is also associated with hypothermia and reduced post natal growth among live born piglets, and higher mortality after birth (Herpin et al., 1999).

Cold stress is a critical factor affecting piglet survival (Curtis, 1970). Newborn piglets have extremely little body fat. In contrast to many other mammalian neonates, including humans, piglets lack brown fat (Trayhurn et al., 1989). Brown fat cells have lots of mitochondria and produce large amount of heat (Sjaastad et al., 2003). Instead piglets use other methods to keep up their body temperature like erecting their fur (technically they do even if the effect is limited because of their minimal fur), shivering and increasing their metabolic rate (Stombaugh et al., 1973). They also have behavioural adaptations that play an important role in maintaining body temperature. The piglets huddle close to the sow and their litter mates. This takes part especially during the first three days of life (Titterington & Fraser, 1975). The preference for huddling close to the sow is a bit risky regarding to the risk of crushing (Wechsler & Hegglin, 1997). Piglets with low weight gain spend more time next to the sow (Weary et al., 1996).

When the piglet gets stuck under the sow it can die from suffocation or traumatic injury. One study by Weary et al. (1996) showed that likelihood of death increased with time trapped under the sow. This may indicate that many piglets died of suffocation and not by injuries.

Behaviour of the sow and its effect on piglet survival

The mortality rate differs between litters even if they are raised in the same environment (Fraser, 1990). Individual variation in maternal behaviour may explain some of the variation. The behavioural pattern of domestic sows has almost remained the same as their wild ancestor (Jensen, 1988). Sows housed indoors in crates or pens also perform nest building behaviour. A study by Thodberg et al. (1999) showed that sows that are given access to nesting material were more active prior farrowing, but less active during the parturition. However a more recent study by Thodberg et al. (2002) could not verify this. Jensen (1993) suggests that the initial phase of the nest building behaviour is triggered by internal factors whereas the later phase is triggered by feed-back and external stimuli. The sows need the feedback from the completed nest to terminate their nest building behaviour. Thodberg et al. (2002) made another interesting finding; gilts that were active during farrowing continued being so, on the first day post parturition. The reverse, that calm gilts were less active on the first day, was also confirmed. This relation was not found for sows that farrowed their second time which may indicate that experience affect this relationship. There is also a difference in activity during farrowing between sows kept indoors and sows that live in a semi-natural environment. In a semi-natural environment the sow is usually more passive during farrowing, she seldom change posture and do not perform so much piglet directed behaviour. The passiveness may favour piglet survival by protecting them from the risk of crushing (Jensen, 1988).

Two types of posture changes of the sow that can cause danger for the piglets are rolling and lying down. Sows spend most of their time during farrowing and after parturition lying on their side (Petersen et al., 1990; Vieuille et al., 2003). To do so comfortably they have to sometimes change posture so they are not lying with the same side down all the time. Therefore the sow has to roll over. Rolling is also a part of the weaning process where the sow makes it more difficult for the piglets to get access to the teats (Jensen, 1988). Fast rolling

seems to be the most dangerous movement for the piglets and rolls in crates takes longer time than in pens (Weary et al., 1996). In pens, the rollings that resulted in crushing tended to be faster than the ones that did not (Weary et al., 1998). According to a study by Herskin et al. (1998), provision of nest material may reduce the risk when it comes to piglet crushings caused by rolling. In their study some sows were provided with nest material and they were compared with sows without access to nest material. There were more sows that crushed piglets among the ones that just had a plain concrete floor compared to the ones that had nesting material.

There are several studies showing that the manner in which a sow shifts from standing up to lying down can cause dangerous situations for her piglets (Marchant et al., 2001, Vieuille et al., 2003, Weary et al., 1998). Sows can lie down in different ways: they can lie down on their belly, on their side, lie down by falling on the side or lie down by using a wall to lean at. Lying down by falling on the side is considered more dangerous for the piglets (Wechsler et al., 1997). The risk of crushing is lower if the sow lean against something when she lies down. In a study by Marchant et al. (2001) the potentially dangerous situations, when the sow lies down, were reduced from 36% to 4%. 15% of these dangerous occasions resulted in piglet death when the sow lies down without leaning against anything, compared to 0.5% when she did. The sows (newly farrowed and kept in pens) in Marchant et al. (2001) study preferred lying down by leaning against a surface and did only lay down in other ways in 11% of the occasions. A study by Damm et al. (2006) shows similar results, in 80% of the occasions the sows used a wall when they lie down.

Before the sow lies down she often performs a certain behaviour repertoire, called pre-lying behaviour. At first, she ploughs with her snout through the bedding material. This may serve as a way of making the piglets aware of her, wake them up from sleep and make them move so they gets visible (Blackshaw & Hagelsø, 1990). Much pre-lying behaviour reduces the number of lying down events that can be considered as dangerous. It is also safer if the piglets are more clustered together than if they are spread out (Marchant et al., 2001). The later is probably because it is more difficult for the sow observe all piglets if she have to detect each individual. Sow behaviour when she lies down on a piglet is of importance for the piglet's chances of survival. As earlier described, many piglets seem to die from suffocation. A piglet can survive relatively long under the sow. In a study by Weary et al. (1996) two third of the piglets that were trapped for four minutes or longer survived. So there is a time period when the sow can save the piglet's life by her actions. When a piglet gets trapped under the sow it screams. Then, the desirable behaviour is that the sow moves so the piglet is released. Some sows seem to be less responsive to piglet distress calls than others (Hudson et al., 1991). A genetical correlation between response to piglet distress calls and piglet mortality has been found, showing that selection for sows who respond strongly to piglet distress calls can be expected to improve piglet survival (Grandinson et al., 2003).

A study by Andersen et al. (2005) showed that sows that did not performed any fatal crushing performed more nest building activity, had a more protecting mothering style and avoided conflicts to a larger extent in the grouping situation when the sows were put together after weaning. They also reacted faster at piglet distress calls, showed attention to the piglets sooner after the distress call and nosed more at their piglets when changing posture. Another result from this study was that 33% of the sows that crushed piglets to death had nosed or oriented towards the piglets immediately before the fatal crushing. Andersen et al. (2005) conclude that this might indicates that the sow lies on piglets on purpose and that there may

be a way for the sow to reduce maternal investment. The benefit for the sow to do this is if this act can result in more offspring in the future (Mannings & Dawkins, 1998).

Sometimes newly farrowed sows can show aggressiveness towards the offspring. This behaviour is known as savaging and can occur even if the sow had shown good maternal behaviour to earlier litters (Chen et al., 2008). There are studies showing that savaging are more common in gilts which suggest that maternal experience might have some influence (Randall, 1972; Harris et al., 2003). Savaging sows are generally more restless (Chen et al., 2008) and savaging can also be related to fear (Forde, 2002). Fear and anxiety by the sow has been shown to affect piglet survival. Janczak et al. (2003) found that higher levels of fear of humans were associated with longer duration of farrowing, larger variation in inter-birth intervals and a higher level of piglets dying without milk in their stomachs. Higher fear were also associated with higher number of stillborn and higher piglet mortality (of those that were live born) before 3 weeks of age.

Effects of maternal behaviour on piglet growth

The sow's behaviour also has an effect on piglet growth. The availability of milk affects as well as differences in the individual sow's nursing behaviour. As earlier mentioned sows ability to produce milk varies between individuals (Fraser et al., 1988) but there are also differences in nursing behaviour between sows. Valros et al. (2002) found that sows have individual nursing patterns that are repeatable within sow and lactation period. This implies that sows have stable individual behaviour patterns. They also found that nursing frequency was positively related to piglet growth.

A study by Robert & Martineau (2001) showed that cross-fostering has negative effects on piglet growth. Cross-fostering is carried out to equalize litter size and in that way reduce pre-weaning mortality. Robert & Martineau (2001) found that cross-fostering results in disturbed nursing, increased fighting among piglets and impair piglet growth. Sows with adopted piglets spent less time lying down, snapped more at the piglets and had equally number of successful nursings but more of the unsuccessful ones (nursings without milk let down) compared to sows without adopted piglets. The unsuccessful nursings were mainly because of sows terminating the nursing. There were more fights in litters with adopted piglets and most fights occurred at the udder of the sow. Adopted piglets were most impaired in growth and the resident piglets were lighter than the piglets in the control group. Thus, it can be concluded that cross-fostering changes the sows behaviour and that this may contribute to the impaired growth of the piglets.

Environmental factors affecting sow behaviour

There are several environmental factors that can affect the behaviour of the sow. Floor type is one of them. Bonde et al. (2004) found that abnormal lying down behaviour, interruptions and slipping seem to be affected by the flooring but stepping seemed not to be related to this factor. The behaviour called stepping is described as resting on front part but stepping several times with the hind legs, this is not a part of the normal laying down sequence in sows. As earlier described the access to nest material may reduce piglet crushings caused by rolling (Herskin et al., 1998). Type and amount of bedding may also have an effect because if the sow cannot lie comfortable she may change posture more often (Edwards & Furniss, 1988). Rooting around in the bedding is a part of the pre-laying behaviour (Blackshaw & Hagelsø, 1990) so absence of bedding means that she cannot perform this properly. It has been shown

that sows seem to prefer to lean against a surface when they lie down (Merchant et al. 2001; Damm et al., 2006). A study by Damm et al. (2006) showed that sows avoid walls with a piglet protection rail. In this study sows that lie down using wall with the rail often drop the hindquarter hard onto the rail in the final stage of the lying-down sequence. This may cause the sow pain and explain why they used other types of walls when they had the opportunity to choose. If there are no more pleasant alternatives the sow may choose to lie down without support. How the sow is housed also affects her behaviour. In outdoor systems the sow often has access to a paddock. The sow is then able to control nursing frequency by wandering around in the paddock. Even if the piglets follow her this action restricts nursing (Hötzel et al., 2003). There are also indoor systems, consisting of farrowing pens which the piglets cannot leave and a communal area which the sow shares with others sows. This system also gives the sow control of the nursing frequency (Weary et al. 2002).

Physiology and health in relation to maternal behaviour

Physiology and health status can affect the behaviour of the sow. Thodberg et al. (2002) studied maternal behaviour in sows and used animals that previously, at younger age, had been tested for behavioural reactivity. The authors suggest that the extreme sows in this test had similarities to proactive and reactive types described for rodents. These two types of coping styles differ both behaviourally and endocrinologically. In mice, proactive individuals show more active avoidance behaviour, nest-building, rutine formation and less flexibility than reactive individuals. Proactive individuals get high levels of catecholamines in the blood when they are stressed, but the cortisol levels stays low. For reactive is it the other way around, they get high levels of cortisol and low levels of catecholamines (Koolhaas et al., 1999). Proactive and reactive coping styles have also been studied in pigs. A study by Janczak et al. (2003) could not confirm that there are different coping styles in pigs whereas Ruis et al. (2000) got results supporting that there is. Thodberg et al. (2002) found that individuals showing proactive behaviour in the behavioural reactivity tests were behaving less flexible when it came to nursing. The reactive individuals appeared to be more in control of the nursing behaviour. However, the authors also recorded other traits in this study that did not fit the proactive/reactive theory (Thodberg et al., 2002).

A study by Bonde et al. (2004) shows that the sow's lying down behaviour can be affected by her health status. In their study 41% of the sows showed difficulties to lie down. The sows studied were lactating sows 2-3weeks post parturition. Body condition, lameness, hind feet wounds, hoof length and number of parities were associated with changes in lying down behaviour. Fat sows were more likely to step while lying down and lame sows were more likely to show uncontrolled lying-down behaviour. Sows were more likely to have hind limb lesions if they slipped when they lie down. However, it was not clear whether the hind limb injuries were caused by the slipping or the other way around, that hind limb lesions cause slipping. If the sow had overgrown hooves she was more likely to show a lying behaviour that differs from the normal lying-down behaviour sequence. Sows in the 4th-5th parity were less likely to slip when lying down than younger and older sows. This can be explained with that the sows that slipped in earlier parities probably were removed because of the underlying causation for the slipping, for example joint problems. Slipping probably increased for the older sows because of their increasing age.

Discussion

Piglet survival is of importance because it affects the farmer's economy and the welfare of the pig. To increase profit and pig welfare is it important to investigate factors affecting this. Some of the variation in mortality between litters may be explained by individual variation in maternal behaviour. Therefore it is of interest to find out more about the sow's maternal behaviour and how it affects the survival and growth of the piglets.

Due to animal welfare considerations crates are forbidden in Sweden. This makes good maternal behaviour to an even more important issue. Sows in crates have fewer possibilities to perform their maternal behaviour. When the sows are housed in a less restricting environment, like loose housed or in farrowing pens, bad maternal behaviour becomes more visible. This means that sows in a less restricting environment will have a greater influence on the growth and survival of their offspring than sows in crates.

Domestic sows perform almost the same behaviour as their wild ancestors (Jensen, 1988). This is also the case for sows kept indoors in pens or crates. They have of course more limited possibilities to perform their behaviour under these circumstances, but they still have the motivation for specific pig behaviour patterns. In a restricted environment sows are more active during farrowing than sows kept in semi-natural environment (Thodberg et al., 2002). It could be a result of the restricted environment. A restricted sow may become stressed prior to farrowing, and continue to be so during farrowing, because she cannot perform her natural behaviour and build a suitable nest. The findings by Thodberg et al. (1999), that sows were more active prior to farrowing and less active during farrowing when given access to nest material, supports this theory. In a semi-natural environment the sow can express her natural behaviour to a much larger extent so that she might be more satisfied compared with the sows kept indoors. She have unlimited access to different kinds of nesting material so she can build a satisfying nest.

If the sow not gets the ability to build a nest she is satisfied with she might not stop nesting. This is because the later phase of the nesting behaviour is triggered by feed-back and external stimuli (Jensen, 1993).

Sows indoors are often kept very close to other sows. Sows living under natural conditions leave the group when they are about to farrow (Jensen, 1989) and it is likely that this behaviour has been evolutionary favoured; that it has increased the sow's fitness in some way. The hypothesis of why the sow leaves the group is that the aloneness is necessary for the piglets and the sow to learn to recognize each other and to avoid cross suckling (Jensen, 1986). One thing that may have a negative impact on the piglets' survival is that sows kept close to each other can hear vocalizations from the other sows' piglets. This may habituate her to the sound and in that way make her less attentive and responsive to the sounds that really mean something; the sounds from her own piglets. It is important that the sow react to distress calls from the piglets, otherwise she might crush them. Crushings often have underlying causes and they are interlinked. The piglet can be weakened for some reason or even already dead when the sow lies down on it. So, the sow cannot be blamed alone but her behaviour can in some cases affect the outcome. If she rises up to a sitting or standing position she may be able to save the piglet because many piglets die of suffocation (Weary et al. 1996). Because there is a genetic correlation between response to piglet distress calls and piglet mortality (Grandinson et al., 2003) it would most likely be possible to affect this trait by genetic selection.

Some sows are more responsive to the piglets' scream than others (Hudson et al. 1991). The question is what differ those sows from the other ones? Is there any explanation for this variation? The main opinion about crushings seems to be that sows crushes piglets by mistake, but that some sows are more caring than others. Andersen et al. (2005) questioned this a bit by presenting their theory about reducing maternal investment. The point with reducing maternal investment is to be able to have more offspring in the future (Manning & Dawkins, 1998). Most of the fatal crushing occurred the two first days after parturition and this supports Andersen et al. (2005) theory because then the maternal investment is still on a low level. The sows that crushed piglets had generally larger litters and this also support this theory because a large litter means a larger investment (Andersen et al. 2005). If Andersen et al. (2005) theory is correct; how can killing piglets increase the sow's fitness? Infanticide is present in various species and the causations seem to be species dependent. Female rabbits sometimes kill their young and eat them. Boyd (1985) suggest that this may be one way for the rabbits to adjust the balance of stored nutrients and litter size in relation to the capacity to obtain nutrients from the environment. But this seems not to be the case for pigs because Andersen et al. (2005) do not mention anything about sows eating their crushed piglets. There is also a theory on sex-biased parental investment called the Trivers-Willard hypothesis. It predicts that parents will bias their sex ratio toward sons when in good condition and toward daughters when in poor condition. That daughters are more benefitting than sons during poor conditions are explained by that males in poor body condition, which can be a result of poor environment, seldom gets a chance to mate (Trivers & Willard, 1979). This theory is sometimes used to explain infanticide. In a study made on wild boars they counted and sex determined fetuses in the uterine of wild boar females killed by hunting and they saw some tendency to biased litters. Small litters contained more males and large litters more females (Servanty et al., 2007). So it seems that there is a relationship between sex-ratio and litter size already early in pregnancy. If sex-ratio can be shifted already before birth it would probably be more inexpensive than provide them with nutrients during the whole pregnancy, give birth to them and then crush them. The piglets' sex is not noted in Andersen et al. (2005) study so it is unclear if they crushed one sex more than the other one.

In a study by Bonde et al. (2004) 41% of the lactating sows showed difficulties when lying down. Sows seem also to prefer to use a wall when they lie down (Marchant et al., 2001). If they have difficulties with lying down they may have problems with rising as well. This might affect their response when they lie down on a piglet, by decreasing their motivation and ability to get up. There may be underlying causes for their difficulties to lie down, for example joint problems. In nature there are no walls to lean at so it seems a bit strange why the sows have this preference. It may be a result of bad leg condition, body size, body shape etc. Wild boars differs from pigs in this traits and therefore do not have the same need for support when they lie down. Another thing that may reduce the sows' motivation to be careful is that she cannot escape her piglets when she is in a crate or pen. This gives her less option to decide when she would like to nurse and when she would not. Instead the piglets will initiate nursing which may make the sow irritated. Cross-fostering may have the same effect because there are more fights among the piglets in those litters (Robert & Martineau, 2001).

For the reactive/proactive theory (Thodberg et al., 2002) it still seems to be questionable if this kind of coping styles exists in pigs. So there is need for more research before applying this on maternal behaviour in sows. If this theory can be verified it can probably be interesting to see if and how it affects maternal behaviour, if one of the two styles is more successful when it comes to caring for the offspring. If that is the case there would be of importance for

the breeding selection because it heritable in mice for instance (Koolhaas et al., 1999), and it is likely that is the case in pigs too, if different coping styles actually exist.

To improve piglet survival it would probably be effective to increase bedding material because several studies show that it is of importance for sow behaviour (Edwards & Furniss, 1988; Blackshaw & Hagelsø, 1990; Herskin et al., 1998) and that for example straw also physically protects the piglets from crushing. Another preventive measure could be to make more attractive walls or other surfaces when designing the farrowing pens to encourage the sow to lie down in a safer way. Sows finds walls without farrowing rails more attractive to lean against (Damm et al., 2006). One explanation for that is that sows may hurt their hindquarters on the rails when they lie down. So removing farrowing rails may also decrease the risk of leg injuries and pain, which would have a positive effect on sow behaviour and welfare. Avoiding cross-fostering is also a good idea because it has been shown that cross-fostering has a negative impact on the sow's behaviour and it also impairs the growth of the piglets. Good leg quality is also of importance so they can move freely and lie down and rise in a better way.

Conclusion

There are differences in maternal behaviour between sows and this has effects on the survival and growth of the piglets. Maternal behaviour is of importance for the production, especially when it comes to non-crated sows. The sow's behaviour is also highly dependent on the provided conditions; her behaviour is affected by the environment and availability of resources. Genetical selection on good maternal behaviour and good health, and improvements in the environment will probably have a positive effect on piglet survival and growth.

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