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Dynamic Mixing to Increase Group Size

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One of the roles we play in raising livestock is that of social managers of the animals. We decide which animals live together in a group, and when and how the group is formed. In the case of gestating sows, we decide which sows live with each other during their period of gestation. Our default social group, the one that happens if we disregard our role as managers, would be the breeding cohort. This would include all of the animals that were bred during a set period, which on most farms would be a week.

In previous articles, we have discussed the most common social management decisions, which involve sorting the cohort according to one or more of the following criteria: nutritional needs, competitiveness, or experience with the housing system (particularly ESF). The outcome of this sorting would be multiple groups, each of which is more uniform than the original breeding cohort. Another outcome is that the groups are smaller than the cohort as a whole. These groups are often managed as static groups, that is, no animals are added to a group once it has been formed.

The two main options for managing sow groups are to either keep them as a large (breeding cohort) group that includes a great deal of variation, or to form a series of small groups that are very uniform. But there is another option. Dynamic grouping involves adding animals, usually from a subsequent breeding cohort, to a previously formed group. If you simply combine two entire cohorts, you have a very large group with a great deal of variation. But if you combine animals already sorted by one of the above factors, you have a larger group of uniform sows. An example would be a group comprised of only gilts, but from two or more breeding cohorts. Dynamic social management exists in order to create larger groups of animals. However, it involves a second re-grouping event which will result in another bout of aggression. Is there an advantage to dynamic mixing?

Why Larger Groups?

There are a variety of reasons to house sows in larger groups. One of the most evident to operation managers is that sows in large groups (over 40 animals) require less space per animal than those in smaller groups. The EU recommendations are that the standard recommended space allowance should be increased 10% for groups of 6 or fewer animals, but can be decreased by 10% when group size is of 40 or above, animals. (Council Directive, 2001).

A second reason for using larger groups is related to building costs, because as pen size increases the ratio of perimeter:area decreases. What this means is that the amount of penning needed (and related costs) per sow decreases as group size increases. To house 15 sows in a square pen at 1.8 m^2 (19.4 sq. ft.) per sow requires a 27 m^2 (291 sq.ft.) pen (5.2 x 5.2 m, 17 x 17 ft) with 20.8 m of perimeter penning. To house 30 sows in a square pen at the same space allowance would require a 54 m^2 pen (7.4 x 7.4 m, 24 x 24 ft) with 29.6 m (97 ft) of perimeter penning. On a per sow basis, penning requirements are reduced by nearly 30%.

A third reason to house sows in larger groups is to take advantage of expensive technology. This is best illustrated by the ESF system. The major cost of this system is the feeding station which must be able to identify each sow, dispense a specific amount of feed for each sow, and keep track of which sows have fed. The technology can be used to manage individual feed with preprogrammed increases throughout gestation, to identify problem sows that are not eating regularly, to sort sows out of the group for management events (pregnancy checks, vaccinations, moving to farrowing), and even for heat detection. The system is costly, and it is to the producer's advantage to minimize the cost per sow. If your group size is 30 animals, the cost per animal will be double that for groups of 60 using the same single feeding station.

One additional reason for keeping large groups relates to the social behaviour of pigs. Pigs in small groups have a strict social linear hierarchy whereby one animal (the alpha) is dominant to all others, and a second animal is dominant to all but the alpha pig etc. Such a rigid hierarchy requires effort to establish and maintain.

Consecutive vs. Staggered Dynamic Groups

The most common means of dynamic grouping is by forming 'consecutive' groups. A group of pigs is placed into an empty pen and more animals are added over consecutive weeks until the pen is full (see Figure 1.). The system is easy to manage and eventually all of the sows will be removed for farrowing before a new dynamic group begins to form.

An alternative to the consecutive system is a 'staggered' group. In this system the addition of new pigs to a group is staggered, with several weeks between each entry. Between these weeks the newly bred animals are placed in other pens in the system (see Figure 1). The staggered system has two advantages related to the time of grouping and space use. Sows enter a pen after breeding but, unlike the consecutive system, no new pigs are added for several weeks allowing the initial group to be well past implantation before another round of aggression occurs. In addition, when the new sows are added, those already present are well established socially and further along in pregnancy; both of which will reduce aggression (Hemsworth et al., 2006).

In terms of space use, new sows are added to a dynamic pen within a week of the previous group being moved to farrowing. The result is that no pen sits empty, or partially filled, for an extended period of time. Anothe advantage is that the staggered system can operate with one fewer pens than a consecutive system.

Some studies have used staggered system with grower/finisher pigs in an attempt to reduce floor space allowance (Moore et al., 1994). The new group of pigs added every few weeks fought very little and slept by themselves in a corner of the pen. A similar 'retreat' to an unused area of the pen has been reported for new sows in a dynamic system (Moore et al., 1993). A staggered system was used at Prairie Swine Centre with sows in an ESF, and although we could not compare it directly with a consecutive system, we saw no deleterious effects of dynamic grouping on productivity (Gonyou et al., 2006) nor aggression (Strawford et al., 2008).

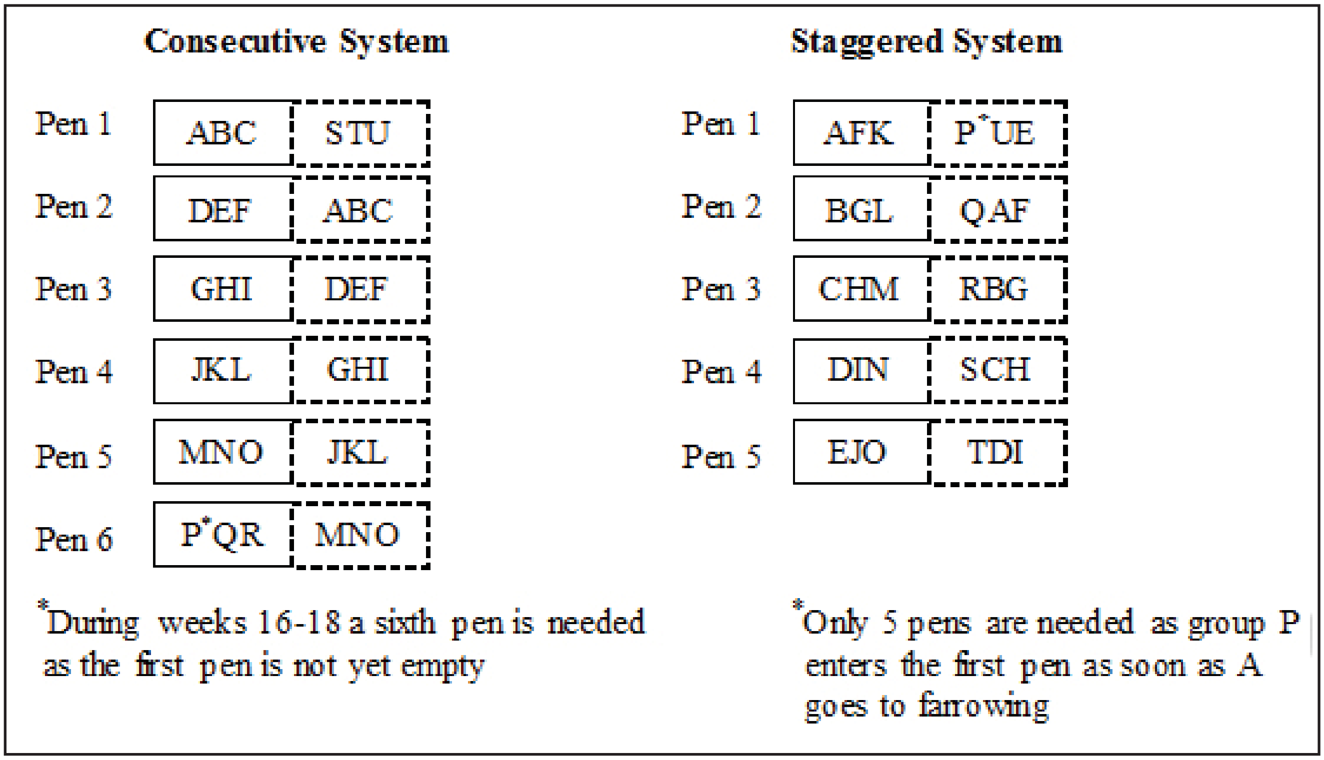

Figure 1. Dynamic mixing of breeding sows in consecutive and staggered systems.
N.B. Groups A, B, C etc represent weekly breeding cohorts

The system works when the benefits of being a dominant animal exceed the cost of maintaining the hiearchy. From research with growing pigs we know that an alternative system forms when the benefits of being dominant are less than the costs. In large groups, pigs become more tolerant of other animals and do not need to maintain a strict linear hierarchy reinforced by aggression (Andersen et al., 2004). The result is that pigs from large groups fight less than pigs from small groups (Samarakone and Gonyou, 2009). The benefits of being dominant in competitive sow housing systems such as floor feeding may always be greater than the costs of that status, but in non-competitive systems such as ESF and gated stalls we can expect to see social tolerance develop and reduced aggression in larger groups. ESF can be competitive in overstocked situations and pushed systems, most ESF systems now have been studied at 80 sows/feeder.

Is Dynamic Grouping all that Different?

A key concept of dynamic grouping is that a new group of sows is added to an already established group. These are often referred to as the ‘unfamiliar’ (or ‘new’), and the ‘familiar’ (or ‘resident’) sows, respectively. In general, aggression within the new combined group occurs between ‘familiar’ and ‘unfamiliar’ sows. Aggression among familiar animals is very low, and unfamiliar animals appear to avoid aggression as much as possible as they are the ‘invaders’ attempting to join the established group (Krauss and Hoy, 2011).

If we consider a static system, in which all members of a breeding cohort are grouped together on the same day, we find some similarities with a dynamic group. In a typical operation animal flow is such that over 50% of the sows in a static group are likely to have been grouped together during their previous gestation. These are the animals which were not culled and that cycled normally after weaning. These animals will recognize each other as group mates (Arey, 1999) and are similar to the familiar sows in a dynamic system. The unfamiliar sows in a static system are the gilts, and the sows that failed to cycle normally after the last gestation (delayed estrus, or found open and rebred). Thus, in a static system we have large proportions of familiar and unfamiliar animals, similar to what we have in a dynamic system.

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There are, however, some differences. The unfamiliar animals in a dynamic system include all parities in a proportion similar to that of the familiar animals. In the static system, the majority of the unfamiliar animals will be gilts which lack both size and social experience to compete for dominance. Also, in the dynamic system, re-grouping aggression will occur after each addition of new sows, at least twice during a gestation. In a static system, re-grouping aggression only occurs once during a sow's gestation.

We know that newly added sows in a dynamic system will try to avoid confrontation with the established group by lying in a separate area (Moore et al., 1993). In terms of management it may be helpful to section off the loafing area to the existing sows a few days before a new group is added so they can claim that space when they arrive. To ensure that there are enough new animals to act as a cohesive group it appears that the new group should be at least 20% of the resident group (O'Connell et al., 2004)

Static vs. Dynamic

Most experimental farms operate using either a static or a dynamic system for their group-housed sows, but few have made systematic comparisons between these systems. As a result, most advice is based on professional judgment, experience and common sense, not scientific data. The advantage of static groups is that there is only one re-grouping event, with aggression minimized to a period of a few days. In a dynamic system there are at least two, and sometimes up to three or more re-groupings, each of which is associated with a period of aggression. However, sows enter the group as 'unfamiliar' animals only when introduced to the pen, and then become 'resident' animals for all subsequent additions. Their level of injuries is likely to be higher following their initial entry than when subsequent groups are added.

Dynamic Management in Non-ESF Systems

Before implementing a management system in an operation, producers should ensure that the benefits obtained will outweigh the costs. Dynamic systems result in some social costs to the animal, but we have seen that this is minimal. In the case of ESF, where large groups allow us to take advantage of electronic management, the benefits of large groups will often outweigh the costs of a dynamic management system needed to achieve those large groups. Are there advantages to large groups in other feeding systems that would justify the use of a dynamic grouping system?

The greatest benefit to large groups in non-ESF systems would be the reduced floor space per sow needed in groups of over 40 sows. The 10% reduction in space requirements would be advantageous, but there are also costs to managing these large groups. When dynamic groups are used, the resulting large group will have to be sorted for management practices such as pregnancy checking, vaccination, and moving to farrowing. Without the convenience of electronic sorting, as can be done in ESF, those procedures would be more labour intensive. The extended social instability of a dynamic system may also contribute to greater competition in an already competitive system. Although it may be possible to use dynamic grouping in floor feeding, short stall or gated stall systems, it is doubtful that the advantages in these competitive feeding systems would outweigh the disadvantages. For the most part, dynamic social grouping should be restricted to ESF systems.

In studies in which both static and dynamic systems were compared the results show some variation. Neither Strawford et al. (2008) nor Anil et al. (2006) observed a difference in aggression between the two systems. However, Anil et al (2006) reported a difference in injury scores, with higher levels observed in dynamic groups, while Strawford et al (2008) did not. Interestingly, the difference in injury scores was not evident on the day following introduction, but rather two weeks later. This suggests that dynamic pens took longer to stabilize their social structure than did static groups. Neither research group reported differences in the stress response (cortisol levels) of sows between the two systems.

Gonyou et al., (2006) saw no difference in productivity between static and dynamic systems over a period of five gestations. It should be noted that they used a staggered dynamic system which avoided re-grouping a second time during the pre-implantation period. Nonetheless, it would appear that the relatively minor differences in aggression and/or injuries between static and dynamic systems are not significant enough to affect productivity. It should also be noted that in all of these comparative studies total group size was confounded with social management system, with dynamic grouping associated with larger groups. Such would be the case on commercial farms as well, and so the results are still applicable to normal production management.

Dynamic grouping has some negative consequences for the sows, but these appear to be minor and can be offset by providing extra space or protective barriers as discussed in previous articles. If dynamic grouping allows producers to obtain some positive benefits for the animals, then it can be used to an advantage. The advantages of an ESF system, such as improved control over feed intake, would seem to warrant the use of dynamic grouping in smaller herds to obtain an efficient group size.

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