All-in/all-out (AIAO) swine production is a system that keeps animals together in groups as they move through the phases of production. The groups are closely matched by age, weight, production stage, and condition so that animals from different groups are not mixed during their stay on the farm. Each group is moved into a phase of production together, such as into an empty nursery, and is moved out of that phase as a group according to a production schedule. When a group moves forward, the facility is completely emptied.

AIAO is the norm for most production systems today. AIAO in an ideal world is by site, which is rarely practical, but it can also be by barn, room, “air space,” or pen. In an AIAO system, sows are bred as groups to farrow during a 5- to 10-day period. By comparison, sows in a continuous-flow system are bred continuously and farrow continuously. In a continuous-flow system, pigs move as individuals, not as closely matched age groups, and a facility is never totally emptied because pigs or sows are always moving through it.

Advantages of AIAO

Changing from a continuous-flow system to AIAO, or from AIAO by pen to room or barn, can both improve production and reduce costs. Some farms may benefit more than others by switching. AIAO production provides the following benefits:

- Reduced disease transmission
- Improved management
- Improved pig performance

Compare these advantages in each stage of production in order to decide whether AIAO will benefit your farm.

Reduced Disease Transmission

One of the greatest advantages of AIAO is that it breaks the chain of infection and prevents disease buildup. Infectious organisms have two main sources: other pigs and the environment. In an AIAO system, infection from other pigs is reduced or eliminated because once a group is established, no pigs are added to it. Pigs that have similar ages, immunities, and disease histories are kept together, thus reducing infection from older hogs that may be shedding organisms to which younger pigs have not been exposed. In addition, infection from the environment is reduced or eliminated in an AIAO system because the facility can be totally emptied and sanitized between groups.

Improved Management

One way that AIAO enhances the producer’s ability to manage is that the pigs within each group have similar nutritional and environmental requirements. The confinement facilities can be better adapted to meet pigs’ environmental requirements for temperature and ventilation since pigs that are closely grouped by age have the same requirements.

AIAO also makes it easier to keep records of data such as feed consumption, pig performance, and disease occurrence because the pigs are run as a group. It also makes it easier to keep records of days to market. In continuous-flow systems, days to market is often not accurately measured. With an AIAO system, however, a group of pigs, or a few selected members of a group, can be ear notched or ear tagged with the week of their birth. Those pigs can then be accurately monitored for the number of days they take to finish. For example, pigs born in the first week of January are week 1. If pigs born in week 1 are still on the finishing floor by July 1, they will have completed week 26 (approximately 180 days, or 6 months) and should be finished. Keeping these kinds of records will establish an objective benchmark for performance.
**Improved Pig Performance**

In all stages of production, AIAO has a great potential for improved pig performance. In the grow-finish stage, for example, AIAO can increase feed efficiency and daily gain. Increased average daily gain from AIAO translates to decreased days to market; improved feed efficiency from AIAO translates to lower feed costs.

**How AIAO Works**

Well-managed swine farms are successfully using AIAO in all phases of production, from farrow to finish.

**Farrow**

AIAO improves control and treatment measures for the major disease problem of nursing pigs: diarrhea. With continuous flow, the farrowing area often serves as a disease reservoir, constantly infecting each new litter. With good sanitation in AIAO, passing diseases between groups is not a problem. In addition, because pigs in AIAO are close to the same age, development of their immune systems is similar.

You will benefit from AIAO in farrowing if your preweaning death losses exceed 12 percent or stillbirths exceed 8 percent of all pigs born. Herds using AIAO in the farrowing phase can expect to meet or exceed these production goals.

**Nursery**

Better control of the pig's environment with AIAO systems is a definite advantage in the nursery phase. Because pigs are closely grouped by age and size, you can set the temperature to meet their needs, not the needs of a group of pigs with widely different ages and sizes. In addition, energy expenses can be reduced because the nursery facilities are more energy efficient.

Disease control in the nursery is also enhanced by AIAO. A pig's temporary immunity obtained at birth from the sow's colostrum reaches a low point when the pig is about 3 to 4 weeks old. This occurs at a time when pigs are weaned on many farms. These pigs are at an increased risk of contracting infectious disease when their temporary immunity is low and they are still developing their own immunity. If these pigs are moved into an area that has not been sanitized or that contains older pigs that may be shedding infectious organisms, they are at a higher risk. Emptying a nursery pen, room, barn, or site allows it to be sanitized, which reduces or eliminates contamination of the next group.

**Grow-Finish**

With multisite production, many farms have gone to AIAO by barn or site for grow-finish. For farms with single-site production, there is an even greater benefit to AIAO in grow-finish. Controlled studies at various locations have consistently demonstrated a 7 to 10 percent improvement in both feed efficiency and average daily gain with AIAO. If groups of hogs in grow-finish are housed in separate air spaces rather than just in separate rooms in the same facility, further benefits will occur. Average daily gain and feed efficiency may improve another 7 to 10 percent.

In addition, adopting AIAO is a major step toward reducing respiratory disease (pneumonia) in grow-finish units. When pigs are moved from the nursery to grow-finish, preventing nose-to-nose contact between pigs in different groups will limit the spread of respiratory disease. If hogs of different age groups do not share the same air space, the spread of respiratory disease will be halted.

**Feeder Pig Finishers**

Because an AIAO system moves pigs through as an entire group, it provides several advantages to the feeder pig finisher. First, an AIAO system can help prevent disease spread in feeder pigs. Commingling purchased feeder pigs from more than one source increases the chance of disease. The risk of disease increases further when purchased feeder pigs are placed into a continuous-flow system without a break between purchased groups.

Highly stressed pigs with different levels of immunity are mixed with pigs from other farms. They are then placed on a finishing floor close to older hogs that may be shedding and recirculating different infectious organisms. Many commingled feeder pigs suffer from bloody scours, salmonella, pleuropneumonia, and other serious diseases.

In an AIAO system, all pigs are brought onto the farm in one group and grown out together without contacting another group. This group is marketed once or twice, with all pigs sold the second time. Not only does this decrease the chance of disease transmission between feeder pigs of different ages and farm histories, but it makes the treatment of such hogs much easier if they do become sick. You can handle water medications more easily and focus attention on the hogs during the period when they first arrive and are most likely to become infected.
Nutritional management of feeder pigs is also enhanced in an AIAO system because diets can be modified as a group rather than one pen at a time.

**Outdoor Systems**

Although outdoor systems have often been associated with decreased management requirements, many well-managed modern swine farms have hogs outside in some, if not all, phases of production. These farms also benefit when they employ AIAO as a part of their system. As part of an AIAO system, the swine are moved together in similar age groups. Avoiding contact with other groups can prevent disease transmission.

**Requirements for AIAO**

Adopting an AIAO system usually requires some changes. For one thing, it often means building more facilities. For another, it means eliminating tail-enders, or runts. And finally, an AIAO system requires setting up and following a production schedule.

**Establishing Adequate Facilities**

One essential characteristic of an AIAO system is not mixing animals from different groups during their stay on the farm. Grouping means that more facilities are required in an AIAO system. Because facilities must be emptied between groups, producers may feel that space is not used as efficiently as possible. However, use of space may actually be improved because AIAO improves pig performance in that after AIAO is established, more and healthier pigs are coming through the system.

Avoiding contact between groups is another essential characteristic of an AIAO system. In outdoor systems, contact can be prevented by electric fencing to prevent nose-to-nose contact between groups.

In feeder pig finishing, the pens should be completely separate. Pigs should not have nose-to-nose contact, wastes from one group should not contact another, and air spaces should be separate. In the grow-finish stage, a facility can be converted to separate rooms to accommodate AIAO hogs. However, air spaces between rooms in a grower or finisher barn are not separate if there is flow beneath floors, over pits or flush gutters, and over partitions that do not reach from floor to ceiling. To break these points of air flow, extend partitions from floor to ceiling, drape plastic from floors to pit surfaces so that air does not flow across, and ensure that exhaust fans from one room do not force air into the intake of another.

**Eliminating Tail-Enders or Runts**

In a true AIAO system, tail-enders can only be allowed to accumulate off-site. Sorting tail-enders back to a following group defeats the purpose of AIAO. A group composed of closely age- and size-matched pigs should be moved together. The pen should be marketed no more than twice and the entire pen sold the second time. If pens cannot be marketed twice without leaving lightweight pigs behind, separate the tail-enders from succeeding groups completely away from the main facility. This may mean moving them to outside finishing on pastures or to another farm.

Eliminating tail-enders is an advantage of AIAO because those hogs cost more money than they ever return. To obtain the benefits from an AIAO system, exceptions cannot be made for slow-growing hogs.

In continuous-flow systems, tail-enders tend to accumulate, and their numbers can be significant. Tail-enders are chronically affected with disease, do not grow well or convert feed efficiently, and may never reach an acceptable market weight. When these pigs are sorted back, susceptible younger pigs are infected by disease-causing organisms shed by chronically sick hogs. Tail-enders are "typhoid Marys" and should be marketed as barbecue hogs or humanely euthanized. If tail-enders are sold for slaughter, drug withdrawal times must be met.

**Establishing a Production Schedule**

In order for pigs to be moved as a group, they must begin as a group. AIAO begins in the breeding herd, which must be managed with a production schedule. This means hand mating or supervised/controlled mating. Pen mating can be used only if the number of groups farrowed per year is reduced so that a facility can be filled and then emptied within a reasonable space of time, usually no more than a 3- to 4-week period. There still must be a complete break between groups. If the groups are not closely matched in age, the advantage of an AIAO system decreases. Ideally, the age spread in a group should not exceed 2 weeks.

Failure to properly manage the breeding herd can result in too few or too many sows farrowing to fully use facilities. However, once producers become accustomed to managing a production schedule for breeding and movement of pigs though the system, they find it easier to manage.
Production Schedules for AIAO

Production scheduling is advanced planning of every activity and movement on the farm. Ideally, the time to schedule production is before the first barn or pen is built. Realistically, however, production scheduling is often adapted to more traditional systems.

Planning animal flow through buildings is the first step. The facilities must fit the flow. In order to plan animal flow, you must make several calculations. First, decide the number of animals you want to market and how often you want to market them. Then set up the breeding herd to farrow enough pigs into the system to produce the desired number at the end, allowing for expected losses at each phase. Setting up the breeding herd requires calculating the number of sows per group, the number of litters, and the number of sow groups that are needed. Once the animal flow is established, then time for all other activities (breeding, farrowing, weaning, cleaning, etc.) can be scheduled.

For the following example calculations, assume that a producer wants to market 1,200 pigs per year.

Number of Sows

After deciding the number of pigs to be marketed, a producer should determine the number of sows that must farrow per group. This number is determined by the following expected average levels of production:

- Number of pigs born live per sow
- Pig survival at each subsequent phase
- Farrowing rate (percentage of sows that farrow after breeding)

Number of pigs weaned per sow:

\[
\text{Number of pigs weaned per sow} = \frac{\text{average number born live} \times \text{percent survival}}{\text{at each stage}} \times 0.97
\]

\[
= 12 \times 0.9 (90\% \text{ preweaning survival}) \times 0.97 (97\% \text{ nursery survival}) \times 0.98 (98\% \text{ grow-finish survival})
\]

\[
= 10.27 \text{ pigs}
\]

Number of sows to farrow:

\[
\text{Number of sows to farrow} = \frac{\text{(number of pigs to be marketed)}}{\text{(number of pigs weaned} \times \text{farrowing rate)}}
\]

\[
= \frac{1,200}{(10.26 \times 0.90)}
\]

\[
= 130 \text{ sows}
\]

In other words, if a producer wants to market 1,200 pigs, assuming a 90 percent farrowing rate, 130 sows must be bred.

Number of Litters

The number of litters produced per year depends on the following:

- Number of days between farrowings (farrowing interval)
- Average weaning to breeding interval
- Length of gestation
- Weaning age
- Farrowing rate

Farrowing interval:

\[
= \text{average weaning to breeding interval} + \text{gestation} + \text{weaning age}
\]

\[
= 5 + 114 + 21
\]

\[
= 140 \text{ days}
\]

Number of litters per year:

\[
= (\frac{\text{days per year}}{\text{farrowing interval}}) \times \text{farrowing rate}
\]

\[
= (\frac{365}{140}) \times 1.0 (100\% \text{ farrowing rate})
\]

\[
= 2.6 \text{ litters}
\]

Assuming a farrowing rate of 100 percent, a sow could theoretically have a litter every 140 days, or 2.6 litters per year (365 days per year ÷ 140 days between farrowing).

Since every female available for breeding does not farrow, farrowing rate must be considered. With a farrowing rate of 90 percent, the number of litters produced per year is reduced to 2.34.

Number of litters per year:

\[
= (\frac{365}{140}) \times 0.90
\]

\[
= 2.34 \text{ litters}
\]

Number of Sow Groups

Calculating the number of sow groups means that a producer must determine the following:

- The time facilities are used for each group (facility schedule).
- Number of days sows are in crates before farrowing (acclimation period).
- Weaning age
- Cleanup days
Facility schedule:
\[= \text{acclimation period} + \text{weaning age} + \text{cleanup days}\]
\[= 4 + 21 + 3\]
\[= 28 \text{ days}\]

With sows in crates 4 days before farrowing, a weaning age of 21 days, and 3 days for cleanup between groups, the facility schedule is 28 days.

Now, the number of sow groups can be calculated.

Number of sow groups:
\[= \frac{\text{farrowing interval}}{\text{facility schedule}}\]
\[= \frac{140}{28}\]
\[= 5 \text{ groups}\]

With one barn or area, the number of sow groups is 5. With more farrowing facilities, the number of groups this system can accommodate will increase. With 2 farrowing facilities, the number of groups this system can accommodate will increase to 10 (2 facilities × 5 groups per facility = 10).

**Time from One Group Farrowing to the Next**

Farrowing frequency is the time from one group farrowing to the next. With one farrowing facility, farrowing frequency and facility schedule are equal. With 2 or more farrowing facilities, the farrowing frequency is the facility schedule divided by the number of facilities.

Farrowing frequency:
\[= \frac{\text{facility schedule}}{\text{number of facilities}}\]
\[= \frac{28}{2}\]
\[= 14 \text{ days}\]

In other words, a group of sows will farrow every 14 days.

Convenience is another consideration in determining the time between groups farrowing. Farrowing frequencies in multiples of 7 (7, 14, 21, 28, 35, etc.) result in activities scheduled on the same day of the week. Some managers prefer a schedule that matches the days in a work week. For example, weaning on Thursdays results in most sows coming in heat early the following week. Other schedules may maximize use of facilities, but they may also be more inconvenient.

**Time in Grow-Finish**

Scheduling the time pigs are in grow-finish and deciding the numbers of groups in grow-finish can be more difficult than scheduling the breeding herd. To schedule time for grow-finish, a producer must know how long each group stays in each stage of production. With AI-AO, a group of pigs cannot be weaned until the previous group has left the nursery and it has been cleaned. To move pigs from the nursery to grow-finish, market hogs must be sold. In addition, growth rate is a factor.

To determine time in the grow-finish stage, a producer must know the following:

- Age when pigs are to be marketed
- Days of nursing
- Days in the nursery

Number of days pigs in grow-finish:
\[= \frac{\text{average days when marketed} - \text{days of nursing} - \text{days in nursery}}{\text{farrowing frequency}}\]
\[= \frac{180 - 28 - 32}{35}\]
\[= 120 \text{ days}\]

If pigs are marketed at 180 days of age, weaned at 28 days, and in the nursery 32 days, pigs will stay in the grow-finish area no more than 120 days, assuming there is one farrowing barn and one nursery.

Now the number of pig groups in grow-finish can be determined as follows:

Number of groups in grow-finish:
\[= \frac{\text{days in grow-finish}}{\text{farrowing frequency}}\]
\[= \frac{120}{35}\]
\[= 4 \text{ groups}\]

If the production schedule has groups of pigs moving in every 5 weeks (35-day farrowing frequency) the grow-finish area must hold 4 groups of pigs (see example production schedules: Four-Group System).
Conclusion and Example Production Schedules

The production schedule can now be written down. Use a Julian calendar to compute the days of the year on which production events fall. (In a Julian calendar, the days of the year are numbered from 1 to 365, with January 1 being day 1 and December 31 being day 365. (A Julian calendar is attached at the end of this publication.) Various computer software programs are also available to help you develop a production schedule to fit any given farm.

The following example schedules should help you develop a suitable production plan for your unit. These schedules are based on the Julian calendar, and the days are numbered from 1 to 365. If you decide to begin breeding the first group of sows on March 13th, that date corresponds to day 1 on the sample schedules (day 72 on the Julian calendar). The farrowing date is 114 days later, July 5th (day 186 on the Julian calendar).

The schedules for single-group, two-group, four-group, and five-group systems, which follow, can be accomplished in one farrowing facility. However, there must be adequate farrowing crates, stalls, or huts for every sow in a group. The seven-group, ten-group, and twenty-group systems are additional examples that may work on some farms.

Single-Group System

This is a simple schedule since only one group of sows is involved. To get the sows farrowing regularly during the year, they are bred on their second heat after weaning. Pigs are weaned at 42 days of age and marketed at 180 days unless previously sold as feeder pigs. This type of unit is typically outside, so the only facility requirements are a farrowing lot with 43 farrowing huts or shelters, 6 breeding/gestation lots (up to 8 sows per lot), and a nursery pen(s). This example includes the option of selling feeder pigs at 70 days of age.
Schedule for five sow groups

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Schedule for ten sow groups

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Two-Group System

The single-group schedule can be modified to reduce the number of sows farrowing at once by splitting the sows into two groups but keeping the farrowings close together.

Four-Group System

With four groups of sows, weaning at 28 days of age and 6 days from weaning to breeding, the farrowing interval is 148. The farrowing frequency is 37 days, allowing sows to be moved into crates 4 days before farrowing and having 5 cleanup days after weaning. Pigs remain in the nursery 34 days, allowing 3 days for cleaning. Hogs are marketed 180 days after farrowing.

This schedule can be modified to allow for a weekly schedule. The farrowing frequency is 35 days, but there is an additional week of downtime after group 4.

Five-Group System

In the five-group system, pigs are weaned at 21 days of age. They will move into the grow-finish building 42 to 56 days after weaning.

With a second farrowing facility, 5 additional sow groups are possible.

Twenty-Group System

With twenty sow groups, weekly farrowing, 5 post-weaning days to rebreeding and 3-week weaning, the farrowing interval is 140 days and the farrowing frequency is 7 days. Even though the pigs are weaned at 3 weeks, the next group does not farrow until 1 week later. The extra time allows for cleaning and moving sows in 3 to 5 days before farrowing. This example illustrates the facility schedule.
### Schedule for twenty sow groups

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W. F. "Frank" Owsley, Extension Specialist, Associate Professor, and Soren Rodning, Extension Veterinarian, Associate Professor, both in Animal Sciences, Auburn University, and James Floyd, former Extension Veterinarian.

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