



Author

Scheduling All-In-All-Out Swine Production

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All-In-All-Out (AIAO) swine production is a system that keeps animals together in groups. Animals from different groups are not mixed during their stay on the farm. The groups are closely matched by age, weight, production stage and condition. The 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 system production systems today. AIAO in an ideal world is by site, which is rarely practical. AIAO 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 improve production and reduce costs. Some farms may benefit more than others by switching. Compare the advantages in each stage of production in order to decide if AIAO will benefit your farm. AIAO production:

- Reduces disease transmission.
- Improves management.
 - Allows better environmental control.
 - Improves record keeping.
- Improves pig performance.

Reduces Disease Transmission

AIAO breaks the chain of infection and prevents disease buildup. Infectious organisms have two main sources: (1) other pigs and (2) the environment. Infection from other pigs is reduced or eliminated in an AIAO system because once a group is established, no pigs are added to it. Pigs that have similar ages, immunities, and disease histories are kept together. This grouping reduces infection from older hogs which may be shedding organisms to which younger pigs have not been exposed.

Infection from the environment is reduced or eliminated in an AIAO system because the facility can be totally emptied and sanitized between groups.

Improves Management

AIAO enhances the producer's ability to manage. Management is enhanced because 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, because pigs that are closely grouped by age have the same requirements.

AIAO also makes keeping records easier. Keeping records of feed consumption, pig performance, and disease occurrence is an easier task when the pigs are run as a group. Sound management decisions can then be based on good records. Another record which can help improve management is 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, 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.

Improves Pig Performance

In all stages of production AIAO has a great potential for improved pig performance. In the grow-finish stage, 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. AIAO scheduling will benefit all phases of production from farrow to finish.

Farrowing

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 pre-weaning 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. Energy expenses can be reduced because 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 it 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 which has not been sanitized or which 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 multi-site 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 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 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 Pigs

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 on to 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 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.

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: 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 may 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 which do not reach from floor to ceiling. To break these points of air flow, try the following: extend partitions from floor to ceiling, drape plastic from floors to pit surfaces so that air does not flow across, and insure 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 through 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 which 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, we'll 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:

- The number of pigs born live per sow.
- Pig survival at each subsequent phase.
- The farrowing rate (the percentage of sows which farrow after breeding).

$$\begin{aligned} \# \text{ Pigs weaned} & \\ \text{per sow} & = \text{average number born live} \times \text{percent survival at each stage} \\ & = 12 \times .9 \text{ (90\% pre-weaning survival)} \times .97 \text{ (97\% nursery survival)} \times .98 \text{ (98\% grow-finish survival)} \\ & = 10.27 \text{ pigs} \\ \# \text{ Sows to farrow} & = (\# \text{ pigs to be marketed}) / (\# \text{ pigs weaned} \times \text{farrowing rate}) \\ & = 1,200 / (10.26 \times .90) \\ & = 130 \text{ sows} \end{aligned}$$

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:

- The number of days between farrowings (farrowing interval).
- The average weaning to breeding interval.
- Length of gestation.
- Weaning age.
- Farrowing rate.

$$\begin{aligned} \text{Farrowing interval} & = \text{The average weaning to breeding interval} + \text{gestation} + \text{weaning age} \\ & = 5 + 114 + 21 \\ & = 140 \text{ days} \end{aligned}$$

$$\begin{aligned} \# \text{ Litters per year} & = (\text{days per year} / \text{farrowing interval}) \times \text{farrowing rate} \\ & = (365 / 140) \times 1.0 \text{ (100 percent farrowing rate)} \\ & = 2.6 \text{ litters} \end{aligned}$$

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.

$$\begin{aligned} \# \text{ Litters per year} & = (365 / 140) \times .90 \\ & = 2.34 \text{ litters} \end{aligned}$$

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 = acclimation period + weaning age + cleanup days
 = 4 + 21 + 3
 = 28 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.

Sow groups = farrowing interval / facility schedule
 = 140 / 28
 = 5 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 X 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 = facility schedule / number of facilities
 = 28 / 2
 = 14 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 AIAO, 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.

Days pigs in grow-finish = average days when marketed – days of nursing – days in nursery
 = 180 – 28 – 32
 = 120 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.

$$\begin{aligned} \# \text{ Groups in grow-finish} &= \text{days in grow-finish} / \text{farrowing frequency (days between groups)} \\ &= 120 / 35 \\ &= 4 \text{ groups} \end{aligned}$$

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

Now the production schedule can 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 circular.) 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 which 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 one sow group				
Breed	Farrow	Wean	Sell feeder pigs	Sell market hogs
1	115	157	185	295
183	297	339	2	112
365	114	156	184	294
182	296	338	1	110

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.

Group	Breed	Farrow	Wean	Sell feeder pigs	Sell market hogs
1	1	115	157	185	295
2	22	136	178	206	316
1	183	297	339	2	112
2	204	318	360	23	133

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.

Group	Breed	Farrow	Wean	Move to G/F	Market
1	1	115	143	177	295
2	38	152	180	214	332
3	75	189	217	251	4
4	112	226	254	288	41
1	149	263	291	325	78
2	186	300	328	362	115
3	223	337	365	34	152
4	260	9	37	71	189

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.

Group	Breed	Farrow	Wean	Move to G/F	Market
1	1	115	143	175	295
2	36	150	178	210	330
3	71	185	213	245	365
4	106	220	248	280	35
1	148	262	290	322	77
2	183	297	335	387	112
3	218	332	360	27	147
4	253	2	30	62	182

Five Group Schedule

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.

Group	Breed	Farrow	Wean	Move to G/F	Market
1	1	115	136	178-192	295
2	29	143	164	206-220	323
3	57	171	192	234-246	351
4	85	199	220	262-276	14
5	113	227	248	290-304	42
1	141	255	276	318-332	70
2	169	283	304	346-360	98
3	197	311	332	9-23	126
4	225	339	360	37-51	154
5	253	2	23	65-79	182

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

Ten group schedule

Group	Breed	Farrow	Facility	Wean	Move to G/F	Market
1	1	115	A	136	178	295
2	15	129	B	150	192	309
3	29	143	A	164	206	323
4	43	157	B	178	220	337
5	57	171	A	192	234	351
6	71	185	B	206	248	365
7	85	199	A	220	262	14
8	99	213	B	234	276	28
9	113	227	A	248	290	42
10	127	241	B	262	304	56
1	141	255	A	276	318	70
2	155	269	B	290	332	84
3	169	283	A	304	346	98
4	183	297	B	318	360	112
5	197	311	A	332	9	126
6	211	325	B	346	23	140
7	225	339	A	360	37	154
8	239	353	B	9	51	168
9	253	2	A	23	65	182
10	267	16	B	37	79	196

Twenty-Group System

Twenty group schedule

Group	Breed	Farrow	Facility	Wean	Move to g/f	Market
1	1	115	A	136	178	295
2	8	122	B	143	185	302
3	15	129	C	150	192	309
4	22	136	D	157	199	316
5	29	143	A	164	206	323
6	36	150	B	171	213	330
7	43	157	C	178	220	337
8	50	164	D	185	227	344
9	57	171	A	192	234	351
10	64	178	B	199	241	358
11	71	185	C	206	248	365
12	78	192	D	213	255	7
13	85	199	A	220	262	14
14	92	206	B	227	269	21
15	99	213	C	234	276	28
16	106	220	D	241	283	35
17	113	227	A	248	290	42
18	120	234	B	255	297	49
19	127	241	C	262	304	56
20	134	248	D	269	311	63
1	141	255	A	276	318	70
2	148	262	B	283	325	77
3	155	269	C	290	332	84
4	162	276	D	297	339	91
5	169	283	A	304	346	98
6	176	290	B	311	353	105
7	183	297	C	318	360	112
8	190	304	D	325	2	119
9	197	311	A	332	9	126
10	204	318	B	339	16	133
11	211	325	C	346	23	140
12	218	332	D	353	30	147
13	225	339	A	360	37	154
14	232	346	B	2	44	161
15	239	353	C	9	51	168
16	246	360	D	16	58	175
17	253	2	A	23	65	182
18	260	9	B	30	72	189
19	267	16	C	37	79	196
20	274	23	D	44	86	203

With twenty sow groups, weekly farrowing, 5 post-weaning days to re-breeding 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.

Julian Calendar

Day	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	Day
1	1	32	60	91	121	152	182	213	243	274	305	335	1
2	2	33	61	92	122	153	183	214	244	275	306	336	2
3	3	34	62	93	123	154	184	215	245	276	307	337	3
4	4	35	63	94	124	155	185	216	246	277	308	338	4
5	5	36	64	95	125	156	186	217	247	278	309	339	5
6	6	37	65	96	126	157	187	218	248	279	310	340	6
7	7	38	66	97	127	158	188	219	249	280	311	341	7
8	8	39	67	98	128	159	189	220	250	281	312	342	8
9	9	40	68	99	129	160	190	221	251	282	313	343	9
10	10	41	69	100	131	161	191	222	252	283	314	344	10
11	11	42	70	101	131	162	192	223	253	284	315	345	11
12	12	43	71	102	132	163	193	224	254	285	316	346	12
13	13	44	72	103	133	164	194	225	255	286	317	347	13
14	14	45	73	104	134	165	195	226	256	287	318	348	14
15	15	46	74	105	135	166	196	227	257	288	319	349	15
16	16	47	75	106	136	167	197	228	258	289	320	350	16
17	17	48	76	107	137	168	198	229	259	290	321	351	17
18	18	49	77	108	138	169	199	230	260	291	322	352	18
19	19	50	78	109	139	170	200	231	261	292	323	353	19
20	20	51	79	110	140	171	201	232	262	293	324	354	20
21	21	52	80	111	141	172	202	233	263	294	325	355	21
22	22	53	81	112	142	173	203	234	264	295	326	356	22
23	23	54	82	113	143	174	204	235	265	296	327	357	23
24	24	55	83	114	144	175	205	236	266	297	328	358	24
25	25	56	84	115	145	176	206	237	267	298	329	359	25
26	26	57	85	116	146	177	207	238	268	299	330	360	26
27	27	58	86	117	147	178	208	239	269	300	331	361	27
28	28	59	87	118	148	179	209	240	270	301	332	362	28
29	29		88	119	149	180	210	241	271	302	333	363	29
30	30		89	120	150	181	211	242	273	303	334	364	30
31	31		90		151		212	243		304		365	31
Day	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	Day