

The Successful Introduction of AI

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▪ AI Trends

The use of artificial insemination (AI) in the US has grown rapidly from approximately 8% in 1991 (PIC internal figures, 1995) to approximately 50% utilization this year, 1999 (PIC internal figures, 1999). PIC predicts AI utilization to peak at 80% before the year 2005. Markets in mature AI nations such as the Netherlands and Spain achieve approximately 80% AI utilization, therefore PIC believes similar results could be expected in all mature AI markets.

During this same period there has been a gradual transition from on-farm collection to purchasing semen, which is a trend that PIC expects to continue. Other predicted trends would be a decrease in the number of doses per sow per year inseminated, currently at 6.5, to 5 doses/sow/year, volume per dose from 100mL to 70mL and concentration per dose from 3 billion 'viable' to 2 billion 'viable' or less. PIC expects these trends to occur over the next 2-5 years. A standard definition of 'viable' will also be determined.

The introduction and application of AI into all swine production facilities is expected to accelerate over the next 2 years as packers begin to pay or penalize producers for meat quality. This will encourage producers to adopt complete AI, with the transition from natural service to AI or from combination matings to complete AI.

▪ AI for the Right Reasons and with the Right Expectations

Producers, regardless of size and locality should implement AI into their production systems only when they have implemented other production technologies, such as genetic source, "all-in-all-out", split sex feeding and

phase feeding. Only when these practices have been successfully implemented, should you consider the introduction of AI.

The primary reasons for using AI should be –

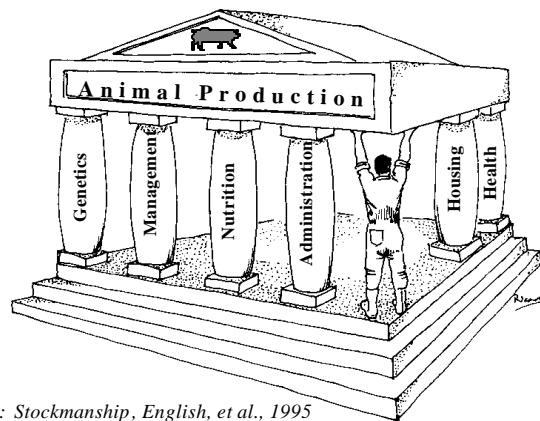
- ▶ Decreasing Genetic Lag – Genetic lag is the length of time between when PIC creates genetic improvement at the nucleus level to the time in which improvement is expressed at the producer and market level. PIC estimates that the initial implementation of AI will decrease the genetic lag by nearly 2 years versus the traditional natural service reproduction programs.
- ▶ Reduced health risk versus multiple matings by of natural service boars – The risk of delivering an economic damaging disease in a semen dose can be minimized by beginning with high health AI boars, isolation, acclimatization, blood testing, slaughter checks etc.
- ▶ Increase production flexibility – When a producer changes packers or the packer changes their requirements, producers can change boar products quickly.
- ▶ New technologies – New technologies developed by research institutes and universities are being developed that will allow us to better predict the performance of a dose of semen. Only technologies that add a tangible benefit should be added to boar stud facilities.
- ▶ Increase reproductive performance – Semen evaluation at the boar stud has the ability to increase reproductive performance when the semen is inseminated at the correct time relative to ovulation. Few producers that use natural service boars actually evaluate semen quality. Dr Flowers discovered in a North Carolina trial that up to 30% of all natural service boars could be infertile or sub-fertile at any one time. This would be reduced if semen were purchased from a reputable boar stud.
- ▶ Housing productive sows can increase facility output where boars were previously housed – Females that can produce 20-25 pigs per sow per year could potentially replace the majority of natural service boars that previously occupied space within an operation. This is provided that there is farrowing, nursery and finishing space and of course a market for these additional pigs.

▪ **The Forgotten Pillars – People and Stockmanship**

Today, too many corporate and family farms invest in technology and buildings and overlook the most important factor in any swine facilities success. Good stockmanship is the key to success and the selection of personnel and

comprehensive training is essential. Peter English in his book "Stockmanship" demonstrated the importance of the stockman in a single drawing (English et al., 1992).

Stockmanship *The Forgotten Pillar*



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Source: *Stockmanship*, English, et al., 1995



At the end of the day, the best performing units perfect the basic skills and are able to perform these 7 days a week for 52 weeks per year, every year. These units do not depend on gimmicks and time-savers, they simply aim to get every female pregnant, first time, every time and they invest their time and expertise accordingly to achieve this set task. Committing sufficient time up front, saves a lot of time down the line. Its sounds easy admittedly, but the best farms make it look so easy.

Dr Gonzalo Castro, formerly Production Director of Super Pollo in Chile, continues to use a slide entitled "The 3 keys to successful swine production". These keys are –

- ▶ People
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Super Pollo's figures for 1997 based on 52,500 sows, averaged 91.5% farrowing rate, 11.4 born alive, 25.2 pigs per sow per year and 6.7% pre-weaning mortality.

Admittedly they have more people than in typical North American farms, but even if the ratio's were the same North American farms could not perform to the same level consistently, the underlying factors being high staff turnover and alternative work choices. Therefore, choose your people carefully, train them well and do what it takes to retain the exceptional technicians.

▪ **On-farm vs. Purchased Semen**

In the US, many producers that have formerly collected and extended semen on-farm have now decided to purchase semen. The reasons for changing are:

- ▶ Similar costs
- ▶ High staff turnover
- ▶ Convenience
- ▶ More boar studs
- ▶ Dependable delivery system
- ▶ Access to genetically improved boars
- ▶ Packer specifications

Of course, many producers still collect on farm successfully, but PIC believes over the next few years, technology will be incorporated into boar studs that will revolutionize the business and the investment could only be financially justified in studs of 200 boars or greater. Therefore, PIC's recommendation to our US producers is to align yourself with a stud of 200 boars or more that is able to incorporate these new technologies, as they become available.

The recommendation would be to purchase semen if there is a local source and concentrate on thorough heat checking and accurate timing.

▪ **Semen Storage and Management**

Semen should only be stored in a purchased semen cooler with a digital read-out. Poor semen storage is a common weakness and generally temperature variation, monitoring and semen rotation are managed inconsistently, if at all.

Semen should be stored at 17°C and should be gently rotated twice daily; to re-suspend the sperm cells and re-expose them to the nutrient source contained in the extender.

Semen transferred to the barn must be stored in an insulated container and should only contain sufficient semen for 1 hour worth of inseminations. Otherwise the ambient air temperature of the barn will start to alter the temperature of the semen. A quality team should be able to inseminate no more than 8 sows per hour. Team breeding is an essential component to AI success.

Therefore, if there are 4 people in the team, only 32 doses should be taken to the barn. Ideally, supply a small cooler that will limit the number of doses that can be transferred to the barn and avoid coolers that have wheels - if they can move it, they will fill it.

In addition to the semen, place gel packs that have been stored alongside the semen at 17°C semen, inside the insulated container. This will help buffer the semen from the ambient air temperature in the barn.

▪ Transition from Combination Matings to Complete AI

The use of combination matings, normally natural service followed by 1 or 2 artificial inseminations, is an excellent way to introduce AI into your production system. However it should only be used as a stepping-stone to complete AI.

The benefits of using combination matings are:

- ▶ Maintain Production levels
- ▶ Practice AI
- ▶ Develop routines
- ▶ Understand delivery system

Boar to sow ratios should be as follows (based on 3 natural services/week):

Breeding Method	Boar:Sow Ratio
Natural Service	1:20
Combination (on-farm collection)	1:43
Combination (purchased semen)	1:63
Complete AI (on-farm collection)	1:150 – 1:175
Complete AI (semen delivered)	1:200 (heat detection/ stimulation)

Combination matings should only be practiced for a 3-6 month period. A plan should then be developed to start breeding some of the females only with AI.

Ideally start with the most reproductive sows (cycle within 4 to 5 days post-weaning), moving onto gilts, late cycling sows and finally sows that recycle. Long-term, a commitment to move onto complete AI must be made, otherwise the progeny produced will be a mixture of older and newer genetics which could cause both management and marketing challenges.

▪ **Pen Mating**

During the introduction of AI into a facility, due to the learning curve and staff turnover challenges, it has been found that inseminating in an open pen with mature, boars in adjacent pens, has enabled units to perform at an acceptable/high level, even with an average quality workforce. Moving every female to the breeding pen undoubtedly takes more time, but it helps minimize the effects of habituation and pre-insemination exposure. It also allows the female to express natural behavior in an unconfined area and selection of boar stimuli. This in turn, reduces any chances of forced/late insemination which can undermine the well timed previous insemination and reduces discharge commonly seen 3-5 days post-insemination, when the insemination has been administered late or with poor hygiene (Rozeboom et al., 1998).

Additionally, if the first insemination is performed during standing estrus with good boar exposure, this then determines the timing of all subsequent inseminations. If the first insemination is miss-timed in a crate situation, subsequent inseminations are also often performed at the incorrect time.

▪ **Estrus Detection and Insemination Timing**

Estrus detection should be performed twice daily, at each end of the working day. In the morning the whole barn should be thoroughly checked and only weaned sows and eligible gilts need to be checked in the afternoon. Organized heat checking with a mature colored boar that releases plenty of pheromones will facilitate accurate estrus detection and allow for optimal timing of insemination. The more you know about how and when a female comes into heat will allow the timing of the first insemination to be correct.

Here are a few important facts to remember:

- ▶ Semen survival inside the sow from AI is approximately 24 hr compared with 36 – 42 hr from natural service.
- ▶ Most females ovulate 36-48 hr after the onset of estrus; the key is to know when a female first enters standing estrus.
- ▶ The first insemination must occur at least 6-8 hr before ovulation so the semen is “ready and waiting” for the first eggs to be released (Hunter, 1988) and to allow for the semen to capacitate (see Table below).
- ▶ Most sows release 70% of all their eggs in the first third of their ovulation period, therefore it is essential to have one insemination inside the female and capacitated before she releases her first eggs, otherwise litter size potential will be compromised.
- ▶ Sows stay in standing estrus longer than gilts, 2-3 days vs. 1-2 days.

Influence of Time of Mating on Subsequent Fertility in Pigs^a



Estimated Age of Eggs at Fertilization	Eggs Fertilized Normally	Viable Embryos at 25 Days
<u>Hours</u>	<u>%</u>	<u>No.</u>
0 (control)	90.8	12.0
4	92.1	11.7
8	94.6	8.7
12	70.3	6.8
16	48.3	4.8
20	50.9	5.0

^a 108 gilts

Note the loss in the 8 hour group of fertilized eggs by day 25 of gestation.
Source: R.H.F. Hunter, 1988

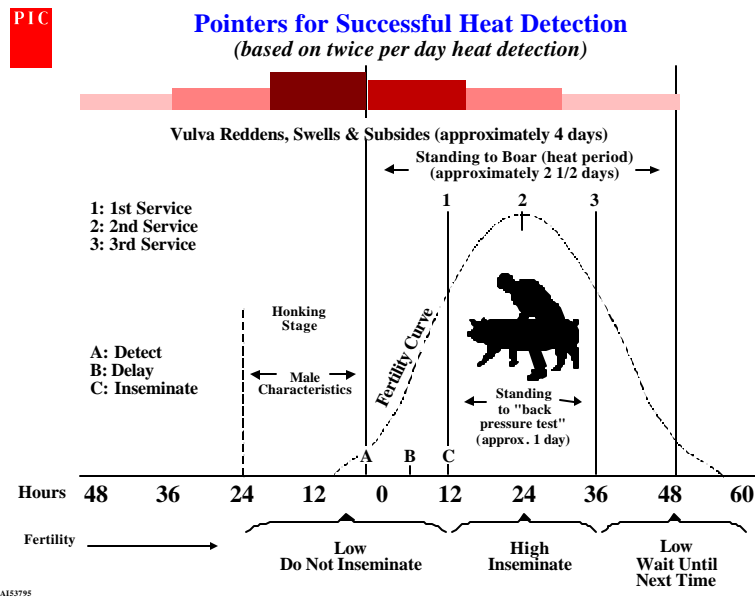


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As females approach estrus, they go through a series of behavioral changes, some of which are more visible in gilts than sows (see Figure next page).

The key to successful insemination is to treat every animal as an individual and have a protocol to cater for different groups of animals. The groups should be:

- ▶ Weaned sows cycling early
- ▶ Weaned sows cycling normally
- ▶ Weaned sows cycling late
- ▶ Gilts
- ▶ Re-cycles/re-breeds

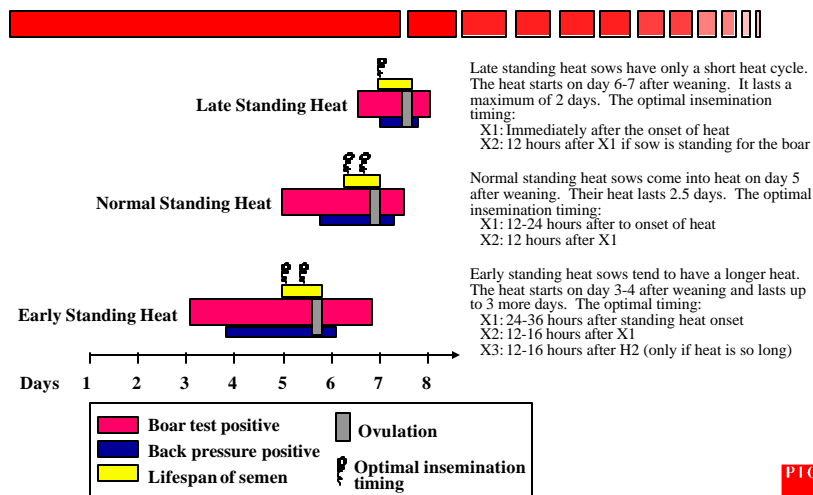


The best research into the timing of weaned sows has been performed by the University of Hanover at Mariensee and from the team at the University of Wageningen in the Netherlands. The next illustration can be used as a guide to the optimal timing for weaned sows.

For gilts and re-cycles, the treatment should be identical. As gilts have short standing estrus periods, it is essential that the first insemination is performed immediately after first signs of standing estrus. Then aim to inseminate twice again in the next 24 hours i.e. AM/PM/AM or PM/AM/PM. There should be a minimum of 6-8 hours between inseminations in the same day.

Similarly, re-cycles that have already proven to be problem/sub-fertile female and therefore should be inseminated immediately after first detection and again 12 hours later.

The Optimal Insemination Timing (based on twice per day heat check)



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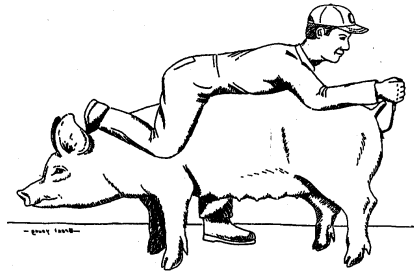
Source: Dr. K. Weitze, Germany, 1994



■ “Be the Boar”

A mature boar should be secured, nose to nose with the female and his movements backward and forwards should be limited. The boar should be active at all times and ideally release pheromones throughout the insemination process. If necessary, change the boar regularly. Before the insemination begins, pre-stimulation should be performed by pulling on the flanks and by massaging the sows underline. This will cause oxytocin letdown, which will produce smooth muscle contraction, which will transport the semen to the site of fertilization. Since the introduction of AI into PIC USA back in 1993, they have coined the phrase “Be the Boar”, meaning that you should first observe everything a working boar performs during normal courtship behavior and aim to replicate as many of these activities as possible during the insemination process. Many actions that a boar performs before, during and after the mating are performed for very precise reasons. Most of these are aimed at maximizing uterine contractions and therefore semen transportation.

PIC AI Motto: *Be The Boar*



■ **Conclusions**

To conclude, the best recommendation would be to introduce AI slowly but surely. The safest method of introduction is through the combination method, but there needs to be a plan in place and a transition to at least some complete AI usage within 6 months of the first AI introduction. Until the transition to complete AI is reached, the producer is never going to fully appreciate the value of AI boars and the marketing opportunities that utilizing the newest AI boars can deliver.

■ **References**

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