A Practical Approach To Swine AI

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Introduction:

Artificial insemination of swine, where fresh collected semen is used, is not new to the swine industry. However, breeding on a large scale with frozen semen is relatively new. Initial investigations were conducted as recently as 1971 by Crabo and Einarsson (1971); Graham et al., (1971) and Pursel and Johnson (1971) which resulted in successful reproductive performance using frozen boar sperm. Additional procedures for freezing and thawing boar sperm, which produced conception rates and litter sizes acceptable to the swine industry, were conducted by Crabo et al., (1972); Pursel and Johnson (1972); Richter and Liedicke (1972); Salamon and Visser (1972, 1973); Vicente (1972); and Wilmut and Polge (1972).

Artificial insemination of swine as it is known today became a practical reality when simplified freezing and thawing techniques were developed by USDA-ARS animal scientists Pursel and Johnson (1975). In addition to simplified freezing and thawing, improvements in the procedure included reduced storage volumes and sperm numbers per insemination, and increased sperm survival, which resulted in reproductive success rates approaching those routinely obtained with fresh sperm.

Research at Dickinson with swine AI has been conducted with frozen semen purchased from a commercial midwestern supplier. The projects summarized in this review were conducted in three phases under farm conditions typical of swine producers operating in southwestern North Dakota. The first experiment was designed as a pilot investigation comparing natural service and AI of synchronized sows where one insemination was used. In a second experiment synchronization was used throughout and one insemination was compared with two. To answer questions about AI among unsynchronized pigs a third experiment using virgin gilts was conducted comparing natural service with AI. Measurements recorded throughout these experiments included conception rate, total number of pigs born, number of pigs born alive, number of pigs weaned, time and labor requirements for heat detection and breeding, and any problems associated with thawing and handling semen during insemination.

Experiment One:

Twelve of 22 mature Yorkshire and Yorkshire X Hampshire sows were artificially inseminated with 60 ml. reconstituted boar semen following synchronization with a combination of pregnant mare semen (PMS) and human choronic gonadotrophin (HCG). PMS (1000 IU) was administered subcutaneouly the first morning after weaning, and HCG (500 IU) was given intramuscularly 56 hours following the PMS injection. The sows were inseminated

Parts of two litters of pigs produced by artificial insemination at the Dickinson Experiment Station.

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by appointment 24 hours after the administration of HCG. Breeding in the natural service group was conducted with a purebred Yorkshire boar.

Thawing and reconstitution of semen in these trials was completed according to the supplier's recommendations. Frozen semen pellets were held in a dry, clean styrofoam thaw box for exactly three minutes after being removed from the liquid nitrogen canister, and were then added to the physiological extender which had been preheated in a water bath to 42°C. Total reconstituted semen volume was 60 ml. for the first two experiments and 80 ml. in the third experiment. Artificial insemination was conducted immediately after reconstitution with a hollow centered, pliable, rubber inseminating spirette affixed with a rubber tubing connector, and a 60 cc disposable syringe.

During the administration of synchronization hormones and breeding, the pigs were held in individual pens in a heated barn. When no longer in standing heat they were removed from the barn and placed in drylot with a boar. All pigs that returned to estrus were removed from the trials.

Experiment Two:

In the second trial one insemination was compared with two inseminations. Mature sows were also used in this trial, and were synchronized using the same procedure described in experiment one. All sows in trial two were inseminated 24 hours after receiving the HCG injection. Sows in the treatment group receiving two inseminations were given a second insemination 8 hours later.

Experiment Three:

In trial three 66 unsynchronized Yorkshire and Yorkshire X Hampshire gilts were assigned to one of two groups and were bred either natural service or artificial insemination with frozen boar semen. A purebred Yorkshire boar was used to breed the natural service group. A mixed semen was used in this experiment to reduce the freezing variable that exists among boars, and was specially prepared to contain an equal volume of semen from Duroc, Landrace, and Chester White boars. Heat detection, which is very critical, was conducted using a teaser boar that was allowed to circulate among all females each morning and evening. Once detected in standing heat the gilt was marked, removed from the lot, and housed in the heated barn during the insemination period. Insemination times recommended by the semen supplier were used and consisted of two inseminations, one 12 hours and a second 24 hours after detection in standing heat.

Table 1. Synchronized sow performance, AI versus natural service. Experiment 1

	AI	Natural service
No. head	12	10
No. settled	7	8
% Conception	58	80
No. pigs born	7.0	10.1
No. pigs born alive	6.0	9.8
No. pigs weaned	5.7	9.3

Results:

Conception rate and litter size in the first investigation, which was conducted as a pilot study, were lower among the sows that were synchronized and artificially inseminated with reconstituted frozen semen. Boar performance contributed heavily to the lowered conception rate of those sows bred artificially. The semen of Yorkshire origin settled only 20% of the five sows exposed, whereas 86% of those sows exposed to Hampshire semen conceived. Results of the pilot study were promising enough to warrant further investigations with AI and frozen semen.

In the second trial, which was designed to evaluate one versus two inseminations among synchronized sows, conception rate was improved substantially, but no improvement in litter size was measured. In the second trial, as shown in Table 2, an especially low conception rate and litter size resulted. Although boar variability is certainly a potential cause, heat stress probably was the major contributing factor. The average daytime high in August was 86°F. and September averaged 77°F. Seventeen days during August were 85°F. or above with seven of those days having daytime temperatures between 91 to 100°F. As expected, September had a cooler average temperature; however, one week near the time of breeding was very warm with a record 103°F. recorded on September 7. Research conducted by Edwards et al., (1968) and Teague (1970) clearly illustrates that high air temperatures reduce the incidence of estrus, decrease ovulation rate, decrease embryo survival, and increase the number of stillborn pigs. In their studies, when air temperatures were kept below 85°F., ovulation rate and embryo survival were highest.

Table 2. Synchronized sow performance, one insemination versus two. Experiment 2

	Fall 1976		Spring 1977	
	1 Insem.	2 Insem.	1 Insem.	2 Insem.
No. head	7	8	6	6
No. settled	5	7	2	3
% Conception	71.9	87.5	33	50
No. pigs born	8.2	8.4	3.7	4.3
No. pigs born alive	6.8	6.8	3.5	4.3
No. pigs weaned	6.0	4.9	3.5	4.3

Results of trials one and two indicate that pigs treated with the hormones PMS/HCG were satisfactorily synchronized. Additional research with their use is necessary however, to pinpoint the optimum time of insemination when using them.

In trial three, breeding methods comparing natural service with artificial insemination among unsynchronized gilts resulted in successful reproductive performance for both treatments. As shown in Table 3, there is a slight trend favoring the natural service group. However, no significant difference for treatments existed for conception rate, total number of pigs born, number of pigs born alive, and the number of pigs weaned.

Although no difference in reproductive performance was measured between treatments the labor requirement for the AI group in trial three was very high, which will probably limit its popularity among swine producers until further research with synchronization becomes available.

These trials show that both purebred and commercial pork producers can capitalize on the advantages of swine AI using frozen semen. Just how AI is used by the individual producer will depend upon his breeding objective. Purebred breeders have the opportunity to sample a large number of bloodlines at a very reasonable cost to produce genetically superior offspring. On the other hand, AI enables commercial pork producers to close their herds and thus reduce the risk of importing potentially hazardous disease organisms. Using AI on a herdwide basis is not recommended. However, interested commercial hogmen should look to it as a means of producing genetically superior replacement gilts and herd boars to be used under natural breeding conditions.

Through swine AI the pork producer has a large genetic pool and breeding flexibility at his disposal. However, experience gleaned at this station clearly indicates that above average management and high labor input are necessary for it to be a success.

Table 3. Unsynchronized gilt performance, AI versus natural service. Experiment 3

	Fall 1977		Spring 1978		Fall 1978		Combined results	
	AI	Natural service	AI	Natural service	AI	Natural service	AI	Natural service
No. head	11	11	9	11	12	12	12	34
No. settled	9	11	7	8	8	10	24	29
% Conception	90	100	78	73	67	83	75	85
No. pigs born	9.4	9.5	10.4	11.6	8.3	10.6	9.3	10.4
No. pigs born alive	8.8	8.9	9.5	10.8	8.0	10.3	8.8	10
No. pigs weaned	7.8	6.5	8.9	10.1	7.6	9.5	8.1	8.7

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