Investigational Use of Artificial Insemination In Farm Swine

by

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INTRODUCTION

Although artificial insemination (AI) in swine has been developed commercially in many parts of the world (Norway[1], Japan[2], Belgium[3], France[4], England[5], and some areas in the United States[6]), it has not been used extensively in Iowa on a commercial basis. The application of this technique for experimental purposes, together with information reported in the literature, illuminates some problems and helps explain why this procedure has not developed in Iowa.

The following is a report of field experience with a small artificial insemination research project. The purpose was to develop a population of swine of uniform age and genetic background for nutritional experiments. In these trials it was desired to subordinate the effects of genetic variation on the results of nutritional studies. The methods described would be suitable for "on-the-farm" swine AI programs conducted cooperatively by the swine raiser and the local veterinarian.

MATERIAL AND METHODS

Fifty-seven Yorkshire-Landrace cross gilts 9 months of age were confined together on pasture with unheated shelters. The gilts were observed daily for swelling and redness of the vulva. Gilts that manifested signs of proestrus were brought into a central building and held there until more definite evidence of estrus could be observed and insemination performed.

A young Poland China boar 10 months old was used to supply the semen which was collected by the gloved hand methed. (Figure 1) The first collections were made while the boar mounted one of the gilts that was in standing heat. After the second collection, the boar became accustomed to mounting a dummy and this method was used for the remaining collections. One collection was made each morning, six days a week for three weeks of the AI project. After removal of the mucous material, the semen was diluted with homogenized milk that had been treated in the manner customarily used for diluting bull semen. The milk was heated 25 minutes in a double boiler. After cooling to 100° F and filtering, 1,000,000 I. U. of penicillin and 1 gram of dihydrostreptomycin were added to each 100 ml of milk. Table 1 lists the volume of all the semen collections and the dilutions that were necessary to accomplish the inseminations for each day. Eighteen semen collections with an average volume of 118 ml were made. One hundred and fifteen inseminations were made. The dilution ratio varied from 1:2 to 1:5 and the insemination dose varied

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Figure 1. Hand method of boar semen collection.

Figure 2. Method of inseminating sows.

TABLE 1.

"On-the-Farm" Artificial Insemination Trial in Swine Using Semen From Poland China Boar No. 9

Date	No. Sows Inseminated	Day of Insemination 1	2	3	Volume of Semen Collected	Dilution	Final Volume	Insemination Dose
Mon. 3-21-60	8	8	0	0	150 ml.	1:3	600 ml.	75 ml.
Tue. 3-22-60	7	4	3	0	140 ml.	1:4	700 ml.	100 ml.
Wed. 3-23-60	6	2	4	0	120 ml.	1:4	500 ml.	100 ml.
Thur. 3-24-60	6	3	0	3	120 ml.	1:4	600 ml.	100 ml.
Fri. 3-25-60	9	6	3	0	125 ml.	1:5	750 ml.	80 ml.
Sat. 3-26-60	9	3	6	0	115 ml.	1:5	690 ml.	75 ml.
Sun. 3-27-60	No Inseminations				No Collection			
Mon. 3-28-60	3	0	3	0	135 ml.	1:2	270 ml.	90 ml.
Tue. 3-29-60	6	6	0	0	120 ml.	1:3	480 ml.	80 ml.
Wed. 3-30-60	8	3	5	0	115 ml.	1:4	575 ml.	72 ml.
Thur. 3-31-60	4	1	3	0	110 ml.	1:2	330 ml.	80 ml.
Fri. 4-1-60	1	0	1	0	105 ml.	Undiluted		100 ml.
Sat. 4-2-60	2	1	0	1	100 ml.	1:1	200 ml.	100 ml.
Sun. 4-3-60	No Inseminations				No Collection			
Mon. 4-4-60	5	4	1	0	125 ml.	1:3	500 ml.	100 ml.
Tue. 4-5-60	9	4	4	1	120 ml.	1:3	480 ml.	60 ml.
Wed. 4-6-60	10	6	4	0	115 ml.	1:4	575 ml.	57 ml.
Thur. 4-7-60	8	2	6	0	110 ml.	1:4	550 ml.	65 ml.
Fri. 4-8-60	8	6	2	0	105 ml.	1:3	420 ml.	50 ml.
Sat. 4-9-60	6	0	6	0	100 ml.	1:3	400 ml.	66 ml.
Total	115	59	51	5	Ave. 118 ml.			Ave. 80 ml.

between 50 and 100 ml, averaging 80 ml. The dilution factor was determined by the number of gilts selected for insemination. In one instance, semen for only one sow was needed, therefore, raw undiluted semen was used.

Gilts were observed and presented for insemination on the basis of behavior and appearance of the vulva. Inseminations were performed daily during the morning, immediately after collection and preparation of the semen. Inseminations were accomplished by means of a modified bovine inseminating pipette as described by Lovell, 1958[7], and a plastic squeeze bottle, similar to that used by Aamdal and Hög-

set, 1957[1]. Some were inseminated three days. A few gilts were inseminated only once, but most gilts were inseminated two days in succession. Many gilts required restraint in a chute during the insemination procedure, especially for the first insemination (Figure 2).

RESULTS

Table 2 lists the number of inseminations per gilt, the number of gilts that had litters, the number that did not conceive, and percentage of conception.

Thirty-five gilts did not have litters. Some returned to heat after conclusion of the AI project and were bred to the boar and subsequently had litters; others were disposed of. Two of the gilts that did not have litters were inseminated at two different heat periods with a 9-day interval of time between heats which indicated that they may have had a split estrus or an abnormal heat cycle.

Table 3 is an analysis of the litters that resulted from artificial insemination. The conception rate was 38.6%. Twenty-two gilts delivered normal litters after a normal gestation period, producing a total of 204 pigs. The average litter size was 9.27. Table 4 shows the number of sows grouped according to gestation periods.

Table 5 presents an analysis of the conception rate by day and by week. It may be observed that the conception rate was 35% during the first week, 23% during the second, and 48% during the last week. The increased conception rate during the last week may have been due to increased perception and experience of the herdsman in selecting gilts that were in estrus.

DISCUSSION

Conception Rate

The conception rate of 38.6% was much lower than was anticipated. The trial was not considered valid because the single boar probably would have yielded more litters by natural service than he did by artificial insemination.

Litter Size and Birth Weight

An average litter size of 9.27 pigs per litter and an average birth weight of 2.82 pounds was considered satisfactory for gilts.

TABLE 2

Gilts Arranged According to Number of Days Inseminated

No. of Days Inseminated	Total Gilts	Number Conceived	Number Not Conceived	Percentage of Conception
1	7	0	7	0
2	43	20	23	47
3	5	2	3	40
4*	2	0	2	0
Total	57	22	35	38.6

*Two gilts were inseminated two days during two different heat periods that were separated by 9-day intervals. Neither one conceived.

TABLE 3

Litters of the 22 Gilts that Conceived Following Artificial Insemination

Gilt	Insemination 1st	2nd	3rd	Date of Last Insemination	Gestation Period	Number of Pigs	Average Birth Weight
4643	+	+		3/22/60	116	9	3.4
4622	+	+	+	3/24/60	114	10	2.6
4560	+	+	+	3/24/60	113	8	2.8
4564	+	+		3/25/60	115	10	2.8
4921	+	+		3/26/60	114	13	2.5
5320	+	+		3/26/60	114	13	2.6
5111	+	+		3/26/60	116	8	3.0
4583	+	+		3/26/60	114	9	2.9
4461	+	+		3/28/60	115	7	2.9
4463	+	+		3/30/60	114	11	2.9
4620	+	+		3/30/60	114	9	2.4
4932	+	+		4/5/60	115	8	2.3
3971	+	+		4/5/60	116	10	2.7
5120	+	+		4/6/60	115	7	3.4
4753	+	+		4/6/60	117	6	2.9
4161	+	+		4/7/60	114	7	3.8
4471	+	+		4/7/60	114	10	3.5
4530	+	+		4/7/60	116	9	2.1
4441	+	+		4/7/60	116	12	2.4
4531	+	+		4/8/60	115	12	2.7
4761	+	+		4/9/60	116	8	2.8
5100	+	+		4/9/60	116	8	2.7
Average					115	9.27	2.82

Selection of Gilts for Insemination

One weakness of the program was the method of observing the gilts for heat. More detailed observations of the gilts should have been carried out and perhaps if selection of gilts and insemination had been done twice a day, rather than just once each day, better results would have followed. Many of the gilts did not stand very well for the insemination, and it was necessary to devise a chute to restrain them. Probably many unnecessary inseminations were given in our eagerness to not pass up any gilts. According to the suggestion of Madden[8], if more discrimination had been used in selecting females

TABLE 4

Litters of 22 Gilts According to Gestation Period, Litter Size, and Average Birth Weight of Pigs

No. of Sows	Gestation Period	Litter Size Av. for Group	Birth Weight Av. for Group
1	113	8	2.8
8	114	9.9	2.9
5	115	7.8	2.8
7	116	9.1	2.7
1	117	6	2.9
22	115	9.27	2.82

for service, the conception rate may have been greatly increased. It appears that the experience of the first two weeks of the project may have been responsible for the improved conception rate of 48% during the last week. It is probable that the conception rate in this type of project could be improved to 60% which would then be commensurate with what is reported in Norway, Aamdal[10], 1964, but this would require more labor and time of experienced people in checking gilts. Madden[8] reported conception rates up to 74% following a careful program of selecting only sows that were in standing heat and refusing to inseminate sows that were not standing.

Estimation of Cost of the Program

One aspect of this project that is frequently overlooked in discussions of AI in swine is the amount of time, labor, and effort that is required to carry out the program.

The cost of observing the gilts to detect proestrus and the labor involved in bringing them into the central house for further observation must be considered.

In this project considerable time and effort was used in collecting semen from the boar and the restraint and insemination of the gilts. This project required 3 people for three hours six days each week for three weeks. One could estimate the cost of this as follows:

Inseminator	$5.00 per hour
Herdsman	2.50 per hour
Helper	2.50 per hour
	$10.00 per hour
3 hours each day	30.00 per day
18 days	540.00
Equipment & Materials	100.00
	$640.00 for 22 litters
	$ 30.00 per litter

$5.57 per insemination for 115 inseminations

The question of the practicality of using AI on a custom or individual basis as was done in this project on an Iowa farm is frequently raised. Iowa is one of the most concentrated areas of swine production in the world. The swine herds are large and the margin of profit is small. Management and the economics of the enterprise make it necessary to economize as much as possible on the labor used in the swine operation.

Farmer-Breeder Should Understand Limitations

There has been some recent interest among veterinarians and swine raisers in Iowa in the possibilities of using AI to achieve certain genetic or disease control objectives. Unless unusually good methods of heat detection and timing of inseminations are used, a conception rate of approximately 40% can be expected. This percentage of conception could undoubtedly be increased by more careful observation and selection of gilts for insemination. It is doubtful that the Iowa swine

TABLE 5

Conception Data by Week and Day

Day of Week	No. of Last Services	Number that Conceived	Number that did Not Conceive	Percentage of Conception
First Week				
Mon.	5	0	5	0
Tue.	3	1	2	33
Wed.	3	0	3	0
Thur.	3	2	1	66
Fri.	3	1	2	33
Sat.	6	4	2	66
Total	23	8	15	35
Second Week				
Mon.	3	1	2	33
Tue.	1	0	1	0
Wed.	5	2	3	40
Thur.	3	0	3	0
Fri.	0	0	0	-
Sat.	1	0	1	0
Total	13	3	10	23
Third Week				
Mon.	0	0	0	-
Tue.	5	2	3	40
Wed.	4	2	2	50
Thur.	6	4	2	67
Fri.	2	1	1	50
Sat.	6	2	4	33
Total	23	11	12	48
Grand Total	59	22	37	37

operation can afford the time and labor that is required for detection of heat, separation, restraint, and manipulation of sows during insemination. The results would have to be much better than 40% conception to justify the cost. Also, the results in genetic improvement and disease control need to be very profound to justify this cost. Usually, when a large swine producer understands the limitations of the program due to these factors, his enthusiasm in AI in swine decreases very rapidly. In the opinion of the author, this is the reason why commercial AI in swine has not developed and flourished in Iowa as it has in some other areas of the world. Where the swine herds are small, 4 or 5 sows on a farm, it is worth the additional labor to avoid having a boar on the farm and time is usually available to observe and detect heat periods. This is usually not the case in large Iowa herds.

If a program such as we have outlined in this article is carried out in a large swine operation in Iowa, it should be done cooperatively between the herdsman and the veterinarian. This means that much of the work would be done by people who are inexperienced in the problems of swine AI. There are many details that require attention to obtain the best results like temperature control, sanitation, prevention of contamination of the semen sample and addition of antibiotics to the semen. These details are frequently neglected when the operation is taken out of the laboratory into the barn or swine shelter. Aamdal[10], 1964, has pointed out the importance of keeping the bacterial count on boar semen below 10,000 bacteria/1 ml. To accomplish this low bacterial count, veterinary or very well trained technical assistance is necessary.

Beyond the phase of collection and preparation of semen, experience is important in selecting and inseminating gilts as pointed out by Self,[6] 1961. As a result of the combination of all these limitations, the conception rate with "on-the-farm" AI programs in large swine herds in Iowa usually is much lower than expected. Herrick,[9] 1950, pointed out some of the limitations to development of swine AI. Technology has advanced considerably since his review but the economic factors have focused more attention on the need to economize on labor costs; this reduces the amount of individual attention each sow receives in Iowa.

SUMMARY

Twenty-two, or 38.6%, of 57 gilts inseminated with semen collected from one boar during a period of 3 weeks had litters. A total of 204 pigs were born with an average birth weight of 2.82 pounds and an average litter size of 9.27.

CONCLUSIONS

1. Artificial insemination in swine can be used to achieve certain goals which are valuable in specific instances such as: Rapid progress in breeding; increasing the number of females that can be mated to a single boar during a limited period of time; control of health problems in a swine herd.

2. The limitations to achieving these goals are: High cost of maintaining a supply of low bacterial count semen; semen must be used within 5 hours after collection for best results; much attention must be given to the individual female to ascertain the optimum time for insemination; the cost of labor involved in observing, handling, and inseminating sows.

3. At the present stage of technical development of AI in swine, it is doubtful that it will replace natural service in the large swine operations of the Midwest for the following reasons: High quality boars are available at prices 2 to 3 times market value; the cost of semen preparation and insemination is higher than the difference between purchase and market price of boar plus feed costs of boar; the requirements of additional labor for heat detection, handling, and assistance during insemination is an additional cost of production that is not necessary with natural service.

4. Unless the farmer-breeder is willing to increase his labor cost in order to observe sows on an individual basis, it is not prob-

able that the conception rate in swine AI will reach acceptable levels in Iowa.

5. If reliable systems of estrous synchronization could be developed for field use, the additional labor costs associated with swine AI would be greatly reduced.

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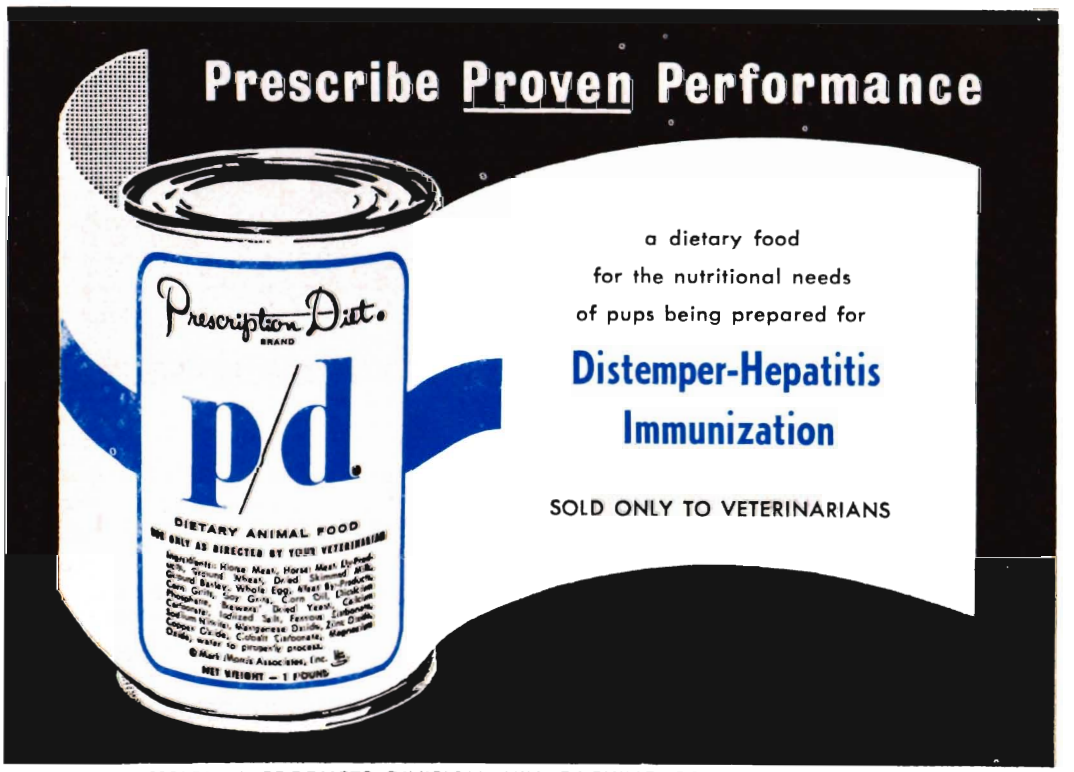

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