Optimum Administration of P.G. 600® for Fertile Estrus Induction in Swine

Purpose: Compare the efficacy of P.G. 600® when administered to prepuberal gilts and sows by either subcutaneous or intramuscular injection.

Technical Report No. 16

Implications

- Studies demonstrate a 25% improvement in estrus induction rates in prepuberal gilts when P.G. 600® is administered subcutaneously.
- In one controlled study, subcutaneous injection of prepuberal gilts with P.G. 600® was 46% more effective in inducing estrus and increased ovulation by 12%.
- Data suggest that maximum advantage will be gained if P.G. 600® is administered to sows at weaning.
- 89% of sows treated with P.G. 600® exhibit signs of estrus within 4-5 days of weaning.
- With subcutaneous injections, one would expect a 70-80% estrus response rate when using P.G. 600® in prepuberal gilts. The maximum response will occur when gilts are treated within 20-30 days of natural puberty.
- This would influence an additional 10-20% of treated gilts to express estrus when compared to intramuscular injection.
- Subcutaneous injection may reduce the number of P.G. 600® injections required because of increased numbers of animals available for breeding and fewer fertile replacement gilts needed.
- Subcutaneous injection of P.G. 600® using a 1.5 inch, 20 gauge needle should reduce potential P.G. 600® leakage.

Overview

A literature review was commissioned of P.G. 600® studies conducted over the past 30 years. Its intent was to evaluate injection methods in prepuberal gilts and sows. The mean estrus induction rates, in over 13 studies, for prepuberal gilts were 79% after subcutaneous injection versus 62% after intramuscular injection, a 27% improvement. In a single controlled study, P.G. 600® was 46% more effective in inducing estrus when it was injected by the subcutaneous rather than the intramuscular route. Fewer replacement gilts may be required if P.G. 600® is administered by subcutaneous injection. This can be a great economical benefit.

For best results, P.G. 600® should be administered to sows at the time of weaning, since 89% of sows treated with P.G. 600® exhibit signs of estrus within 4-5 days of weaning.

Introduction

Modern swine reproduction relies upon the use of precision breeding. Commercial pork production breeding decisions are dictated by the necessity to maintain precise farrowing schedules to optimize pig production. Fertile estrus expression in a defined number of days is critical and relevant to all decisions involved in mating sows and gilts. Swine breeding that results in consistent conception and farrowing of large litters requires proper preparation and planning. Farrowing expectations are dependent upon having the correct number of fertile replacement gilts available within the breeding period. Efficiency in managing the replacement pool will influence the ability to optimize sow culling, manage the size of the gilt pool, breed the minimum number of replacements and adjust gilt nutritional programs to maximize litter size and breeder longevity.

Expression of estrus and the estrous cycle is random in individual gilts once maturity is reached while genetics and environment also affect onset of puberty, estrus expression and length of the estrous cycle. Spur of the moment management adjustments often become necessary and can be costly in terms of animals, feed, labor and space. P.G. 600® assists the swine breeder in maximizing production efficiency.

P.G. 600® contains 400 IU serum gonadotropin (PMSG) and 200 IU chorionic gonadotropin (HCG) per 5 ml. dose. Indications are as follows:

Prepuberal Gilts: P.G. 600® is indicated for induction of fertile estrus (heat) in healthy prepuberal (non-cycling) gilts over five and one-half months of age and weighing at least 85 kg (187 lb.).

Sows at weaning: P.G. 600® is indicated for induction of estrus in healthy weaned sows experiencing delayed return to estrus.

Materials and Methods

A literature review was conducted of P.G. 600® studies conducted over the last 30 years with the primary intent of evaluating the method of injection. Studies conducted in both gilts and sows were included. Parameters measured included age of the gilt, weight, days from P.G. 600® injection to occurrence of estrus signs, percent of gilts exhibiting signs of estrus, number of ovulations per gilt and, in sows, the pregnancy rate and litter size.

The review also considered method of injection as it relates to restraint requirements, needle breakage and P.G. 600® leakage from the injection site.

Results and Discussion

Results of studies in prepuberal gilts are presented in Tables 1 and 2.

A data summary of 13 prepuberal gilts studies is included in Table 1. A direct comparison of injection methods in the same study occurred in only one of these. This study is also presented separately in Table 2. Table 1, overall there was a 27% increase in the number of prepuberal gilts exhibiting signs of estrus after subcutaneous P.G. 600® injection as compared to those receiving intramuscular treatments. Of those exhibiting induced estrus, there was a 4.6% increase in the number of gilts ovulating among those receiving subcutaneous injections as compared to the intramuscular group. The difference in days to estrus between the groups was not considered significant. In the controlled study, there was also a 46% increase in gilts exhibiting signs of estrus and a 12% increase in ovulations when compared to the intramuscular group.

There were insufficient data to determine if subcutaneous administration is superior, however, there was some preliminary suggestion that improvement similar to that seen in prepuberal gilts may occur in sows. More research is necessary. Limited data suggested that there were no differences in pregnancy rate and litter size.

The reviewer suggested that leakage of P.G. 600®, which has low viscosity, may be minimized by subcutaneous injection.

This review of published literature clearly indicated that subcutaneous injection of P.G. 600® in prepuberal gilts is more effective in inducing estrus than is intramuscular injection. The reason for this response is not nearly as clear. It is hypothesized that P.G. 600®, when injected into muscle rich in blood vessels, is quickly absorbed from the injection site. This may result in a sharp increase in P.G. 600® blood levels followed by rapid drug metabolism and elimination. Subcutaneous tissue has less blood supply than does muscle and therefore P.G. 600® may be more slowly absorbed from the injection site. The rate at which P.G. 600® is absorbed and reaches peak blood levels may be more important than the rate at which it is eliminated. A gilt that is very near puberty age may have ovaries containing many semi-mature follicles that are almost ready to undergo final maturation at first estrus. These follicles may soon grow to a size sufficient to produce enough estrogen to cause signs of estrus. If the follicles are quite large at the time of intramuscular P.G. 600® injection, they may respond to the rapid increase in gonadotropin concentration in the blood soon after injection. These large follicles may ovulate before enough estrogen is present for observable signs of estrus. Subcutaneous injection, however, may cause a slower increase of gonadotropin blood levels permitting additional maturation time for follicles and sufficient estrogen production. Estrus response and expression may therefore be greater.

In addition, variations in response to P.G. 600® may occur and could be due to the age at which gilts reach puberty. Puberty may, in turn, be influenced by genetics, nutrition and management related factors.

The farm manager should keep in mind that a high estrus response rate occurs when P.G. 600® is administered by subcutaneous injection. This is especially true when combined with normal puberty induction management such as transport and boar exposure. Only healthy, fast growing gilts that are within ***20-30 days of expressing estrus normally should be selected for induction of estrus.***

A good comparison of P.G. 600® when administered to sows by either subcutaneous or intramuscular injection was not possible due to differences in parity and day of injection.

To be most effective, P.G. 600® must be administered to weaned sows on the day of or day following weaning. In excess of 89% of sows show signs of estrus within 4-5 days of P.G. 600® injection.

Critical Success Points:

- Treatment ***will not induce estrus*** in gilts that have ***already reached puberty (begun to cycle)***. Gilts that are less than five and one-half months of age or that weigh less than 85 kg (187 lb.) ***may not be mature enough to continue normal estrous cycles*** or maintain a normal pregnancy to full term after treatment.
- Treatment will not induce estrus in sows that return to estrus normally three to seven days after weaning. Delayed return to estrus is most prevalent after the first litter (p_1). Delayed return to estrus often occurs during periods of adverse environmental conditions and sows mated under such conditions may farrow smaller than normal litters.

The directions for use approved by the U.S. Food and Drug Administration specify that one dose (5 ml. of reconstituted P.G. 600®) should be injected into the gilt's or sow's neck behind the ear through a one and one-half inch, 20 gauge, hypodermic needle.

Recent P.G. 600® studies conducted in the U.S. demonstrate the method of administration can significantly influence the estrus induction response in prepuberal gilts.

Table 1.
Effect of Administration of P.G. 600® by the Intramuscular and Subcutaneous Routes in Prepuberal Gilts (13 Studies)

	Group		
	Intramuscular P.G. 600®	Subcutaneous P.G. 600®	% Difference (SC/IM)
Average Age (Days)	176	173	
Average Weight - lbs.	209	180	
Days to Estrus	4.5	4.7	4
% Exhibiting Signs of Estrus	62	79	27
% Ovulating	87	91	5

Table 2.
Effect of Administration of P.G. 600® by the Intramuscular and Subcutaneous Routes in Prepuberal Gilts (Single Controlled Study)

	Group			
	Control	Intramuscular P.G. 600®	Subcutaneous P.G. 600®	% Difference (SC/IM)
Days to Estrus	5.9	4.8	4.6	-/4
% Exhibiting Signs of Estrus	15	52	76	46
% Ovulating	18	77	86	12

Age of Gilts: 5.5 - 6.0 Months
Weight Range: 180-240 lbs.

References: Knox, R.V., G. Miller, K. Willenburg, S.I. Rodriguez-Zas. 2001. Effect of administration of P.G. 600® to sows at weaning and the time of ovulation as determined by transrectal ultrasound. J. Anim. Sci. 78: 1732-1737

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