Costs and Returns of Using P.G. 600® to Induce Heat in Gilts

Technical Report No. 3

Swine producers in the United States face continuing competition from other livestock and poultry producers to lower production costs and improve product quality. Increases in reproductive efficiency in swine herds can lead to lower production costs and therefore to increased returns. Use of effective, approved methods for inducing estrus in gilts can lead to improved reproductive efficiency.

Currently, the number of replacement gilts brought into breeding herds is much larger than the number of gilts farrowed, because only those replacement gilts observed in heat during the scheduled breeding period can be mated. Gilts not mated are culled or held for mating in subsequent breeding periods.

Induction of heat at a predictable time in prepuberal gilts can reduce not only the number of replacement gilts maintained but also the time interval from breeding herd entry to mating, thereby decreasing costs and increasing returns.

Effects of P.G. 600

P.G. 600 is a combination of 400 IU of Pregnant Mare Serum Gonadotropin (PMSG) and 200 IU of Human Chorionic Gonadotropin (HCG). This product, which can induce estrus in prepuberal gilts, is already sold and used in many other countries.

In 1984-1985, university scientists conducted a controlled study to determine the effectiveness of P.G. 600 in inducing estrus in prepuberal gilts in commercial herds in this country1. A total of 678 gilts were used in trials on 10 farms: 3 swine units in Illinois, 3 units in Missouri and 4 units in North Carolina. All of these units were intensely managed, most or all of the animals were housed in total confinement, and herd size ranged from 150 to 1,000 sows.

P.G.600 was administered in a single injection to gilts in the treated groups on day zero of the trials as the gilts were moved from finishing to breeding herd facilities. All gilts were heat checked daily for 28 days after the trials began, and those in estrus were mated naturally once daily during estrus.

Each day during the study, the cumulative (total) percentage of gilts observed in heat was higher, on average, for gilts treated with P.G. 600 than for gilts in the control group (Table 1). Moreover, during the first 5 days of the trial, the percentage of additional gilts coming into heat each day was much higher for treated gilts than for control gilts. After 5 days, 52% of the gilts treated withP.G.600 were observed in heat compared to only 25% of the control gilts. This 27% difference was the maximum difference observed during the 28-day trial period.

No significant differences between the control gilts and the gilts treated with P.G. 600 were observed, on average, for the following production variables:

- farrowing rate,
- pigs born alive per litter,
- pigs born dead per litter,
- pigs weaned per litter,
- days to estrus after weaning,
- percentage in heat after weaning,
- percentage rebred.

Costs and Returns

To estimate the effects of P.G. 600 on the costs and returns for swine units with different production systems, partial budgets were developed for nine case farms, four from Illinois and five from North Carolina. While the case farms selected had different production systems and a substantial range in size, all were intensely managed confinement units.

Thus the trial results can appropriately be applied to these units. Also, these swine units are typical of intensely managed confinement operations in the Midwest and Southeast. Finally, records for these farms were available, and they contained the production and financial data required for an economic analysis of the cost and return to using P.G. 600.

Using the production and financial data provided by the case farms and the results of the controlled study on inducing estrus, a computer spreadsheet for a swine unit was used to develop two partial budgets for each farm: (1) a base budget where P.G. 600 was not used and (2) a treatment budget where P.G. 600 is used.

Annual costs and returns in the base budgets were calculated using the study results for control gilts to determine percentage of replacement gilts in heat during each farm's breeding period (Table 1). Similarly, annual costs and returns in the treatment budgets were calculated using the study results for percentage of treated gilts in heat. Finally, using the two partial budgets for each case farm, estimated annual gross return to P.G. 600 per farm is the difference between the annual net return for the treatment budget and the annual net return for the base budget. Estimated annual gross return per gilt treated is calculated by dividing annual gross return to P.G. 600 per farm by the number of gilts treated on that farm.

Table 1.

P.G. 600® Farm Trial Results

Days after treatment	Total percent in heat: Control	Total percent in heat: P.G. 600®	Replacement gilt factor*: Control	Replacement gilt factor*: P.G. 600®
5	25	52	4.00	1.92
10	41	59	2.44	1.69
14	45	63	2.22	1.59
21	52	67	1.92	1.49
28	58	73	1.72	1.37

*Replacement gilt factor, which equals 1/total percentage in heat, is the number of replacement gilts that must be brought into the breeding herd to have one gilt in heat during the scheduled breeding period.

Partial Budgeting Approach

To demonstrate how the production and financial data obtained from each case farm were used to estimate the gross return to P.G. 600, the production and financial data for one case farm together with its base and treatment budgets were presented as an example. Because its production system and production levels are representative of many commercial herds of the same size, the North Carolina Swine Development Center (NCSDC) was selected as the example. The Center's herd, which operates like a commercial swine unit, has 119 producing sows divided into 7 sow groups, each with 17 sows (Table 2). A new group of sows is farrowed every 21 days (a 21-day farrowing frequency). Pigs are weaned at 28 days of age, and the breeding period for each farrowing group is 10 days. With this production system there are 17.15 group farrowings per year.

Considering the herd's average conception and abortion rates for sows, average gilt conception rates, and sow deaths, a minimum of 6 replacement gilts must be bred per group farrowing to maintain a constant group size (6 x 17.15: 103 gilts bred annually, Table 2). Based on the trial results for control gilts, on average, only 41% of the replacement gilts brought into the breeding herd cycled within the 10-day breeding period, so 2.44 replacement gilts were required to have one gilt in heat (Table 1). In the control group, 15 replacement gilts (6 x 2.44) were required to breed 6 gilts per farrowing group, which totaled 257 gilts annually (15 x 17.15 = 257 gilts).

Table 2.

Production Data and Average Prices, 1987
North Carolina Swine Development Center

Production data:	
Farrowing frequency (days)	21
Number of sow groups	7
Females per group (head)	17
Producing sows (head)	119
Breeding period (days)	10
Lactation period (days)	28
Farrowings/group/year	2.45
Groups farrowed/year	17.15
Average conception/group	
Sows	0.80
Gilts	0.77
Abortion rate	0.04
Sow deaths/group farrowed	0.52
Replacement gilts:	
Purchase price ($/head)	150
Cull price ($/cwt)	42.91
Cull weight (lbs/head)	310
Feed prices:	
Corn ($/bu)	2.30
Soybean meal ($/ton)	212

	Base Budget	Treatment Budget
Minimum number of gilts to breed:		
Per group farrowed	6	6
Per year	103	103
Replacement gilts required:		
Per group farrowed	15	10
Per year	257	171

Again, based on the farm trial averages, 59% of the P.G. 600-treated gilts will come into heat during the first 10 days, so only 1.69 replacement gilts are required to have one gilt in heat. Thus when P.G. 600 is used, only 10 replacement gilts are required per farrowing group (or 171 gilts annually), a replacenent gilt saving of 5 gilts per group farrowing or 86 gilts per year.

Using production data and average prices for 1987, estimates of the Center's annual output, revenue, expense, and net return for the base budget and treatment budget are presented in Table 3.

Annual output in the two budgets is the same except that 86 additional replacement gilts were purchased, maintained and then sold as cull gilts in the base budget. Estimated annual revenue was larger for the base budget because the 86 additional replacement gilts required were sold as cull gilts. However, estimated annual expense for the base budget was also larger as these 86 additional replacement gilts were purchased and additional feed and other variable expenses were incurred.

Thus, net return for the treatment budget exceeded the net return for the base budget by $3,240, which represents the estimated gross annual return to using P.G. 600 for this case farm. This return of $3,240 is the gross return to using P.G. 600 because the cost of P.G. 600 and the cost of administering it were not included in the treatment budget.

Since 171 gilts were injected in the treatment budget, the gross return per gilt treated was $18.95.

Table 3.

Base and Treatment Budgets:
North Carolina Swine Development Center

	Base Budget	Treatment Budget	Difference (B–T)
Estimated Annual Production:			
Minimum gilts	103	103	0
Required replacement gilts	257	17186	
Feeder pigs	2559	2559	0
Cull sows	62	62	0
Cull gilts	187	101	86

	Base Budget	Treatment Budget	Difference (B–T)
Estimated Annual Revenue:			
Cull gilts	$ 24,609	$ 13,290	$ 11,319
Other livestock	114,696	114,696	0
Total revenue	$ 139,305	$ 127,986	$ 11,319
Estimated Annual Expense:			
Replacement gilts	$ 38,054	$ 25,369	$ 12,685
Feed expense	30,508	28,944	1,564
Variable expense	10,181	9,871	310
Non-variable expense	16,299	16,299	0
Total expense	$ 95,042	$ 80,483	$ 14,559
Returns to land, labor, management, overhead, owner equity, and risk	$44,263	$47,503	
Gross return to P.G. 600®			$ 3,240
Gross return to P.G. 600® per gilt			$ 18.95

Changes in Prices and Production Data

The $18.95 per head return to using P.G. 600 was calculated using 1987 average prices and production data for the Center. This estimated gross return will vary as the price of replacement gilts brought into the herd, price of replacement gilts culled, corn and soybean meal prices, sow conception rate and replacement gilt factor vary. Each of these factors is varied to determine the magnitude of change in gross return to using P.G. 600. Gross return to P.G. 600 is also affected by frequency of farrowing, and this effect is analyzed by comparing farms with different farrowing frequencies.

Table 4.

Gilt Price Changes and P.G. 600® Return:
North Carolina Swine Development Center

	Cull Gilt Prices ($/cwt)			
Repl. Gilt Price ($/head)	30	40	43	50
	Return to P.G. 600® ($/head)			
100	14.14	(1.29)	(5.77)	(16.91)
150	38.87	23.44	18.95	8.02
200	63.59	48.17	43.68	32.74

Gilt Prices

As the price of replacement gilts brought into the herd rises and the price of cull replacement gilts falls, the replacement gilt savings achieved with P.G. 600 becomes more valuable and the gross return to P.G. 600 increases (Table 4). Holding the price of a replacement gilt at $150 per head, the gross return per head increases from $18.95 to $38.87 as the price of cull replacement gilts falls from $43 to $30 per hundredweight.

As the price of a replacement gilt brought into the herd increases from $150 to $200 per head, holding the cull replacement gilt price at $43 per hundredweight, the gross return to P.G. 600 increases from $18.95 to $43.68 per head. Thus, changes in the purchase price and the cull price of replacement gilts have substantial effects on the return to P.G. 600®.

Feed Prices

As the prices of soybean meal and corn increase, returns to P.G. 600 increase because feed expenses in the base budget rise relative to feed expenses in the treatment budget (Table 5). Holding corn prices at $2.30 per bushel, gross return to P.G. 600 increases from $18.95 to $21.23 per head as the price of soybean meal rises from $212 to $300 per ton. As the price of corn increases from $2.30 to $3.50 per bushel, holding soybean meal at $212 per ton, the return per head to P.G. 600 increases from $18.95 to $21.56.

Since these changes in return are relatively small, the estimated return to P.G. 600 appears to be more sensitive to changes in the prices of replacement gilts than to changes in feed prices.

Sow Conception Rate

As the sow conception rate fails, holding sow group size at a given level, the minimum number of replacement gilts to be bred increases. In turn, there is an accompanying increase in the number of replacement gilts required so that the appropriate number of gilts are in heat during the breeding period.

Thus, a farm's replacement gilt savings and annual gross return from using P.G. 600 increase as the sow conception rate falls (Table 6). As average conception rate falls from 80% to 70%, total farm return increases from $3,240 to $4,537. Return per head is unchanged as the number of head treated also increases.

Table 5.

Feed Price Changes and P.G. 600® Return: North Carolina Swine Development Center

Corn Price ($/bu)	Soybean Meal Price ($/ton) 200	212	250	300
	Return to P.G. 600® ($/head)			
2.00	18.10	18.27	18.83	19.55
2.30	18.78	18.95	19.51	21.23
2.50	19.20	19.37	19.92	20.65
3.00	20.29	20.46	21.02	21.74
3.50	21.38	21.56	22.11	22.84

Replacement Gilt Factor

Net return in the base budget is calculated assuming that the total percentage of gilts coming into heat during the 10-day breeding period is equal to the total percentage of control gilts coming into heat during the first 10 days of the farm trials (41%, on average). Thus 2.44 replacement gilts (1/0.41) are required for each gilt bred.

As the replacement gilt factor for gilts not treated with P.G. 600 decreases relative to the replacement gilt factor for treated gilts, the replacement gilt saving and return obtained from using P.G. 600 decreases (Table 7). For example, as the replacement gilt factor for untreated gilts decreases from 2.44 to 2.22, holding the replacement gilt factor for gilts treated with P.G. 600 at 1.69, the annual replacement gilt saving with P.G. 600 decreases from 86 to 52 head and the return per head declines from $18.95 to $11.37.

Table 6.

Sow Conception Rate Changes and P.G. 600® Return: North Carolina Swine Development Center

Conception Rate (%)	Return to P.G. 600® ($/year)
90	1,945
80	3,240
70	4,537
60	5,185

Farrowing Frequency: Nine Case Farms

Farrowing frequency for the nine case farms analyzed in this study varied from 21 days to 7 days (Table 8). Generally, the length of the breeding period declined as farrowing occurred more frequently. Using production and financial data provided by these farms and holding replacement gilt purchase and cull prices constant at $160 per head and $40 per hundredweight, respectively, gross return to using P.G. 600 was estimated for each farm.

Table 7.

Replacement Gilt Factor Changes and P.G. 600® Return: North Carolina Swine Development Center

		Replacement Gilts Required (RGF)		
Base RGF	Base % Heat	Base	Treatment	Return to P.G. 600® ($/head)
1.82	55	189	171	3.79
2.00	50	205	171	7.58
2.22	45	223	171	11.37
2.44	41	257	171	18.95
2.86	35	292	171	26.53

The effects of changes in production data and prices on estimated gross return to P.G. 600 also were calculated for each case farm, but those results are not presented here, because they are consistent with results presented above for the North Carolina Swine Development Center.

Based on the results for these nine case farms, average gross return to P.G. 600 was positive for each farrowing frequency, but the return declined as frequency of farrowing increased (Table 9). Estimated average return per gilt decreased from $25.54 with a 21-day farrowing frequency to $8.16 with a 7-day farrowing frequency. Swine units that farrowed less frequently and breed over a shorter interval obtained higher gross returns from using P.G. 600 because: (a) replacement gilts were held for short intervals before mating, and (b) fewer gilts were culled and sold at a low price relative to their purchase price.

Summary

P.G. 600 is a management tool that has potential for increasing reproductive effiency in swine breeding herds by controlling induction of estrus in prepuberal gilts as they enter the breeding herd.

Combining the results of a study of P.G.600's effectiveness in controlling estrus induction in prepuberal gilts with production and financial data for nine case farms, estimated gross return to P.G. 600 averaged $15.26 per gilt treated when replacement gilt purchase and cull prices were $160 and $40 per head, respectively.

Table 8.

Production System and Size: Nine Case Farms

State	Farrowing Frequency (days)	Breeding Period (days)	Producing Sows (head)
IL	21	21	49
NC	21	10	119
IL	15	14	250
IL	10	3	330
IL	7	7	120
NC	7	7	221
NC	7	7	252
NC	7	7	920
NC	7	7	960

Table 9.

Return to P.G. 600® per Gilt by Farrowing Frequency: Nine Case Farms

Farrowing Frequency (days)	Number of Farms	Return to P.G. 600® ($/gilt)	
		Average	Range
21	2	25.54	23-28
10-15	2	22.74	19-26
7	5	8.16	0-15

Estimated gross return per gilt treated for the nine farms ranged from $0 to $28.39. These estimates of gross return to P.G. 600 will change as the replacement gilt prices and production data used in the partial budgets change. Gross return to P.G. 600 increases as replacement gilt purchase price and prices of corn and soybean meal increase, and gross return decreases as replacement gilt cull price, replacement gilt factor, sow conception rate, and farrowing frequency increase. Since data on the retail price of P.G. 600 are not available, the cost of treatment could not be considered in this analysis. Hence, the estimated return to P.G. 600 is a gross return.

P.G. 600® is a registered trademark of Intervet, Inc.

Literature Cited

1See J.H. Britt. B.N. Day, SK Webel, and M.A. Brauer, "Induction of Fertile Estrus in Prepuberal Gilts by Treatment with a Combination of Pregnant Mare Serum Gonadotropin and Human Chorionic Gonadotropin (PG. 600®)," Journal of Animal Science.

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