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Abstract

One hundred eight barrows with an initial weight of 120 lb were utilized to determine the effects of porcine somatotropin (PST) administration period and duration on growth performance and carcass characteristics of finishing swine fed to 280 lb. Pigs were injected daily in the extensor muscle of the neck with either a placebo or 4 mg pST. Treatments included: (A) placebo injection from 120 to 280 lb; (B) pST injection from 120 to 280 lb; (C) pST injection from 120 to 230 lb and then placebo injection from 230 to 280 lb; (D) placebo injection from 120 to 230 lb and then pST injection from 230 to 280 lb; (E) placebo injection from 120 to 170 lb, pST injection from 170 to 230 lb, and then placebo injection from 230 to 280 lb; and (F) placebo injection from 120 to 250 lb and then pST injection from 250 to 280 lb. All pigs were fed a corn-soybean meal diet containing 1.2% lysine. Performance data were collected and evaluated for three weight ranges: 120 to 230 lb, 230 to 280 lb, and 120 to 280 lb. Two pigs from each pen were slaughtered to determine carcass characteristics. The first pig was slaughtered at 230 lb and the second pig at 280 lb . Average daily gain (ADG), average daily feed intake (ADFI), and feed conversion (F/G) were all optimized when pigs were treated with pST for the entire time from 120 to 230 lb and from 120 to 280 lb. Longissimus muscle area (LEA), backfat thickness, percentage carcass muscle, and kidney fat were all improved at 230 lb when pigs were injected with pST. There was no difference in these carcass traits when pigs were injected with pST from 120 to 230 lb compared to pigs treated with pST from 170 to 230 lb. These same carcass characteristics measured in pigs slaughtered at 280 lb showed significant improvement with pST treatment compared to the control. However, when pST treatment lasted the entire trial (120 to 280 lb), there was significant improvement in carcass characteristics over pST treatments of shorter duration. Whole ham weight was unaffected by pST treatment at either slaughter weight, but trimmed ham weight was improved by pST treatment at 230 lb. Daily protein accretion rate (DPA) and daily fat accretion rate (DFA) were optimized at both slaughter weights by pST treatment that lasted for the duration of the trial. Organ weights were increased by pST treatment but were unaffected by administration period or duration of pST treatment. These data indicate that growth performance and carcass characteristics were maximized when pST was administered continually from 120 to 280 lb.; Swine Day, Manhattan, KS, November 21, 1991

Keywords

Swine day, 1991; Kansas Agricultural Experiment Station contribution; no. 92-193-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 641; Swine; Repartition; GF; Performance; Carcass; Heavy weight

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EFFECTS OF PORCINE SOMATOTROPIN ADMINISTRATION AND ITS DURATION ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING SWINE FED TO 280 LB

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Summary

One hundred eight barrows with an initial weight of 120 lb were utilized to determine the effects of porcine somatotropin (pST) administration period and duration on growth performance and carcass characteristics of finishing swine fed to 280 lb. Pigs were injected daily in the extensor muscle of the neck with either a placebo or 4 mg pST. Treatments included: (A) placebo injection from 120 to 280 lb; (B) pST injection from 120 to 280 lb; (C) pST injection from 120 to 230 lb and then placebo injection from 230 to 280 lb; (D) placebo injection from 120 to 230 lb and then pST injection from 230 to 280 lb; (E) placebo injection from 120 to 170 lb, pST injection from 170 to 230 lb, and then placebo injection from 230 to 280 lb; and (F) placebo injection from 120 to 250 lb and then pST injection from 250 to 280 lb. All pigs were fed a corn-soybean meal diet containing 1.2% lysine. Performance data were collected and evaluated for three weight ranges: 120 to 230 lb, 230 to 280 lb, and 120 to 280 lb. Two pigs from each pen were slaughtered to determine carcass characteristics. The first pig was slaughtered at 230 lb and the second pig at 280 lb. Average daily gain (ADG), average daily feed intake (ADFI), and feed conversion (F/G) were all optimized when pigs were treated with pST for the entire time from 120 to 230 lb and from 120 to 280 lb. Longissimus muscle area (LEA), backfat thickness, percentage carcass muscle, and kidney fat were all improved at 230 lb when pigs were injected with pST. There was no difference in these carcass traits when pigs were injected with pST from 120 to 230 lb compared to pigs treated with pST from 170 to 230 lb. These same carcass characteristics measured in pigs slaughtered at 280 lb showed significant improvement with pST treatment compared to the control. However, when pST treatment lasted the entire trial (120 to 280 lb), there was significant improvement in carcass characteristics over pST treatments of shorter duration. Whole ham weight was unaffected by pST treatment at either slaughter weight, but trimmed ham weight was improved by pST treatment at 230 lb. Daily protein accretion rate (DPA) and daily fat accretion rate (DFA) were optimized at both slaughter weights by pST treatment that lasted for the duration of the trial. Organ weights were increased by pST treatment but were unaffected by administration period or duration of pST treatment. These data indicate that growth performance and carcass characteristics were maximized when pST was administered continually from 120 to 280 lb.

(Key Words: Repartition, GF, Performance, Carcass, Heavy Weight.)

Introduction

To take advantage of inexpensive grain prices and maximize packing plant efficiency, many swine producers are marketing their hogs at much heavier weights. A drawback to this trend is the characteristic slow growth and excessive fat deposition of these pigs after they reach 230 lb. The decline in growth rate can be costly to the producer by slowing down

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production flow and tieing up facilities. Also, overly fat pork does not have high consumer or packer appeal.

Use of pST during the finishing phase has the potential to alter pig performance and make it more advantageous to feed pigs to heavier weights. Because of the costs in time and labor of injecting pST, it is necessary to determine the proper time of administration and duration of treatment to achieve maximum benefit.

Therefore, the objective of this experiment was to determine the effects of pST administration and its duration on growth performance and carcass characteristics of finishing pigs fed to 280 lb.

Procedures

One hundred eight crossbred barrows (Yorkshire × Duroc × Yorkshire) with an average initial weight of 120 lb were allotted on the basis of weight and ancestry to one of six treatments. Pigs were housed in a modified open front building with three pigs per pen and six pens per treatment. Treatments included: (A) placebo injection from 120 to 280 lb; (B) pST injection from 120 to 280 lb; (C) pST injection from 120 to 230 lb and then placebo injection from 230 to 280 lb; (D) placebo injection from 120 to 230 lb and then pST injection from 230 to 280 lb; (E) placebo injection from 120 to 170 lb, pST injection from 170 to 230 lb, and then placebo injection from 230 to 280 lb; and (F) placebo injection from 120 to 250 lb and then pST injection from 250 to 280 lb. Injections were given daily in the extensor muscle of the neck and pST dosage level was 4 mg. Pigs were fed a corn-soybean meal diet (Table 1) containing 1.2% dietary lysine. The diet was formulated to contain at least 200% of NRC (1988) recommendations for other amino acids. Pigs were weighed at 14-d intervals until the mean weight of pigs in a pen reached 230 lb. At this time, one pig per pen was slaughtered for recording carcass measurements and organ weights. The other two pigs remained on experimental treatment and were weighed at 7-d intervals until they reached a final mean weight of 280 lb. One of the two remaining pigs was then slaughtered for carcass measurements and organ weights. At the start of the trial, six pigs with an average weight of 120 lb were slaughtered, and the right hams were ground to determine a baseline for protein and fat composition. Pigs slaughtered at 230 and 280 lb had the right ham removed and ground for determination of protein and fat accretion rates. A whole ham weight was recorded. The fat then was removed, and the ham was reweighed to obtain a trimmed ham weight. Each ham was also evaluated for color, firmness, and marbling. Production measurements taken included ADG, ADFI, and F/G.

Table 1. Composition of Diet

Ingredients	Percentage
Corn	54.55
Soybean meal (48%)	34.10
D-L methionine	.05
Soybean oil	6.00
Monocalcium phosphate	3.05
Limestone	1.00
Vitamin premix	.50
Trace mineral premix	.20
Selenium premix	.05
Salt	.50
Total	100.00
Calculated analysis, %	
Crude protein	20.84
Lysine	1.20
Ca	1.26
P	1.00

Results and Discussion

Average daily gain for pigs fed from 120 to 230 lb (Table 2) was greatest for those pigs

that received pST during this entire time. Pigs treated with pST from 120 to 230 lb gained 20% faster than the pigs that received no pST ($P < .01$) and 12% more than the pigs that were treated with pST from 170 to 230 lb. There was a decrease ($P < .05$) in ADFI for pST-treated pigs, with control pigs consuming 7% more feed. There was no difference in ADFI when comparing pigs treated with pST for the entire time to pigs treated for the shorter period. Feed conversion was improved ($P < .01$) for pST-treated pigs by 24% compared to the control pigs receiving placebo injections. Pigs that were pST-treated from 120 to 230 lb had an average improvement of 15% in F/G ($P < .01$) over pigs that received pST from only 170 to 230 lb.

In terms of performance from 230 to 280 lb, ADG was 25% higher ($P < .01$) for those pigs receiving pST compared to control pigs. Pigs that received pST from 250 to 280 lb showed a 33% increase in ADG when compared to pigs that were pST-treated from 230 to 280 lb. Daily feed intake was greater ($P < .01$) for placebo-injected and pigs injected with pST from 250 to 280 lb compared to pigs receiving pST for the entire time period. Porcine somatotropin-treated pigs consumed 28% less feed than the other pigs during this period of the trial. Feed conversion was improved ($P < .01$) for pST-treated pigs by 37% compared to control pigs. There was no difference in F/G between pST treatments.

There was a numerical advantage in daily gain for pigs treated with pST for the entire trial (120 to 280). These pigs had a 10% increase in gain over pigs that received no pST or pST treatment for a shorter duration of the trial. Control pigs receiving placebo injections for the entire trial consumed 15% more feed ($P < .01$) than pigs receiving pST treatment for the entire trial. There was no difference ($P > .17$) in ADFI between pST treatments, but pigs treated with pST for the entire trial did have a numerical reduction in feed consumption of 8% compared to pigs treated with pST for shorter durations. Feed conversion was optimized ($P < .01$) for pigs treated with pST for the entire trial, with those pigs showing a 20% improvement in F/G over pigs that received no pST and a 15% improvement over pigs treated with pST for a shorter duration.

When pigs were slaughtered at 230 lb, there was a reduction ($P < .01$) in average backfat thickness. Pigs injected with pST had 20% less backfat than control pigs (Table 3). Duration of pST treatment had no significant effect on LEA, but there was an 8% increase in LEA when pigs were given pST for the entire time rather than receiving it from 170 to 230 lb. All pST-treated pigs showed a 23% increase in LEA ($P < .01$) when compared to placebo-treated pigs. Percentage carcass muscle increased 12% ($P < .01$) for pST-treated pigs slaughtered at 230 lb compared to control pigs killed at the same weight. Kidney fat was 35% less ($P < .01$) when pigs were injected with pST compared to no pST treatment. Whole ham weight was not affected by pST, but trimmed ham weight increased 6% ($P < .05$) with pST treatment. The subjective evaluation of ham color showed no effect from pST or duration of treatment. Ham firmness was affected by pST treatment, with all pST-treated pigs having a 17% decrease ($P < .04$) in firmness compared to control pigs. Porcine somatotropin treated pigs also had a significant decrease in marbling ($P < .03$). Hams from pST-treated pigs slaughtered at 230 lb scored 34% lower in marbling than hams from control pigs.

Pigs slaughtered at 280 lb exhibited 11% less backfat ($P < .04$) when treated with pST for the entire trial (120 to 280 lb) than when given pST for a shorter duration or not at all. There was a 13% increase ($P < .03$) in LEA when pigs were given pST injections for the entire time of the trial. Percentage carcass muscle was also increased ($P < .01$) with increasing duration of pST treatment. Those pigs injected with pST showed a 6% increase in percentage carcass muscle compared to pigs

only receiving a placebo injection. Pigs injected with pST for the entire trial had an 8% increase ($P < .01$) in percent muscle compared to pigs treated with pST for a shorter duration. Kidney fat was decreased by 28% ($P < .01$) when pigs were injected with pST compared to control pigs. Pigs treated with pST for the entire trial and from 230 to 280 lb showed an average decrease of 29% in kidney fat compared to the other pST-treated pigs. Whole ham weight and trimmed ham weight of pigs slaughtered at 280 lb was unaffected by pST treatment of any duration when compared to control pigs. Ham color and firmness scores were also unaffected when pigs were treated with pST. Ham marbling showed a significant decrease ($P < .04$) of 25% when pigs were treated with pST. Pigs treated with pST for the entire duration of the trial showed a numerical trend ($P < .06$) toward less marbling when compared to pST treatments of shorter duration.

Daily protein accretion rate was increased ($P < .01$) by 55% when pigs were treated with pST and slaughtered at 230 lb (Table 4). Among pST treatments, those pigs receiving pST from 120 to 230 lb had a 35% increase ($P < .01$) in DPA compared to pigs injected with pST from 170 to 230 lb. Daily fat accretion (DFA) rate was 69% lower for pST-treated pigs ($P < .01$), with pigs receiving pST for the entire time having a 66% lower DFA ($P < .02$)than pigs injected with pST from 170 to 230 lb. Pigs slaughtered at 280 lb showed an increase ($P < .01$) in DPA when given pST for the entire trial. Pigs treated with pST from 120 to 280 lb had a 34% increase in DPA compared to control pigs and a 28% increase in DPA compared to pST-treated pigs on the other treatments. Fat accretion rate was 28% lower ($P < .05$) when averaged across all pST treatments than it was for pigs receiving a placebo injection. Pigs receiving pST from 120 to 280 lb, from 120 to 230 lb, and from 230 to 280 lb had a 43% reduction in DFA compared to pigs injected with pST from 170 to 230 lb and from 250 to 280 lb.

Organ weights recorded at the time of slaughter included heart, liver, kidneys, lungs, and spleen (Table 5). All organ weights for pigs slaughtered at 230 lb were significantly heavier ($P < .03$) for pigs treated with pST compared to control pigs. Pigs slaughtered at 280 lb had a significant increase ($P < .05$) in heart, liver, and kidney weights when treated with pST. Those pigs treated with pST for the entire trial showed an increase ($P < .03$) in organ weight when compared to the pigs on pST treatments that were shorter in duration.

The results of this study indicate that growth performance of pigs fed to 230 or 280 lb is optimized when pigs are injected with pST for the entire finishing phase rather than for shorter durations. Porcine somatotropin treatment improved carcass traits of pigs slaughtered at 230 lb. However, there was no difference in carcass characteristics between pigs treated with pST from 120 to 230 lb and pigs that were pST-treated from 170 to 230 lb. Pigs slaughtered at the heavier weight of 280 lb had larger LEA, less backfat thickness, greater percent muscle, and less kidney fat when they were treated with pST from 120 to 280 lb compared to the pST treatments of shorter duration. Daily protein and fat accretion rates were improved ($P < .05$) at both slaughter weights for pigs given pST for the entire finishing phase. These results demonstrate that if pigs are fed to the conventional weight of 230 lb, carcass traits can be improved with pST injections from 170 to 230 lb. However, if pigs are to be fed to the heavier market weight of 280 lb, pigs must receive pST treatment for the entire time period (120 to 280 lb) to achieve optimum improvements in efficiency, carcass traits, and protein and fat accretion rates.

Table 2. Effect of pST Administration Period and Duration on Growth Performance[a]

	Weight, lb	PST (+) or Placebo (-) Injection					
	120-170	-	+	+	-	-	-
	170-230	-	+	+	-	+	-
	230-250	-	+	-	+	-	-
Item	250-280	-	+	-	+	-	+
ADG, lb							
120-230		1.87^{bc}	2.19^{d}	2.24^{d}	1.93^{c}	1.98^{c}	1.72^{b}
230-280		1.97^{cd}	1.64^{bc}	1.44^{b}	1.90^{c}	1.32^{b}	2.36^{d}
120-280		1.89	2.05	2.02	1.87	1.83	1.84
ADFI, lb							
120-230		6.12	5.79	5.57	6.29	5.88	6.07
230-280		7.36^{c}	5.34^{b}	8.12^{c}	5.38^{b}	7.20^{c}	7.08^{c}
120-280		6.48^{cdef}	5.62^{b}	6.12^{bd}	6.02^{bc}	6.15^{be}	6.16^{bf}
F/G							
120-230		3.27^{d}	2.65^{b}	2.49^{b}	3.26^{d}	2.97^{c}	3.54^{e}
230-280		3.74^{b}	3.66^{b}	5.70^{c}	2.87^{b}	5.61^{c}	3.02^{b}
120-280		3.44^{e}	2.75^{b}	3.04^{c}	3.22^{cd}	3.37^{de}	3.34^{de}

[a]Each treatment mean represents six replications. There were three pigs per replication from 120 to 230 lb and two pigs per replication from 230 to 280 lb.
[bcdef]Means with unlike superscripts differ ($P < .05$).

Table 3. Effect of pST Administration Period and Duration on Carcass Characteristics[a]

	Weight, lb	pST (+) or Placebo (-) Injection					
	120-170	-	+	+	-	-	-
	170-230	-	+	+	-	+	-
	230-250	-	+	-	+	-	-
Characteristic	250-280	-	+	-	+	-	+
Backfat, in							
230 lb		1.40[c]	1.17[b]	1.04[b]	1.39[c]	1.15[b]	1.41[c]
280 lb		1.50[bc]	1.36[b]	1.47[b]	1.45[b]	1.52[bc]	1.73[c]
Longissimus, muscle, in^2							
230 lb		4.36[bd]	5.32[e]	5.45[e]	4.28[bc]	4.97[cde]	4.21[b]
280 lb		5.11[b]	5.97[d]	5.25[bc]	5.89[cd]	5.19[b]	5.05[b]
Percent muscle							
230 lb		50[b]	55[c]	58[d]	51[b]	55[c]	49[b]
280 lb		48[b]	54[e]	50[cd]	52[de]	50[bc]	48[b]
Kidney fat, g							
230 lb		1365[c]	848[b]	772[b]	1322[c]	899[b]	1194[c]
280 lb		2518[e]	1459[b]	1882[c]	1473[b]	1967[cd]	2315[de]
Whole ham weight, lb							
230 lb		19.97	20.45	20.73	20.33	20.35	20.22
280 lb		25.68	25.82	25.67	25.68	25.52	25.05
Trimmed ham weight, lb							
230 lb		15.82[b]	16.90[cde]	17.22[de]	15.88[b]	16.50[bd]	15.95[bc]
280 lb		19.88[bc]	20.65[c]	20.27[bc]	20.62[c]	19.57[bc]	19.17[b]
Ham color score[f]							
230 lb		2.92[bc]	2.42[b]	2.75[bc]	2.67[bc]	2.67[bc]	3.00[c]
280 lb		3.00[bc]	2.92[bc]	3.00[bc]	3.25[c]	2.83[bc]	2.67[b]
Ham firmness score[g]							
230 lb		2.83[b]	2.33[bc]	2.17[c]	2.50[bc]	2.17[c]	2.67[bc]
280 lb		2.80	2.67	2.50	2.58	2.83	2.67
Ham marbling score[h]							
230 lb		2.08[cd]	1.33[b]	1.33[b]	2.00[cd]	1.67[bc]	2.50[d]
280 lb		2.60[d]	1.50[b]	1.67[bc]	2.25[cd]	2.00[bcd]	2.33[cd]

[a]Each treatment mean represents six replications with one pig per replication.
[bcde]Means with unlike superscripts differ ($P < .05$).
[f]Based on a scale with 1 = extremely pale, 3 = uniformly grayish pink, 5 = dark.
[g]Based on a scale with 1 = soft and watery, 3 = moderatley firm and dry, 5 = very firm and dry.
[h]Based on a scale with 1 = trace, 3 = small, 5 = abundant.

Table 4. Effect of pST Administration and Duration on Ham Protein and Fat Accretion Rates[a]

	Weight, lb	PST (+) or Placebo (–) Injection					
	120-170	–	+	+	–	–	–
	170-230	–	+	+	–	+	–
	230-250	–	+	–	+	–	–
Item	250-280	–	+	–	+	–	+
DPA, g							
120-230 lb		9.94[bc]	15.64[e]	16.90[e]	10.23[bd]	12.04[cd]	8.63[b]
120-280 lb		11.56[bc]	15.48[d]	14.43[cd]	13.94[cd]	10.62[b]	9.43[b]
DFA, g							
120-230 lb		15.41[d]	4.51[bc]	1.80[b]	16.91[d]	9.36[c]	17.64[d]
120-280 lb		21.84[d]	9.93[b]	14.06[bc]	11.91[b]	22.85[d]	19.30[cd]

[a]Each treatment mean represents six replications with one pig per replication.
[bcde]Means with unlike superscripts differ ($P < .05$).

Table 5. Effect of pST Administration Period and Duration on Organ Weight[a]

	Weight, lb	pST (+) or Placebo (–) Injection					
	120-170	–	+	+	–	–	–
	170-230	–	+	+	–	–	–
	230-250	–	+	–	+	–	–
Organ	250-280	–	+	–	+	–	+
Heart, g							
230 lb		326	356	377	328	372	333
280 lb		360[b]	421[cd]	405[cd]	392[bd]	355[b]	388[bc]
Liver, g							
230 lb		1542[b]	2124[c]	2110[c]	1751[b]	2059[c]	1592[b]
280 lb		1898[b]	2323[c]	1981[b]	2084[b]	1944[b]	2037[b]
Kidneys, g							
230 lb		375[b]	480[c]	453[c]	361[b]	454[c]	340[b]
280 lb		416[b]	525[c]	464[b]	448[b]	455[b]	453[b]
Lungs, g							
230 lb		752[b]	902[bc]	958[bd]	806[b]	1096[cd]	722[b]
280 lb		847	961	743	1043	867	1059
Spleen, g							
230 lb		148[bc]	187[de]	181[ce]	133[b]	178[cd]	139[b]
280 lb		172	213	203	226	186	188

[a]Each treatment mean represents six replications with one pig per replication.
[bcde]Means with unlike superscripts differ ($P < .05$).