An Economic Analysis of Pork Production in Hoop and Confinement Facilities: A Winter Comparison

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Summary and Implications

The two types of pork grow-finish production facilities compared in this study are hoop and total confinement. Results of this study, which was conducted from September 27, 2000 until February 21, 2001 showed profit to be $9.26 per pig greater for the confinement-raised pigs. This study represents the seventh group of pigs finished at the pig research facilities at the Iowa State University Rhodes Research Farm. The profit difference experienced with this group was the largest experienced to date.

An important issue with this group was that extreme weather conditions prevented marketing the pigs at optimal times. Neither system's pigs could be sold at the proper time because of extreme cold and heavy snow. Moreover, the hoop pigs were placed on feed over a three week period but were all sold on the same day (Table 2) causing a wide range in market weight and a disparagement of premiums. Additionally, the weather was more severe during this trial than with any of the previous trials. The daily highs and lows during December 2000 averaged 15 and 12 degrees, respectively, below the 50-year averages for the area.

The lower fixed cost advantage of the hoops was offset by the significantly higher variable input needs such as feed and bedding. Results of this group point out the importance of management and weather in determining the profit differences between the two systems. Average daily gain and feed efficiency has constantly been lower for the hoop-raised pigs for the winter trials. However, the difference for this trial was much more dramatic. The extreme weather conditions were likely a major contributor. The hoop pigs expended far more energy in keeping warm. This points out the importance of weather in production systems which have limited control on air temperature and flow.

Introduction

This report is part of an ongoing research project that is being conducted at the Iowa State University Rhodes Research Farm. This research is aimed at comparing two swine finishing facility types under a wide range of circumstances. This report provides results from a group of pigs finished during the winter season of 2000-2001. The evolution of the swine industry has forced industry members to reevaluate their operations and utilize an increasing amount of risk management. An unpublished survey conducted in May of 2001 showed that hoop buildings are becoming an increasingly important part of the swine industry. Hoop buildings became widely available in 1995 or 1996 and have grown to represent 4% of the market hogs finished in Iowa.

Materials and Methods

The following is a report that details the seventh group of hogs, which were on test from September 27, 2000 until February 21, 2001 at the Rhodes Research Farm. Results are evaluated by using the actual production numbers while using the average or typical costs for feeder pigs, feed, etc. along with average market hog prices. This allows for comparison of expected costs and returns for normal input costs and hog price conditions. Future reports will examine the risks and efficiency of the use of capital of the two systems. Prior reports have evaluated results for previous groups of hogs raised in the hoop and confinement facilities (1,2).

Results and Discussion

Productivity

Production efficiencies have a large and direct effect on the economics of the operation. Important information would be the percent of pigs marketed, feed efficiency, and average daily gain. The percent of pigs marketed also has a direct effect on the system's returns because the pigs marketed need to cover the entire systems costs. Feed efficiency shown in this report reflects this by using the weight of the marketed animals (at the plant) and the total feed consumed by the group on test. During this trial the hoop facilities marketed more than a full percentage point less hogs with 94.7% of the confinement hogs marketed and 93.68% of the hoop hogs being marketed (Table 1). Feed efficiency was .39 pounds of feed per pound of gain higher for the hoop pigs than for the confinement pigs. Feed efficiency was 3.53 for the hoop pigs and 3.14 for the confinement pigs.
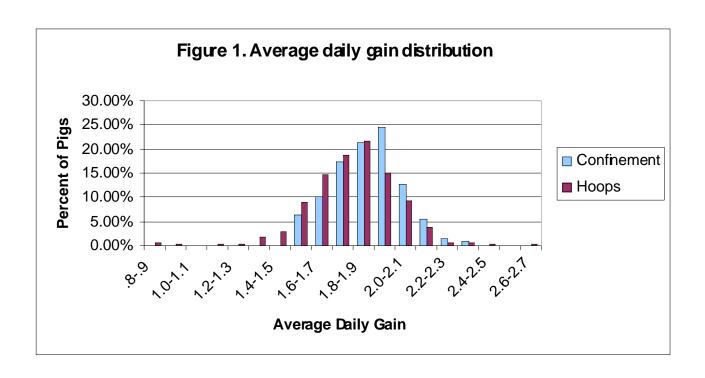
Table 1. Productivity information table.

	Hoop	Confinement	Difference
Total pigs started	459	132	
Start weight	34.7	37.9	-3.17
Culls	9	3	6.00
Cull rate	1.96%	2.27%	-0.31%
Death	20	4	16.00
Death loss %	4.36%	3.03%	1.33%
Average daily gain*	1.71	1.81	-0.10
Total days	57606	15750	
Total feed	348522	89734	
Feed efficiency*	3.53	3.14	0.39
Farm sale weight	275.75	273.53	2.22
Plant sale weight	262.32	263.28	-0.96
Yield	76.60%	76.90%	-0.30%
Hot carcass weight plant	200.93	202.46	-1.53
Average days on feed	134.00	126	8.00
Facility days	142.00	134	8.00
Percent pigs marketed	93.68%	94.70%	-1.02%
Pigs marketed	430	125	

*Using plant sale weight

The hogs fed in the confinement system had an average daily gain that surpassed the hoops by a tenth of a pound a day. The confinement hogs started lighter (3.17 lbs.), were on feed eight fewer days, and finished almost a full pound heavier than the hoop pigs. The confinement pigs also had three tenths of a percent higher yield than the hoops. This resulted in the confinement system marketing 1.53 lbs. of carcass weight more per hog (200.93 vs. 202.46).

The distribution of average daily gains using farm weight is shown in Figure 1. The graph demonstrates that the confinement system has a narrower range and a higher average daily gain. This may be reflected by the stocking pattern, but is also influenced by the weather patterns. The hoop pigs were brought in over a three-week time period and were marketed in one day (Table 2) while the confinement system hogs were started all at the same time and also sold at the same time. However, with this group the confinement system would be able to turn their system eight days sooner than the hoop system or take the pigs to a higher weight in the same time period.

Figure 1. Average daily gain distribution

Table 2. Marketing information.

	Hoop Pigs Marketed	Confinement Pigs Marketed	Hoop Percent Marketed	Confinement Percent Marketed
02/15/01	459		100	
2/21/01		132		100
Total	459	132	100	100

Economic Results

Economic results provide a comparison of costs and returns of the two production systems. Sensitivity tables will provide information showing the impact of changes in selected costs, revenue, or production efficiencies such as feed price, feeder pig price, etc.

Facility costs are budgeted at $180 per pig space for a confinement operation and a $55 per pig space for the hoop system (Table 3). Fixed costs were calculated at 13.2% of the investment for confinement and 16.5% for hoops. The confinement facilities are depreciated over 15 years, whereas the hoops are depreciated over 10 years. Insurance and taxes represent 1.5% of the fixed investment with interest at 10% for both confinement and hoops. The confinement could turn the facilities 2.59 times a year while the hoops could be turned 2.45 times a year.

Fuel, repairs, utilities, vet, medical, marketing and misc. are based on Iowa State University and Midwest Plan Service, Livestock Enterprise Budgets. Bedding for this group was 336 lbs. per hog marketed with a cost of $20 per 1,200 lbs. Labor was valued at $10.00 per hour with .2 hours per head in the confinement and .27 hours per head for the hoop hogs. Feed prices were set at $.06 per pound, which is a typical average price with grind, mix, and delivery included. All the feed used was applied only to the pigs that were marketed.

Feeder pigs as well as market hog prices were calculated using a rounded average price from the 1990 to 1999 time period. The feeder pig prices then take into account costs from dead or culled pigs as well as a 10% interest rate that is charged against all expenses except labor and marketing costs. Market hog prices were switched to carcass weight basis in order to take into account the yield differences and lean premiums. The yield premiums for the

confinement pigs was .3% and the lean premium was $.46 per carcass hundred weight based on sales to Excel. The lean and yield premiums for the hoop system was based upon the hogs in the second hoop building. These hogs reflected a marketing weight, which was close to the confinement pigs' sales weight. This was necessary since one hoop building had much higher weight than the confinement pigs and another had a much lower weight due to the length of each group on feed. It should be noted that the lean premiums would vary depending upon the packer that is used. The revenue from the culled hogs was estimated as half the revenue from a marketed hog per cwt. live weight.

The result of the trial is that, for this winter group, there is a total difference in net revenue of $9.26 per hog marketed with a net cost difference of $7.41 per hog marketed in favor of the confinement system (Table 3). This is due to a $12.35 reduction in operating costs, and a -$.15 difference in cull pig revenue overcoming higher fixed costs of $5.09 per pig. Operating costs represented the largest difference with bedding or feed costs differences alone offsetting the lower fixed costs. The total bedding for the hoop system saw its highest total to date with almost a $6.00 cost per pig. This in part can be attributed to the difference in weather conditions; the winter was quite severe. The confinement system received an additional $1.85 in revenue per pig. The revenue was calculated by using the carcass weight of the average pig for each facility type on trial and multiplying it by the average value per carcass weight received from 1990 to 1999, $60 (rounded to the nearest dollar). The confinement system also had a $.46 per carcass hundred pounds added value due to the lean premium advantage over the hoop system.

Tables 3. Group seven swine grow finish production budget.

Item	Hoop	Confinement	Difference
Facility Investment			
Building (per pig space)	$55.00	$180.00	-125
Feed & manure handling	$36.00	$36.00	0
Total initial investment	$91.00	$216.00	-125
2.6 Turns/Year final day out + 8 days	2.45	2.59	-0.14
Total initial investment per turn	$37.15	$83.44	-$46.29
Fixed Cost			
Percent interest taxes, depreciation, insurance	16.5%	13.2%	
Facility cost per hog marketed	$6.54	$11.63	-$5.09
Fixed cost per CWT marketed	$2.49	$4.42	-$1.92
Operating costs			
Feeder pigs	$38.00	$38.00	$0.00
Feeder pig death loss	$2.56	$2.13	$0.43
Interest on feeder pig	$1.35	$1.27	$0.09
Fuel repairs utilities	$1.07	$1.06	$0.01
Bedding	$5.98	$0.00	$5.98
Feed ($.06/LB)	$48.65	$43.07	$5.58
Vet/Med.	$1.60	$1.58	$0.02
Interest on mixed costs	$1.02	$0.80	$0.22
Labor	$1.50	$1.50	$0.00
Marketing costs	$2.88	$2.85	$0.03
Total operating cost	$104.61	$92.26	$12.35
Operating costs/ CWT marketed	$40.89	$35.04	$5.84
Total cost (per pig marketed)	$111.16	$103.90	$7.26
Total cost per CWT*	$42.38	$39.46	$2.91
Revenue from cull pigs per head	$1.00	$1.15	-$0.15
Net cost (per pig marketed)	$110.15	$102.74	$7.41
Net cost pr CWT*	$43.00	$39.02	$3.97
Lean premium difference (per hot CWT)		$.46	-$.46
Revenue from $60 per hundred carcass weight**	$120.56	$122.41	-$1.85
Net revenue per hog marketed	$10.41	$19.66	-$9.26

* Uses Plant Sale Weight
** Confinement revenue includes the $.46 per CWT Premium as well as the yield premium.

Economic Effects of Production Efficiency

As shown in Table 1 there were production efficiency differences between the two systems. The following sensitivity tables will focus upon feed efficiency and average daily gain, which is shown by the market weight. However, it does not perfectly reflect ADG due to differences in starting weight and days on feed.

Tables 4 and 5 are most effectively used to measure the effects of varied average daily gain, feed costs, and feed efficiency. Table 4 provides the total pounds of feed needed for selected marketing weights and feed efficiencies. The starting feeder pig weight was based upon 35 lb. feeder pigs.

By using the total pounds of feed, shown in Table 4, Table 5 can be used to determine the total feed costs under different feed prices, feed efficiencies, and market weights. For example, producing a 275 lb. pig at a 3.5 feed efficiency would require 840 lbs. of feed. By rounding the feed to 850 lbs. you can determine the effects of feed price on total feed costs. If the feed price is $.05, the total feed costs would be roughly $42.50. However, at $.07 it would be $59.50 or a $17 increase.

Table 4. Sensitivity of total pounds of feed needed by feed efficiency and market weight.

Feed Efficiency	Market Weight							
	235	245	255	265	275	285	295	305
2.9	580	609	638	667	696	725	754	783
3.0	600	630	660	690	720	750	780	810
3.1	620	651	682	713	744	775	806	837
3.2	640	672	704	736	768	800	832	864
3.3	660	693	726	759	792	825	858	891
3.4	680	714	748	782	816	850	884	918
3.5	700	735	770	805	840	875	910	945
3.6	720	756	792	828	864	900	936	972

Based on a 35 # Feeder Pig

Table 5. Sensitivity of the total feed cost by pounds of feed and feed price.

Feed Price	Pounds of Feed									
	650	675	700	725	750	775	800	825	850	875
$0.0450	$29.25	$30.38	$31.50	$32.63	$33.75	$34.88	$36.00	$37.13	$38.25	$39.38
$0.0475	$30.88	$32.06	$33.25	$34.44	$35.63	$36.81	$38.00	$39.19	$40.38	$41.56
$0.0500	$32.50	$33.75	$35.00	$36.25	$37.50	$38.75	$40.00	$41.25	$42.50	$43.75
$0.0525	$34.13	$35.44	$36.75	$38.06	$39.38	$40.69	$42.00	$43.31	$44.63	$45.94
$0.0550	$35.75	$37.13	$38.50	$39.88	$41.25	$42.63	$44.00	$45.38	$46.75	$48.13
$0.0575	$37.38	$38.81	$40.25	$41.69	$43.13	$44.56	$46.00	$47.44	$48.88	$50.31
$0.0600	$39.00	$40.50	$42.00	$43.50	$45.00	$46.50	$48.00	$49.50	$51.00	$52.50
$0.0625	$40.63	$42.19	$43.75	$45.31	$46.88	$48.44	$50.00	$51.56	$53.13	$54.69
$0.0650	$42.25	$43.88	$45.50	$47.13	$48.75	$50.38	$52.00	$53.63	$55.25	$56.88
$0.0675	$43.88	$45.56	$47.25	$48.94	$50.63	$52.31	$54.00	$55.69	$57.38	$59.06
$0.0700	$45.50	$47.25	$49.00	$50.75	$52.50	$54.25	$56.00	$57.75	$59.50	$61.25
$0.0725	$47.13	$48.94	$50.75	$52.56	$54.38	$56.19	$58.00	$59.81	$61.63	$63.44
$0.0750	$48.75	$50.63	$52.50	$54.38	$56.25	$58.13	$60.00	$61.88	$63.75	$65.63

Table 6 demonstrates the effects on feed cost per hundred weight gain for selected feed efficiencies and weights. The table is based on a $.06 cost per pound of feed at different market hog weights and feed efficiencies. It provides information on how the weight and feed efficiency affects the feed cost of gain. With a feed cost of six cents a drop in feed efficiency of .1 pounds would reduce the break-even production cost by $.52-$.54. However, there is a trade off here, as a reduction of sale weight can increase other costs as far as the breakeven price is concerned.

Table 6. Sensitivity of the feed cost per cwt. by feed efficiency and market weight.

Feed Efficiency	Market Weight							
	235	245	255	265	275	285	295	305
2.9	$14.81	$14.91	$15.01	$15.10	$15.19	$15.26	$15.34	$15.40
3	$15.32	$15.43	$15.53	$15.62	$15.71	$15.79	$15.86	$15.93
3.1	$15.83	$15.94	$16.05	$16.14	$16.23	$16.32	$16.39	$16.47
3.2	$16.34	$16.46	$16.56	$16.66	$16.76	$16.84	$16.92	$17.00
3.3	$16.85	$16.97	$17.08	$17.18	$17.28	$17.37	$17.45	$17.53
3.4	$17.36	$17.49	$17.60	$17.71	$17.80	$17.89	$17.98	$18.06
3.5	$17.87	$18.00	$18.12	$18.23	$18.33	$18.42	$18.51	$18.59
3.6	$18.38	$18.51	$18.64	$18.75	$18.85	$18.95	$19.04	$19.12

Market weights can have a significant effect on the comparison of systems. Table 7 demonstrates the effects on the breakeven market weight vs. various total fixed costs. With this approach the effects of spreading fixed costs across heavier market weights can be examined. For example, with a $12 fixed cost, such as the level of the confinement system, and a 245-pound market weight there is a fixed cost expense of $4.90 per cwt. but with a 275-pound market hog there is a fixed cost of $4.36 per cwt. or a difference of $0.54. For hoop raised hogs, the same weight comparison and fixed costs of $6.00 there would be a fixed cost difference of $.27. This amplifies the sensitivity of the

confinement system to average daily gain and adds risk to the operation where marketing is controlled by pig flow or the need for space for incoming pigs.

Table 7. Sensitivity of fixed costs per cwt. by market weight and fixed costs.

Fixed Cost/Hog	Market Weight							
	235	245	255	265	275	285	295	305
5	$2.13	$2.04	$1.96	$1.89	$1.82	$1.75	$1.69	$1.64
5.5	$2.34	$2.24	$2.16	$2.08	$2.00	$1.93	$1.86	$1.80
6	$2.55	$2.45	$2.35	$2.26	$2.18	$2.11	$2.03	$1.97
6.5	$2.77	$2.65	$2.55	$2.45	$2.36	$2.28	$2.20	$2.13
7	$2.98	$2.86	$2.75	$2.64	$2.55	$2.46	$2.37	$2.30
7.5	$3.19	$3.06	$2.94	$2.83	$2.73	$2.63	$2.54	$2.46
8	$3.40	$3.27	$3.14	$3.02	$2.91	$2.81	$2.71	$2.62
8.5	$3.62	$3.47	$3.33	$3.21	$3.09	$2.98	$2.88	$2.79
9	$3.83	$3.67	$3.53	$3.40	$3.27	$3.16	$3.05	$2.95
9.5	$4.04	$3.88	$3.73	$3.58	$3.45	$3.33	$3.22	$3.11
10	$4.26	$4.08	$3.92	$3.77	$3.64	$3.51	$3.39	$3.28
10.5	$4.47	$4.29	$4.12	$3.96	$3.82	$3.68	$3.56	$3.44
11	$4.68	$4.49	$4.31	$4.15	$4.00	$3.86	$3.73	$3.61
11.5	$4.89	$4.69	$4.51	$4.34	$4.18	$4.04	$3.90	$3.77
12	$5.11	$4.90	$4.71	$4.53	$4.36	$4.21	$4.07	$3.93
12.5	$5.32	$5.10	$4.90	$4.72	$4.55	$4.39	$4.24	$4.10
13	$5.53	$5.31	$5.10	$4.91	$4.73	$4.56	$4.41	$4.26

Based on $.06 per pound of feed

Although feeder pig prices are not considered fixed costs they are a sunk costs after purchase. They again reflect an increase in sensitivity at higher prices, which increases the risk of poor performance. For example, with a 275 lb. finished hog and a $35 feeder pig, $12.73 per cwt. is needed in order to cover the cost of the feeder pig. If the finished weight were decreased by just 10 lbs. to 265 then it would require an additional $.52 per hundred pounds of sale weight in order to break even against the cost of the feeder pig. Selling at heavier weights spread the cost of the feeder pig over more pounds.

Table 8. Market hog price needed to cover feeder pig purchase cost.

Feeder Pig Cost	Market Weight							
	235	245	255	265	275	285	295	305
$20	$8.51	$8.16	$7.84	$7.55	$7.27	$7.02	$6.78	$6.56
$25	$10.64	$10.20	$9.80	$9.43	$9.09	$8.77	$8.47	$8.20
$30	$12.77	$12.24	$11.76	$11.32	$10.91	$10.53	$10.17	$9.84
$35	$14.89	$14.29	$13.73	$13.21	$12.73	$12.28	$11.86	$11.48
$40	$17.02	$16.33	$15.69	$15.09	$14.55	$14.04	$13.56	$13.11
$45	$19.15	$18.37	$17.65	$16.98	$16.36	$15.79	$15.25	$14.75
$50	$21.28	$20.41	$19.61	$18.87	$18.18	$17.54	$16.95	$16.39
$55	$23.40	$22.45	$21.57	$20.75	$20.00	$19.30	$18.64	$18.03
$60	$25.53	$24.49	$23.53	$22.64	$21.82	$21.05	$20.34	$19.67
$65	$27.66	$26.53	$25.49	$24.53	$23.64	$22.81	$22.03	$21.31
$70	$29.79	$28.57	$27.45	$26.42	$25.45	$24.56	$23.73	$22.95
$75	$31.91	$30.61	$29.41	$28.30	$27.27	$26.32	$25.42	$24.59

Tables 9 and 10 demonstrate the effects of the revenue differences at selected market weights and prices. Since the two groups could be marketed at different weights they are shown in different tables. Table 9 is the revenue received from pigs in the hoop buildings using the yield from the trial and the selected carcass weights.

Table 9. Hoop revenue per hog by using carcass price per hundred pounds and market weight.

Price per Carcass Weight	235	245	255	265	275	285	295	305	315
				Market Weight					
$25	$45.00	$46.92	$48.83	$50.75	$52.67	$54.58	$56.50	$58.41	$60.33
$30	$54.01	$56.30	$58.60	$60.90	$63.20	$65.50	$67.79	$70.09	$72.39
$35	$63.01	$65.69	$68.37	$71.05	$73.73	$76.41	$79.09	$81.77	$84.46
$40	$72.01	$75.07	$78.14	$81.20	$84.26	$87.33	$90.39	$93.46	$96.52
$45	$81.01	$84.46	$87.90	$91.35	$94.80	$98.24	$101.69	$105.14	$108.59
$50	$90.01	$93.84	$97.67	$101.50	$105.33	$109.16	$112.99	$116.82	$120.65
$55	$99.01	$103.22	$107.44	$111.65	$115.86	$120.08	$124.29	$128.50	$132.72
$60	$108.01	$112.61	$117.20	$121.80	$126.40	$130.99	$135.59	$140.18	$144.78
$65	$117.01	$121.99	$126.97	$131.95	$136.93	$141.91	$146.89	$151.87	$156.85
$70	$126.01	$131.38	$136.74	$142.10	$147.46	$152.82	$158.19	$163.55	$168.91
$75	$135.01	$140.76	$146.50	$152.25	$158.00	$163.74	$169.49	$175.23	$180.98
$80	$144.02	$150.14	$156.27	$162.40	$168.53	$174.66	$180.78	$186.91	$193.04

Table 10 also uses yield values from the trial but also includes the lean premium difference which was $.46 per carcass hundred weight (confinement vs. hoop). The difference in revenue reflects the effects of the lean and yield difference. This difference varies by $5. There is roughly a $.04 difference in revenue between the two systems. For every increase of 10 lbs. of market weight there is a $.05-$.06 increase in revenue of the confinement over the hoops. For example, a 275-pound hog at $60/cwt receives $126.40 for the hoop system and $127.85 for the confinement, a difference of $1.45. If the weight is increased to 285 the systems earn $130.99 and $132.50, a difference of $1.51.

Table 10. Confinement revenue per hog by using carcass price per hundred pounds and market weight.

Price per Carcass Weight	235	245	255	265	275	285	295	305	315
				Market Weight					
$25	$46.01	$47.97	$49.92	$51.88	$53.84	$55.80	$57.76	$59.71	$61.67
$30	$55.04	$57.39	$59.73	$62.07	$64.41	$66.76	$69.10	$71.44	$73.78
$35	$64.08	$66.81	$69.53	$72.26	$74.99	$77.71	$80.44	$83.17	$85.89
$40	$73.12	$76.23	$79.34	$82.45	$85.56	$88.67	$91.78	$94.89	$98.01
$45	$82.15	$85.65	$89.14	$92.64	$96.13	$99.63	$103.13	$106.62	$110.12
$50	$91.19	$95.07	$98.95	$102.83	$106.71	$110.59	$114.47	$118.35	$122.23
$55	$100.22	$104.49	$108.75	$113.02	$117.28	$121.55	$125.81	$130.08	$134.34
$60	$109.26	$113.91	$118.56	$123.21	$127.85	$132.50	$137.15	$141.80	$146.45
$65	$118.29	$123.33	$128.36	$133.39	$138.43	$143.46	$148.50	$153.53	$158.56
$70	$127.33	$132.75	$138.17	$143.58	$149.00	$154.42	$159.84	$165.26	$170.67
$75	$136.36	$142.17	$147.97	$153.77	$159.58	$165.38	$171.18	$176.98	$182.79
$80	$145.40	$151.59	$157.77	$163.96	$170.15	$176.34	$182.52	$188.71	$194.90