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An Economic Analysis of Swine Rearing Systems For North Dakota

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Abstract

Growing-finishing pig performance and the extent to which growth performance and carcass characteristics are altered by housing type was documented using barley-field pea, 3-phase diets when pigs were grown to 260 pounds in outdoor pens (OP), hoop buildings (HC), and conventional confinement (CC) facilities. Pigs used across treatments were raised from matings between PIC C-22 females and PIC Line 356 boars. Compared to (HC) reared pigs, pigs grown in (CC) grew faster (P<.05), consumed less feed (P<.001), and, although not significant, tended to be more feed efficient. Feed cost per pound of gain did not differ and was nearly equal between the three rearing systems.

Carcass weight in the (CC) treatment was lighter (P<.05) due to transportation scheduling problems, and therefore, was used as a co-variate to adjust for the observed difference. Carcass loin depth and percent lean values did not differ between rearing systems. Percent yield was greater (P<.05) among pigs reared in either the (HC) or (CC) systems when compared to the (OP) production system. Fat depth was lowest (P<.10) and fat free lean index highest (P<.10) among pigs reared in (CC).

Economically, after premiums and discounts were applied total carcass value was greater (P<.10) among pigs reared in the (CC) system. Combining a trend toward greater loin depth among (CC) reared pigs with lower fat depth resulted in carcass lean premiums that were 15.5% higher than premiums observed for the (OP) and (HC) treatments.

Based on production and carcass data collected in this study, a rearing systems enterprise analysis was conducted to estimate net return per pig from each system. Parameters used in the evaluation included turns/year, facility investment, fixed costs, operating costs, and total carcass value after premiums and discounts were applied. Net return per pig for each system was determined after the total cost per pig marketed was deducted from the total carcass value received. Accounting for all business parameters, rearing in the hoop structures returned the greatest net return per pig. Compared to the (CC) system, (HC) and (OP) reared pigs returned 6.63% and 4.07% more net

income, respectively. When the systems are compared to a 1,000 head finishing floor, five 200 - 220 head hoop structures would generate an estimated $6,160.00 more net return than the (CC) system. In the model, an outdoor penning system has the potential to enhance net return by $3,780.00. This added revenue would likely be dedicated to servicing debt rather than facility expansion.

Introduction

Housing systems for confinement rearing of growing-finishing pigs are expensive. North Dakota pork producers want to finish pigs but they and their lenders are apprehensive about investing in permanent, special purpose, structures that cost upwards of $180/finished pig space. Hoop-type, low-input structures with a one-time capacity ranging from 200-220 pigs are very appealing since they can be built for approximately 1/3 the cost of conventional buildings, are easily converted to other uses, can be dismantled and moved, and are environmentally friendly. Economic analysis comparing conventional and hoop-type rearing systems does not exist for North Dakota, but is essential if lenders are going to be comfortable loaning long-term capital for erection of these unconventional structures.

A rearing system that will allow producers to lower input costs, while producing quality pork in an environmentally acceptable manner is important to survival of the swine industry on family farms in North Dakota. This rearing systems research, requested by family-farm size pork producers and members of the ND Pork Producers Council, and funded by the ND Agricultural Products Utilization Commission, has the potential to help producers revolutionize the way they raise market hogs, reversing the state's declining hog population. Finishing hogs is economically sound, considering their sustainable value-added potential when utilizing ND's extensive supply of crops and by-products. This research will contribute to livestock sustainability by encouraging the expansion of market hog finishing in North Dakota using hoop buildings and deep bedding.

Moreover, successful adoption of hoop-type rearing systems in ND will contribute to distribution of swine waste over a greater land surface area, reducing potential contamination of surface and groundwater supplies. Compared to liquid manure, manure from deep bedding composted before field application is less prone to leach or runoff. Deep bedding also reduces the offensive odor associated with liquid manure.

Long-term return on investment of 11.8% from hog production in Missouri, over the 20 year period from 1977 to 1996, clearly demonstrates that hogs can be a profitable enterprise. Data from this investigation suggesting that hoop structures are an economically viable rearing system will facilitate increased hog production in North Dakota that will stimulate business activity. Increasing the number of hogs produced in the state will multiply business activity intensively within the agricultural sector, and extensively within the non-agricultural business sector that indirectly provides goods and services to the industry. North Dakota has lost hog production of approximately 100,000 head. Regaining this lost output will recover an estimated $9.6 million dollars of business activity.

Our research team hypothesizes that adopting hoop buildings will not only lower facility acquisition and fixed costs, but will be environmentally acceptable as well. Objectives for the project are as follows:

Objectives

1. Evaluate growth performance, feed efficiency and carcass traits of growing-finishing pigs reared in outdoor open lots, in low-input hoop buildings and in conventional confinement facilities.

2. Monitor and establish environmental database relative to the pig living space and correlate to pig growth in hoop and conventional growing-finishing rearing systems.

3. Prepare enterprise analysis of hoop and conventional grow-finish rearing systems.

4. Incorporate growth, carcass, and economic data into the NDSU Hog Finishing Model, and conduct educational seminars to present results of rearing system analysis to existing and potential pork producers and North Dakota's agricultural lenders.

Materials and Methods

Growing-finishing pig performance and the extent to which growth and carcass performance is altered by housing type was documented using barley-field pea, 3-phase, growing-finishing diets. The housing types compared included outdoor lots, hoop-type, and conventional confinement. The outdoor lot and hoop rearing treatments were conducted at the Dickinson Research Extension Center, and the conventional confinement treatment was conducted at the Willard Dill Farm, New England, ND.

Pigs used in the experiment were produced at the DREC swine unit and transferred to the respective rearing systems. Pig Improvement Company (PIC) pigs were used in the experiment and originated from matings between PIC line 356 boars and line C-22 females.

The hoop building treatment, designed for total one-time finished hog capacity of 150 pigs/turn, was subdivided lengthwise to provide for replication, deep small-grain straw bedding was used and cleaned out between each group of All In/All Out pigs. Manure removed was composted and later applied to crop land. The conventional confinement facility used was not managed as an All In/All Out facility, however, pens were cleaned between groups.

Barley-based diets supplemented with field peas, as shown in Table 1, were prepared at the DREC using a New Holland Model 855 grinder-mixer, and were formulated to meet or exceed NRC (1998) recommendations for each growth phase of a 4-phase feeding regimen. Vitamins and micro-minerals were also added to meet or exceed NRC (1998) recommendations for each growth phase. Lysine and methionine deficiencies were met using crystalline product in each experimental diet. The meal-type diets were prepared with mean particle sizes ranging from 700 - 900 microns.

PIC feeder pigs ranging in starting weight from 60 to 73 pounds were fed to an end point of approximately 260 pounds and transported to John Morrell Packing Company, Sioux Falls, SD, where carcass measurements were obtained from Fat-O-Meter readings taken by plant personnel. Measurements for growth and carcass characteristics are shown in Table 2.

Growth performance data, carcass lean premiums and discounts, carcass yield premiums and discounts, and sort margins were used to develop an economic comparison of the three swine growing-finishing rearing systems.

The data was analyzed using Proc. GLM procedure of SAS (SAS, 1996). Hot carcass weight differed significantly in an initial analysis, and, therefore, was used as a co-variate to adjust carcass measurements across treatments.

Results and Discussion

Growth Performance

Initial starting weight, and subsequently, the number of days on feed, were similar for the hoop and outdoor pen treatments, however the starting weight for pigs assigned to the conventional confinement group were 13 pounds heavier because the confinement treatment could not be started until the project's commercial cooperator emptied and pressure washed pens. The heavier starting weight also contributed to less total weight gain among the confinement reared pigs. Compared to hoop reared pigs, pigs grown in confinement grew faster ($P<.05$), consumed less feed ($P<.001$), and tended to be more efficient than the other rearing systems. Feed cost per pound of gain did not differ and was nearly equal across treatments.

Carcass Characteristics

Hot carcass weight was lighter ($P<.05$) for pigs reared in confinement. This occurred when transportation arrangements in western North Dakota to the plant in Sioux Falls, SD necessitated terminating the confinement treatment approximately 2 weeks earlier than previously scheduled. As a result, carcass weight was used as a covariate in the analysis to adjust for the observed difference in carcass weight. After the adjustment, carcass loin depth and percent lean values did not differ between rearing systems. Percent yield was significantly greater ($P<.05$) among pigs reared in either the hoop or conventional confinement treatments compared to the outdoor pens. Fat depth was lowest ($P<.10$) and fat free lean index highest ($P<.10$) among pigs reared in conventional confinement. By contrast, pigs reared in the hoop system had greater fat depth ($P<.10$) and the lowest fat free lean index ($P<10$). Pigs reared in the outdoor pen environment were intermediate.

Carcass Economics

Initial base market price before any premiums or discounts were taken favored carcasses from pigs reared in the outdoor pen system of management. However, after premiums and discounts were applied total carcass value was greater ($P<.10$) among pigs reared in the conventional confinement system. Due to a lower fat depth and subsequent higher fat free lean index, carcass lean premium was 15.5% greater in confinement. Yield margin for confinement pigs was substantially lower than that of pigs reared in outdoor pens ($P<.05$) and similar to that of pigs reared in the hoop.

Rearing System Enterprise Analysis

Based on the production and carcass information summarized in Table 2, a rearing systems enterprise analysis was conducted to estimate net return per pig from each system. The analysis was completed using an Excel® spreadsheet which is downloadable from the Dickinson Research Extension Center's web page, and is shown at the end of this report. Parameters used in the evaluation included turns/year, facility investment, fixed costs, operating costs, total carcass value after premiums and discounts were applied, and net return per pig for each system after total cost per pig marketed was deducted from the total carcass value received. Considering the parameters used in the analysis, pigs reared in the hoop system returned the greatest net return per pig of $33.19 compared to $31.84 and $30.99 for conventional confinement. Expressed as a percentage, and compared to the conventional confinement system, hoop reared pigs returned 6.63% greater revenue, and when the conventional confinement system is compared to the outdoor lots, the net return per pig was 4.07% greater.

When these data are compared at commercial production levels, i.e., a 1,000 head conventional confinement finishing floor, hoop rearing in five 200 - 220 head hoop structures would generate an estimated $6,160.00 more net return than the conventional confinement system. This analysis assumes the added revenue would be dedicated to servicing debt rather than facility expansion. When the added net return observed for the outside pen system is expanded and contrasted with the conventional confinement system, an additional $3,780.00 would be available to service debt.

Table 1. Rearing Systems 4-Phase Diets.

Phases:	**Phase 1 (56 - 80)**	**Phase 2 (81 - 140)**	**Phase 3 (141 - 195)**	**Phase 4 (196 - 245)**
Ingredients:				
Barley	62.2	62.4	69.6	74.7
Peas	35.0	35.0	28.0	23.0
Dical Phos.	1.0	.85	.75	.65
Limestone	.85	.85	.75	.75
Lysine	.25	.08	.12	.15
Methionine	.28	.20	.12	.09
TM Salt	.30	.30	.30	.30
Vitamin/Mineral Premix	.15	.15	.15	.15
Tylan 40 Medication	0.0	.20	.20	.20
Analysis:				
Crude Protein	15.5	15.3	14.8	14.5

Lysine	.98	.85	.80	.77
Tryptophan	.18	.18	.18	.17
Meth + Cystine	.58	.51	.45	.43
Phosphorus, Total	.55	.52	.50	.48
Phosphorus, Avail.	.29	.26	.24	.23
Lysine: Energy Ratio (g/Mcal ME)	3.20	2.74	2.61	2.51

Table 2. Growth Performance and Carcass Characteristics Among Pigs Reared in Conventional Confinement, Hoop Buildings, and Outdoor Lots.

System	Hoop	Confinement	Outdoor Pens	P-Value
Growth Performance:				
Days Fed	115[a]	88[b]	120[a]	.004
Gain, lbs.	210[a]	172[b]	229[a]	.0034
ADG, lbs.	1.82[b]	1.95[a]	1.91[a]	.038
Feed/Head, lbs.	682[a]	535[b]	732[a]	.0007
Feed/Head/Day, lbs.	5.93	6.07	6.09	.652 NS
Feed:Gain, lbs.	3.25	3.10	3.19	.537 NS
Feed Cost:Gain, $	.146	.143	.144	.775 NS
Carcass Characteristics:				
Hot Carcass Wt., lbs.	186[a]	175[b]	184[a]	.020
% Yield	74.2[a]	73.5[a]	70.6[b]	.019
% Lean	53.7	54.9	52.7	.125 NS
Loin Depth	2.06	2.10	2.06	.254 NS
Fat Depth, In.	.73[a]	.66[b]	.71[ab]	.060

Fat Free Lean Index	48.9[a]	49.8[b]	49.2[ab]	.062
Carcass Economics:				
Base Market Price, $	116.86[a]	117.86[a]	122.32[b]	.018
Lean Premium Factor, $	2.94[a]	3.60[b]	3.01[a]	.024
Lean Premium, $	5.24[a]	6.39[b]	5.56[a]	.025
Yield Margin, $	(3.41)[a]	(4.38)[a]	(9.41)[b]	.018
Sort Margin, $	(.34)[a]	.02[b]	(.73)[c]	.025
Total Carcass Value, $	118.34	119.90	117.74	.075

[ab]Values with unlike superscripts differ (P<.05), and (P<.10).

Click Here for Comparison of Swine Rearing Systems in Microsoft Excel® format.

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