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Justin Cech
University of Nebraska at Lincoln, jcech@huskers.unl.edu

Darrell Mark
University of Nebraska - Lincoln, dmark2@unl.edu

Rodger Johnson
University of Nebraska - Lincoln, rjohnson5@unl.edu

Philip S. Miller
University of Nebraska - Lincoln, pmiller1@unl.edu

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Justin D. Cech
Darrell R. Mark
Rodger K. Johnson
Phillip S. Miller[1]

Summary

This report evaluates the economic costs of production and profits for energy-restricted and conventional gilt development programs. Production and performance data and input and output prices were used to construct enterprise budgets for both groups. Results indicate that restricting feed intake during gilt development lowered breakeven selling prices for market pigs by an average of $0.17/cwt for two prolific maternal lines through their first four parities.

Introduction

The traditional method of developing breeding gilts is to provide feed on an ad libitum basis until they are bred. The conventional reasoning behind self-regulation of feed intake is to allow gilts to grow as fast as possible to hasten the onset of puberty because more mature animals typically have a greater likelihood of successful conception; thus, this method has been viewed as both production and profit enhancing. However, body weight has not been conclusively shown to affect age at puberty. Kirchgessner et al. (1984) reported that reducing energy intake to 70 to 75% of ad libitum intake did not affect age of first estrus, while Le Cozler et al. (1998) reported that gilts fed to 80% of full intake had a later first-detected estrus than gilts fed to appetite. However, in the Le Cozler study, age of service was not different between control and energy-restricted gilts. Additionally, this conventional process may result in an increased probability of overweight gilts and, therefore, the possibility for lower production due to breeding difficulties. Increased body weights could also cause mobility problems later in life, leading to increased culling rates or even death losses, both of which can negatively affect profits.

In a multiyear study, Johnson et al. (*2005-2008 Nebraska Swine Reports*) focused on reducing these production inefficiencies by restricting energy intake to 75% of ad libitum for two prolific maternal lines of gilts from 123 to approximately 226 days of age. This restricted energy development program should result in less feed and feed expense compared to conventionally developed gilts, but it also may lead to more late maturing gilts that have to be culled, thus increasing overall development costs. Therefore, economic differences between conventional and restricted energy development programs are not clear. This project develops an enterprise budget for each development program to determine the relative profitability of each system over four parities.

Materials and Methods

An enterprise budget was created to estimate revenue and costs using production data from the Johnson et al. studies. The unit of measurement for the budget was an individual sow and the budget was organized into three main sections: gilt development, nursery and market pig production for the first four parities, and an output page summarizing the revenues and costs for the sow and her market pigs throughout their lifetime. Included in the development section are production parameters (e.g., average daily gain, feed intake, initial weight, ending weight, days spent in the development program, etc.), cull credits, building and equipment costs, interest, veterinary expense, utilities, labor, and ration composition. The nursery and market pig production section includes production parameters similar to those in the development section (e.g., average daily gain, feed intake, etc.), but also includes 3 sow and 12 market pig feed rations, sow and market-pig cull credits, fixed costs for both the breeding sow and her offspring, interest cost, income, fixed costs, and additional variable costs (Table 1). Parity-specific results are then reported in the form of breakeven selling price for progeny and in total profit/loss. In the summary section of the budget, all costs and credits are summed and results are reported both as total profit/loss earned per sow for each treatment and in the form of breakeven selling price of market pigs by treatment.

The maternal lines used in the study were Large White-Landrace (LWxLR) and Nebraska Line 45 cross (L45X) described in the previous report (Johnson et al. 2010). The LWxLR and L45X gilts were half-sibling as they were produced by dams that were artificially inseminated with semen of the same industry maternal line boars. Production records including number of pigs weaned, weaning weights, lactation feed intake, etc. through four parities were kept for each sow. These production data, along with input and output prices and other production assumptions, were used to construct the budgets. Feed costs were calculated using typical ration compositions based on NRC requirements and 2004-06 historical average prices were used for input and output prices (Table 1). Fixed costs,

Table 1. Input and output prices per unit.[1]

Item	Price per Unit	Unit	Type of Expense	Cost per Pig	Cost per Litter
Market Swine Selling Price[2]	$0.43	/lb	Veterinary and Health Cost	$4.72	
Corn	$2.14	/bu	Utilities	$1.57	
Soybean Meal	$200.08	/ton	Marketing and Transportation Costs	$1.68	
Tallow	$0.29	/lb	Other Misc. Costs		$10.00
Dicalcium Phosphate	$0.22	/lb	Labor		$62.28
Limestone	$0.02	/lb	Annual Fixed Costs (per pig-space)	$18.24	
Salt	$0.07	/lb	Annual Fixed Costs (per sow-space)		$79.30
			Breeding Costs		$20.00

[1]Prices from 2004-06.
[2]Liveweight basis.

Table 2. Event probabilities for two prolific maternal lines.

	Line			
	LWxLR		L45X	
Outcome	Ad Libitum	Restricted	Ad Libitum	Restricted
Parity 1 Litter	0.7714	0.7910	0.8695	0.8152
Parity 2 Litter	0.4581	0.5298	0.4846	0.5477
Parity 3 Litter	0.3848	0.4140	0.3841	0.4697
Parity 4 Litter	0.2888	0.3265	0.3242	0.3610

Table 3. Revenue and cost of production for two prolific maternal lines.

	Line					
	LWxLR			L45X		
Item	Ad Libitum	Restricted	Difference[1]	Ad Libitum	Restricted	Difference[1]
Total cwts Produced (per sow)[2]	46.41	51.35	4.94	49.84	52.81	2.97
Revenue (per sow)	$2,008.75	$2,222.51	$213.76	$2,157.25	$2,286.02	$128.77
Gilt Production (per gilt)						
Variable Costs	$123.59	$115.11	($8.48)	$120.29	$113.08	($7.21)
Fixed Costs	$6.91	$7.67	$0.76	$6.46	$7.02	$0.56
Total Costs	$130.50	$122.78	($7.72)	$126.75	$120.09	($6.66)
Market Swine (per litter through 4 parities)						
Variable Costs	$1,411.31	$1,566.71	$155.40	$1,526.61	$1,628.85	$102.24
Fixed Costs	$253.64	$280.63	$26.99	$272.39	$288.65	$16.26
Total Costs	$1,664.95	$1,847.34	$182.39	$1,799.00	$1,917.50	$118.50
Total Cost (per sow)	$1,795.45	$1,970.12	$174.67	$1,925.75	$2,037.59	$111.84
Profit/Loss (per sow)	$213.30	$252.39	$39.10	$231.49	$248.43	$16.93
Breakeven Selling Price (per cwt)[2]	$38.69	$38.37	($0.32)	$38.64	$38.58	($0.06)

[1]Restricted minus *Ad Libitum*.
[2]Liveweight basis.

veterinary expense, transportation costs, utilities, breeding cost and amount of labor are from Lawrence and Ellis (Iowa Estimated Monthly Returns from Farrowing and Finishing Hogs; Table 1). An agricultural labor wage rate of $10.53/hour is from the National Agricultural Statistics Service.

Profits and breakeven selling prices were calculated by finding the revenue, fixed cost, variable cost, and total cost for each possible scenario which varied according to length of time the gilt/sow remained in the program before being culled. These outcomes were gilt development, gilt through first parity of market pigs, gilt through second parity, gilt through third parity, and gilt through fourth parity. The probability of each of these outcomes was used to determine the weighted average revenue, costs, and profit for an average gilt entering the program. Because gilts from each treatment and line had different probabilities of successfully farrowing each of the four parities, different probabilities were used for each treatment, line, and parity. These probabilities are summarized in Table 2. For example, ad libitum LWxLR gilts have a cost of gilt development of $149.63 ($153.78 from Table 3 plus breeding costs and subtracting cull credits) and a cost of first, second, third, and fourth parity litters of approximately $883.85, $924.93, $826.74, and $724.47 (fourth parity cost includes a credit for selling value of sow), respectively. The probabilities of these outcomes occurring are 1, 0.7714, 0.4581, 0.3848, and 0.2888, respectively. Multiplying the probability of each outcome by each of the cost components in the budget and summing those products results in a total cost of $1,796.64.

Results

Results for each line and treatment are summarized in Table 3

(Continued on next page)

in the form of revenue, fixed costs, variable costs, and total costs for gilt development and market pig production. Energy-restricted gilts were more productive than nonrestricted females as they produced an average of 5.12 more cwts per developed LWxLR gilt (48.05 cwts sold per ad libitum gilt vs. 53.17 cwts sold per restricted gilt; Table 3) and 2.97 more cwts per developed L45X gilt (49.84 cwts sold per ad libitum gilt vs. 52.81 cwts sold per restricted gilt; Table 3). The increased production was primarily caused by energy-restricted females having a greater probability of farrowing a litter than an ad libitum gilt at each parity. An average energy-restricted LWxLR gilt had a greater probability of farrowing first, second, third, and fourth parity litters than ad libitum females. Contrary to LWxLR gilts, an average energy-restricted L45X gilt did not have a greater probability of farrowing a first parity litter, but did have a greater probability of farrowing second, third, and fourth parity litters than an average ad libitum gilt. However, in no case were these differences statistically significant. Additionally, as selling price increases, energy restriction during gilt development becomes more economically advantageous because, as previously mentioned, energy-restricted gilts produced a greater number of hundredweights than ad libitum gilts.

In addition to being more productive, limit-fed gilts were also less expensive to produce by an average of $9.74 for LWxLR females ($153.78 per ad libitum gilt vs. $144.04 per restricted gilt; Table 3) and $7.58 per L45X gilt ($149.59 ad libitum vs. $142.01 restricted; Table 3). Although fixed costs were $0.73 greater per gilt for restricted LWxLR females ($6.64 ad libitum vs. $7.37 restricted; Table 3) and $0.53 per gilt more expensive for restricted L45X gilts ($6.21 ad libitum vs. $6.74 restricted; Table 3), this was more than offset by the large reduction in variable costs for energy restricted females (Table 3). Variable costs are lower because energy-restricted females consumed less feed than their ad libitum counterparts.

On average, progeny from restricted fed LWxLR gilts had a $0.47/cwt lower breakeven selling price than ad libitum market pigs ($37.39/cwt ad libitum vs. $36.92/cwt restricted; Table 3). However, progeny from energy-restricted L45X dams had a $0.14/cwt higher breakeven selling price than progeny from nonrestricted dams ($37.78/cwt ad libitum vs. $37.92/cwt restricted; Table 3). The lower breakeven selling price can be attributed to the increased production of energy-restricted gilts and also to the lower feed cost of limit feeding gilts during development.

The results from the budget analysis make sense intuitively. For instance, market swine production costs were greater for energy-restricted gilts from both genetic lines because they produced a larger number of offspring. One peculiar result, which was seemingly contradictory, was the greater profit and higher breakeven selling price in the L45X genetic line. One would assume the group with the lower breakeven selling price of progeny would also correspond to a greater profit or a lower loss. However, because restricted gilts produced a greater number of progeny, the magnitude of the profit/loss generated by the restricted gilt is greater than that of the ad libitum. To reiterate what was said previously, when profits are large for an average ad libitum gilt, they are greater for an average restricted gilt and when losses are large for an ab libitum gilt, they also are larger for a restricted gilt because of the increased reproductive production.

One important caveat to this research was an increased rate of culled animals during the development stage when restricting energy in developing gilts. Because of this, a greater number of gilts at the beginning of the program would be needed, leading to larger fixed costs incurred per developed gilt. As previously mentioned, this increase in fixed costs is more than offset by the decrease in feed costs when restricting energy, but could have practical implications for swine producers as more barn space would be needed to produce the same number of breeding gilts as the traditional method of gilt development.

These results have important implications for swine producers as restricting energy intake for breeding gilt production did not adversely affect sow productivity. The savings of feed costs counteracted the negative aspects of energy restriction in gilt development (increased rate of culling during development, etc.). Additionally, producing breeding gilts approximately $8.66/head cheaper, which was the average difference in energy-restricted females, reduced progeny breakeven selling prices in this study by an average of approximately $0.17/cwt sold. Although this cost-savings is small, swine production is a low-margin industry where saving pennies per cwt are essential to a successful business.

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[1]Justin D. Cech, graduate student and Darrell R. Mark, associate professor, Department of Agricultural Economics, University of Nebraska–Lincoln; Rodger K. Johnson and Phillip S. Miller, professors, Animal Science Department, UNL.