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High Input Costs and Market Weights[a]

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Introduction

The pork industry is struggling with an unusual set of economic conditions. Prices received for market hogs are at an all time high. However input costs are also at or above record values. To be successful, pork producers must have a good understanding of not only their herd efficiency and cost of production but also where the efficiency breakpoints occur, indicating points of diminishing returns. This is especially true for market pig weights.

Over the last two decades lean growth and efficiency have dramatically improved which has resulted in pigs with improved lean gain at heavier market weights. Compared to historical averages, pigs are leaner at heavier weights; however, the underlying biological principles have not changed; notably, that as pigs get heavier body fat increases and feed efficiency worsens. Most contemporary terminal cross pigs have been profitable at heavier weights; however, differences in lean growth do exist across different terminal cross lines. Yet this has had less economic consequence during times of lower grain prices. Unfortunately as input prices have increased, so has cost of gain. Pigs with less than ideal lean growth may no longer be profitable at heavier market weights due to increased cost of gain compared to the past decade. Therefore it has become more critical to establish an optimum market weight in order to market pigs before they become an economic liability. The objective of this article is to determine optimum market weights, using varying scenarios based on contemporary assumptions of input costs and pig performance.

Estimation Methods

Optimum market weights were calculated for three different scenarios with differing input prices of corn, soybean meal, and the resulting cost per ton of the last ration fed to finishing pigs. An existing spreadsheet tool from Dr. John Lawrence, Iowa State University was used. This Excel™ spreadsheet tool is available to pork producers on the internet at http://www.extension.iastate.edu/agdm/ldmarkets.html. In addition, the marketing information for an existing packer marketing matrix was used. The buying program used was considered to be more favorable for heavy weight pigs. Lean percent premiums and discounts along with possible sort loss were included in the calculations to determine results applicable to contemporary pork production.

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Assumptions

To complete these calculations, background information and assumptions were needed to set typical feed costs and pig performance. Information used in these analyses is provided in Table 1. Dried distillers grains with solubles (DDGS) were held at a constant price. Pig performance used is listed in Table 2. Pigs were assumed to grow 1.88 lb per day, regardless of the final weight in which they were marketed. Pigs were not considered for marketing until they reached 258 lb. Furthermore, it was assumed that the decision to market pigs would occur in weekly increments. That is, if pigs were not marketed at a given weight, they would be held for an additional seven days. In addition it was assumed that space was not limiting, such that pigs could be marketed at any weight chosen without space concerns for the rest of the production schedule. Furthermore it was also assumed that there would be no change in the percentage of dead or downer pigs observed if pigs were marketed at heavier weights.

Marginal feed efficiency as pigs increased in weight was also estimated. Typically feed efficiency is measured from pig placement, either as a weaned pig or feeder pig, until reaching market weight. However, to determine optimal market weight it is critical to know what feed efficiency is from two different ages or weights that occur later in the growth phase. In Figure 1 is an example. Feed efficiency is shown two ways. The first is feed efficiency calculated for the entire growth phase to different end weights starting at 220 lb. For instance, with an end weight of 220 lb feed efficiency, measured as pounds of feed per pound of gain, is approximately 3.0 for the entire growth phase. For an end weight of 290 lb feed efficiency is 3.4 for the entire growth phase. The second representation for feed efficiency is for marginal feed efficiency. That is the feed efficiency between two different weights, regardless of the feed efficiency up to the initial weight. For instance the marginal feed efficiency from 220 to 230 lb is approximately 3.8 lb feed per pound of gain while from 280 to 290 lb; the marginal feed efficiency is approximately 4.8. Marginal feed efficiency was developed for each of the beginning and ending weights evaluated adapting results from previous research completed at Michigan State University (Edwards et al., 2006).

Lean percentage also changed as pigs increased in weight. For example, the initial market weight evaluated was 258 lb with an estimated lean percentage of 55%. When pigs were held for an additional week, their subsequent end weight was 271 lb (Table 3). Feed efficiency for the additional week, measured as feed/gain, was 3.8 and at marketing their percent lean was 54.5%. Under the packer grid used, there was no sort loss for 271 lb pigs. In addition each carcass achieved an additional $2.57 per head in lean premium.

Optimum Weight and Feed Price

To determine the influence of differing feed input costs differences in pig performance for different market weights are listed in Table 3. The results of the three different feed price scenarios are found in Figure 2. The results are reported as the value change per head for pigs kept to the heavier weight. For example in Scenario 1, the results state that if pigs were marketed at 271 lb they would be worth $5.73 more than if they were marketed at 258 lb. The interpretation holds true for each category. For instance within Scenario 1, pigs marketed at 284 lb would be worth $4.72 more than pigs marketed at 271 lb. However, within Scenario 1, pigs marketed at 297 lb, would be worth $1.08 less than pigs marketed at 284 lb. The results are also cumulative across each category. For example in Scenario 1, pigs marketed at 284 lb would be worth $10.55 more ($5.73+$4.72) than pigs marketed at 258 lb.

With the underlying cost and animal performance assumptions, pigs continued to increase in value up to 284 lb, even for Scenario 3 which listed corn at $9 per bushel. For all three scenarios, pigs at 284 lb were of greater value to the farm than pigs marketed at either 258 or 271 lb. However, for all three scenarios pigs lost value after reaching 284 lb, with the greatest loss logically occurring in Scenario 3 in which corn was valued at $9 per bushel and soybean meal was $400/ton. It must emphasized that the results provided were developed to illustrate how pig performance, including growth, marginal feed efficiency and lean percentage at different market weights can impact return to the farm. If pigs grew slower, or had worse marginal feed efficiency, the final results could have indicated that pigs may need to be sold at a lighter weight than 284 lb. On the other hand, the results also provide some reasoning as to why pig market weights have been at or above 270 lb for much of first six months of 2011.

Optimum Weight with Increasing Feed Costs and Changes in Feed Efficiency

There are some terminal cross lines that can maintain lean percentage through heavier weights. To determine how this may influence the decision on market weight, a subsequent analysis was developed that included the initial three scenarios for differing feed prices, however, lean percentage remained constant and feed efficiency was changed to reflect improved lean percent through heavier weights. The assumptions used for this evaluation are listed in Table 4.

Within this assessment, compared to the initial evaluation, lean percentage and feed efficiency was more desirable through heavier weights. This led to heavier optimum market weights. Pigs remained profitable through 297 lb (Figure 3) for all three feed price scenarios. For Scenario 1, pigs remained profitable through 310 lb. This demonstrates how important it is to know the marginal feed efficiency and lean percentage at different market weights. This information allows a pork producer to determine if their pigs can remain lean and maintain favorable feed efficiency through heavier weights. If so, then profitability per pig may be increased due to improved cost of gain. However, if producers know their pigs do not maintain favorable feed efficiency and lean percentage through heavier weights, marketing pigs at a lower weight could improve profitability per pig sold, versus selling them at a heavier weight with an unfavorable cost of gain.

Optimum Weight if Growth Rate Declines

The initial evaluations of optimum market weight assumed a favorable growth rate (ADG=1.88 lb/day) through heavier weights. Though the pig has its highest growth rate in the later phase of growth as it reaches market weight, not all terminal cross pigs will growth as fast as stated in the initial evaluation of this exercise. Therefore a lower growth rate was evaluated to determine how optimum market weight may change. Average daily gain was changed from 1.88 to 1.58 lb/day. As in the previous evaluations, growth rate was maintained through a four week scenario. Since pigs grew slower, lean percent and feed efficiency was altered to reflect slower growth. The assumptions used are those listed in Table 5.

Compared to the initial evaluation for market weight (Figure 2) returns per pig improved through 291 lb except for Scenario 3 in which feed costs were higher (Figure 4). However, it should be noted that increases in pig value were marginal from 276 to 291lb for feed price Scenarios 1 and 2. For instance, the lowest feed price scenario, Scenario 1, the value of each pig marketed as they increased in weight from 276 to 291 lb was just $1.35 per head. In Scenario 2, pigs increased in value by only $0.43 per head for the same weight increase. In those cases where pork producers have growth performance similar to that evaluated in this analysis, other factors impacting profitability and farm operations may be considered in determining optimum market weight.

Optimum Weight with Increasing Feed Costs and Feed Additive Use

As feed prices have increased pork producers have evaluated usage of feed additives that may either improve pig performance, feed efficiency or both. Once such feed additive is Paylean™, marketed by Elanco. Paylean has been reported to improve growth, feed efficiency, lean percentage and yield. To effectively use Paylean, the ration, compared to typical finisher rations, must contain higher levels of amino acids to support the increased lean gain as feed consumption declines. This results in higher ration costs. For this evaluation the different grain prices listed in Table 1 were used but, the cost per ton of finishing ration was increased $33.30 to account for the inclusion of Paylean and increased levels of amino acids. The assumptions used in this evaluation are those listed in Table 6. However, this evaluation was conducted differently than those previously discussed. Initial weight was 245 lb instead of 258 lb. This was the pig weight when Paylean was first included in the feed. In addition, Paylean was fed for two weeks before pigs would be marketed. Therefore no pigs were assumed to be marketed until they had been consuming Paylean for two weeks. Thus, pigs were not marketed until they reached 276 lb. As can be seen in Table 6, average daily gain was improved along with feed efficiency, lean percentage and dressing percent as compared to Table 3.

The potential returns are in Figure 5. As can be seen pigs remained profitable under all three feed price scenarios through 276 lb. For the lowest feed price scenario, Scenario 1, pigs remained profitable through four weeks on Paylean to 303 lb, while under Scenario 2, pigs neither lost nor returned any further value while on Paylean to 303 lb. In closely reviewing the results, some practical considerations become apparent. For Scenario 1, pigs returned just an addition $1.13 when retained from 290 to 303 lb. In this case other production system factors may drive the decision on what weight to market pigs. The same was true for Scenario 2, when pigs were held from to 276 to 290 lb. These pigs returned just an additional $1.36 per head. Furthermore under Scenario 3 in which corn was price at $9 per bushel, retaining pigs from 276 to 290 lb returned the farm a meager $0.18 more per head for seven additional days in the barn. Under circumstances of high grain prices it may be prudent to market pigs soon after feeding Paylean for two weeks, if circumstances allow for that and pig performance is similar to that simulated in this evaluation.

Conclusion

Determining optimum market weight will differ from farm to farm. This decision will be based on lean growth potential, marginal feed efficiency through heavier weights, the packer grid in which market pigs are priced and space availability within the production system. Many have suggested that feed costs will remain above historical averages for the foreseeable future. Producers should carefully determine optimum market weight to improve profit potential and reduce risk. Producers can contact the authors to further discuss the results of this evaluation and determine its applicability to their production system.

[a]Reference to commercial products does not imply endorsement by the authors or Michigan State University.

Literature Cited

Edwards, D.B., R.J. Tempelman and R.O. Bates. 2006. Evaluation of Duroc- vs. Pietrain-sired pigs for growth and composition. J. Anim. Sci. 84: 266-275.

Table 1: Market Assumptions

Item	Scenario 1	Scenario 2	Scenario 3
Corn, $/bu.	5.54	6.95	9.00
Soybean Meal - 48%, $/ton	299.00	370.00	400.00
Dried Distillers Grains w/Solubles, DDGS, $/ton	200.00	200.00	200.00
Finishing Feed, $/ton	215.80	257.80	302.20

Table 2: Pig Performance Assumptions

Item	Value
Late Finishing Average Daily Gain, lb/day	1.88
Yield, %	75
Expected Change in Base Price, $	65
Base Lean Percentage @ 258 lb	55
Opportunity Cost per Pig Space, $	0.00
Downer/Dead %	0

Table 3: Performance of Pigs Marketed at Increasing Market Weights

	Beginning Weight			
Item	**258**	**271**	**284**	**297**
ADG, lb/day	1.88	1.88	1.88	1.88
End Weight, lb	271	284	297	310
Lean, %	54.5	54.0	53.5	53
Feed/Gain	3.8	3.9	4.0	4.1
Yield, %	75	75	75	75
Change in Sort Loss, $/head	0	0	-2.96	-3.25
Change in Lean Premium, $/head	2.57	1.70	-0.99	-1.13

Table 4: Change in Lean Premium as influence by Increasing Market Weights, No Change in Lean Percent and Improved Feed Efficiency.

	Beginning Weight			
Item	**258**	**271**	**284**	**297**
ADG, lb/day	1.88	1.88	1.88	1.88
End Weight, lb	271	284	297	310
Lean, %	55	55	55	55
Feed/Gain	3.80	3.85	3.90	3.95
Yield, %	75	75	75	75
Change in Sort Loss, $/head	0	0	-2.96	-3.25
Change in Lean Premium, $/head	2.57	1.7	3.29	1.56

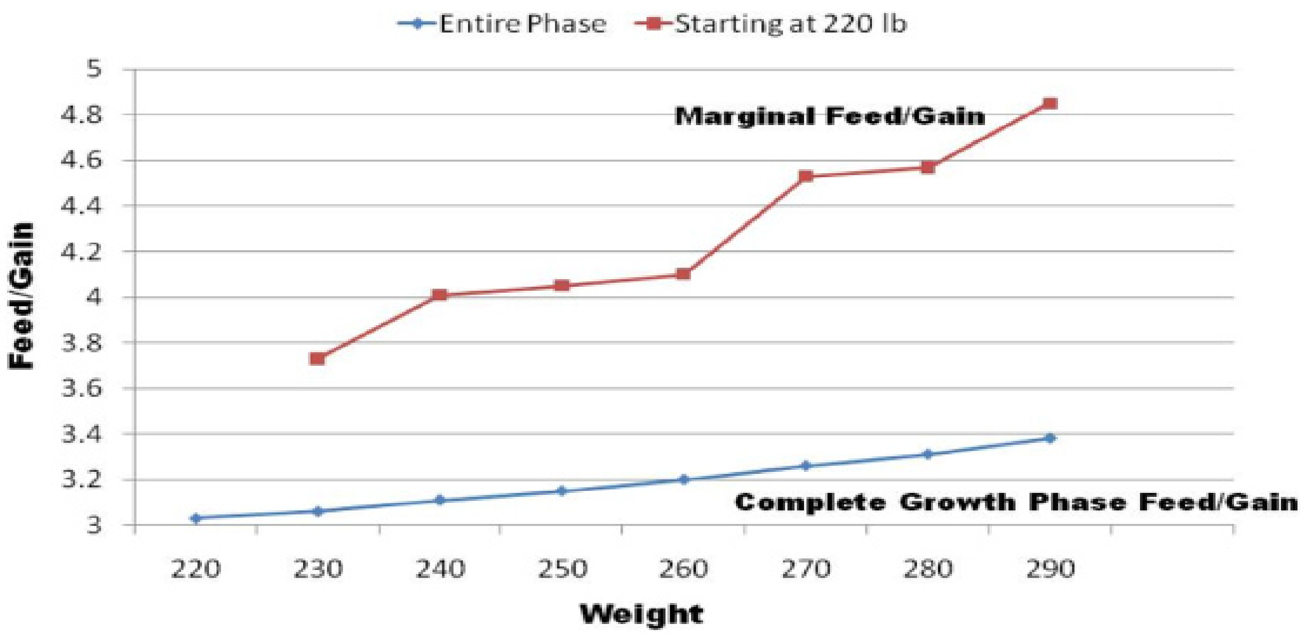
Table 5: Change in Lean Premium as influence by Increasing Market Weights and a Growth Rate of 1.58 lb/d in late finishing.

	Beginning Weight			
Item	**258**	**269**	**280**	**291**
ADG, lb/day	1.58	1.58	1.58	1.58
End Weight, lb	269	280	291	302
Lean, %	55	54.5	54	53.5
Feed/Gain	3.8	3.9	4.0	4.1
Yield, %	75	75	75	75
Change in Sort Loss, $/head	0	0	0	-6.05
Change in Lean Premium, $/head	0.96	3.10	-1.06	-1.18

Table 6: Change in Lean Premium as influence by Increasing Market Weights and Feeding Paylean™.

	Beginning Weight			
Item	**245**	**261**	**276**	**290**
ADG, lb/day	2.29	2.14	2.0	1.88
End Weight, lb	261	276	290	303
Lean, %	55.2	54.9	54.5	54.2
Feed/Gain	3.2	3.55	3.8	3.94
Yield, %	75.2	75.5	75.5	75.5
Change in Sort Loss, $/head	0	0	-1.33	-1.34
Change in Lean Premium, $/head	3.54	1.04	2.93	2.09

Figure 1. Feed Efficiency for Complete Growth Phase and Marginal Feed Efficiency at Increasing Market Weight.



Adapted from information provided by John Lawrence, ISU.

Figure 2. Change in Value per Head with Increasing Feed Costs

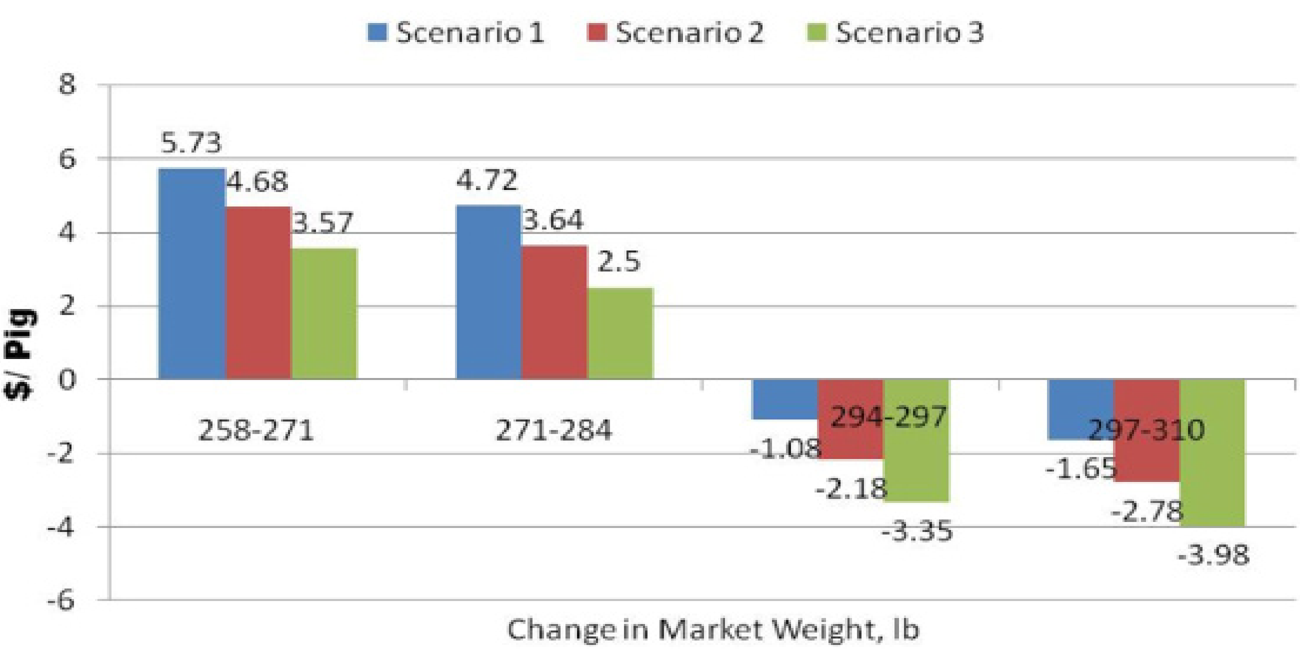


Figure 3. Change in Value per Head with Increasing Feed Costs and Lean Percent Remains Constant

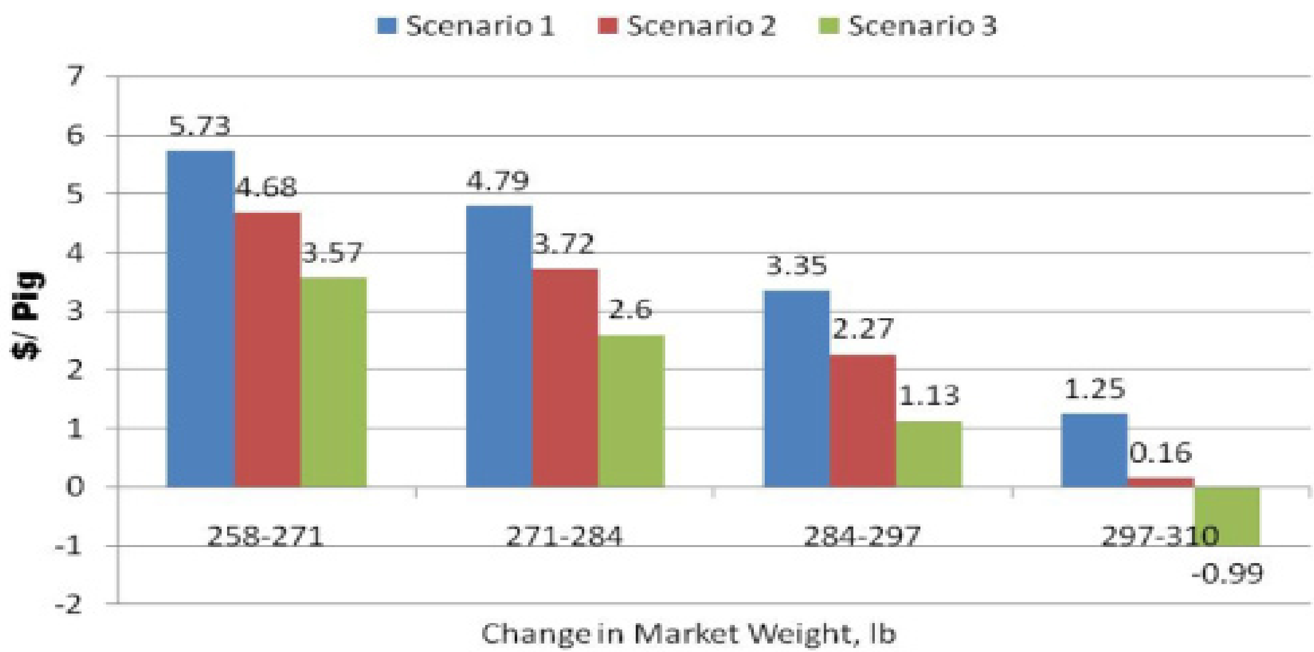
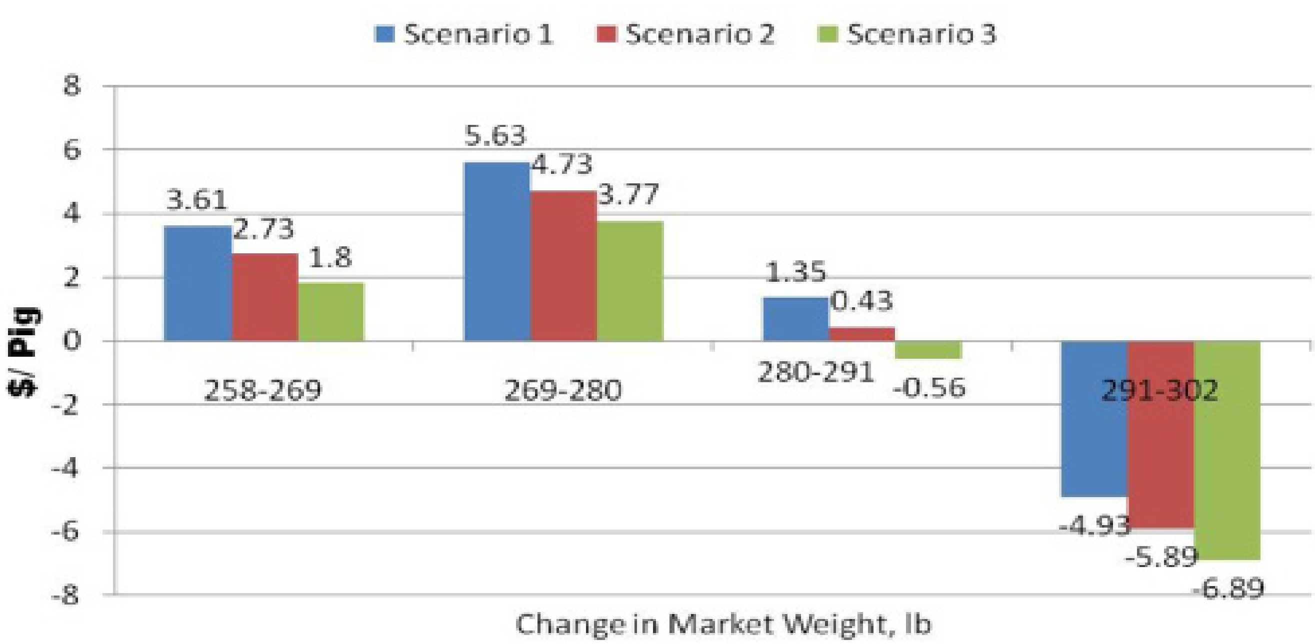


Figure 4. Change in Value per Head with Increasing Feed Costs and lower Average Daily Gain



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Pork Fat Quality, Iodine Values, and Feeding DDGS

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Summary: *Swine processors are putting an emphasis on carcass fat quality by focusing on determining iodine value.*

The inclusion of distiller's co-products in swine rations has been researched for more than a half a century. More recently, research in regard to feeding Distillers Dried Grains with Solubles (DDGS) to pigs has focused on the nutrient concentration, nutrient digestibility, feeding value and potential effects on carcass composition and quality. Due to high commodity prices, pork producers have faced the challenge of trying to lower ration costs. Producers are caught between the rock and the hard spot, as traditional corn and soybean feed prices increase and DDGS is economically justified in swine diets at greater amounts.

DDGS is one of the most abundant and competitively-priced alternative feedstuff available to pork producers. The feeding of amounts greater than 15 to 20% may be reasonable based on dollars and on growth performance. Bergstrom and others (2009) reported that feeding 60% DDGS for about 80% of the grow-finish period was part of the regimen which provided the greatest net income. Cromwell and co-researchers on the North Central Coordinating Committee on Swine Nutrition (NCCC-42; 2011) stated that up to 45% of a high-quality DDGS can be included in diets with very little effect on pig growth performance. They cautioned that to efficiently utilize these greater amounts of DDGS, diets need to be formulated on a standard ileal digestible amino acid basis using supplements of synthetic lysine and tryptophan, which keep the dietary protein concentration from being excessive. Table 1 below summarizes the changes in performance reported in recent studies where 30% or more DDGS have been included in the diet of hogs throughout the finishing period.

Continued

High Input Costs ...

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Figure 5. Change in Value per Head with Increasing Feed Costs and Feeding Paylean™

[a]Cost per ration in each scenario was increased $33.30/ton to reflect the cost of Paylean and increased nutrients added in the feed.

Table 1. Summary of growth performance of grow-finishing pigs when fed 30% or greater dietary DDGS.				
Study	DDGS, % of diet	Change in ADFI, %	Change in ADG, %	Change in F:G, %
Jacela et al., 2010	30 (vs. 0%)	-6.3	-3.6	-2.9
Bergstrom et al., 2010	60 (vs. 20%)	+0.5	-2.0	-2.6
Ulrey et al., 2010a & b	45 (vs. 0%)	-9.0	-8.0	Not different
Cromwell et al., 2011	45 (vs. 0%)	-1.1	-4.2	-2.1

Inclusion of DDGS in swine finishing rations may have an impact on carcass fat quality. These carcass quality factors include: the slice ability of bellies for bacon, an oily appearance in the retail package and reduced shelf life. Therefore, in order to meet customer expectations, swine processors are putting an emphasis on carcass fat quality by focusing on determining iodine values of pork fat.

Iodine value (IV) can be used as an indicator of overall fat firmness. This measurement estimates the amount of unsaturation present in the fatty acids present in carcass fat. Unsaturated fatty acids are less firm or categorized as "softer". Iodine values are reported on grams per 100 gram basis (DeRouchey et al., 2010). Typically, a lower value is more ideal and would indicate that there are more saturated fatty acids present in the carcass composition. Furthermore, respective packing plants have currently set IV thresholds ranging from 72 – 74. The jury is still out. The strength of the relationship of IV to pork belly attributes is being debated in packing and in research (Cromwell and Rentfrow, 2011).

DDGS is an excellent addition to swine diets in all phases of pork production in regard to energy and digestible phosphorus. However, a high concentration of linoleic acid in the oil of DDGS causes carcass fat to become softer and therefore resulting in IV's that are not acceptable (Stein and Shurson 2009). Numerous research reports have indicated that carcass fat composition is affected by dietary ingredients and the fatty acid composition that is fed.

A NCCC-42 collaborative study reported by Cromwell and others (2011) evaluated moderate to high inclusion rates of DDGS in growing-finishing swine diets to determine the effect of carcass quality and belly firmness of swine. This study involved 9 research stations, 560 crossbred pigs and a common source of DDGS from a single plant. The average beginning weight of pigs across research stations was 72 lb and ended with an average weight of 266 lbs. Results of this study as it relates to iodine values are presented in Table 2. DDGS inclusion rates of 13 and 22% result in IV's of 70 and 74, respectively.

Table 2. Mean iodine values of lipids in backfat of pigs fed distillers dried grains with solubles (DDGS (adapted from Cromwell et al., 2011).)				
	% DDGS			
Item	0	15	30	45
University of Wisconsin	59.3	72.5	74.6	83.8
University of Minnesota	62.5	67.4	77.0	82.3
University of Kentucky	64.8	70.9	76.6	84.4
North Carolina State University	65.1	67.7	79.1	82.1
Oklahoma State University	65.6	71.6	78.5	88.3
Purdue University	65.7	71.4	80.1	87.8
University of Missouri	65.8	72.6	78.1	81.7
The Ohio State University	65.9	72.9	72.2	83.9
University of Nebraska	66.9	71.4	77.1	83.2

Iodine values vary among studies. In contrast to those values in Table 2, Benz et al. (2010) reported IV's 70.2, 71.5, 72.4, 73.3, and 74.5 when 0, 5, 10, 15 and 20% dietary DDGS were fed, respectively. Cromwell and Rentfrow (2011) reported an IV of 60.9 in carcasses of hogs feed 0% DDGS (lower than Benz et al. (2010) and NCCC-42; Table 2). Bergstrom and others (2009) reported an IV of 81.7 when 60% of the diet was DDGS (lower than 45% as reported by NCCC-42; Table 2).

DDGS Withdrawal Regimens

Removing DDGS late in the finishing phase, a portion or all, is one strategy to lower pork fat IV and achieve acceptable pork fat quality when pigs are fed DDGS at greater inclusion rates earlier in grow-finish. A study conducted at Michigan State University by Hill et al., (2008), indicated that feeding well balanced commercial swine diets with 20 to 30% DDGS results in acceptable performance and carcasses when DDGS were removed from the diet 30 days prior to harvest. Ulrey and coworkers (2010) fed 45% DDGS throughout finishing and compared it to diets containing corn and soybean meal only and withdrawal of all DDGS for 2 and 4 weeks pre-slaughter, respectively. Iodine values were 60.9, 78.8, 74.3, and 70.4 for the corn, soybean meal only, the continuous 45% DDGS throughout finishing, the 2-week withdrawal, and the 4-week withdrawal regimens, respectively. Bergstrom and others (2009) fed 60% DDGS throughout most of the grow-finish period, switching to 20% in the last 3 weeks, but did not achieve an IV of 70 or less. In Table 3, is a summary of two studies that compared fat quality from pigs, fed a typical corn, soybean meal ration with no DDGS to pigs fed 30% DDGS in the finishing ration. All DDGS was removed from the ration, for varying lengths of times, before harvest. Fat quality was sampled at different locations on the pork carcass. Withdrawal of all the DDGS from the finishing diet did not totally decrease IV's to those observed when 0% DDGS was fed throughout the finishing phase. From these and other studies, we also know that leaving small amounts of DDGS in the diet during the withdrawal period lessens the reduction of IV. Finally, these studies indicate that the best DDGS feeding-withdrawal strategy to meet IV thresholds is still not clear.

Table 3. Change in iodine value with preslaughter withdrawal feeding regimen.

			30 % DDGS in Finishing Rations			
	Fat		DDGS Withdrawal (all DDGS) Time before Marketing			
Reference	Sample Site	CSBM[a]	no withdrawal	3 weeks	6 week	9 weeks
Xu et al., 2010	Belly	58.82	71.22	68.19	64.47	62.73
Jacela et al., 2009	Backfat	66.89	74.24	72.77	73.19	Not studied
Jacela et al., 2009	Belly	67.82	75.40	73.90	73.53	Not studied
Jacela et al., 2009	Jowl	68.60	74.65	73.34	72.59	Not studied

[a]CSBM – Standard Corn-Soybean Meal diet with no DDGS.

Conclusions

DDGS will be available for feeding swine and the cost of corn and other ingredients will encourage producers to do so. Packers and processors will continue to evaluate product manufacturing and finished product quality. Iodine value is the measure currently being discussed as the most useful indicator of fat quality. Expect research to find more accurate fat quality measures which will allow for better precision of inclusion of DDGS in feeding strategies. In the meantime, completely withdrawing DDGS from the diet at least 3 weeks before harvest is the surest approach to achieving IV's currently being sought by packers. Producers should also evaluate all other feed ingredients in the diet to determine if they, like DDGS, are providing pigs unsaturated fats and contributing to undesirable pork fat quality.

References listed on page 15.

Live Swine Carbon Footprint Calculator is now available for pork producers

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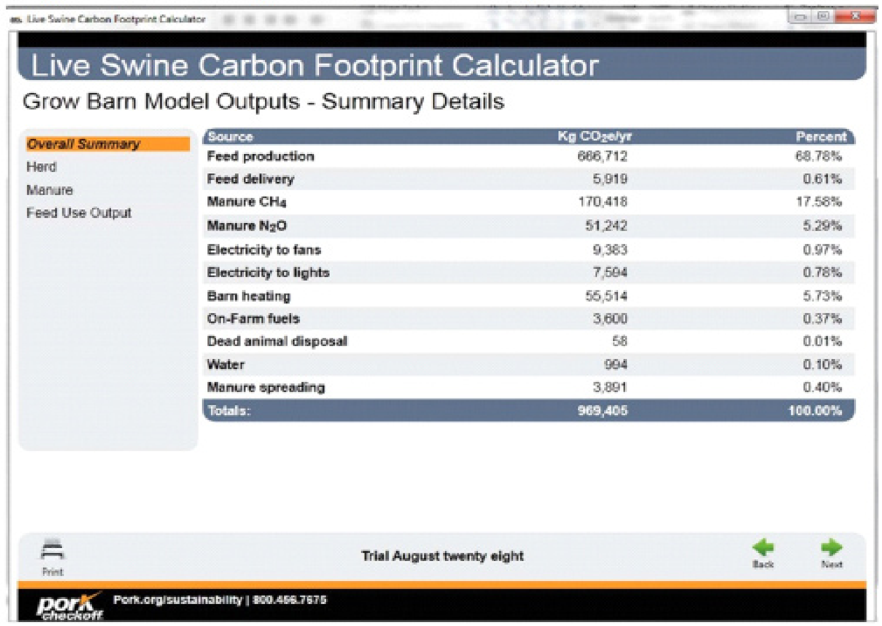
Using a recently released tool from the National Pork Board, pork producers can now calculate their farm's carbon footprint.

Figure 1: Summary of live carbon footprint calculator



Source	Kg CO_2e/yr	Percent
Feed production	666,712	68.78%
Feed delivery	5,919	0.61%
Manure CH_4	170,418	17.58%
Manure N_2O	51,242	5.29%
Electricity to fans	9,383	0.97%
Electricity to lights	7,594	0.78%
Barn heating	55,514	5.73%
On-Farm fuels	3,600	0.37%
Dead animal disposal	58	0.01%
Water	994	0.10%
Manure spreading	3,891	0.40%
Totals:	969,405	100.00%

During the June 2011 World Pork Expo the National Pork Board released the Live Swine Carbon Footprint Calculator. The calculator was developed to provide swine producers a user-friendly tool that estimates the amount of greenhouse gases (GHG) released from their production site. While there isn't a right or wrong answer contained in the report, the Pork Board suggests the calculator be used to establish a current benchmark level of greenhouse gases emissions. Once a farm's benchmark is established additional calculations can then be used to estimate possible reductions in GHG as a result of improved management and production practices. Reductions in GHG are possible through improved feed efficiency, reduced energy requirements and changes in manure handling practices.

The National Air Quality Site Assessment Tool (NAQSAT) is another useful tool for determining opportunities to reduce farm GHG emissions with output that complements the output from the Live Swine Carbon Footprint Calculator. For more information on NAQSAT and a link to the online tool see the article recently posted on the MSU Extension News at: http://news.msue.msu.edu/news/article/new_tool_for_assessing_air_emissions_from_livestock_farms

Greenhouse gases associated with pork production include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Methane has 24 times and nitrous oxide has 298 times the global warming potential of CO2. The carbon footprint calculator expresses CH4 and N2O global warming potential on a CO2 equivalent (CO2e) basis. The output reports GHG emissions as kg of CO2e per year, per pig and per kg of pig raised.
Inputs into the calculator require knowledge of:

- The building dimensions and the insulation R value in both the walls and ceiling.
- Diets fed to the pigs in the barn including the number of phases and the percent of each ingredient contained in each ration. Contract growers will need to collect this information from their contracted farms.
- Basic manure handling practices such as type of manure storage, months when manure is hauled, size of loads and average distance to the fields used for manure applications.
- The total wattage of the lights used in the barn.
- The number of fans in the barn, their CFM (cubic feet per minute) and wattage. The wattage will be on the manufacturer's label found on the side of the fan motor and the CFM will be on either the fan housing or contained in the manufacturer's information delivered with the fan.
- Estimate of annual fuel usage, including fuel used for manure removal but not feed delivery.
- An estimate of the annual water usage. Tables for estimating annual water use can be found at: web1.msue.msu.edu/waterqual/WQWEB/swine.doc.

Figure 1 provides an overall summary from the Swine Carbon Footprint Calculator for a sample 2,000 head, deep pit, finishing barn, selling 5,100 head annually at an average weight of 275 lbs. and feed efficiency of 2.98 lb feed per lb gain. For this sample farm, 68.8% of the estimated 969,405 kg (1,068.8 tons) CO2e annually emitted are attributed to feed, 22.9% to manure (CH4 and N2O combined) and 7.5% to barn heating and electricity. The high percent of GHG emissions attributed to feed is directly related to the N2O losses associated with the growing crops and, to a lesser degree, the fossil fuels required for crop production including the fuels used in the manufacturing of Ag chemicals and nitrogen fertilizers.

Improving feed efficiency to 2.69 lbs. feed per lb. gain decreased GHG emissions 11.6% to 856,576 kg (944.4 tons) CO2e annually while the break down attributable to feed, manure and barn utilities, 70.1%, 21.2% and 7.7% respectively, remained relatively the same. Improving feed efficiency provides the dual benefits of reducing GHG associated with feed production and reducing CH4 and N2O emissions associated with enteric fermentation and manure management (Nguyen, 2010). The relationship between GHG attributed to feed and GHG attributed to manure remained relatively constant as feed efficiency improved.

Using a feed efficiency of 2.98, the Live Swine Carbon Foot Print Calculator estimated an emission of 1.52 kg CO2e per kg live pig. Improving feed efficiency to 2.68 reduced the carbon footprint to 1.35 kg CO2e per kg live pig.

The 12% decrease in GHG emissions resulted from improved feed utilization. Additional gains are possible. Nguyen (2010) compared three scenarios: 1) improved feed efficiency, 2) shortened length of time manure is stored in the barn (to less than 15 days), and 3) improved manure management including utilizing manure for energy production prior to using it as a replacement for commercial fertilizer. His model predicted a 49% reduction in GHG emissions if all three areas were improved simultaneously.

The swine carbon footprint calculator software is available free from the National Pork Board. It requires either Windows XP, Vista, 2000 or Windows 7. Contact the Pork Boards service center at info@pork.org for more information.

The Live Swine Carbon Footprint Calculator was written by Dr. Rick Ulrich and Dr. Greg Thoma from the University of Arkansas, Dept. of Chemical Engineering.

Resources:

Nguyen, L. T., J. E. Hemansen and L. Mogensen, 2010, Fossil energy and GHG saving potentials of pig farming in the EU, Energy Policy 38 (2010) 2561 – 2571

Further reading:
Hermansen, J. E. and T. Kristensen, 2011, Management options to reduce the carbon footprint of livestock products, Animal Frontiers 1 (1) 33-39, Available on line: http://animalfrontiers.fass.org/content/1/1/33.full.

Time for a Biosecurity Tune Up

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As we forge into the fall months of 2011, high feed costs, animal welfare concerns and environmental matters are all issues struggling to take top priority with today's pork producers. High on that list of priorities as we move into the winter months must also be a review of Biosecurity protocols for individual facilities and production flows. Biosecurity can be defined as procedures, efforts and programs established to reduce the risk of disease introduction in to pig populations (Conner, 2001). Both external and internal Biosecurity protocols need to be reviewed for their effectiveness in keeping out new agents and minimizing the disease challenge present within a barn or herd.

Biosecurity and sanitation practices are implemented on many pork production units to prevent the introduction of pathogens to the herd or groups of pigs within a herd (Amass, 2001). A disease challenge such as salmonella, influenza, mycoplasma and porcine reproductive and respiratory syndrome (PRRS) not only affects the health and productivity of the herd, it also diminishes employee satisfaction with their job and decreases the profit margin for the producer. PRRS is an economically significant disease that has been estimated to cost the US pork industry approximately $560 million a year (Dee, 2010). Preventing and controlling the spread of diseases such as PRRS, within and between pig populations is critical to the success of producing high health pigs and is the basis of Biosecurity programs.

Biosecurity is a complex concept compiled of various protocols, theories and management procedures. Implementing and reviewing some of the procedures discussed below will put you on the right track for producing high health pigs and proper utilization of Biosecurity protocols. As you evaluate your Biosecurity program for effectiveness and impact you need to look at both direct and indirect routes of contamination.

Direct routes of contamination include live animals and genetic material (i.e. semen) and are large factors when it comes to controlling the spread of disease. Purchasing your semen and replacement stock from verified sources that are monitored via testing protocols is necessary when protecting the health of your herd. The procured animals must be transported in a clean and disinfected vehicle and loaded and unloaded properly using clean and disinfected load areas (Tubbs, 2001). When introducing new animals into the herd an isolation period is critical to evaluate the health status of the animals. Isolation should occur in facilities separate from the production site and located a minimum of 120 meters (approximately 130 yards) from the breeding herd (Dee, 2010). Animals should stay in isolation for a period of at least 30 days and assessed daily for clinical signs of disease. Management of isolation facilities should take place following completion of all duties at the breeding or parent site; employees responsible for duties in the isolation unit should shower out after checking the unit and not return to the breeding/parent herd until the following day. Replacement stock should be blood tested 24-48 hours after arrival to the isolation facility as well as 5-7 days prior to entry into the breeding unit (Dee, 2010). Implementing these isolation techniques and testing protocols will aid you in protecting your herd from the introduction of new disease agents and maintain the current health level of your herd.

Another area to evaluating the biosecurity at your facility is to look at the indirect routes of contamination. Indirect routes of contamination are methods of transmitting disease mechanically through; people, vehicles, facilities and non-human vectors such as, needles and supplies. Controlling all aspects of indirect contamination on farms is one of the biggest challenges in pork production. Not only must you identify and utilize biosecurity protocols that work for your facility, you must train employees and service people to strictly follow the guidelines that you have set in place. Consistent evaluation and audits of these guidelines are required to keep your facility and employees functioning at a higher level of biosecurity awareness.

In order to maintain a high level of biosecurity at your facility you should apply an all in/all out management system to your pig flow, reducing the flow of disease from older pigs to younger more naïve animals. All in/all out (AI/AO) standard operating procedures allow you to group pigs according to age and empty or fill entire rooms at once. When working with piglets, if your site is involved in a disease outbreak it is important to move as few piglets between litters as possible, reducing cross-fostering of litters and decreasing the spread of disease.

In order to maximize the benefits of Al/AO protocols it is extremely important to wash, disinfect and dry your facility between groups of pigs. When auditing your sanitation procedures on the farm you should prioritize the following protocols with employees: Completely remove all organic material from area and power-wash all surfaces, extra attention should be given areas that are hard to reach and may harbor organic matter. Once the area is surface clean, a disinfectant should be applied to the area. Commercial disinfectants need to be researched so that the product is effective on diseases specific to your facility. The application of disinfectants via a foamer allows for better visualization of where product has been applied and also prolongs the contact between the chemical and surface areas (Dee, 2010). Once the washing and disinfection procedures have taken place, it is important to allow the area sufficient time to dry. This single step is critical when controlling disease, as inactivation of a virus is directly related to length of drying time.

Another potential source of indirect contamination can be found in fomites. Fomites are non-human vectors such as, needles, coveralls, supplies and containers that can transport and spread disease. Needles can be contaminated by injecting an animal that is infected with a virus, continued use of the same needle between animal's results in the spread of the disease. If your farm is experiencing a disease outbreak needle use protocols should be examined. Options of changing needles frequently or implementing a needle-free injection process can be used to reduce this risk; however these practices are not guaranteed to completely eliminate the spread of a virus. Boots and coveralls are also vectors that transfer disease, washing coveralls and boots after daily use are minimal biosecurity protocols that should be implemented on the farm.

As we review our risk of contamination via fomites we need to look at the delivery of supplies and items that may be brought into the farm by vendors. A way to reduce the instance of disease transfer on these types of fomites (supply boxes, bags and tools) is to incorporate a disinfection and drying (D&D) room on your facilities. A D&D room is an area where supplies or contractor tools are received for biosecurity processing before they enter the farm. These rooms are the only entry method for supplies and tools and need to follow strict protocols. In these locations an employee will apply disinfectant to the entire supply container or tool, covering every side with a foaming disinfectant. It is very important to apply the disinfectant with a foaming applicator verses fogging the room, as the direct contact of the foam will work to kill any live virus that might be traveling on the outside of the container. A D&D room may not be an option for all facilities and the "double bagging" method of transferring supplies can also reduce the risk of disease spread. This practice requires all supplies or tools entering the farm to be placed in a "double-bag", once the items have reached the farm, the outer bag is removed and the items can be brought into the facility.

Personnel that work at swine facilities are also at risk of spreading disease. Although people are typically not a carrier of disease, as most organisms do not live in the human membranes, they can carry the disease on their person or clothing to different areas of the farm. When the swine facility is equipped with a shower all employees should follow a shower in/out protocol every time they enter and exit the facility. If this option is not available for the facility, employees, at a minimum should wash their hands and change clothes, coveralls and boots between visits to different sites. Down time of one night for personnel that have come in contact with pigs at another site or pigs with a different level of herd health is recommended. In order to limit access to a facility, all exit doors should be equipped with a locking mechanism and utilized at all times. Keeping the doors locked is a simple way to restrict movement (Lambert, 2009).

Biosecurity risks should be evaluated and prioritized for each facility and production flow. This first step will help producers develop practical, effective biosecurity protocols, while remaining in line with the cost of production for their individual production scheme. A continuous review and training program should be implemented for all farm employees and vendors in order to make a biosecurity plan function in the manner that it was designed. Spot checks on employees and vendors, along with correcting deficiencies, will help maintain biosecurity efforts. Biosecurity practices and reviews of on-farm application will go a long way to help you protect the health of your swine herd. Stopping disease at the door of the farm will enable you to maintain your health status and continue to produce healthy pigs.

Literature Cited

Amass, S.F. 2001. Biosecurity: What Really Works. Swine Health Epidemiol, special biosecurity issue, National Institute for Animal Agriculture: 1,5.
Conner, J.F. 2001. Biosecurity becomes necessity for 21st Century pig production. Swine health epidemiol, special biosecurity issue, national Institute for Animal Agriculture: 1,5.
Dee, S.A., 2010 Biosecurity protocols for the prevention of spread of porcine reproductive and respiratory syndrome virus. Swine Disease Eradication Center, University of Minnesota College of Veterinary Medicine.
Lambert, ME., and D'Allaire, S., 2009. Biosecurity in Swine Production: Widespread Concerns?, Advances in Pork Production, Volume 20, page 139.
Tubbs, R. 2001. Isolation of incoming breeding stock to prevent introduction of disease., Swine Health Epidemiol, special biosecurity issue, National Institute for Animal Agriculture: 1,5.

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References

Benz, J. M., S. K. Linneen, M. D. Tokach, S. S. Dritz, J. L. Nelssen, J. M. DeRouchey, R. D.
Goodband, R. C. Sulabo, and K. J. Prusa. 2010. Effects of dried distillers grains with solubles on carcass fat quality of finishing pigs. J. Anim. Sci. 88: 3666-3682.
Bergstrom, J. R., M. D. Tokach, S. S. Dritz2, J. L. Nelssen, J. M. DeRouchey and R. D.
Goodband. 2009. Effects of feeder design, gender, and dietary concentration of dried distillers grains with solubles on the growth performance and carcass characteristics of growing-finishing pigs. Swine Day Report of Progress 1020, Kansas State University, Agricultural Experiment Station and Cooperative Extension Service. Pp. 252-261.
Cromwell, G. L. and G. Rentfrow. 2011. DDGS in swine diets – does it impact processing of
cured bellies and eating quality of port? Proceedings of Midwest Swine Nutrition Conference, September 8, Indianapolis, IN.
Cromwell, G. L., M. J. Azain, O. Adeola, S. K. Baidoo, S. D. Carter, T. D. Crenshaw, S. W.
Kim, D. C. Mahan, P. S. Miller and M. C. Shannon. 2011. Corn distillers grains with solubles in diets for growing-finishing pigs: A cooperative study. J. Anim. Sci. 89: 2801-2811.
DeRouchey, J., M. Tokach, S. Dritz, B. Goodband and J. Nelssen. 2010. Iodine value and its
impact on pork quality. Kansas Swine Profitability Conference, Kansas State University. Article found on ThePigSite.com
Hill., G. M., J. E. Link, D. O. Liptrap, M. A. Gieseman, M. J. Dawes, J. A. Snedegar, N. M.
Bello and R. J.Tempelman. 2008. Withdrawal of distillers dried grains with solubles (DDGS) prior to slaughter in finishing pigs. J. Anim. Sci. 86 (Suppl. 2): 52. (Abstr.)
J. Y. Jacela, J. Y., J. M. Benz, S. S. Dritz, M. D. Tokach, J. M. DeRouchey, R. D. Goodband, J.
L. Nelssen, and K. J. Prusa. 2009. Effect of dried distillers grains with solubles withdrawal regimens on finishing pig performance and carcass characteristics. Swine Day Report of Progress 1020, Kansas State University, Agricultural Experiment Station and Cooperative Extension Service. Pp. 181-191.
Stein, H. H., and G. C. Shurson. 2009. Board-Invited Review: The use and application of
distillers dried grains with solubles in swine diets. J. Anim. Sci. 87: 1292-1303.
Ulery, M. C., G. L. Cromwell, G. K. Rentfrow, M. D. Lindemann, and M. J. Azain. 2010a.
Attempts to improve belly firmness in finishing pigs fed a high level of DDGS. J. Anim. Sci. 88:(E-Suppl. 3):91.
Ulery, M. C., G. L. Cromwell, G. K. Rentfrow, M. D. Lindemann, and M. J. Azain. 2010b. Belly
firmness and bacon quality from finishing pigs fed DDGS with various withdrawal times and with added tallow. J. Anim. Sci. 88:(E-Suppl. 2):553.
Xu, G., S. K. Baidoo, L. J. Johnston, D, Bibus, J. E. Cannon and G. C. Shurson. 2010. The
Effects of feeding diets containing corn distillers dried grains with solubles, on growth performance and pork quality in grower-finisher pigs. J. Anim. Sci. 88: 1388-1397.

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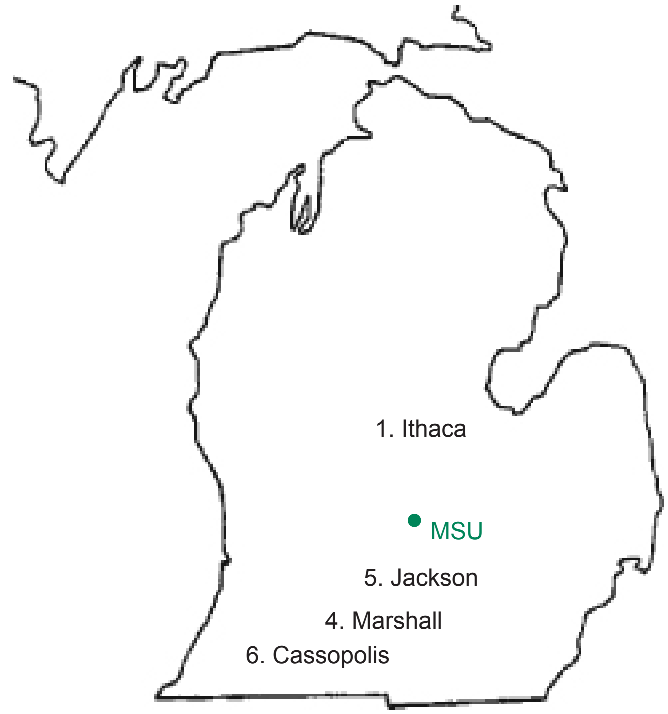

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