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FINISHER MANAGEMENT GUIDE

Products and answers that work®

FINISHER MANAGEMENT GUIDE

Hubbard Feeds helps swine producers optimize their performance in the finishing stage by providing cost effective nutrition programs that meet or exceed customer expectations.

GUIDE SUMMARY

ENVIRONMENTAL IMPACT ON GROWTH

Day to day management of the pigs and barn are the single greatest factor in differentiating highly productive farms from others. If pigs from the same sow farm (same flow and genetics) went to three different farms, and fed the same diets, each farm would still have different performance outcomes. This is due to the differences in environment and stockmanship at each of the individual farms. With all other factors being equal, pigs are a product of their environment. Their health, growth, and efficiency is dependent on the person taking care of them and the environment within the barn. Careful observation and timely response can make the difference between a group of pigs meeting performance expectations or falling short.

When you walk into a barn to check on the pigs, there are a number of things to look for that if not addressed, could lead to reduced growth performance. These factors include:

Barn Sanitation

Access to quality feed and water

Temperature

Ventilation (air quality, air flow, humidity)

Barn Sanitation

Prior to the first fill of pigs, the barn should be cleaned and allowed adequate time to dry. Numerous studies have found that when pigs are raised in a clean environment compared to a dirty environment they had a 10% improvement in ADG and an 18% improvement in feed intake. The main objective is to decrease the amount of pathogens that can be transmitted between groups of pigs. This can be accomplished by:

1) Thoroughly removing organic matter from all surfaces (floor, fences, feeders, waterers, etc.). The presence of organic matter will provide a safe haven for pathogens and decrease the efficacy of disinfectant. The effective removal of visible organic matter can result in a 90% reduction of bacteria from the environment.
2) Properly diluting and applying disinfectants.
3) Allowing for proper downtime and drying between groups. Viruses can survive in wet environments for an extended period of time compared to dry environments. A study found that the PRRS virus could survive in water for 11 days, whereas it died quickly once it was dry.

Taking the extra time to remove all of the organic matter, properly diluting and applying disinfectant, and allowing the barn to dry completely before loading pigs can result in improvements in gain and feed intake, due to decreased presence of pathogens.

Access to Quality Feed and Water

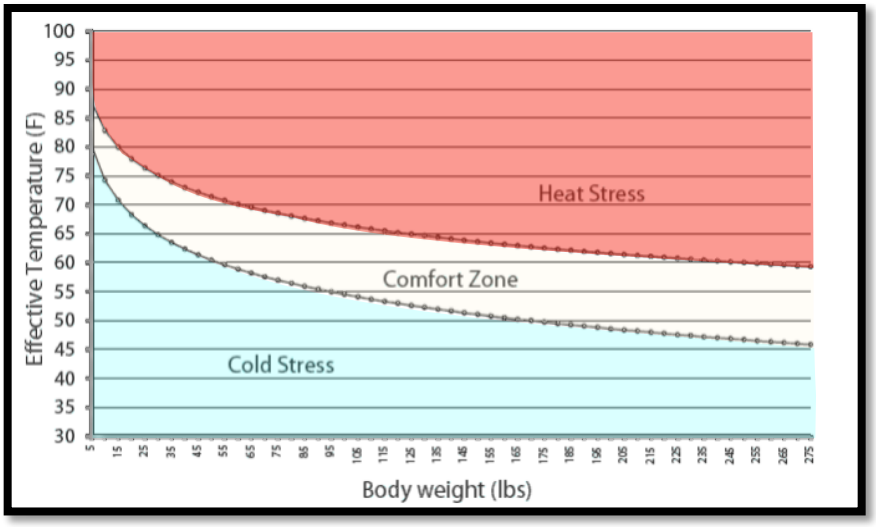
Uninterrupted access to quality feed and water is essential in reducing stress and maintaining growth performance. Caretakers walking the barns on a daily basis need to check feeders and waterers closely to ensure pigs have access to clean feed and water. The Water Quality and Feeder Management sections of the Hubbard Finisher Management Guide provides more extensive information on these topics.

Optimal Environment

The high lean, fast growing pigs in production today are more susceptible to environmental stress and temperature extremes compared to their predecessors. In order to maintain growth and feed efficiency it is important to ensure that pigs remain within their thermoneutral zone. Once a pig falls outside of that zone they will become stressed and setbacks in performance can be observed.

ENVIRONMENTAL IMPACT ON GROWTH

When pigs are kept at temperatures below their comfort zone they will consume more feed in an effort to maintain their body temperature, resulting in decreased feed efficiency. Conversely, pigs housed at temperatures above their comfort zone will decrease feed intake and daily gains will slow down. In modern swine barns pigs are at a greater risk of experiencing heat stress rather than cold stress. Therefore, it is important to ensure that all fans, sprinklers, cool cells, and other cooling equipment is adequately maintained so that they are properly functioning during the hot summer months.



In conjunction with temperature, it is important that your barn is properly ventilated to provide pigs with an optimal environment. Despite the thermostat reading falling within the pigs comfort zone, it may not actually be the environment that they are experiencing.

Effective temperature is a concept similar to that of wind chill and heat index. For example, 60°F is a favorable temperature for a 125 lb pig. However, 60°F combined with a high air speed (100 ft/min) would be cold, and consequently the pig would be diverting energy from growth to maintaining its body temperature. The chart at the right shows the effects of wind speed on temperature.

Air speed (ft/min)	Temperature adjustment
0	0
30	-7
90	-13
300	-18

On the other hand, the temperature within the barn needs to be adequately adjusted to account for the additional heat production from the growing pig. For every 60-80 lbs of gain, the pig will produce an additional 200 btu/hr of heat. Therefore, CFM's (cubic feet/min) need to be properly adjusted to account for the increasing heat production. Using the chart below, a 1000 head barn averaging 100 lbs in August would require 75,000 CFM. Conversely, if that same 1000 head barn in August housed pigs weighing 250 lbs the required CFM would be 120,000.

Recommended Ventilation Rates, CFM per pig			
Pig Weight, lbs	Minimum	Mild Weather	Hot Weather
30-75 lbs	3	15	45
75-150 lbs	7	24	75
150-280 lbs	10	35	120

Humidity is also an important indicator of proper ventilation. Simply put, humidity is the amount of water vapor in the air. During the winter months, humidity is generally lower due to cooler air having a lower water holding capacity. It is suggested to increase ventilation rates when the outside temperature drops below the set point, in an effort to decrease humidity within the barn. However, during warmer months when outside temperature exceeds the set point, increasing ventilation rates will not decrease humidity within the barn. This is due to warm air having a higher water holding capacity than cooler air. It is recommended to operate at 65% relative humidity or less. This level of humidity will decrease condensation and wet floors within the barn.

Ventilation is also a key player in keeping gases such as ammonia, hydrogen sulfide, and carbon dioxide below allowable concentrations. These gases, at high enough levels, can be detrimental to animal and worker health and productivity. Below are guidelines for gases typically monitored in swine barns. It is important to note that readings should be taken at pig level to most accurately reflect what the pig is experiencing.

Ammonia – 10 ppm

Carbon dioxide – 3000 ppm

Hydrogen sulfide – 5 ppm

Pigs are very adaptive and as their environment changes, they acclimate by diverting energy away from growth to some other biological function. This makes identifying possible environmental stressors more difficult since the pig may seem to be eating and growing at a normal rate. However, careful evaluation of the pigs and their surrounding environment will help catch potential health and growth problems before they arise.

Environmental Impact on Growth FAQ

- **What type of disinfectants are most effective for swine barns?**
  - There is no single disinfectant that will work on every farm. It is important to select a disinfectant that has a label claim against the pathogen that you are trying to kill. Disinfectants are more effective on clean surfaces. It is important to use apply the disinfectant according to label directions. The contact time recommended on the label should elapse (usually 10 minutes). Dipping objects in disinfectant generally is not as effective as scrubbing or wiping an object with disinfectant. Commonly used disinfectants include a phenolic disinfectant, (One-stroke Environ); a quaternary ammonia compound (Roccal-D Plus); a chlorine compound, sodium hypochlorite (household bleach); an oxidizing agent, (Virkon S); and a quaternary ammonium/glutaraldehyde combination product (Synergize).

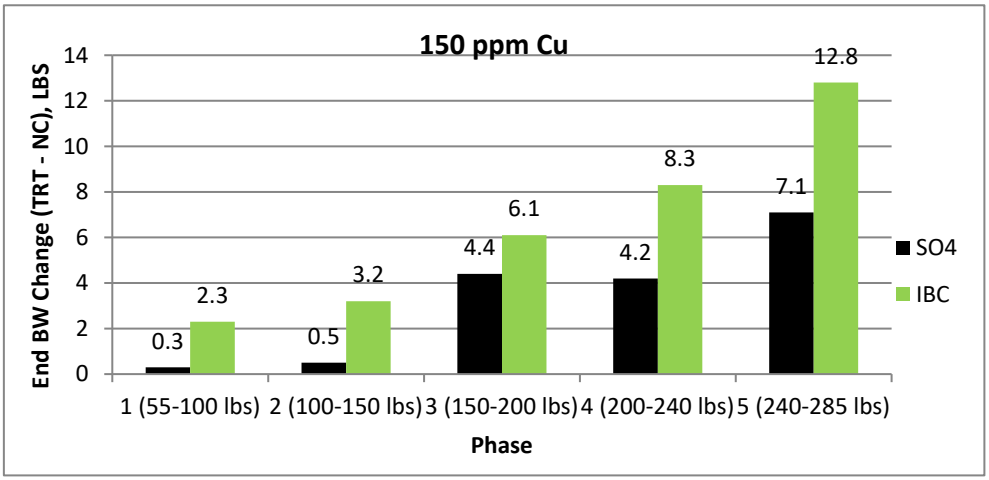
- **What can I do to help decrease the amount of dust present in my barns?**
  - The use fat or oils (1%) in swine diets can reduce the level of dust in the barns. Cleaning barns in between groups can also reduce dust accumulation. Many farms are using Electrostatic particle ionization units which work by emitting large numbers of negatively-charged ions into the air — some 10 million billion negative ions per second. These ions impart a negative charge to dust particles floating in the air, driving them to positively-charged barn surfaces, where they stick — just like metal filings adhere to a magnet. Dust may be collecting on the surface but it isn't free floating in the air affecting pigs' respiratory systems.

- **What type of resources are available for worker safety in swine barns**
  - The National Pork Board website has a number of resources on worker safety along with an "Employee Safety Toolkit." All this information can be found on their website, www.pork.org under the Resources section.

FEED ADDITIVES

While the goal of a nutrition program is to provide the proper level of nutrients to meet the pig's needs for growth and performance, there are times when additional nutrients can be beneficial. The number of feed additives and their intended purposes are many and far ranging. The information below will focus on the general use and potential benefits of the most commonly used feed additives.

- **Copper Sulfate and Copper Chloride**:
  Copper has been shown to have a growth-promoting quality in nursery and growing pigs. Generally levels between 125-250 ppm of copper are most effective with the higher levels of copper showing an improvement in both ADG and feed efficiency in growing pigs. Copper chloride (IBC) has the same or even better results than copper sulfate (SO4) with the advantages of a lower feeding level. The use of copper at high levels, above 250 ppm, can produce negative effects on pig performance along with toxicity risks at greater levels.



Source: Kansas State University, 2013

- **Zinc Oxide**
  Research has shown improvements in nursery pig growth rate and a reduction in diarrhea when pigs are fed therapeutic levels of zinc oxide between 3000-4000 ppm.

- **Magnesium Oxide**
  Most cereal grains and plant protein products contain fairly high levels of magnesium, so with proper care and a carefully formulated diet, a deficiency of magnesium would not be a concern. However, some studies have shown that supplementary levels of magnesium can reduce stress and aggressive behavior in pigs. Magnesium oxide can be added to swine diets at the rate of 5-10 lbs per ton to reduce stress and cannibalism.

- **Potassium Chloride**
  Potassium chloride can be added to late finishing diets to help reduce shrink during marketing. The typical inclusion rate is 1-2 lbs per complete ton of feed.

- **Chromium**
  Chromium can be added to the diets in the form of chromium picolinate, nicotinate, yeast or propionate. Chromium improves glucose utilization by enhancing the effects of insulin binding to cell receptors. Research has shown that chromium supplementation (200 ppb) can enhance leanness in grow-finish pigs by reducing backfat and increasing loin eye area.

- **Carnitine**
  Carnitine is a lysine metabolite that functions within the cell to transport lipids into the mitochondria for use as energy. It has also shown promise in reducing backfat in finishing pigs. Carnitine may also increase birth and weaning weights of young pigs when fed to sows and influence muscle fiber development of the fetuses in gestating sows.

- **Essential Oils**

  Essential oils are the aromatic oily liquids derived from materials such as flowers, leaves, fruits, and roots. Essential oils can act as antimicrobials and antioxidants enhancing the immune response and reducing diarrhea in pigs. Interest in essential oils continues to grow in popularity, especially with the use of antibiotic-free nutrition programs. Individual essential oils have different specificities, which has led to inconsistent results. The value of a multiple oil product is a more consistent response given the diversity of gut bacterial populations at different farm locations and at different times.

Encapsulated Essential Oils – this process protects the essential oils, improves palatability and makes them heat stable.

- **Mannan-oligosaccharides (MOS)**

  Derived from the yeast cell wall of *Saccaromyces cerevisia*, MOS functions in the gastrointestinal tract in two ways. First, MOS adsorbs and excretes pathogenic bacteria that would otherwise attach to the intestinal epithelium. Secondly, MOS enhances the response of the immune system. Research has shown a positive effect on ADG, FC and ADFI for pigs fed MOS.

- **Probiotics and Yeast:**

  Probiotics or direct-fed microbials (DFM) are used to enhance gut intestinal health. Direct fed microbial's are defined by the FDA as a source of live "viable" naturally occurring microorganisms. In general these microorganisms fall into one of three categories: 1) lactic acid producing bacteria 2) bacteria belonging to the Bacillus genus and 3) Saccharomyces yeasts. There is concern in regards to the viability of these organisms post feed processing, especially following pelleting due to prolonged exposure to high temperatures. Research has shown that the use of DFM's improves ADG and also reduces the incidence of diarrhea.

- **Prebiotics**

  Prebiotics are non-digestible food ingredients that stimulate the growth of beneficial bacteria that will improve the health of the host. Prebiotics include non-digestible carbohydrates and resistant starches (i.e cellulose, xylans). Examples of prebiotics include inulin, MOS and yeast culture products. Prebiotics have an advantage over DFM's in that prebiotics are not affected by heat processing.

Feed Additives FAQ

- How do I know when a feed additive should be used?
  - In most cases, pigs receive their daily nutrient requirements through the diets fed to them. However, when health challenges occur or when there are specific performance expectations, the use of a feed additive may be beneficial.

- Does Hubbard Feeds routinely recommend certain feed additives?
  - Hubbard Feeds has a number of products that we recommend when additional nutrition support is needed. These products are known as our OptiCare line of feeds. A few of the more common ones are highlighted below:
    - GutCIE – an all natural fermentation based feed additive that contains L*actobacillus acidophilus*, GutCIE promotes the growth of beneficial bacteria in the gastrointestinal tract. This translates into improved feed intake and average daily gain
    - Assist is a combination of copper chloride and a yeast culture product designed to be used in grow-finish pigs. Copper chloride has been shown to improve average daily gain. The yeast culture product helps pigs manage stress caused by specific disease challenges and is a tool to reduce mortality associated with Hemorrhagic Bowel Syndrome (HBS).
    - Opti-Remedy is a blend of essential oils that reduces the harmful bacteria in the gut. The combination of essential oils from oregano, thyme, cinnamon, capsicum and citrus fruit extract also promote the growth of beneficial bacteria in the gastrointestinal tract. Opti-Remedy can be used in all stages of pig production.
    - Opti-Pak Efficiency – a nutrition fortification pack formulated for the last 40-80 lbs of gain in finishing pigs. Opti-Pak Efficiency improves average daily gain and feed conversion by increasing the digestibility of the diet.

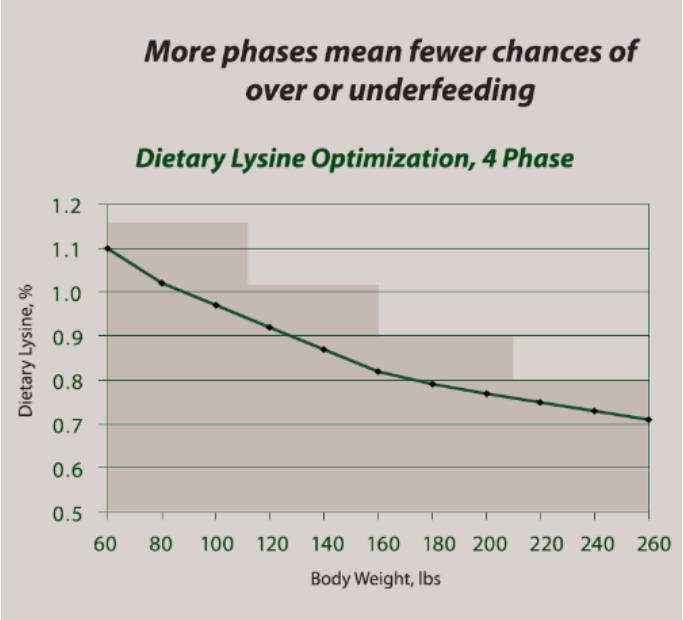
- Tailbiting is a problem in my herd. Which feed additives should I consider?
  - Tailbiting can be caused by a number of factors and nutrition is often viewed as the culprit. Before considering a feed additive, a thorough review of the ventilation system should be done to make sure there is enough air movement and the temperatures are correct for the season and size of pig. Stocking density should also be analyzed since pigs that are crowded will have tendency to exhibit undesirable behaviors. Magnesium oxide is often added to the diet because of the calming effect it can have on pigs, which may then reduce cannibalism.

FEED BUDGETING

Feed budget management is an important part of delivering proper nutrition throughout a pig's growth cycle. Following a well-designed feed budget serves two purposes, it reduces the chance of underfeeding important diets and over feeding the higher cost diets.

Phase Feeding and Nutrition

The purpose of phase feeding is to accurately deliver the right nutrients at the right time throughout a pig's growth cycle. As a pig's body weight and feed intake increases, its requirement for digestible amino acids, phosphorus, and other key nutrients decreases. Phase feeding allows diets to be formulated based on a pig's specific weight range and nutritional needs, while minimizing the under- and over-feeding of nutrients, as depicted in the graph to the right.



Feed Budget Development

A feed budget is a practical tool used to manage the amount of feed pigs receive during each phase of growth. Feed budgets eliminate the need for weighing pigs to determine when it is time to switch to the next diet. Instead, feed budgets use consumption data that estimates how much feed each pig consumes during a certain weight range. Every production system is different so it is important to develop a feed budget based on your pig's genetics, target market weight, dietary energy levels, and performance history. This will increase the accuracy of delivering the right feed at the right time during the pig's growth cycle.

Utilizing performance history, dietary phases are ordered and delivered based on an estimated feed intake per pig. The table on the next page shows an example of a feed budget. You can see that a 25-40 lb pig is projected to consume an average of 27 lbs of feed. Therefore, if you have a 1000 head barn you would order 13.5 tons of the N3 diet. When the 13.5 tons of N3 has been delivered, you would then switch to the next phase in your program, which in this case is GF #1. This group of pigs would require 20 tons of this stage of feed.

Example Budget

Diet #	Pig Weight	Lbs. per Pig	Tons per 1000 hd	Est. Days
N#3	25-40	27	13.5	11
GF #1	40-60	40	20	13
GF #2	60-80	45	22.5	12
GF #3	80-120	100	50	23
GF #4	120-160	110	55	21
GF #5	160-200	115	57.5	20
GF #6	200-230	95	47.5	15
Paylean or GF #7	230-280	170	85	23

Total Feed Usage per hd.(Lbs)	702	Start Date	4/14/2015
Total Feed Usage per 1000 hd. (Tons)	351	End Date	8/30/2015
Total Weight Gained per hd.	255		
Estimated Feed:Gain	2.75		
Total Days on Feed	138.00		
Estimated Average Daily Gain	1.848		

Budgeting for Paylean

While diet changes in a swine feed budget are based off pounds per pig fed, the one exception to the rule is Paylean® (ractopamine hydrochloride from Elanco). Paylean has a diminishing financial return the longer it is fed. Back-calculating from the estimated date a group of pigs will be closed out is the best way to feed Paylean.

Recommendations for feeding Paylean:

- A single step Paylean program *(feeding only one rate of Paylean)* should be fed for the duration of 22- 25 days pre-closing of a group of pigs.
- A step up Paylean program *(feeding two rates of Paylean with the later rate increased from the first)* should be fed for 28-30 days total with each rate being fed for 14-15 days each.

Using Feed Budgets to Determine a First Cut

Feed consumption is the best indicator of live body weight. After careful analysis of historical close out data a protocol can be developed for determining when to take the first cut of pigs to market. For example, let's assume based on historical farm data that when a group of 50 lb feeder pigs consumes an average of 505 lbs per pig, the average group weight will be 230 lbs. Given this average group weight of 230 lbs, the top 15% will have an average weight of 270 lbs and can be marketed.

Feed Budget Compliance

A feed budget compliance analysis is an important process that measures how closely a feed budget is being followed. If too many or too few pounds of one diet is fed, then the subsequent diet's budgeted amount needs to be adjusted up or down to stay compliant with the budget. If no budget adjustments are made, mistakes in feed delivery and ordering will greatly distort the feeding program. Retrospective analysis of feed deliveries is an important exercise that gives insight into what is actually being fed to a group of pigs rather than what is assumed to be fed.

Feed Budget FAQ

- **Why is feed consumption the best predictor of weight?**
  - In general feed is the best predictor because gain is directly related to feed intake. A health challenged group of pigs will have reduced feed intake and gain. Conversely, a high health group of pigs will have an increased feed intake and gain weight faster.

- **How many phases should I feed?**
  - 5-6 diets provide enough phases to properly match the pig's requirements. More phases can be fed but there is little to no financial return in doing so. In addition, feeding more than 6 phases increases the difficulty to properly manage a feed budget leading to feed budget compliance issues.

- **Should I switch to the next phase if there are only a few pounds per pig left?**
  - The question really asks if it is better to continue with the budget or move to the next phase. It's a subjective answer but often the decision is made based on the truck. If less than half a truckload of feed remains on this phase, switch now. If it's more than half a truck, make a full truckload of the current phase, then switch. Just make sure to adjust the amount of feed for the next phase so that the budget remains accurate.

FEED QUALITY

Providing a high-quality feed to pigs involves many aspects along the production chain. It starts with ingredients that are of high nutrient value and free from contaminants. Processing, delivery and storage of the diets can also affect the quality and final composition of the feeds. Understanding the factors that affect feed quality and implementing a quality assurance program will help ensure the best possible nutrition is delivered to the pigs.

Test Weight:
Corn weighing between 40 and 55 lb/bushel will produce the same weight gain in finishing pigs as corn with a 56 lb/bushel test weight when compared on an equal moisture basis. A reduction in feed efficiency can be expected when test weight is reduced more than 10%. When test weight drops below 40 lb/bushel, growth rate and feed efficiency may decrease by 5-10%.

Light test weight grains have a lower bulk density than normal grains, which makes it important to add grains to the diet according to weight, not volume. Light weight grains also contain more fiber and less oil so they tend to be dustier during the grinding process. They may also cause bridging problems in bulk bins. It will take more bin space to hold the same weight of light weight corn, so additional bin space may need to be added to accommodate that.

Mycotoxins:
Environmental conditions that create stress on grains may also cause those grains to be susceptible to mold growth. However, it's important to remember that it's not the mold itself that causes performance problems, but the mycotoxins the molds produce that cause the negative effects. The mycotoxins that are of primary concern in swine diets are aflatoxin, zearalenone, vomitoxin or deoxynivalenol (DON) and fumonisins.

Mycotoxin	Negative Effects	Level of Concern
Aflatoxin	Immune System Suppression Reduced growth performance	200 ppb finishing diets 100 ppb growing pigs
Zearalenone	Red, swollen vulvas in prepubertal gilts Reduced reproduction performance	1 ppm grower diets/3 ppm finisher 500 ppb for replacement gilts
Vomitoxin	Feed refusal; decrease ADG	1 ppm
Fumonisins	Respiratory problems	5 ppm

Mycotoxins can have an additive effect. The levels of individual mycotoxins may be not be high enough to cause concerns, however the combination of multiple mycotoxins, even at low levels, can have a significant effect. Drying the grain and adding mold inhibitors to mycotoxin contaminated grains will decrease any further mold growth, but will have no effect on the mycotoxins already present.

Particle Size and Grind
Grinding grains for swine diets improves feed utilization. By reducing the particle size, the surface area of the grain particle is increased which allows for greater interaction with digestive enzymes. Swine feed efficiency is generally improved 1% for each 100 micron reduction in particle size from 1000 microns down to 400 microns. As micron size decreases, the cost of grinding increases and mill throughput decreases. Taking into account improvements in feed efficiency, processing costs, incidence of gastric ulcers and the potential for feed bridging, the recommended particle size for meal diets is between 650 -750 microns.

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Hammermill vs. Roller Mill

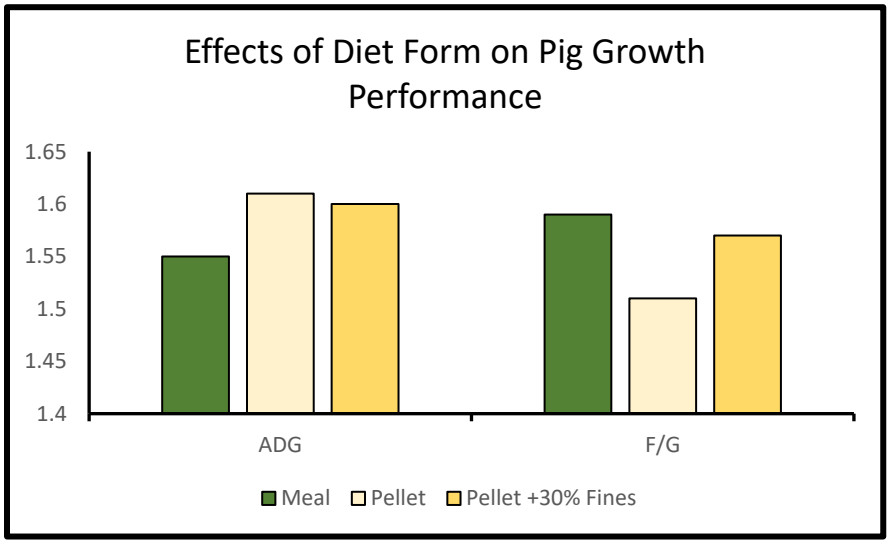
The most popular grain processing options are the hammermill and the roller mill. Hammermills are effective at grinding an array of feedstuffs and are capable of producing a wide range of particle sizes. In comparison to roller mills, hammer mills are noisier and generate more dust and heat during the grinding process, while consuming more energy.

The photo above illustrates corn ground to various particle sizes

Roller mills generate less noise and dust and provide a more uniform particle size/grind, which may improve digestibility and feed flowability. However roller mills require more oversight to maintain a gap with that will produce the targeted particle size. This gap changes as rollers wear and grain qualities change. Hammermills require less oversight by comparison. However, most swine farms prefer roller mills given the more uniform particle size and improved flowability, thereby potentially reducing the incidence of feed bridging in bins and feeders and subsequently out-of-feed events. Many swine farms that utilize roller mills are decreasing ground corn to 500-600 microns. The improvement in feed efficiency needs to offset any increased incidence of feed bridging.

Pelleting

Pelleting diets is an effective way of improving feed efficiency in all phases of swine production. In addition to enhancing performance, pelleting decreases diet segregation and reduces dustiness and issues with feed bridging. Multiple studies conducted by Hubbard Feeds have consistently shown a 5% improvement in ADG and a 6% improvement in feed efficiency when healthy nursery pigs were fed pelleted vs. meal diets. To maintain the feed efficiency benefits of feeding pelleted diets, pellet fines must be minimized. Since having zero fines in swine diets is not realistic, Hubbard conducted a study looking at the performance of pigs fed pelleted diets compared to pigs fed pellets that contained fines to determine at what level fines would be detrimental to performance.



Results of that trial are shown to the right and indicate that performance benefits associated with pelleting diets were lost when pigs were fed pelleted diets with over 30% fines. These findings indicate that some fines can be in the pellets and not affect performance.

Good Manufacturing Practices (GMP)

Quality ingredients and manufacturing processes are the key components of any nutrition program. The FDA has established guidelines and standards for Good Manufacturing Practices (GMP) for animal feeds that must be followed by all feed mills. Good manufacturing practices are the backbone of a good quality control program. They are designed to ensure proper usage of feed additives and prevent feed contamination. Providing a residue free supply of pork for human consumption is extremely important. The Food Safety Modernization Act (FSMA) will provide more direction on manufacturing and producing safe feed for animals intended for human consumption

Sampling of ingredients and finished feeds is an integral part of any quality assurance program. Working with a reputable supplier of ingredients can help ensure quality expectations are met. Yearly maintenance tasks such as a mixer uniformity test can help uncover potential problems before they occur. Keeping retainer samples of manufactured feeds is a good practice so if questions arise the feed sample can be sent off for analysis.

Ingredient storage and shelf life

To prolong ingredient shelf life and quality, follow these guidelines:

1. Keep ingredients at a cool temperature or avoid excessive heat
2. Keep ingredients dry to prevent mold and bacteria growth
3. Prevent rodents and insects from entering the feed
4. Use antioxidants to preserve fats and oils in ingredients and feed
5. Rotate stock and pay attention to expiration dates

Feed Delivery

Delivery of finished feeds is an important part of GMP. Sequencing the unloading process to make sure non-medicated feeds are unloaded first can prevent drug residues. Flushing between medicated feeds can also help prevent residue concerns. Proper identification of bulk bins can reduce the chance of unloading feed into the wrong bin and potentially creating drug withdrawal concerns for pigs near market weight.

FEED QUALITY FAQ

- I want to take samples of my feed. What's the best way to do that?
  - In order to get the most accurate feed analysis, it is important to take multiple samples of a single batch of feed to ensure you are getting the most representative sample. Taking samples of feed as it's being discharged from the auger to the bulk bin is one of the most convenient ways to obtain samples. Another option would be to take probes from each feeder. Regardless of sample location, subsamples should be combined together to create one large sample. A small representative sample can then be taken and stored for later analysis or sent to a lab.

- Where can I find more information on GMP and FSMA?
  - More information on FSMA can be found on the Food and Drug Administration website at http://www.fda.gov/fsma The American Feed Industry Association (AFIA) www.afia.org also has a number of resources for feed manufacturers on their website.

FEEDER MANAGEMENT

Feed accounts for roughly 65-75% of the cost of production, making it the most expensive input within any swine business. Properly formulated diets are only part of the equation when it comes to feeding pigs. The feeder is the final interface between the pig and diet, and if we cannot effectively deliver the feed to the pig we are hurting performance and our bottom line.

To fully grasp the importance of feeder management one needs to consider the amount of feed that passes through a single feeder. Consider a 1200 head barn with 48 pens (25 pigs per pen) and 24 fence line feeders. Assuming pigs enter the barn at 55 lbs and are marketed at 280 lbs with a 2.8 feed efficiency, they will consume 630 lbs of feed.

Feed	***Barn***
630 × 50 = 31,500 lbs of feed/feeder/turn	*31,500 × 24 = 756,000 lbs of feed/barn/turn*
31,500 × 2.8 = 88,200 lbs/feed/feeder/year	*756,000 × 2.8 = 2,116,800 lbs of feed/barn/year*
88,200 ÷ 2000 = ***44.1 tons/feed/feeder/year***	*2,116,800 ÷ 2000=****1058.4 tons/feed/barn/year***

Feed cost = $185.00/ton

44.1 × $185.00 = ***$8,158.50 of feed/feeder/year*** *1058.4 × $185.00 =* ***$195,804.00 of feed/barn/year***

The pounds and dollars of feed that passes through each feeder and barn per year is remarkable. Feeder management is a relatively simple way to reduce feed wastage and increase feed efficiency.

Three main components in successful feeder management are:

Adequate feeder trough space

Proper feeder adjustment/feeder pan coverage

Reducing/eliminating out of feed events

Trough Space

Feeder trough space is an important step in improving overall feeder management. The first step is to determine how many pigs your feeder can handle efficiently. This is dependent on a myriad of factors:

- **Feeder design** – Wet/dry feeders can service more pigs than dry feeders because feed and water are in the same location enabling pigs to eat more feed in less time.

- **Feed form** – If pelleted diets are provided, the feeder will be able to service more pigs due to an increase in eating speed when pigs are presented pelleted diets.

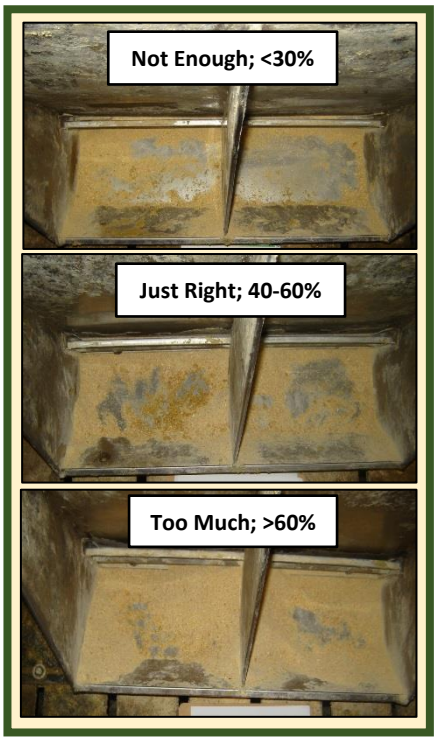
Feeder Type	Stocking Density
Dry Feeder	8-10 pigs per space*
Wet/Dry	12-15 pigs per space**
Tube Feeders	11 pigs/drop/side*
*2" of trough space per pig minimum ** 1" of trough space per pig minimum	

Feeder adjustment

Studies have shown that an improperly adjusted feeder can increase feed wastage by 1.7-5.4%. This could equate to $55.00-175.00 in wasted feed per feeder per group.

Due to the variety of feeder types available there isn't a single setting recommendation for feeder adjustment. Rather, feeder pan coverage is utilized as a measure of proper feeder adjustment.

Growth performance is optimized when pan coverage is approximately 40-60%



It is also important to remember that feeder adjustment isn't a one-time deal when pigs are placed. Feeders should be continually checked and adjusted to maintain proper feeder pan coverage.

Changes in diet composition (fiber) and form (meal vs. pellet) will affect how the feed flows through the feeder. Therefore, feeders should be checked and readjusted if a significant diet change occurs.

> Adjusting feeders is one of those barn chores that often gets overlooked or marked off the to-do list. However, taking a little more time to evaluate feeder pan coverage can pay dividends through increased ADG and decreased feed wastage.

Out-of-Feed Events

An out-of-feed event can be defined as a period of time in which the pigs do not have access to feed as a result of:

- Late feed delivery
- Bridging of bulk bins, feed lines, or feeders
- Clogged feeders
- Equipment error

Regardless of the cause of the out-of-feed event, its impact on the pig is the same. Following an out-of-feed event aggression and fighting may be observed along with an increase in the incidence of ulcers and HBS, and a reduction in daily gain. A potential increase in mortalities, lighter pigs, or more days on feed will occur with an economic impact to the producer.

Feeder Management FAQ

- **What should my feeder trough dimensions be?**
  - Feeder troughs should be 8-12” deep, with a 4-5” lip, and the width should be 1.1 x pig shoulder width.

Pig weight, lbs	Shoulder width	Shoulder width x 1.1
44	6.8	7.5
88	8.5	9.3
132	9.7	10.7
176	10.7	11.8
220	11.5	12.7
275	12.4	13.6

- **What should my micron size be to help prevent feed from bridging?**
  - Mash diets with a particle size below 600 microns will have a tendency to bridge easier in bulk bins and feeders. The general recommendation for particle size in mash diets is between 650-750 microns.

- **Do pigs need an additional water source with wet/dry feeders?**
  - Pigs with wet/dry feeders do not require a secondary water source. All of their water needs can be met through the nipple located in the feeder, assuming that there is adequate feeder space per pig. In addition, with the water nipple being located within the feeder, wet/dry feeders have been shown to reduce water wastage by ~35% when compared to fence line nipple drinkers. When stocking density is high or during hot weather, extra waterers in addition to the water provided via wet/dry feeders have been reported to be of benefit. In sort barns, extra waterers located outside of the food court area have also been reported as being beneficial.

- **I experience a few out of feed events per turn, but my pigs are out of feed for less than 24 hours, will this create any adversely effects?**
  - Regardless of duration an out-of-feed event can have a significant impact on pig welfare, health, and performance.
    - Welfare – Out-of-feed events are stressful and pigs may turn to negative behaviors such as tail- and ear-biting as a coping mechanism. Once feed does become available pigs may exhibit aggressive behavior which can lead to fighting and the increased risk of injury of pigs within a pen.
    - Health – Less than 24 hours of feed deprivation has been shown to cause and aggravate stomach ulcers in growing pigs. In addition, it has been hypothesized that out-of-feed events could play a role in increased incidences of hemorrhagic bowel syndrome.
    - Performance- It has been observed over a 24 hour period, that pigs without access to feed will not compensate for the missed meals once feed does become available. During a 24 hour out-of-feed event, the pig will use its body stores to maintain basic bodily functions. This maintenance cost is equivalent to roughly 1 lb of a corn-soy diet per day. Once pigs regain access to feed they will have to consume an extra pound of feed on top of their normal daily consumption to compensate for the body stores lost during the out-of-feed event, plus the additional feed needed to account for the lost gain. Gut capacity likely prevents pigs from fully recovering from an out-of-feed event, as they cannot physically eat enough feed to make up for lost gain. Therefore, one 24 hour out-of-feed event can be thought as an equivalent to 1 day longer on feed. This could cause some economic set-backs, especially in fixed time systems.

GUT HEALTH

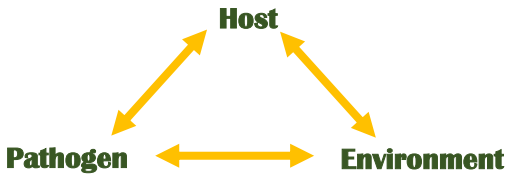
The topic of gut health is commonly associated with nursery pigs. However, all pigs need a healthy and properly functioning gut to perform at their best. Gut health shouldn't become an afterthought once the pigs exit the nursery, it should be an all the time deal. Fighting, out of feed events, marketing, and temperature fluctuations are all examples of some of the stressors a pig will encounter during their time in the finishing barn. How a pig responds to various stressors can in part be attributed to the health status of their gastrointestinal tract.

"A healthy gut will enable a pig to better cope with stress and fight off pathogens."

A single layer of cells, called enterocytes, line the wall of the intestine and are responsible for aiding digestion, nutrient uptake, water absorption, and preventing pathogens and toxins from crossing the epithelium and gaining access to the body and blood stream. A robust and properly functioning gastrointestinal tract is imperative to optimizing pig growth performance and feed efficiency.

This point is illustrated through the disease triangle concept which states that disease requires interactions between the pathogen, host, and environment (stress; Figure 1). Therefore, stressful situations, such as out of feed events, can have a negative impact on a pig's GI tract, and consequently decreases barrier function and increases susceptibility to disease. Barrier function refers to the tight junctions between the intestinal epithelium. The tight junctions and enterocytes can be thought of as tile and grout. Grout is applied between tiles to protect the tile from water and other substances that could get behind the tile and cause damage. The same concept applies to the GI tract, if the tight junctions between the enterocytes remain closed, pathogens cannot pass through and enter the body. However, if these tight junctions open and become "leaky", pathogens and toxins can pass through and enter the body eliciting an immune and inflammatory response. Subsequently, diverting nutrients away from growth and decreasing performance.

Figure 1. The disease triangle

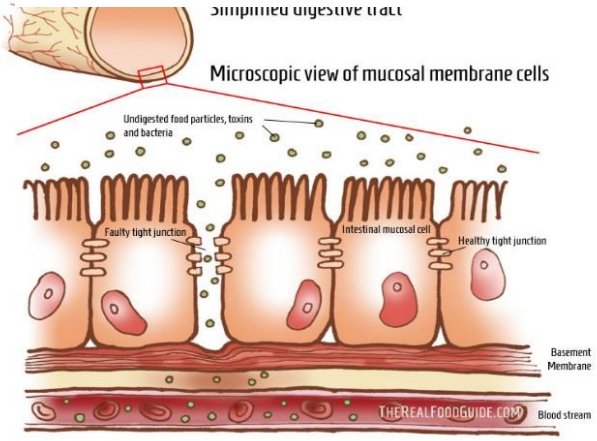


A few ways that we can positively influence gut health on the farm are:

- **Adding fiber to the diets**, such as wheat midds, DDGS, or soy hulls at inclusion rates as low as 1-5% may positively impact gut health. Fiber has a prebiotic effect, where it acts as a substrate for the bacteria, improving the gut micro-environment and immune system.

- **Eliminating out of feed and water events** is one of the easiest ways to improve gut health. When pigs do not have access to water or experience an out of feed event, several stressors are taking place. Pigs become more aggressive towards their pen mates. They do not have enough nutrients to sustain efficient growth. Once the pigs do get access to feed or water, they may over consume and predispose themselves to a twisted gut.

Figure 2. Example of tight junctions and leaky gut.



- **Feed additives** such as copper chloride, yeast products, and essential oils can aid in creating and maintaining a healthy gut environment.
  - **Copper chloride** provided at pharmacological levels acts as an anti-microbial and helps to decrease the growth of disease causing bacteria in the gut.
  - **Yeast products** are added to diets as a food source for the beneficial bacteria within the gut. By providing a food source for the good bugs, we are creating a favorable bacteria balance in the gut and in turn positively impacting gut health.
  - **Essential oils,** such as oregano, cinnamon, thyme, and capsicum, help to promote good gut health by stimulating the growth of the beneficial microbes while suppressing their competitors.

Finally, no gut health discussion is complete without covering Hemorrhagic Bowel Syndrome (HBS) and Ileitis.

- **Hemorrhagic bowel** is an elusive disease in the finisher that seems to strike sporadically and seemingly healthy 4-6 month old finishing pigs. Pigs are diagnosed with HBS post mortem when the pig dies suddenly without out any indication of illness. The pig will present with pale skin, distended abdomen, thin walled small intestine with clotted and unclotted blood present, tarry fecal material in the large intestine, and no lesions or ulcerations of the GIT. Little is known about what causes the onset of HBS but several nutritional and management strategies, such as fiber and reducing out of feed events, may prove helpful in the face of or preventing an HBS outbreak.

- **Ileitis** is a gastrointestinal disease caused by the bacteria *Lawsonia intracellularis*. Common symptoms of ileitis are diarrhea, reduced average daily gain and feed efficiency. However, symptoms are dependent on the type of ileitis: subclinical, clinical/chronic, or acute.

  - **Subclinical** – There are no discernable symptoms, aside from decreasing average daily gain and feed efficiency in the affected pigs. Additionally, environmental stressors such as weather or commingling, could move the disease from subclinical to clinical.
  - **Clinical/Chronic** – Usually affects growing pigs and can result in pasty/watery diarrhea, along with reductions in weight gain and feed efficiency in affected pigs, resulting in an uneven weight distribution among a flow of pigs.
  - **Acute** - Generally appears in finishing pigs and is marked by bloody/black diarrhea, lethargy and weakness. Sudden death may also be a result of acute ileitis.

Figure 3. Pictured to the left are intestine samples from a pig infected with Ileitis and a healthy pig. The intestine sample on the left is much thicker and indicative of Ileitis. While, the sample in the middle is from a normal pig and you can see fingers through the lining.

Gut Health FAQ's

- **What can I do to reduce HBS from happening in finishing?**
  - HBS is very unpredictable and it seems as though anything can cause HBS ranging from genetics to certain times of the year. Hemorrhagic Bowel Syndrome is a multifactorial issue which makes understanding and treating the costly problem particularly difficult. The best advice in preventing a HBS problem is to focus on positively affecting the factors we can control. This would include aspects both outside and inside the pig. Outside of the pig, focus should be placed on appropriately stocking the barn, eliminating out of feed events, and properly ventilating facilities. Efforts inside the pig should be focused on building better gut health, which will ensure that microbial populations do not become unbalanced. Achieving the aforementioned can be accomplished through the measured use of yeasts, essential oils, and antimicrobial products. The most important concept to understand regarding HBS is that your best line of defense is to be proactive and not reactive in preventing outbreaks.
- **I'm facing health challenges in my barn, should I be feeding pellets in finishing?**
  - Pelleted diets should be fed to generally healthy pigs only. That's because pelleting raises the risk of stomach ulcers and usually decreases feed intakes among pigs that are coping with health challenges. The reason why pelleted feeds increase death loss and sort loss in heath challenged pigs is largely unknown. In general, the feed conversion improvement gained by feeding pellets to health challenged pigs in grow finish will be completely negated by the expected increase in death loss and sort loss.
- **At what micron size should my feed be to optimize gut health and performance?**
  - The general rule of thumb is grind feed as fine as possible without causing flowability issues in the bin or the feeder. A complete feed particle size of 500-700 microns are common recommendations for grow finish feed. Grinding feed very fine can benefit feed conversion but the positive effects are negated by the potential out of feed events. Out of feed events caused by fine grinding will increase death loss and reduce average daily gain.
- **What are some products I can use to improve the gut health of my herd?**
  - Assist
    - A combination of yeast culture product and copper chloride that has been shown to increase weight gain in grow-finish pigs. Copper chloride helps decrease the growth of disease causing bacteria and the yeast culture promotes the growth of favorable bacteria.
  - Opti-Remedy
    - A blend of essential oils designed to reduce harmful bacteria and promote good gut health. Opti-Remedy stimulates the growth of beneficial bacteria.
  - Skycis
    - An ionophore used to promote weight gain and feed efficiency in growing pigs. Ionophores decrease the growth of gram positive bacteria and promote the growth of gram negative bacteria. Gram negative bacteria increase the energy status of growing pigs.
- **What role do Mycotoxins play in gut health**
  - Mycotoxins in general can reduce feed intake or cause feed refusal. The effects of having inconsistent intake can cause and increase in HBS, ulcers, and acute ileitis.
- **How do I prevent or treat Iletis?**
  - The use of fiber and gut health products, like essential oils, has been suggested to reduce the incidence of ileitis. A proper medication and/or vaccination protocol should be developed with a veterinarian if your herd is experiencing clinical Ileitis.

MARGIN MANAGEMENT

Risk and margin management are important business strategies that livestock producers use to protect profitably and mitigate financial losses. The goal of margin management is to reduce the financial impact of market variability and increase the profitable periods of production.

Understanding the Cost of Production

The first step to setting up a margin management plan is to understand all of the costs that go into raising a pig. The two types of cost that need to be calculated are fixed and variable cost.

- *Fixed Cost*

  Fixed cost comprises the ongoing costs that occur whether or not pigs are being produced. These costs include facility cost, equipment depreciation, and interest on assets.

- *Variable Cost*

  Variable cost consists of any costs that occur only when pigs are being produced. These costs include feed, transportation, labor, genetic fees, and veterinary expenses.

Understanding Commodity Pricing

Commodity prices are generally based off of the Chicago Mercantile Exchange (CME). A basis value, which is an adjustable figure based on local supply and demand, is then applied to the CME listed price for a given time frame. Future commodity prices can be locked in through trading futures contracts on the CME. Basis price adjustments can be negotiated through suppliers of commodity ingredients like cooperative grain elevators and livestock packing plants.

Calculating Margin

Calculating margin consists of subtracting estimated fixed and variable cost from estimated revenue.

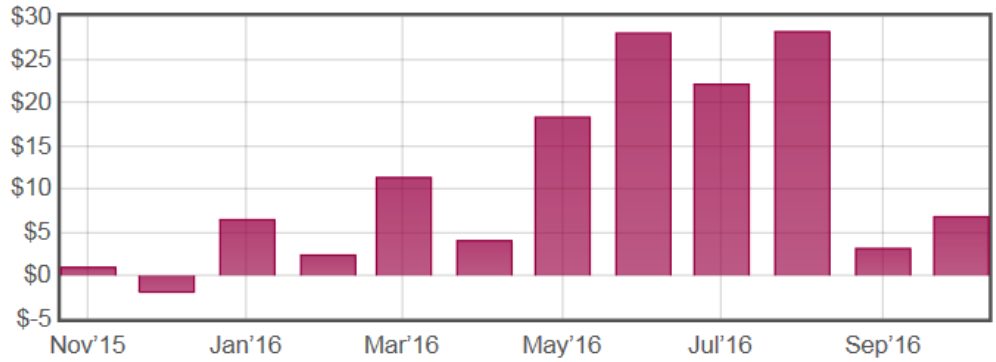
Margin = Est. Revenue – (Est. Fixed Cost + Est. Variable Cost).

Both future revenue and variable commodity cost can be estimated by using CME futures prices.

Margin Modeling

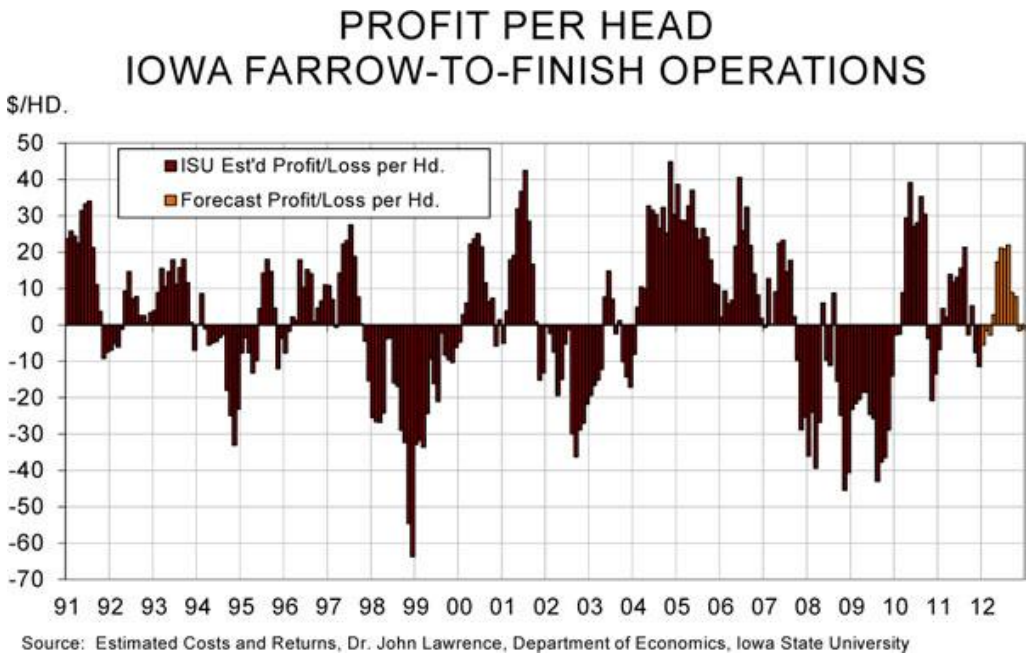
Correctly estimating commodity usage and commodity cost on a per pig basis in the future is a difficult task. Mathematical models can be developed to make estimations easier. Hubbard Feeds offers a margin modeling program called The Crush. The Crush program uses individualized fixed costs and projects future variable costs, revenue and margin per pig based on the CME listed prices. Pictured below is a graphical output page of The Crush program describing the financial return over cost per pig.

Return Over Cost Per Pig



Determining a Desired Profit Per Pig

Once an accurate calculation of future costs and revenue is modeled, the next step is determining what margin/profit per pig is desired. As an example, a target margin per pig may be $4-$10 in the fall/winter marketing periods while a $10-$18 dollar target margin could be set for spring and summer marketing periods. As you can see by the information provided from Iowa State, profit per head is quite variable. Attempting to hit the "high market" can often lead to frustration and lost opportunity. More producers are looking to reduce the financial impact of market variability and increase the profitable periods of production as an overall risk management strategy.



Source: Estimated Costs and Returns, Dr. John Lawrence, Department of Economics, Iowa State University

Executing Trades and Contracts

Once a target margin opportunity is recognized, the next step is executing trades and contracts. To effectively manage margin, trades need to be completed in both input commodities (corn/soybean meal) and revenue generating commodities (lean hogs). A margin is not secured unless both input and revenue generating commodities are traded in tandem. Commodities can be traded on the CME or through packers and grain elevators. Either option can be effective in locking in both input and revenue commodities.

Margin Management FAQ

- **How do I lock in feed ingredients that are not traded on the CME like DDGS?**
  - The best way to lock in DDGS is to trade corn contracts on the CME that equal the amount of DDGS used per pig. DDGS prices follow the corn market and trading corn futures has proved to be an effective hedge.

- **How much of my production and input costs should I protect?**
  - In general it is a good idea not to hedge over 70% of your projected input and revenue commodities. The reason for this recommendation is because pork production can fall short of projections due to health and business disruption (broken contract/facility loss). If you are unable to fulfill the contracts with production, you are still required to financially make good on any profit or loss accrued.

- **How do I estimate my cost of production?**
  - The best way to estimate your cost of production is to review past records to estimate the costs associated with labor, facility, transportation, and feed usage. To estimate the cost of feed, use the CME posted prices of corn and SBM.
- **I feed my own corn. How do I determine a price?**
  - It is important to price the corn you produce based on your local market, because even if you produce corn under the market price, there is opportunity cost you must account for.
- **How do I account for future basis?**
  - Future basis in corn, soybean meal, and lean hogs is difficult to estimate and it varies greatly by region. Generally speaking, historical corn and soybean meal basis by region is posted by grain cooperatives. Lean hog basis estimates can be garnered from packers. It is important to gather and compile 3-5 years of basis data to build a better estimate.

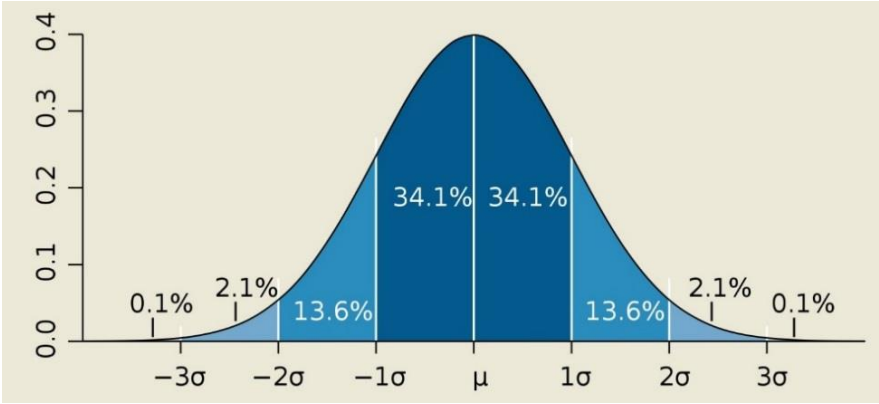
Marketing management can be defined as selecting the correct pig or group of pigs that best meets a packer's specifications of weight and body composition. Marketing pigs is both an art and science that requires the combination of population statistics and the skillful selection of the correct pigs from a group. Improper marketing management leaves money on the table, therefore the goal should be to increase the number of pigs that meet the specifications of a particular packer.

Population Statistics

The following section will give some insight and explanation of the population statistics needed to estimate individual pig weight and marketing metrics. In order to fully understand population statistics one must be familiar with the following terms:

> ***Mean**: the average of a group of numbers (i.e pig weights)*
> ***Standard deviation**: a measure of how far data points are from the mean*
> ***Normalized bell curve**: depicts the distribution of numbers within a data set using the mean and standard deviation.*

For example, the mean (average, μ) weight of a group pigs is 240 lbs, and the standard deviation is 22 lbs. This means that 68.2% of the pigs in the group weigh between 218 lbs and 262 lbs or within one standard deviation (σ) (± 22 lbs) of the average weight of 240 lbs. Therefore of the remaining pigs, half will weigh more than 262 lbs (15.1%) and half (15.1%) will weigh less than 218 lbs.



The chart on the right shows a typical bell curve or population distribution. The dark blue area represents the pigs that fall within one standard deviation of the group. The lighter blue areas represent pigs that are more than one standard deviation from the average.

Packer Matrixes

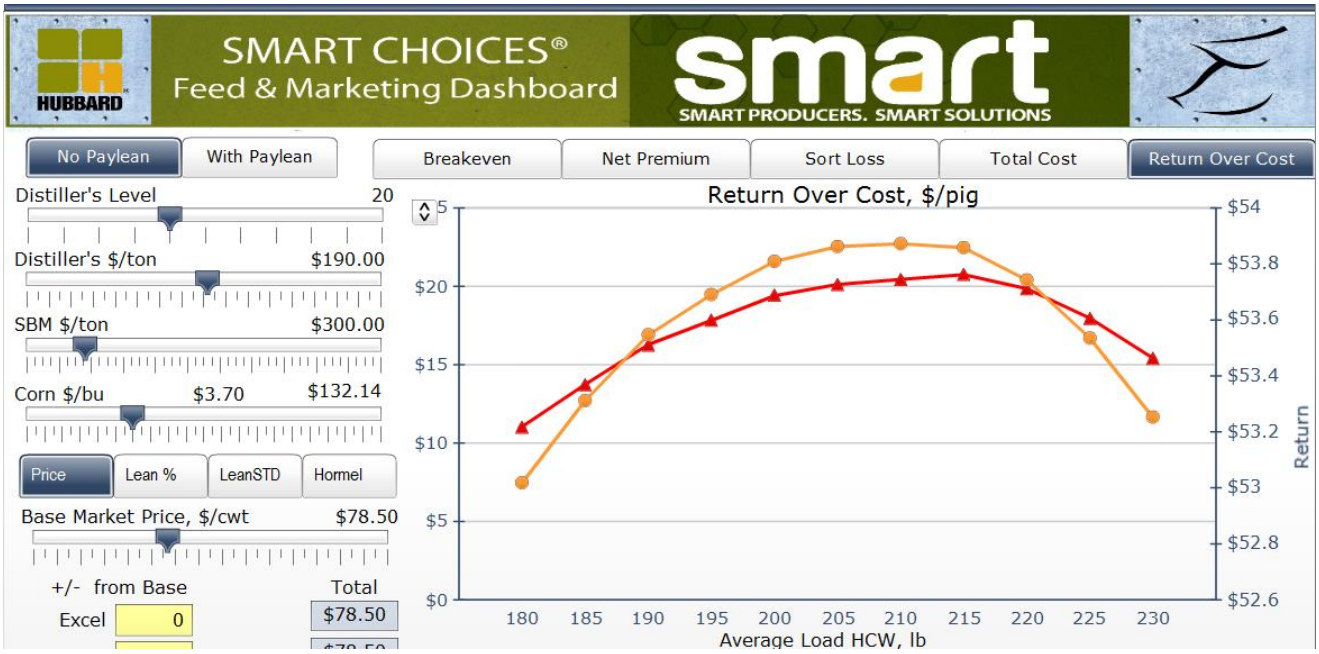
Every packer matrix is unique. It is important to have a thorough understanding of the matrix of the packer or packers to which your pigs will be sold. Most packers use a combination of carcass weight and percent lean to derive a premium payment and a sort loss discount. The producer's goal should be to obtain the highest net return for a selected group of pigs when sold to the packer. There are many factors to consider when selecting pigs and which packer they will be sold to. For example, if your pigs have a low percent lean it would be more advantageous to sell them into a packer's matrix that doesn't use percent lean in their sort loss calculation.

When evaluating a packer matrix it is important to evaluate the sort loss and premium payments based on a group of pigs rather than an individual pig because it is practically impossible to deliver a perfectly uniform group of pigs due to normal group variation. Understanding to what extent sort loss is applied to the light and heavy pigs in a marketed group can

greatly affect the financial returns to the farm. There are a number of tools available to help producers analyze information from their packer and determine how many pigs are not being marketed at the ideal market weight. These spreadsheets often give a financial projection on the impact of reducing sort loss and selling more pigs in the ideal carcass weight range.

Determining a Target Market Weight

Base market price, cost per pound of gain and group variability should all be considered when determining the target market weight for a particular packer matrix. For example if the base market price increases but the cost per pound of gain decreases, it would make sense to increase the average market weight as long as the increase in profit offsets any additional sort loss. Because the calculations required to determine which target market weight gives the highest return are lengthy and complex; Hubbard Feeds has developed the Smart Choices® Feed and Marketing Dashboard to help producers make this determination quickly as market conditions change. A screenshot of the SC Feed & Marketing Dashboard is shown below. It indicates the optimal selling weight based on return over costs at two different packers.



Measuring to Improve Profits

Selling more pigs in the highest paid category will increase net profit per pig. Since selection variation affects the number of pigs in a given category, reducing the standard deviation will reduce the variation. The lower the standard deviation of the load and closer the average weight of the load is to the optimal marketing weight, the greater the return will be on a per pig basis. An excellent carcass weight standard deviation of a load is approximately 13 pounds. This means that 68.2% of the pigs in the load are within 13 lbs of the average load weight. Conversely, a standard deviation of 19 lbs is poor. As a history of marketing performance is compiled, techniques to reduce marketing variation can be implemented to decrease load variation.

Tips to improve hitting the optimal marketing weight and reduce standard deviation

- Consistently measuring load standard deviation and making goals to improve.
- Use feed consumption and the feed budget to guide when the first cut should be made. Feed consumption is the best predictor of weight.
- Build enough time into a flow of pigs so pigs are not forced out of the barn before they can reach their target market weight.

Marketing Management FAQ

- **How much net revenue can be gained per pig by improving my load standard deviation?**
  - Reducing the carcass standard deviation of a load from 19 to 13 pounds can increase revenue up to $3.50 per pig.

- **Why is feed consumption the best predictor of weight?**
  - In general, feed is the best predictor because gain is directly related to feed intake. A health challenged group of pigs will have reduced feed intake and gain. Conversely, a high health group will have an increased feed intake and gain weight faster

- **Does it ever make sense to take the first cut of pigs out of the barn at a lower target market weight to make room in a barn?**
  - At times it makes sense to take the first cut of pigs out of the barn at a lighter weight if the barn is overstocked. Removing pigs out of the barn sooner will increase the growth rate of the remaining pigs in the barn. The increase in performance of the remaining pigs in the barn can offset the lost profit from selling the first cut at a lighter weight. In addition, selling the first cut at a lower target weight helps prevent getting behind on marketings and being forced to sell later groups at weights that are too heavy for the best premium.

TAIL BITING

Vice behavior in swine production facilities is a welfare concern and an economic problem for producers. Tail biting is one of the top vice behavioral problems in grow-finish pigs leading to producer losses due to reductions in gain, secondary infections, death, or carcass condemnations. Tail biting can sporadically affect a single pig, an entire pen of pigs, or can be a pervasive problem facing entire flows of pigs. Numerous factors such as environment, animal husbandry, and nutrition can play a role in triggering this negative behavior.

Anyone who has walked through a pen of pigs has observed individual pigs or even certain genetic lines exhibiting more aggressive behaviors than others. Studies have shown that pigs are naturally attracted to the taste and sight of blood. However, natural behavior is only a piece of the puzzle and as previously stated, numerous other factors can increase the prevalence of tail biting such as:

- Tail docking (too long and inconsistent)
- Barn Management
- Nutrition (out of feed events, salt deficiency, etc.)
- Increased stocking density and overcrowding
- Temperature extremes
- Poor ventilation (poor air quality, drafts, humidity)
- Light (too dim/too bright, less than 6 hours of darkness per day)
- Health challenges

Tail docking

Properly docking tails is one of the best methods to reduce the incidence of tail biting. Docked tails should be uniform in length as it has been reported that herds with variable tail lengths have a greater incidence of tail biting.

Nutrition

Inadequate access to quality feed and water can both act as a trigger for tail biting. Some common feed quality issues associated with tail biting can include mycotoxins, low salt levels, or improperly balanced diets.

Stocking Density

As stocking density increases, so does competition at the feeder and waterer, which can result in increased ear and tail biting. In addition to stocking density, mixing pigs or pens with greater size variation may also have an increased risk of tail biting.

Environment

Several environmental factors within a barn can influence the incidence of tail biting such as: excessive heat or cold, improper ventilation, lighting, dust, or noxious gases. In current production systems, heat stress during the warm summer months is of greater concern than cold stress during the winter months. When pigs reach their upper critical temperature they begin to experience heat stress, which can trigger negative behaviors such as tail biting. It has been observed, in some cases, that misting pigs during hot weather has reduced tail biting. Greater daily temperature variations can result in increased tail biting compared to a consistent temperature outside of the pig's thermoneutral zone.

Drafts and increased humidity caused by improper ventilation can increase pig stress and tail-biting. Barn lighting, too brightly or dimly lit or not enough hours of darkness, may also impact the occurrence of tail biting. It is recommended that fluorescent lights emit 0.2 watts/ft^2, whereas incandescent lights should emit around 0.8 watts/ft^2, with at least 6 hours of darkness. Maintaining an optimal living environment through proper ventilation, lighting and temperature control will have a positive impact on pig welfare and the incidence of tail biting.

What can I do? A Solutions Check List

1. Properly Dock Tails

- Consistent mature length of 2-3 inches

2. Nutrition

- Formulate to proper digestible lysine levels in weight appropriate phases
- Budget the correct pounds per pig of each diet
- Manage mycotoxin ingestion by formulating diets with ingredients containing low levels of mycotoxins and implementing toxin mitigation products. Use of 5-8 lbs magnesium oxide per ton
- Add an additional 2-4 lbs of salt
- Add an additional 2-3 lbs of potassium chloride
- Assure adequate access to good quality water

3. Stocking Density

- Do not exceed pig density of less than 7.5 square ft. per pig
- Evenly remove pigs from every pen during the initial marketing period

4. Barn and Environmental Management

- Eliminate out of feed events
- Adjust feeder settings more open during late finishing when feeder competition is the highest
- Consider increasing minimum ventilation in late finishing
- Consider decreasing the set point in late finishing

5. Implement New Technology

- The AllBite vice mitigation block is a proven technology designed to combat tail biting. AllBite is a poured block containing biologically active ingredients that decrease aggression in pigs while providing a social stimulus. AllBite is a convenient and immediate solution for a producer to combat vice behavior

WATER QUALITY

The quality of water and the amount consumed is extremely important in pork production, but unfortunately can be one of the most overlooked aspects. Pigs that don't drink water, won't consume feed.

Water Intake Considerations

- Water is the first limiting nutrient; far above energy, amino acids, vitamins, and minerals
- Cost of water acquisition along with storage and disposition of wasted water has led to a need for greater understanding of the water availability needs of the pig
- Water consumption has a distinct pattern based on feeding period when nose-operated drinkers are used
  - Peaks two hours after the morning feeding period and one hour after the afternoon feeding period
  - Greatest water usage occurs in late afternoon and early evening
  - Having an adequate number of drinkers along with sufficient water pressure is key to water intake
- The type of drinker affects water usage and wastage
  - 14% decrease in manure volume with swinging drinker vs. gate mounted nipple drinker
  - 25% decrease in water usage with steel bowl drinker vs. swinging drinker
    - Manure quality and ease of handling can be positively affected by reducing water wastage into the pit. With less wasted water ending up in the pit, nutrients are more concentrated, reducing the application expense and increasing storage capacity
- General recommendation is to limit water pressure to 20 psi in drinking supply lines
  - Reduces wastage and makes delivery devices (paddles, nipples) easier to use
- Daily water usage is a good indicator of pig health
  - When water usage drops for 3 continuous days or drops by more than 30% in one day, this may indicate a potential health challenge is occurring.

Water Quality Guidelines

Below is a table that lists the most common components that are evaluated in a water quality test and the acceptable guidelines.

Component	Caution Level
Calcium	150 ppm
Chloride	500 ppm
Hardness	20 grains/gal
Iron	0.3 ppm
Magnesium	80 ppm
Manganese	0.5 ppm
Nitrate	50 ppm
pH	<6.5, >9.0
Sodium	150 ppm
Sulfate	300 ppm
Total Dissolved Solids	1000 ppm

Water Requirements

Below are guidelines for the proper drinker height, flow rate and daily water consumption for wean to finish pigs.

Pig Weight	<12 lbs	12-30 lbs	30-75 lbs	75-150 lbs	150 – Market
Nipple Height (in)	4 to 6	6 to 12	12 to 18	18 to 24	24 to 30
Pigs/Nipple	10	10	10	12 to 15	12 to 15
Flow Rate (cups/Min)	2/3	1	1 ½	2	3
Daily Intake (qts)	0.2 to 0.5	2 to 4	4 to 6 (1-1 ½ gal)	5 to 10 (1 1½ -2 ½ gal)	6 to 18 (1 ½ -4 1/2 gal)

Water Quality FAQ

- **How can I tell if my pigs are getting enough water?**
  - Using the table above will give broad guidelines on where water usage should be at depending on the size of pig. The best way to determine if pigs are receiving adequate water is at the slat level. Observations should be made when pigs are active and undisturbed by chore activities. If there is a line at the water source greater than three pigs during an active period water is limiting. Water demand in the summer increases because of the extra water pigs need to drink. Also the pigs' active periods are reduced, causing higher demand on a water source during shorter time windows.

- **Are there any obvious signs of water quality issues?**
  - Obvious signs of water quality problems can picked up by sight, smell, and pig observation.
  - Visual signs of poor water quality include off color, unclear or visual sediment in water. In addition, heavy discoloration of equipment and walls around water sources can indicate high manganese or iron content.
  - Poor quality water can have a foul odor. This can indicate high bacterial counts or high levels of sulfur and nitrates.
  - Pig observation can indicate water quality problems as well. One indication of poor quality water is if pigs refuse water upon initial entry into a site. In addition, pigs that scour without any pathogen present indicates poor quality water.

- **I think I have a water quality problem on my farm. How can I get my water tested?**
  - In most cases there are local labs that do water quality testing in your area. Speak with your veterinarian or nutritionist for help collecting water samples. New wells and existing wells should be tested on a consistent basis for water quality.

- **What can I do to improve water quality on my farm?**
  - Flushing water lines upon entry of new pigs to a site is a great practice that should be followed with every turn on pigs.
  - Adding chlorine to the water decreases bacterial counts in the water and has been shown to increase water intake.
  - Using low cost acidifiers like citric acid decreases the water pH and inhibits bacterial growth.
  - Utilizing a rural water system may be a good option if it is available in your area.