

10 Steps to a Better Feeding Program

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▪ Introduction

Feed is the single greatest expense in the production of pork, accounting for 60-70% of the cost of production. Therefore to maximize profitability, advanced feeding management and nutritional strategies must be utilized. Strategies to increase the accuracy of diet formulation are an important method of cost control. Underestimation of nutrient needs results in decreased performance and profitability due to increased days to market, increased cost per pig and lower lean yield. Overfeeding of nutrients increases diet costs with no improvement in performance and may lead to environmental problems due to excess nitrogen and phosphorus in manure

Although it is simple in concept, determining the nutrient intake that will be most cost effective is a complicated process. Each individual pig has its own unique set of nutrient requirements, which are determined by three major factors: its lean growth rate, its level of feed intake and its efficiency of nutrient use. In sows the major factor in determining nutrient needs is weight, level of milk production or number of embryos.

▪ How do you determine the nutrient requirements of your pigs under your farm conditions?

Nutritional modelling is used to calculate the nutrient requirements of pigs under given conditions. In nutritional modelling, basic performance information is processed through a series of calculations to explain or predict the relationship between nutrient intake and pig performance. Accurate prediction of nutrient requirements allows for the formulation of economically optimized "best cost" diets that result in a minimum of nutrient over- and underfeeding.

▪ **Should nutrient requirements be based on potential or actual Farm-Specific performance?**

Some swine growth and nutrient requirement models use maximum attainable performance (including maximum lean gain potential) of a given genotype raised under ideal conditions. However, performance of pigs reared under commercial conditions is typically below maximum genetic potential. Therefore, if maximum possible performance is used in the nutrient model the pigs will always be overfed nutrients at unnecessary cost to the producer. Measurement of actual feed intake and performance attained under typical commercial conditions will allow the formulation of 'best cost' diets.

Factors Determining Actual On-Farm Performance

- Genotype
- Gender
- Health status
- Thermal environment (temperature)
- Chemical environment (air quality)
- Facility type
- Feeder type
- Feed intake
- Water intake
- Pen density
- Management factors

The complex interactions between these factors means that feed intake, and thus nutrient composition of the diet, is highly farm specific. Feed intake is the denominator in all nutrient concentration calculations.

$$\frac{\text{Grams of nutrient required per day}}{\text{Grams of feed consumed per day}} \times 100 = \text{Required \% nutrient in diet}$$

Errors in the measurement of actual feed intake will lead to costly errors in the calculation of dietary nutrient concentrations. Therefore accurate assessment of feed intake at various stages of growth is critical to proper diet formulation.

Step 1. Gather information needed for *Farm Specific* feeding program.

- **Production records.** The data required for growing pigs are: daily gain, feed intake, feed efficiency, and carcass composition. Data should be

collected for each major phase of growth by weighing pigs and measuring feed disappearance. See Appendix 1 (*Estimating Feed Intake and Growth Curves on Farms*) for how to accurately determine daily gain, feed disappearance and feed efficiency on your farm.

- **Cost of production** - diet costs, feed cost/unit output, \$ return/pig after feed
- **Diet formulations** - compare formulation to analysis, evaluate ingredient choices
- **Management** - evaluate feed manufacturing (mill calibration) and feeding management
- **Benchmarks** - expected performance of pig genotype

Table 1. Production data required for growing pigs.

Data	Minimum Information	Preferred Information
Initial weight	Pen average	Individual pigs
Market weight	Pen Average	Individual pigs
Growth Rate (ADG or days to market)	Close out data	At several weight or time points
Lean growth rate	Carcass data	Lean content at multiple points (Real-time ultrasound)
Feed intake (or F/G)	Close out data	Multiple points

It is very important that this information be accurate measurements of growth and carcass yield and feed intake. If close out data is used for the model inputs, then multiple observations are absolutely necessary to obtain acceptable results.

Step 2. Compare actual performance to benchmarks.

After collecting all the data listed above you need to compare your farm performance to benchmarks. Benchmarks are useful because they allow you to identify areas of weakness or under-performance that need to be evaluated further. Benchmarks help identify your **opportunity for improvement**. You should determine the appropriate benchmarks for your pigs in consultation with your breeding stock supplier.

When using benchmarks you must be careful to **use those that are appropriate for your operation**, otherwise you may end up with unrealistic

expectations for improvement. You must consider the record keeping system that you use, the initial and final weights of the pigs when you change diets or housing, and the expected performance of the genotype of pigs that you use.

Step 3. Rank problem areas for possible change.

You should begin by ranking the possible changes to your feed program based on potential economic impact and how easy it is to make the change. If you are like most people you will choose the change first that is both easy to make and has a large economic impact. However, you need to think carefully about those possible changes that will require time or money to implement but will pay off in a big way when they are complete.

Each pig production unit is unique and this makes it impossible to give a standard list of how easy it is to make certain feed program changes. However some general principles will apply to most units.

General Ranking for Ease of Implementation

- | | |
|------------------|---|
| Easy | <ul style="list-style-type: none"> Change nutrient levels using same feedstuffs (formulate farm-specific diets) Change of ingredient supplier (buy similar product, better price) Change of ingredient source (buy better product) Break out multi-ingredient mixtures into smaller blends or individual ingredients (Change from supplement to premix, etc. - only do this if mixing system is capable of mixing smaller quantities) |
| Difficult | <ul style="list-style-type: none"> Change feed manufacturing delivery system to permit a greater number of diets and/or more diet phases Change feed storage systems to handle an increased number of feed ingredients |

Potential economic impact will be a key factor in deciding what feed program changes to make. Table 2 lists approximate feed use and feed cost per market pig for various stages of production. This table shows that grow-finish diets account for the largest % of total feed costs. Therefore, this production phase offers the greatest opportunity for reducing feed costs. Unfortunately, current feed tracking and production record keeping systems are the least precise in this phase of production. The information required (see Step #1) to properly evaluate the economic opportunities within your feed program will probably lead you to conduct on-farm feed trials (see Appendix 2 – *Checklist for On-Farm Feed Trials*).

Table 2. Feed use and costs at various stages of production.

Phase	Approx. Kg Feed per pig Marketed ¹	Feed Cost ² \$/Tonne	Approx. Feed Cost per pig Marketed ²	% of Feed Cost per pig Marketed
Breeding Herd (Sows, Boars and Gilt Development)	42	215	\$9.03	13.0%
Nursery (5 to 25 kg)	30	380	\$11.40	16.4%
Grower (25 to 55 kg)	75	215	\$16.12	35.6%
Finish (55 to 110 kg)	165	195	\$32.18	35.0%
Total	312		\$68.73	100.0%

¹Amount of feed required varies *significantly* with changes in starting and ending weights; ²feed costs should be recalculated using current prices.

CAUTION!!!

Performance of a swine herd is not constant and often, the specific causes of performance changes cannot be determined. Many production problems are short term and any change may appear to have solved the problem when it actually had nothing to do with it. You should get as much expert advice as possible before making major or costly changes. Rash decisions to drastically alter feeding and nutrition practices based on incomplete or inaccurate performance data could result in financial disaster.

When considering changes to your feeding program remember that uncontrolled factors may also be affecting performance. The actual impact of diet changes cannot be predicted with complete confidence. Therefore, after any change is made you must carefully monitor the effects on pig performance and cost of production.

Uncontrolled factors that are difficult to measure, that may affect performance include:

- Health, disease status, disease challenges
- Weather changes
- Crop characteristics (e.g. grain quality)
- Management or personnel changes

Step 4. Calculate *Farm-Specific* nutrient requirements.

If the information you collected above indicates that you should be changing the nutrition and feeding program then you probably need to develop *Farm-Specific* nutrient requirements.

At this point, many pig producers are advised to consult a professional pig nutritionist. Decisions need to be made about number of diet phases to feed, weights at which to change diets, use of gender specific diets, interaction between nutrition and environment (i.e., whether nutrition is limiting performance or whether environment/management is limiting performance), cost effectiveness of feed ingredients, advantages of customized premix or supplement, lean growth of your genotype, etc.

For producers who want to try their hand at designing their own feeding program, the NRC Nutrient Requirements of Swine 1998 is one program used for estimating *Farm Specific* nutrient requirements. It consists of a book and a relatively easy to use computer program on CD. This program allows you to enter all the information you gathered in Step 1 and calculates the nutrient composition of the diets required for your pigs under your conditions. **CAUTION** – the information you get out of the program is only as good as the information you put in.

Step 5. Compare calculated nutrient requirements to current formulations.

a) If calculated *Farm Specific* requirements are higher than actual current formulations, evaluate the cost of increasing nutrient specifications in the formulation compared to the potential increase in performance.

b) If calculated requirements are lower than current formulations, evaluate the potential for decreased cost if new formulations were used.

Step 6. Use new *Farm-Specific* requirement estimates to formulate new diets.

The formulation of least cost diets based on *Farm Specific* requirement estimates will require a nutrition consultant. Computer programs for least cost diet formulation are generally expensive and not particularly user friendly. These programs have been designed for advanced use by feed companies and consulting nutritionists and require considerable experience and knowledge to use properly.

Even if you normally use simple diets with only 2 or 3 ingredients you will need information on other ingredients and details of premix formulation to take

advantage of your new knowledge. This will probably require the help of a nutritionist.

Step 7. Predict feed use and costs for new formulations and compare to current performance and production benchmarks.

Before you actually change your diets you should calculate the costs/pig for the new diets, the expected new performance from changing the diets and compare these to your current performance and your chosen benchmarks.

Will these changes actually make you more money or save you money on feed costs?

Will they increase performance or save you enough more money to justify making the required changes?

Step 8. Evaluate costs, quality and effectiveness of feed ingredients and feed manufacturing.

Many textbooks have been written on feed ingredients, feed manufacturing and quality control and the topic is too large to be briefly summarized here.

How you purchase your feed ingredients can have a very large impact on your feed costs and profitability. Buying quality ingredients at the right price is essential.

One of the most common mistakes that people make is to include too many 'magical' feed additives. There are hundreds of 'non-nutritive' ingredients that could be included in pig diets. Although some are cost effective, many of these are not. There is always some new ingredient being promoted that will solve all your problems – but seldom do these live up to their promises. Carefully gather information and get unbiased opinions before you spend hard earned money on feed additives that will not earn you any return.

Regular quality control checks are necessary. Ingredients can vary significantly in nutrient content. Different fields, different soils, different fertilizer and different varieties will all affect the nutrient content of ingredients. You must test your ingredients and diets regularly to ensure that the feed in the feeder matches the feed formulation on paper. There are several feed testing labs in the province that will analyze your ingredients and mixed feed.

If you manufacture your own feeds on farm you must also test your feed mill calibration regularly. There are several fact sheets available from companies that sell on-farm feed mills that describe how to calibrate your mill.

Step 9. Monitor the effect of the changes using performance and cost of production records.

Now that you have made changes to your nutrition and feeding program you must determine if they have been effective. Have these changes produced the desired outcome – have you really reduced feed costs or increased pig performance?

You must return to Step #1 and repeat the gathering of information. Compare the actual change in performance to your original performance (from data in Step #1) , the benchmark (from Step #2) and the predicted improvements (from Step # 7). If you gathered your information carefully and accurately, and followed good advice, then you should be making more money!

Step 10. Regularly re-evaluate your nutrition program, feeding management and new nutritional technologies.

Now that you have made one or more changes you may find that a different problem area has been identified or a new opportunity has appeared that will either reduce costs or increase performance. You need to plan for regular re-evaluation of you nutrition and feeding program to ensure that you keep your feed costs to their optimum level.

▪ Conclusion

This article has focussed primarily on determining nutrient requirements so that cost effective *Farm Specific* diets can be formulated. However, this is only one part of an overall feeding program.

Many aspects of feeding management (i.e. types of feeders, feeder adjustment, feed delivery systems, complete feed vs. farm mixed, particle size, feed wastage, phase feeding, gender diets, diets for meat quality, feed additives, evaluating feed ingredients, etc) have not been fully discussed. These can all have significant impact on the overall cost of your feeding program and should not be ignored just because they have not been dealt with here.

Nutrition is a complex area but given that it is the single largest cost of production, additional effort to improve is almost guaranteed to improve your profitability. Every farm, no matter how well managed, can probably find ways to improve their nutrition and feeding program.

▪ Summary

Step 1. Gather information required to analyze and develop your **farm-specific feeding program**.

- **production records**- daily gain, feed intake, feed efficiency, carcass composition
- **cost of production** - diet costs, feed cost/unit output
- **diet formulations** - compare formulation to analysis, evaluate ingredient choices
- **management** - evaluate feed manufacturing (mill calibration) and feeding management
- **benchmarks** - expected performance of pig genotype

Step 2. Compare actual performance, costs, formulas and management to benchmarks and identify areas needing improvement.

Step 3. Rank problem areas for possible change based on:

- economic impact
- ease of making a change.

Step 4. Calculate *Farm Specific* nutrient requirements using performance information gathered in step 1 and either NRC Nutrient Requirements of Swine computer model or other nutrient requirement program. Be sure to consider using gender specific diets (separate diets for barrow and gilts) and multiple phase feeding.

Step 5. Compare calculated nutrient requirements to current formulations:

- a) If calculated farm specific requirements are higher than actual current formulations, evaluate the cost of increasing nutrient specifications compared to the potential increase in performance.
- b) if calculated requirements are lower than current formulations, evaluate the potential for decreased cost if new formulations were used.

Step 6. Use new *Farm Specific* requirement estimates to formulate new diets.

Step 7. Predict feed use and costs for new formulations and compare to current performance and production benchmarks.

Step 8. Evaluate costs, quality and effectiveness of feed ingredients and feed manufacturing.

Step 9. Monitor the effect of the changes using performance and cost of production records.

Step 10. Regularly re-evaluate your nutrition program, feeding management, and new nutritional technologies.

▪ Appendix 1. Estimating Feed Intake and Growth Curves on Farms

The most precise way to estimate of the growth rate and feed usage is to weigh all feed daily and all pigs weekly during the time the pigs occupy the grower-finisher barn. This is obviously not a practical approach for the average farm. A simpler way exists to estimate feed intake and growth curves. It is not as accurate but it is much simpler and easier and the data is adequate for the average farm.

Procedure: To estimate feed intake and growth curves, detailed observations on at least 6 pens of pigs are required. Select a minimum of 2 pens of pigs at approximately 30, 60 and 100 kg body weight. More pens are better and 3 or 4 pens per weight range will significantly increase accuracy.

The selected pens should be representative of your barn. See Appendix 2, *Checklist for On-Farm Feed Trials*.

Begin by removing the feed from the pen or feeder. Weigh all the pigs and record individual weights. If the pigs are individually identified then record their numbers so you can obtain individual growth rates. If the pigs are not individually identified then you must use the average pen weight in the final calculations. If you do not usually identify individual pigs then you may wish to consider using ear tags for this project. Pigs must be reweighed 7 and 14 days later at the same time of day.

Feed intake data should be collected over at least a two-week period. You must empty the feeder when the pigs are first weighed. The quantity of feed added to the feeder must be carefully recorded. This can be done several ways but the easiest is by weighing 3 or 4 pails of feed (to get an average weight) and recording the number of pails that are added to the feeder during the week. You must fill the pails to the same level every time. You can fill the feeder and record the weight of feed added after the pigs are returned to the pen from weighing. Remember that you must empty the feeder when the pigs are weighed at week 1 and 2 and weigh the amount of feed left, so that feed intake during the week can be estimated.

From these observations, body weight of the pigs versus days in the barn, and feed intake versus body weight of the pigs is plotted on a graph to develop growth and feed intake curves unique to your farm.

Estimates of average and variation in carcass weights and carcass lean yields are required. Data from year-end summaries from the Western Hog Exchange or equivalent reports may be used.

▪ Appendix 2. Checklist for On-Farm Feed Trials

The only thing worse than making decisions based on *no* information is making decisions based on *bad* information. Producers often "test" new products or nutritional strategies. Nearly all these "studies" have no value and in fact are harmful and misleading. Controlled research projects are carefully planned and rigorously executed to be sure that they accurately measure the real differences between dietary treatments. The danger in conducting a poor "test" is that one treatment will appear to produce better performance or more economical gains, when in fact the observed difference was due only to random chance.

Entire textbooks have been written on how to properly conduct valid feed trials. However, the following basic checklist points out some of the key elements that are necessary to conduct a meaningful on-farm experiment.

Checklist for Setting Up a Valid On-Farm Feed Trial:

- | | | |
|--|------------|-----------|
| 1. Are all diets fed concurrently? | Yes | No |
| ▸ Pigs fed each diet must be placed on trial the same day and removed from the trial at a constant date or weight.) | | |
| 2. Are all diets fed in the same facility? | Yes | No |
| ▸ If diets are fed in different barns or rooms, the comparison will be influenced by barn environmental effects, health status, etc. | | |
| 3. Is each diet fed to 3 or more pens? | Yes | No |
| ▸ (Replication is essential to ensure valid comparisons, 3 pens per treatment is a minimum) | | |
| ▸ Note: Two pens sharing the same feeder constitute one pen for measurements of feed intake and feed efficiency. | | |
| 4. Are pens equal? | Yes | No |
| ▸ Pen size, number of pigs, initial weight, sex and genetic background of pigs, and equipment (floor type, feeders, waterers, etc.) must be the same. | | |
| 5. Are litters allocated across treatments? | Yes | No |
| ▸ If a nursery or weaner trial is being conducted, pigs from a litter should be allocated to each treatment. Litter has a very large effect. If the 'best' litter is all on 1 treatment, you will wrongly decide that treatment is the 'best'. | | |

6. Are diets evenly distributed in pens throughout facility? Yes No

- For example, dividing a barn in two and feeding each of two diets to one side of the barn is not a valid trial.

ALL questions must be answered "**Yes**".

If the answer to any of these questions is "**No**", the basic conditions for a valid feed trial have not been met and any conclusions drawn from the trial are invalid.

If you answered "**No**" to any question, then the measured differences in performance are probably due to chance variation, and to factors which have not been adequately controlled by the trial design.

Valid on-farm feed trials are labour intensive and difficult to conduct. To prevent the acceptance of false conclusions, a qualified individual with a background in statistical analysis and experimental design should be consulted.