

1. THE SCIENCE OF NUTRITION

Despite major changes in the nature of the swine industry in Canada, the cost of feed remains the largest single expense involved in raising pigs. Although the exact cost varies greatly depending on grain and protein markets, the total feed bill for the Canadian pork industry approaches one billion dollars. Even modest savings would provide benefits to the swine industry in the millions of dollars.

At the farm level, feed represents slightly more than 50% of the total cost of production and about 75% of the variable costs (Figure 1-1). It surpasses the next largest expense - fixed costs associated with housing - by a factor of three. Simple logic dictates that optimizing feed costs - selecting feeding programs that maximize net income - is a critical step in ensuring success in pork production.

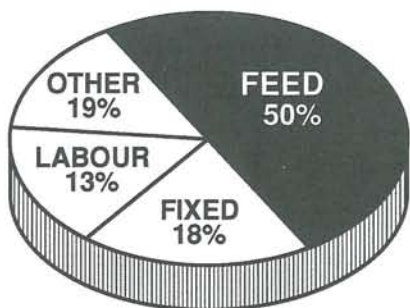


Figure 1-1a. Cost of production budget: all costs.

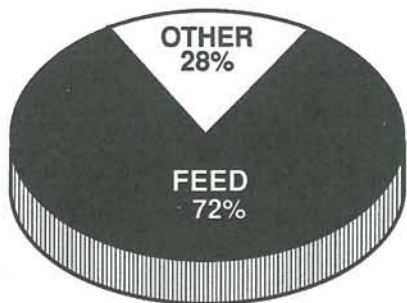


Figure 1-1b. Cost of production budget: variable costs only.

It is our experience that much can be accomplished to reduce feed costs and increase net income. Linking nutrient supply to nutrient requirements represents a reasonable, if not essential goal, but it becomes difficult at the farm level due to differences in genetics, housing, health status and overall production objectives.

Recently, a sampling of farrow-to-finish operations on the Canadian prairies suggested that feed costs, expressed on a per pig sold basis, varied by almost 100%! While the lowest feed cost may not be associated with the highest profitability, it is clear that such variability is inexplicable by normal economic and biological principles. The obvious, and correct conclusion is that nutrients are being wasted; the source of such waste varies from poor feed presentation through to diet over- formulation.

Clearly, opportunities exist for significant cost savings through the application of increased knowledge in nutrition. The nutritionist must be able to identify such opportunities and exploit them effectively. The purpose of this book is to provide practical information on the subject of nutrition to afford nutritionists, pork producers and their associates the capability to exercise greater control over their feeding programs.

What is Nutrition?

What exactly is nutrition? It is the science that studies the nutrients needed by animals: how much of each is required in a healthy diet, how they can be supplied in an economical fashion and how the body utilizes them for maintenance, growth and production. Nutritionists are concerned with improving the chemical analysis of feeds and feedstuffs to better reflect their true value to the animal. Information is drawn from other fields of science, such as biochemistry and physiology, to help us understand the basic processes in the body that dictate the ultimate fate of the feed that animals eat. The essence of nutrition is to define the nutrients required by the animal to perform at a

desired level, identify a suitable source of these nutrients and match the two (requirement and source) in a diet formulation.

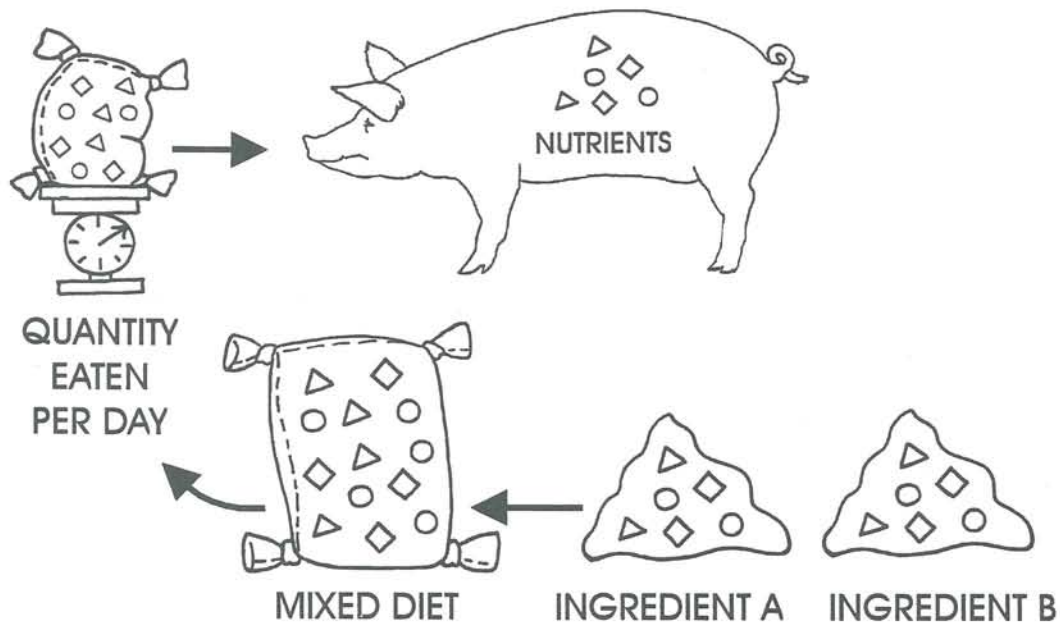
This is not a simple task. Nutrient requirements fluctuate according to many environmental, genetic and physiological influences. For example, growing pigs with a maximum protein deposition rate (Pd_{max}) of 170 grams per day will have a very different requirement for essential amino acids than those with a Pd_{max} of 150 grams per day. Sows housed outdoors require more nutrients, and thus more feed, than sows housed indoors. This is particularly true during the winter.

Diets, therefore, cannot be formulated in a vacuum; the total circumstances surrounding the animal including its environment and the type of farming operation involved must be considered. In the same way that an engineer designs a barn with a view towards the producer's management style and his overall production objectives, the nutritionist must formulate diets that will complement other aspects of the farm. No single diet will suit all farming operations.



Diets can not be formulated in a vacuum. Like designing a barn, feed formulation must consider the total management situation including genetics, housing, health, and of course, economics.

The nutrients supplied by a given ingredient are sometimes difficult to determine with precision, due partly to the limitations of the chemical analyses currently available and in part to the many factors that influence how available these nutrients might be to the animal.



Pig nutrition embraces three components: nutrient requirements, nutrient sources, and daily feed intake.

It is also a challenge to determine the intake of diets, since feed intake will obviously dictate nutrient intake. The physical capacity of the gastrointestinal tract plays a role, particularly in nursing sows, weanling pigs and growing pigs. The importance of feed intake in practical nutrition is becoming increasingly apparent, in part because of the considerable variation that exists among farms - in the order of 30% in the grow out period, for example. Measuring true feed intake is being viewed as increasingly important, although it tends to be a time consuming process.

Palatability is another factor. However, people will often make the mistake of ascribing human tastes to the pig. Yet, the pig will eat many things that humans will not, while some components of the human diet are met with disdain by the pig! Great care should be taken to avoid altering the diet to improve what we might think is its palatability. The pig may have very different opinions on the subject, and the producer may end up with a more expensive, but no more desirable diet.

The Role of the Computer

In the past 15 years, the computer has become an indispensable tool to the professional nutritionist for formulating diets. Farmers who choose to manufacture their own diets now have the added option of using feed formulation programs designed for the home computer. Time will tell if pork producers choose this option, or decide to leave diet formulation to professional nutritionists working for the feed industry, provincial extension services or private consultants.

The use of the computer in formulating diets has met with considerable skepticism, focusing on the mechanical and unfeeling way with which it combines feedstuffs into a diet. This ignores the incredible power the computer brings to the whole area of diet formulation. Certainly, the computer is only as good as the nutritionist operating it and mistakes can be made. However, the chances of error are far more likely with manual calculation. For all their faults, computers are notably less prone to mistakes than their human masters! Dependency on the

computer has led to errors in diet formulation, but invariably these can be traced to human mistakes in programming.

Photo 1 - 1.



The computer can be an enormously useful tool to help monitor the performance of the breeding herd. It is not a replacement for good management; it just makes it easier and more effective.

The computer has allowed the nutritionist to move ahead with much greater speed. A balanced diet contains 40 or more known nutrients. Using manual calculation methods, it would be impractical to consider more than three or four nutrients at a time. With computers, all nutrients can be monitored simultaneously and least-costing programs focus on a dozen or more of the most critical nutrients. The computer also demands much more of its nutritionist master in terms of precise information on nutrient composition, availability, requirements and cost. Researchers have responded by developing knowledge to accommodate this expanded need. Finally, computers are being used increasingly in the development and application of growth simulation models, with the result that specific feeding and management programs can be generated for individual farms. Clearly, in every respect, the livestock farmer has been a beneficiary of these developments.

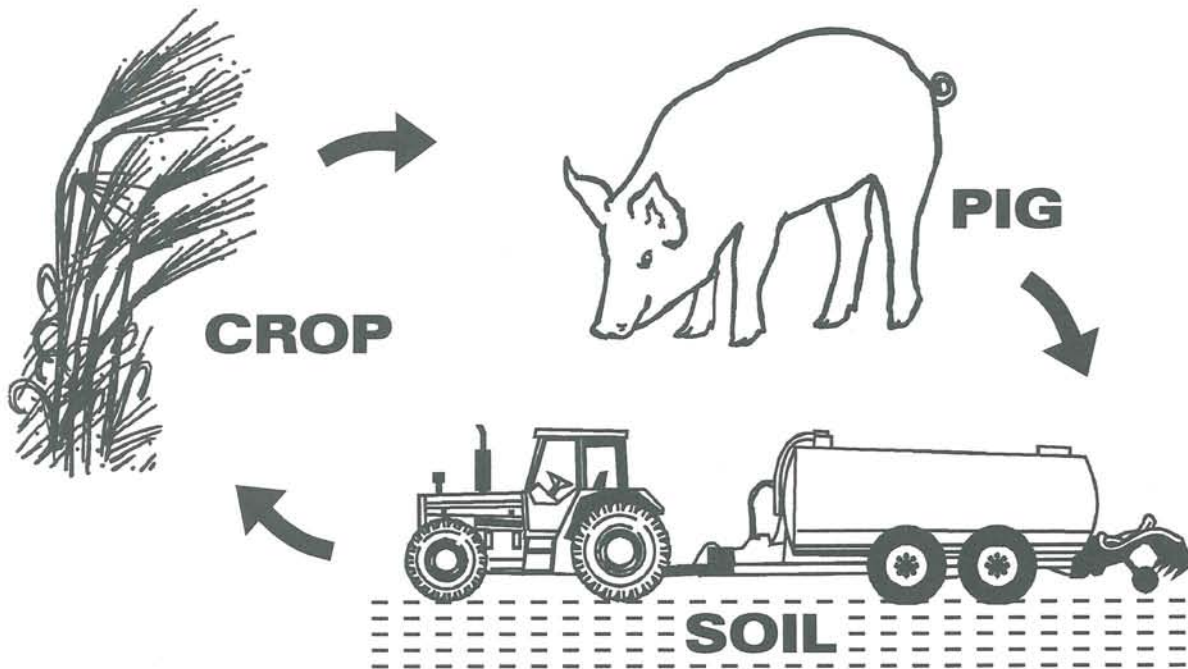
The Future of Nutrition

What does the future hold for the science of nutrition? Already, the advent of biotechnology is having an effect. Reduced costs of synthetic amino acids means that we will have more options for balancing diets, and that our dependency on conventional protein sources such as soybean meal and canola meal will diminish.

Both improved crops and superior genetic quality of pigs will alter the way in which we formulate diets. The most exciting development, however, will be a vastly improved ability to understand how the pig grows and uses nutrients. This knowledge will be of tremendous benefit because it will expand our ability to match the pig's diet with its needs for

growth and production. It will allow us to formulate diets for very specific conditions, such as the growth of lean as opposed to fat in the carcass; and to integrate environment, disease and genetics into the final ration. The costly waste of excess nutrients will be eliminated and pork production will become a much more efficient process.

The rise of the environment as a key issue in pork production, and the role of the diet in determining the nutrient content of slurry, dictates that nutrition and the environment will be intimately linked in the future. Indeed, diet formulation with a view to minimizing nutrient waste not only benefits the environment, but it often leads to reduced production costs. It has forced us all to question how we balance diets and design feeding programs, particularly with respect to amino acid (nitrogen) and phosphorus supply.



The pig plays an integral part in the environment.