FEED FOR PORK OR MANURE

We often think of the hog industry as an efficient user of inputs. But of the nutrients consumed by growing-finishing pigs, less than half are deposited in the carcass as tissue gain. The rest drop through the slats.

The good news is that with little or no impact on hog performance, nutrient excretion can be reduced. This obviously saves on feed costs and reduces the nutrients in the waste stream.

Nitrogen

We feed nitrogen to crops in the form of nitrates, ammonium, or urea. We feed nitrogen to pigs in the form of protein or amino acids.

To calculate how much nitrogen is in the feed, divide the protein percentage by 6.25. A 14 percent crude protein diet contains about 2.25 percent nitrogen.

With a little work, we can estimate the nitrogen balance in the pig. We measure the amount of nitrogen consumed and the amount excreted in the manure (both urine and feces). The difference between these two numbers is the amount the body retains for conversion to tissue or proteins.

If we apply that balance data to a 1,000-head finishing barn, we find a staggering amount of nitrogen flowing through the system (Table 1).

Table 1: Annual Nitrogen Flow in a 1000-Head Growing Finishing Barn

Intake, tons:	18.3
Retained, tons:	7.1
Excreted, tons:	11.2

Of the more than 18 tons of nitrogen consumed, only 7.1 are retained by the pigs. More than 11 tons (61 percent) that was once part of the feed is now part of the manure. These estimates are based on the following assumptions (Table 2).

Table 2: Assumptions

Number of pigs:	1000
Feed intake per pig:	600 lb
Weight gain per pig:	200 lb
Crude protein, grower:	16.5%
Crude protein, finisher:	14.0%
Number of groups/barn/yr:	2.6

Note that these pigs have an efficient feed conversion (3:1). For pigs that are less efficient, the nitrogen waste is even higher.

A simple economical way for reducing nitrogen excretion is through the use of lysine-HCl. You can remove 100 pounds of soybean meal in each ton of feed and replace it with 96.5 pounds of corn and 3.5 pounds of lysine-HCl. This reduces crude protein about 2 percentage units, with no change in performance or carcass traits.

What will it cost to make the change? At current market prices, 100 pounds of soybean meal costs $10, 96.5 pounds of corn costs $5.16, and 3.5 pounds of lysine-HCl will cost $3.50. So the total for the corn + lysine is $8.66. This is significantly less than the $10 you'd pay for the equivalent amount of soybean meal. (Normally, the price comparison is closer to break-even.)

Besides cost, a second benefit is a 20 percent decrease in the amount of nitrogen flowing through the system (Table 3).

Table 3: Annual nitrogen flow, using lysine-HCl in a 1000-head finishing barn.

Intake, tons:	16.1
Retained, tons:	7.1
Excreted, tons:	9.0

Phosphorus

Pigs require less phosphorus than we feed them. The problem is something called phytate — a phosphorus compound found in most grains. Unfortunately this type of phosphorus is not digested by the pig, so we have to oversupplement with inorganic phosphorus.

Phosphorus, unlike nitrogen, does not leach away, so the level of soil phosphorus tends to go up with every load of manure.

Assuming a dietary level of .6 percent phosphorus, the nutrient flow using our same sized grow-finish unit is presented in Table 4.

Table 4: Annual Phosphorus Flow in a 1000-Head Growing Finishing Barn (.6 percent dietary phosphorus).

Intake, tons:	4.7
Retained, tons:	1.3
Excreted, tons:	3.4

If we dropped the dietary phosphorus to .5 percent, we'd still be above the NRC recommendation (.4 percent), but the amount excreted decreases by ¾ of a ton (Table 5):

Table 5: Annual Phosphorus Flow in a 1000-Head Growing Finishing Barn (.5 percent dietary phosphorus).

Intake, tons:	3.9
Retained, tons:	1.2
Excreted, tons:	2.7

A compound that will enable further reductions in dietary phosphorus is phytase. This enzyme, when added to the diet, releases the phosphorus from phytate.

It comes in several forms, none of which has received approval for swine diets in this country. Hopefully, a swine label will be soon coming, as this can reduce phosphorus excretion in our example by another half a ton per year.

Copper

Environmental concerns related to copper in swine feeds are not new. Pigs require less than 20 parts per million (ppm) of dietary copper for normal growth and production. However, many starter diets and even some grower diets contain as much as 250 ppm of copper as a growth promotant.

Since the retention of copper is already low, 95 percent of copper when fed at a 250 ppm rate will be excreted. Under those conditions, copper levels in manure will generally range from 1,000 to 2,000 ppm on a dry matter basis.

What implications does this have for crop production? One group of researchers in Virginia applied manure to the same fields for eight years, resulting in a total copper loading of 235 pounds/acre. This treatment had no effect on corn yields or copper concentrations in the grain. Other studies have produced similar results.

But there are precautions regarding the application manure that is high in trace minerals. First, the pH should be over 6.5. Plants tend to absorb metals more readily under conditions of low pH. Second, leafy vegetables are more apt to accumulate metals than are row crops. And finally, sheep are sensitive to high levels of copper. Copper poisoning has been reported when sheep grazed pastures in which swine manure was applied.

Zinc

Zinc is normally added to the diet at the rate of 200 ppm or less. However, recent reports show that pigs can benefit from higher levels.

According to a recent review in Feedstuffs, Danish scientists first reported a reduction in post-weaning scours through the addition of 2,500 ppm zinc. Researchers at the University of Illinois reported 16 percent increase in weight gain by feeding 3,000 ppm of zinc for two weeks post weaning.

Kansas State University reported that 3,100 ppm of zinc resulted in occasional improvements in diarrhea and feed efficiency. Researchers at Michigan State University saw a trend for improved growth rate by feeding 3,000 ppm of zinc to weanling pigs.

Despite these benefits, it is doubtful that zinc will be used at pharmacological levels to the same extent that copper is. The response is less consistent and short-lived.

Also, zinc interferes with iron, copper, and calcium when fed at high levels and for more than two weeks. And according to Penn State Agronomist Doug Beegle, high zinc levels in the soil have detrimental effects on plant growth.

Chromium

Chromium is an essential element, but the amounts found in normal ingredients eliminate the need for supplementation.

Now it is reported that extra chromium may benefit performance. Research at Louisiana State showed that 200 ppb of chromium (in the form of picolinate) increased loin muscle area 7-22 percent, and reduced 10th rib fat 14-22 percent.

A study at Kansas State University showed that 200 ppb of chromium (as nicotinate) reduced fat depth by .1 inch. Chromium, like copper and zinc, is a trace element. While generally considered no more toxic than that of copper or zinc, chromium toxicity may depend upon the form.

For example, 1,000 ppm is considered the maximum tolerable dietary level for chromium chloride. This is 1,250 times higher than the 800 ppb of chromium (as picolinate) found to impair performance in the Louisiana studies.

The environmental effects of feeding chromium as picolinate or nicotinate are unknown.

Summary

1. Manure handling took on new significance when we began to call it nutrient management. The new term implies that we must know what is in the manure, what is in the soil, and what the crop requires.

2. As nutrient management plans become standard practice for swine producers, the challenge will not only be to handle nutrients effectively, but to reduce nutrients in the waste stream.

3. Nitrogen excretion can be decreased by 20 percent, without changing hog performance, by simply by using lysine-HCl. Phosphorus excretion may be reduced in oversupplemented grower-finisher diets (more than .55 percent) by decreasing phosphorus levels to .45 or .50 percent.

4. Be cautious when using copper, zinc, or chromium at pharmacological doses. Unlike other feed additives that are metabolized to harmless forms, trace minerals are stable. Little if any of the excess is retained by the pig, which means all the extra dietary dose ends up in the manure.

5. The critical area for proper formulation is in the finishing stage. Pigs in this phase of production have the highest feed intakes and therefore produce the most manure.

References

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