

# Effect of Dietary Changes on Manure Nutrient Content and Value

## A.S. Leaflet R2933

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### Summary and Implications

The design of the model is to evaluate a more comprehensive valuation swine feeding programs other than cost per ton of feed or cost per pound of gain. Ingredient supplies and value may be part of the a production system, but if that system depends upon more than pounds of pork out the door, and utilizes manure as a fertilizer input for crop production, then how the pigs are fed has consequences other than feed cost per pig or gain.

The model may be used to help identify the role of swine diet formulations in the determination of manure nutrient content and value. This is just one component within a crop to feed to fertilizer cycle, and there are other factors which may influence the nutrient concentrations in swine manure and manure samples need to be taken and analyzed prior to field application.

### Introduction

The role of swine manure as a nutrient source (fertilizer) for row crops has been increasing in usage and value as commercial fertilizer costs has increased. This practice is an environmentally friendly and synergistic system between pigs and their food source, and thereby has become a motivator for constructing swine facilities, mainly finishing barns.

In many cases, each production entity such as grains, livestock, custom hire, etc. are treated as separate profit centers and must stand on their own. In the past the swine feeding programs were relatively stable with very little changes. However, as the energy cost of swine diets has increased and, feeding programs have been dramatically changed. Coffey (1999) wrote about understanding the nutrient cycle on the whole farm approach and identify which production practice generated the most profitable from those nutrients. system. He suggested taking an additional step to evaluate the interrelationship of how each production unit contributes to the other. Simply put, how do grains affect swine diets; diets affect

manure; manure composition affect fertilizer application rates, rates affect grain yields, and start the cycle again.

The objective of this paper is to illustrate how similar swine basal nutritional programs (lysine, metabolizable energy, available phosphorus) requirements for growth should have dramatic difference on the manure nutrient content and thus the projected value of the manure as fertilizer when applied to cropland.

### Materials and Methods

A swine feed program template was modified to incorporate the new Swine NRC (Eleventh Revised Edition, 2012) recommendations for utilization of nitrogen (N; protein) and phosphorus (P). Total dietary N and P were calculated and the difference between feed intake totals and their requirements was considered nutrient excretion. This difference provided a mechanism to evaluate differences in feeding programs (our scenarios) based on ingredient inclusions, usage of phytase enzyme, and synthetic amino acid(s) to lower phosphorus and crude protein from plant sources respectively.

Five feeding programs (10 dietary phases; 12 to 270 lb body weight) that were similar in total lysine and energy levels and available phosphorus, but differed in the usage of (DDGS, phytase enzyme, and synthetic amino acids were used for the comparisons of manure nutrient content. Feed programs are designated by ingredient inclusions. Corn (C), soybean meal (S), synthetic lysine (L; 4 lb/ton), phytase enzyme (phy); high amino acid levels (HiAA). So the feeding program labelled CSL-phy was comprised of corn, soybean meal, 4 lb of lysine per ton and a phytase enzyme. The model assumed that pigs would eat and grow at the same rate across all feed programs.

### Results and Discussion

Projected manure nutrient content and value are illustrated in Figures 1 and 2. Dietary lysine was constant across feeding programs; however dietary crude protein levels (nitrogen) varied. Diets including DDGS (max. 600 lb/ton) were higher in N whereas diets using high levels of synthetic amino acids were

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lower, thus the amount of N content in manure reflected these differences (Figure 1). Phosphate (P<sub>2</sub>O<sub>5</sub>) was also higher in the manure from diets containing DDGS even though the feed programs were balanced on an available P basis. Including phytase enzyme lowered P excretion (manure P<sub>2</sub>O<sub>5</sub>) as less total P was required to provide the same available P across all diets. Potassium is not a nutrient considered in swine diet formulation so it was not considered in the economical comparisons.

Manure value was calculated based on the pounds of nitrogen and phosphate (phosphorus excretion) for the entire feeding period and equated each on a 1000 gallons of manure basis. As the need for P<sub>2</sub>O<sub>5</sub> varies across regions and/or fields the N and P<sub>2</sub>O<sub>5</sub> values were evaluated separately. Total feed cost and an adjusted (Adj) feed cost per pigs (as adjusted by N and P<sub>2</sub>O<sub>5</sub> value) were calculated to depict feed cost relative to the manure fertilizer value.

Using the price values in the Sidebar, CSL-phy-DDGS program had the best projected feed cost per pig of \$80.59. The feed costs varied by \$1.00 per pig (\$80.59 to \$81.60) whereas the projected manure N and P<sub>2</sub>O<sub>5</sub> value ranged by \$1.30 (\$2.02 to \$3.32) and

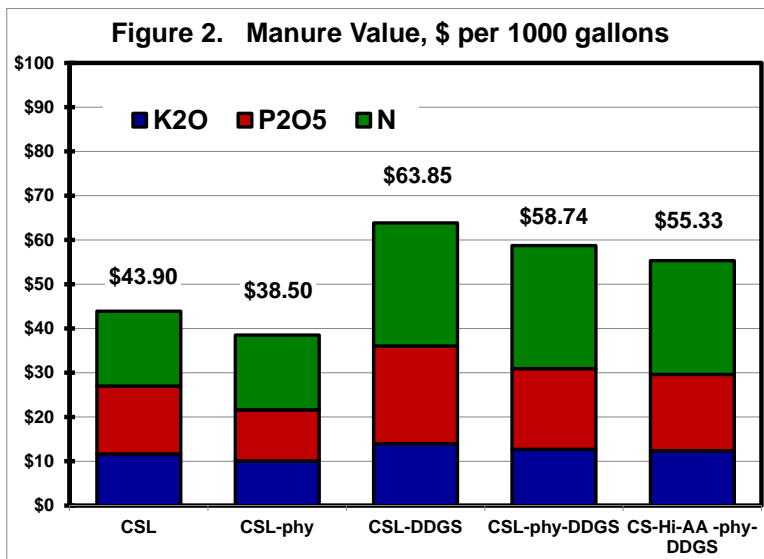
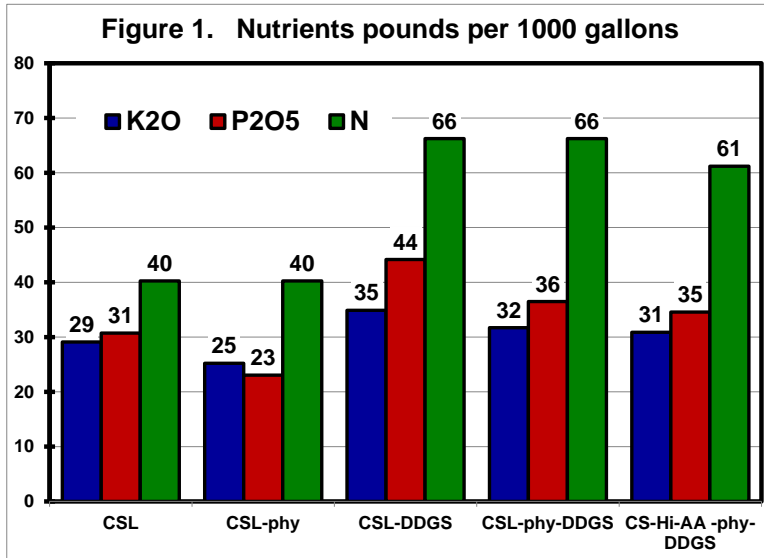
a \$1.26 (\$1.37 to \$2.63) respectively (Table 1). Adjusting pig feed cost by N and P<sub>2</sub>O<sub>5</sub> value lower feed cost by \$5.49 (\$75.10 / pig) for this feed program.

As feed ingredient prices changes so will the feed cost per pig, as will the value of the nutrient content of the manure with the value of crop fertilizers. This is the important part or use of this model. It allows one to evaluate these price changes and make decisions based more than just the value to the pig, but the contribution to the cropping enterprises.

### Assumptions used in the model

- Pig weight = 12-270 lb
- Feed/pig = 698 lb
- Days on feed = 170
- Corn \$4.50/bu
- Soybean meal \$450/ton
- DDGS = \$220/ton
- Manure/pig/day= 0.70
- N = \$0.42 / lb
- P<sub>2</sub>O<sub>5</sub> = \$0.50/lb
- K<sub>2</sub>O = \$0.40 /lb

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**Table 1. Adjusted feed cost with manure nutrient content value**

Feeding Scenario	CSL	CSL phy	CSL DDGS	CSL phy-DDGS	CS-Hi-AA phy-DDGS
<b>Avg Feed Cost, \$/ton</b>	\$234	\$232	\$233	\$231	\$234
<b>Total Feed cost, \$/pig</b>	\$81.56	\$80.89	\$81.31	\$80.59	\$81.60
<b>Manure N value, \$pig</b>	\$2.02	\$2.02	\$3.32	\$3.32	\$3.07
<b>Adj. Feed \$ - N value</b>	\$79.54	\$78.87	\$77.99	\$77.28	\$78.53
<b>Manure P2O5 value, \$pig</b>	\$1.83	\$1.37	\$2.63	\$2.18	\$2.06
<b>Adj Feed \$ - (N &amp; P2O5 value)</b>	\$77.71	\$77.50	\$75.36	\$75.10	\$76.47

Feed ingredient prices: Corn \$4.50 /bu; SBM \$450/ton; Lysine \$0.75/lb; DDGS \$220/ton; Mineral premix \$720/ton; Mineral premix with phytase \$620/ton

Calculating manure value: Nitrogen \$0.42 / lb; P2O5 \$0.50