

## Introduction

Animal production involves the feeding and care of animals to obtain usable end products, such as meat or milk. Since the efficiency with which animals use nutrients is less than 100%, a portion of the nutrients supplied to the animal is excreted as feces. The end/byproducts of metabolism are excreted in urine. Traditionally, these excreta were used as fertilizers for crops and thus were an integral part of the nutrient cycle.

Over the last decade, animal production has expanded significantly. In this expansion, production facilities were clustered in areas with an infrastructure of interest to the animal producers and with proximity to markets, slaughter plants, etc. Because local feed production was inadequate to sustain the expanding animal agriculture, feed ingredients were shipped in from major crop-producing regions, initiating the import of minerals including nitrogen (N) and phosphorus (P) into animal-producing regions. However, because animal waste is bulky relative to its nutrient content, shipping it to the feed-producing regions for use as a fertilizer was economically not viable. Alternative methods to deal with this waste were thus sought and found in lagoon storage<sup>1</sup> and/or in higher than environmentally desired application rates on cropland. Both of these methods resulted in a net accumulation of minerals in the production areas.

Ideally, animal waste is used as a fertilizer on cropland in such a way that nutrients are not accumulated or depleted. Jongbloed and Lenis (1993) calculated the number of pigs that could be held per acre of cropland (mixed crops, predominantly vegetables) to obtain a proper balance in the nutrient cycle. Their calculations show that this is highly dependent on the mineral evaluated. For P, a proper nutrient balance was obtained when the manure from 27 pigs was applied per acre. For copper and zinc, however, the number of pigs from which the manure could be applied per acre was three and four, respectively.

The data from Jongbloed and Lenis illustrate that it is not feasible to reintegrate swine production back into crop production without modifying current swine production methods. This lesson outlines some of the underlying principles for modifying pig diets with the objective of reducing nutrient excretion and ammonia and odor emission.

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<sup>1</sup>Note that lagoons are only storage devices for nutrients such as phosphorus, zinc, and copper.