

Title: A Meta-analysis of best practices for management and land application of swine manure in the Midwestern United States – **NPB #13-046**

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Scientific Abstract:

Manure utilization and the impact of animal production on the environment is a topic of increasing importance as greater emphasis is placed on sustainability and environmental quality. A large quantity of data exists on manure's use as a fertilizer to support crop production as well as its potential impacts on environmental quality; however, often times these works aren't placed in a larger overall context that facilitates decision making on the part of the farmer based on the results. Thus, this work focused on researching these practices in a manner that also focused not only on the manure and the environment, but also the economic realities of different decisions.

Our first objective was to provide a method of determining whether manure was being seen as a waste that needed to be disposed or a resource that could be used to support crop production. This was done by performing a county-by-county estimate of manure nutrient excretion and its nutrient content from all animals produced within a county and comparing it to the estimated crop nutrient removal of nitrogen and phosphorus. This analysis was conducted for Iowa and all Census of Agriculture surveys since 1970. A statewide analysis of crop and animal production in Iowa suggests that about 30% of current nitrogen and phosphorus requirements for crop production could be supplied from manures and litters, while around 40% of the required potassium could be provided. However, neither livestock nor crop production is uniformly distributed across all counties. This unequal distribution suggests that a more disaggregated analysis of crop nutrient requirements and manure nutrient supply is necessary to estimate the risks of excess nutrient loss to the environment. Results indicated that in general all counties had sufficient nutrient utilization capacities to value manure as a resource; however, counties in Northwest Iowa are becoming progressively more manure rich, while counties in Southwestern and Central Iowa are becoming progressively more manure poor. This separation of crop and livestock production is becoming more pronounced, indicating that solids separation and nutrient (especially phosphorus) recovery systems that can concentrate manure nutrients for transport could become more important to help counties maintain nutrient balance and to return manure nutrients to the soil if these trends persist.

Our second and third objectives focused on evaluating two potential practices animal farms could use in handling their manure. The first is manure sampling and testing. It is recognized that manure sampling can reduce environmental impacts as it facilitates selection of proper manure application rates, but little data on its

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economic impact exist. Similarly, nutrient separation techniques are often proposed to create nutrient rich and nutrient poor manure products. The nutrient rich manure could then be more economically transported further from the farm, reducing manure application costs. Though various techniques have been evaluated, no effort has been made to determine what cost and performance requirements are needed to make these technologies economically feasible. To facilitate analysis of these cases economic models were developed. We used value of information theory to determine how information on manure nutrient content could be used to improve selection of manure application rates and the potential benefit this could have in cost savings due to reduced purchase of commercial fertilizer or improved crop performance, depending on if the estimated nutrient concentration would have resulted in under- or over-application of manure nutrients. Similarly, an economic model was used to evaluate how different nutrient partitioning performances would impact manure application costs of farms of various sizes and production characteristics to determine what a farm could pay for a nutrient separation technology