What Is It Worth? The Economic Value of Manure Testing

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Summary and Implications

In many ways, farming is often an exercise in decision-making in uncertain conditions. Agricultural systems are complex, highly variable, and conditions are continuously changing. Moreover, the variable conditions mean that the farmer often lacks information that could be used to make more informed decisions. Sampling and testing can provide farmers with more information, which they can use to improve their decisions. To evaluate the monetary value of manure testing, an economic model was developed. Using published literature values of manure nutrient concentrations and other agronomic factors as inputs, this model assesses how production expenses and incomes change with knowledge of manure's nutrient content. This work demonstrated that manure testing is an important part of maximizing the value of manure; moreover, it is known to be a best management practice for environmental protection.

Introduction

Nitrogen (N) and phosphorus (P) in animal manures are an important source of nutrients for crops. Loss of these nutrients can cause negative environmental impacts; however, proper use of manure offers a redeeming virtue, as recycling manure by land applying it to crop production areas provides an opportunity to close the nutrient cycle. In so doing, the dependence on synthetic and mined fertilizers decreases, farm sustainability improves, and expenses for commercial fertilizers are reduced. Achieving these goals requires knowledge of manure nutrient contents so that appropriate application decisions are made. However, application decisions are often based on prior manure tests or reference values, such as those available from ASABE or Midwest Plan Service. Manure nutrient contents vary widely from farm-to-farm and from year-to-year, such that over- and under-application of nutrients is likely to occur frequently when relying on values from these references.

Given the variability in composition, manure sampling and subsequent testing for nutrient composition is a critical component of proper management. However adoption of annual manure testing is relatively low, with only 20% of farms surveyed annually testing their manure's nutrient content annually. Thus, the objective of this work was to determine, through economic modeling and the theory of the expected value of information, the profitability (or lack thereof) of annual manure testing.

Materials and Methods

Our general approach was to calculate the expected value of information on the manure's nutrient content. The value of this information is the increase in expected profit that a farmer would derive from the collection and use of the new information relative to the expected outcome achieved without the information, i.e., using the assumed nutrient concentrations.

In practice, two methods exist for sampling and testing manure. The first method is to sample the manure before application so that the test results can be used to select the application rates. The second method is to sample the manure during application and use the test results afterward to verify the amount of N applied. When a farmer chooses to sample the manure affects how the nutrient concentration information can be used. Thus, in our work three "knowledge level" options are compared: (1) no manure nutrient testing, (2) pre-application manure testing, and (3) sampling during manure application with nutrient results available post-application.

The model compared the costs and revenue of corn production. Performing this comparison required cost estimates of field activities, the cost of purchased inputs (herbicide and seed), the sale price of corn, the cost of synthetic N fertilizer, the maximum potential yield, and the response of the corn to the applied N.

Results and Discussion

As shown in Table 1, our work suggests that when applying manure at an N-limited rate, sampling manure before application increases profits by \$8 to \$28 ac^{-1}. When applying at a P-limited rate, additional profits of \$1.50 to \$9 ac^{-1} were estimated. The model results illustrate that manure testing is economically beneficial and indicate that when application is nitrogen limited, manure should be sampled prior to application. If applying manure at a phosphorus-limited rate, sampling during application is recommended.

We also found that manure sampling is inherently more valuable in manure management systems that have greater variability in manure nutrient content, such as outdoor storage where weather can have a large impact on nutrient content. Finally, additional variables, such as the ability to consistently control the application rate, estimate the amount of ammonia volatilization, and estimate first-year nitrogen availability, all impact the value of the manure test, as they mean that the manure sample estimate is imperfect, and additional variability remains.

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Table 1. Estimated value of the manure test for different manure type and crop rotations.

	Pre-application		During Application	
Manure Type and Crop Rotation	N limited ($ ac^{-1})	P limited ($ ac^{-1})	N limited ($ ac^{-1})	P limited ($ ac^{-1})
Swine slurry				
Corn-soybean	$8.07	$8.94	$1.37	$8.93
Corn-corn	$12.41	$4.30	$3.39	$4.29
Layer manure				
Corn-soybean	$13.22	$5.82	$4.01	$5.82
Corn-corn	$20.25	$2.74	$8.28	$2.74
Dairy slurry				
Corn-soybean	$12.03	$3.97	$11.10	$3.97
Corn-corn	$27.45	$2.00	$20.42	$2.00
Beef feedlot scrapings (earthen lot)				
Corn-soybean	$12.76	$2.89	$5.64	$2.89
Corn-corn	$20.32	$1.51	$11.12	$1.51