



Science
Societies

What are the barriers and benefits of manure use in cropping systems?

By Richard Koelsch, Daniel Andersen, Erin Cortus, Leslie Johnson, Amy M. Schmidt, Melissa Wilson

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A trailer spreads liquid manure. Photo by Will Parson/Chesapeake Bay Program.

Animal agriculture is tasked with recycling the nitrogen (N) and phosphorus (P) in manures in an environmentally sound manner, typically as a soil fertility amendment (Figure 1). With feed supplies commonly originating from cropland not managed by animal-feeding operations, this recycling requires that manures be

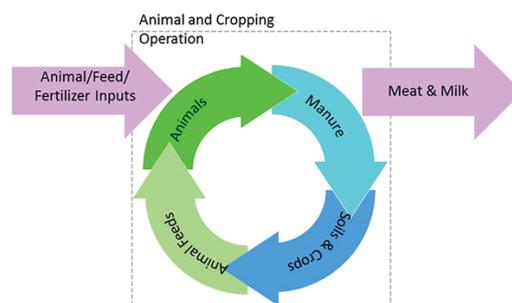


Figure 1, *Recycling of nutrients is critical to an environmentally sound agricultural “circular economy.”*

transferred to crop farms with little or no history of manure. We engaged in a survey of 957 farmers and their advisers to understand their perceptions of the benefits and challenges of manure use in cropping systems. Key take-home messages included:

- A strong recognition exists of manure’s agronomic, yield, and soil health benefits, but there is little understanding of manure’s potential water quality benefits.
- Many challenges frequently become barriers to manure use. The most commonly identified barriers include transportation costs, odor, logistical barriers, and some agronomic questions. Help with these challenges is critical for an expanded role of manure in fertility programs.
- Frequent users of manure recognize the complementary benefits of manure and fertilizer. Helping farmers employ these complementary roles will be critical to expanding manure’s use.

We invite you to examine these findings in more detail below.

Who Responded to Our Survey?

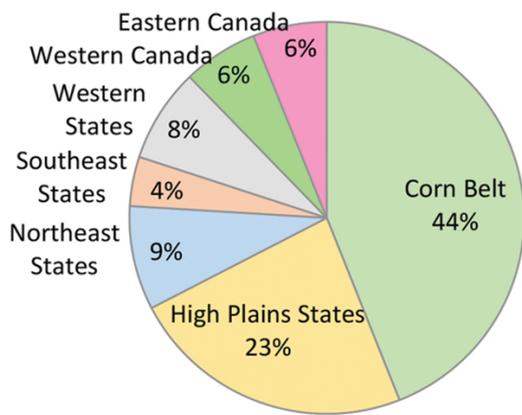


Figure 2, Region of the U.S. and Canada represented by survey participants (N = 957).

A faculty team from the University of Nebraska, University of Minnesota, and Iowa State University is addressing the need to expand the acres receiving animal manures. The project team, with guidance from a stakeholder advisory group of farmers and advisers, implemented a survey of perceptions of animal manure's benefits and challenges. The American Society of Agronomy's International Certified Crop

Adviser (ICCA) Program, *Manure Manager* magazine, and others promoted this survey among farmers and their advisers. The current survey, requiring less than 10 minutes to complete, remains open for additional response at <http://go.unl.edu/manure>.

Responses have been received from 957 individuals from the U.S. and Canada (Figure 2). Our survey responses represent those individuals who have a history of manure use. For example, 73% of farmers responding use manure annually. Our results provide insight to manure's benefits and challenges from frequent users but do not represent perspectives of those crop farmers or advisers with no history of manure use.

Perceptions of Manure's Benefits

Five characteristics identified as "Potential Benefits" by our project's stakeholder advisory group were evaluated for survey participants' perceptions and understanding (Figure 3).

The **agronomic and yield benefits** of animal manures are commonly valued as beneficial, and most believe that they are very or moderately knowledgeable of these topics. Future educational and technical services may need to target in-depth topics

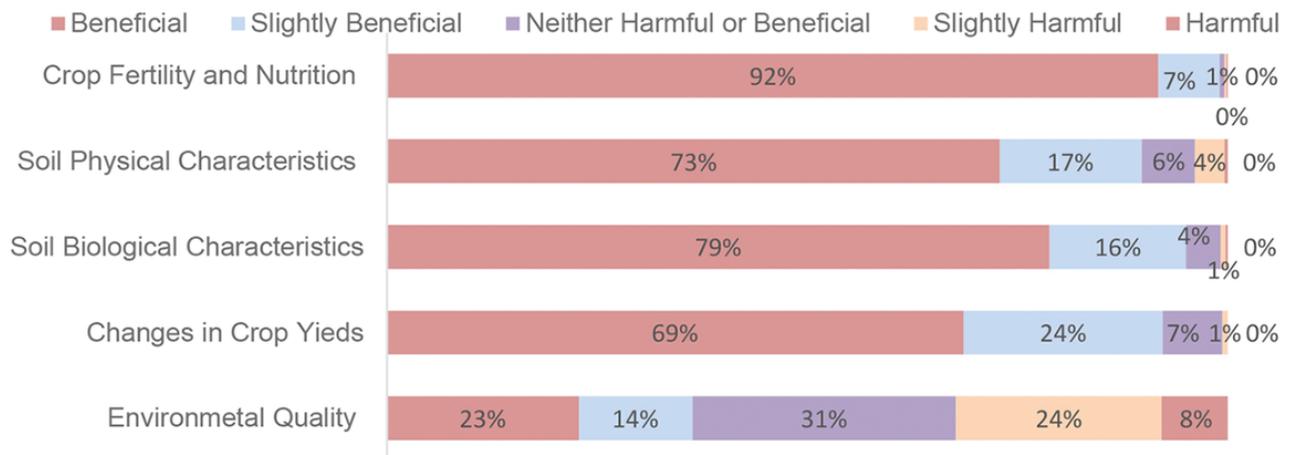
such as (1) integrating manure and fertilizer for optimum crop response and (2) estimating field-specific economic benefits and transportation costs.

Farmers and their advisers share a strong recognition of the value of manure to **soil physical and biological properties**. However, we observed mixed messages on the level of understanding of manure's value to soil health, especially from farmers. Do farmers recognize these benefits but are uncomfortable in communicating them to others? Recent educational experiences with introducing farmers to three soil health measures for identifying preferred fields for manure revealed this to be universally new to farmers. Services connecting manure and soil health will offer value.

Farmers and their advisers have a low opinion and understanding of **manure's benefits to water quality**. Most agricultural audiences have experienced substantial negative press describing the water quality risks from manure, generally associated with its overapplication. Less well understood are the water quality benefits that accompany agronomic manure application rates. Helping farmers and advisers recognize and discuss the water quality benefits of organic fertilizers should be a future focus.

We also learned that frequent users of manure in their decisions or recommendations recognize the **complementary benefits of manure and fertilizer** (Figure 4). Research supports this complementary role as the best opportunity for 10%+ yield increases, a strong argument for moving manure to fields with no manure history. Services to define the complementary fit for manure and fertilizer have an important future.

a. Beneficial / Harmful: To what degree do you consider manure to benefit or harm these cropping system characteristics (n=802):



b. My Knowledge: How knowledgeable are you of manure's impact on the following (n=801):

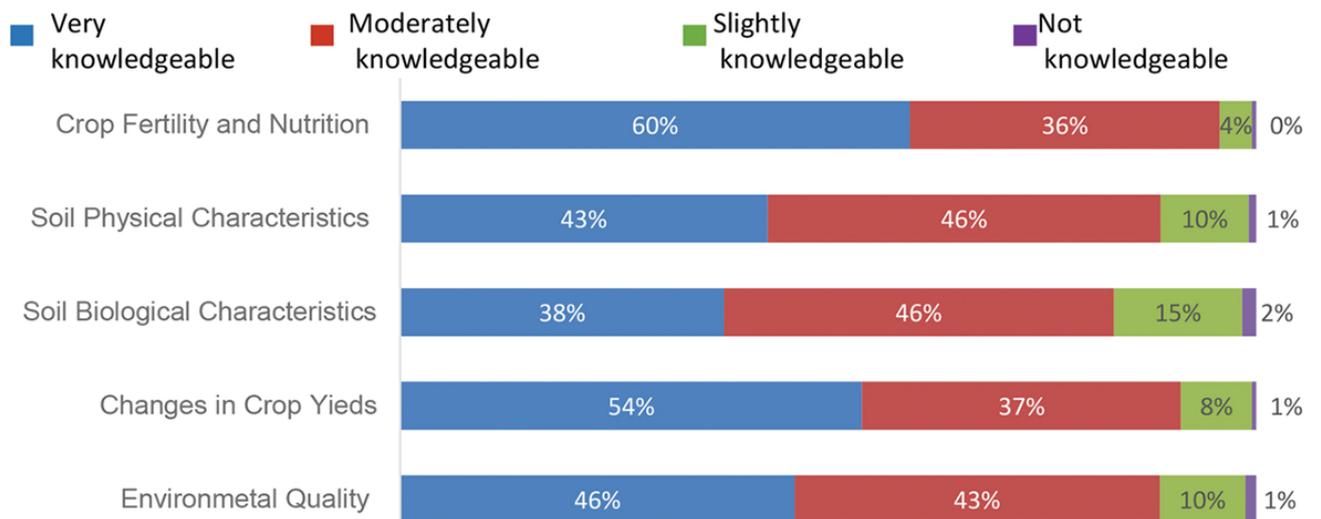


Figure 3, Perceptions and level of knowledge about factors commonly believed to offer benefits to crops or soils.

Fertilizer and Manure

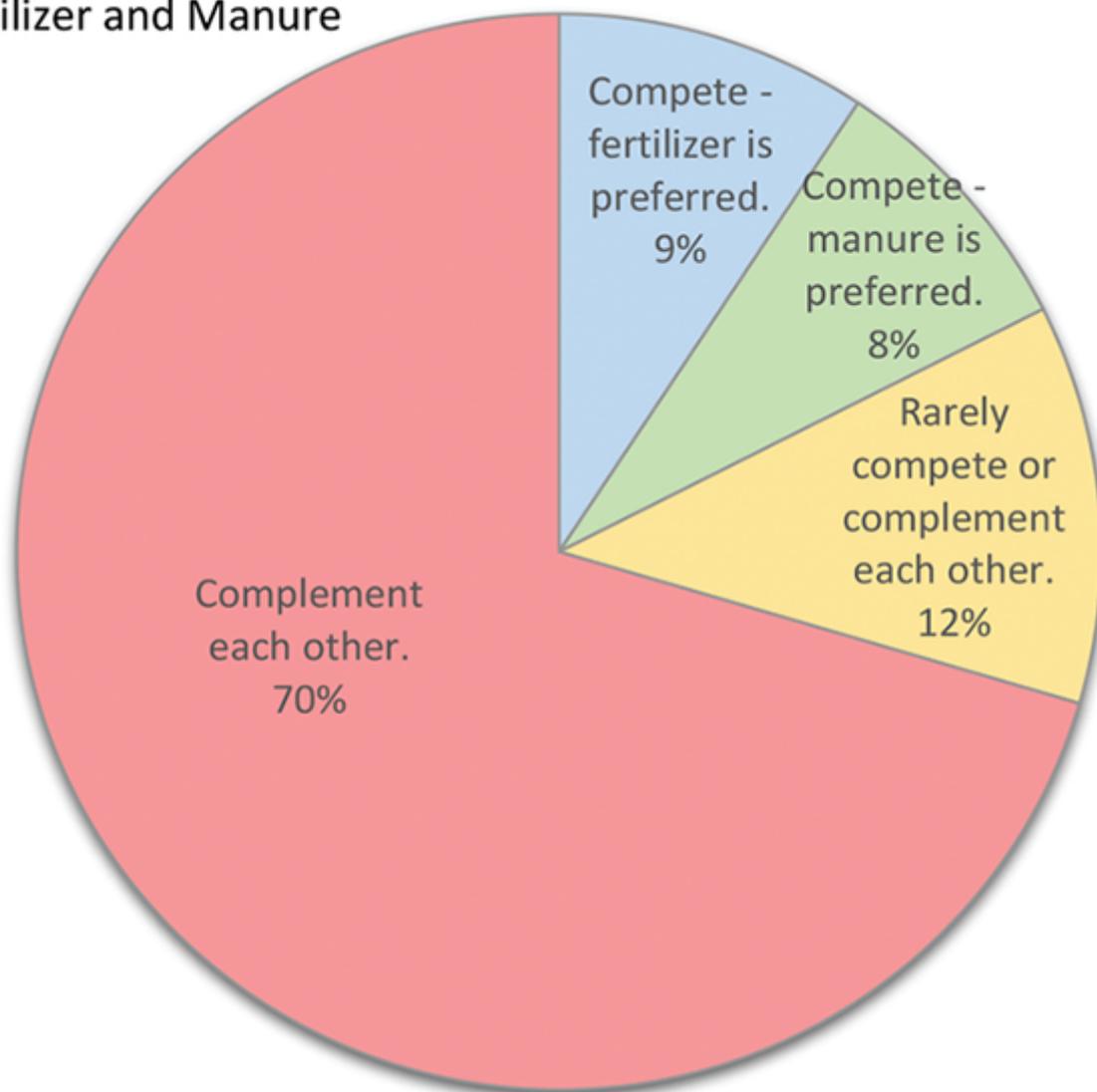


Figure 4, Survey participants' responses to what they personally believe is most true in their management decisions (or recommendations) with respect to use of manure and fertilizer in cropping programs.

Perceptions of Barriers to Manure Use

A wide range of challenges associated with animal manure use can prevent its acceptance for individual fields. Individual regions may need to further assess those regionally specific and audience-specific challenges to best target local needs. However, we would suggest that four challenges commonly must be addressed to avoid becoming barriers to manure use.

Transportation Costs

The cost of transporting manure is Barrier Number 1. Is this perception based on an understanding of today's costs and services available? Businesses providing manure-hauling and land application services have greatly expanded in their availability and the ability to move large volumes across significant distances. The changes that have occurred in the last decade in terms of equipment and business services may suggest a need to re-assess how far manure can be hauled. Helping farmers understand current costs and comparing them with the nutrient value for individual fields is needed. In addition, growing those business services that broker and move manure will be important.

Odor

Farmers desire to be good stewards and good neighbors. Those unhappy calls received by farmers from neighbors about manure odors are a significant barrier for expanding manure use. Options for incorporating manure should be considered. However, recognition that odors are a part of manure application, even with best practices in place, is crucial. Some are training farmers and manure haulers about conditions that lead to air inversions and odor concentration at the ground level. A weather forecast is a powerful tool to identify low-risk application times and locations, thus eliminating many odor nuisance calls.

Logistical Barriers

A range of logistical challenges ranked near the top as common barriers to using manure. Three logistical issues were among the top five challenges. Timely manure nutrient application for agronomic needs when confronted with labor, equipment, and field condition restrictions is tricky business. No single solution will counter these challenges. Robust business services designed to facilitate brokering, transport, and

land application can help with timing challenges. Expanding the application window, such as growing season manure application options, presents additional flexibility for manure.

Agronomic Issues

Manure application comes with a history of agronomic concerns such as compaction, poor uniformity, and potential for weed seed and herbicide resistance concerns. Many agronomic issues are likely to be regionally and manure source specific; thus, the need to adapt to local needs. Education and business service strategies that address emerging precision manure application technologies, towed-hose manure application, designer manures, and composting may have value based upon local or regional needs.

Where Do We Go from Here?

The next important environmental improvement for our management of animal manures will occur as we utilize more crop acres, often managed by a different business from our animal-feeding operations, in the recycling of manure N and P. For this to occur, our team proposes that:

- Crop farmers and advisers need to recognize the agronomic, yield, soil health, and water quality benefits that can accompany the use of manure.
- Solutions need to be found for the top 10 challenges identified in Table 1 plus other locally specific concerns.
- Rural communities should recognize the importance of recycling manure N and P. Communities that grow corn and other animal feeds should be a part of agriculture's circular economy.

Table 1. The following is a list of the top 10 challenges to using manure in cropping systems and the regularity of these challenges being identified as a frequent barrier

(either real or perceived) preventing manure use

Note: 23 additional agronomic, rural community, economic, regulatory, and logistical challenges (not shown here) were available to be selected.

Challenge category	Specific challenge	Regularity of being identified as a frequent barrier
Economic	Transportation and application costs	90%
Neighbor	Odors	78%
Logistical	Timeliness of application	72%
Logistical	Field conditions limiting application	66%
Logistical	Time/labor requirements	63%
Agronomic	Application equipment compaction	57%
Agronomic	Poor uniformity of application	51%
Regulatory	Regulations	50%
Agronomic	Weed seed from manure	48%
Economic	Initial costs for adding manure	46%

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