Socio-technical and environmental dimensions of swine manure management decisions

Clare C. Hinrichs
Iowa State University

Thomas Richard
Iowa State University

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Abstract
Once strictly a farm management concern, manure management is now a matter of state and societal interest. This qualitative study examines why and how farmers in two Iowa watersheds make decisions about manure management for their operations. Farmers interviewed explained the motives, logic, opportunities, and constraints that guide their use of particular management practices.

Keywords
Sociology, Agricultural and Biosystems Engineering, Nutrient Management

Disciplines
Agriculture | Bioresource and Agricultural Engineering | Rural Sociology

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Background

Prior to the advent of synthetic chemical fertilizers, recycling nutrients between livestock and cropland was essential for enhanced agricultural productivity. However, access to inexpensive nitrogen and other chemical fertilizers has made part of that cycle now optional (for crop farmers). This makes it more difficult for some livestock farmers to find cropland for their manure, especially in operations where livestock production has become more specialized and intensive. The issue of manure management has become one of state and societal interest due to the environmental impact of increasing supplies of sometimes poorly managed manure on water and soil quality.

In Iowa, manure management plans are now mandated for farms with a threshold number of livestock units. The plans attempt to help farmers balance nutrient availability with crop nutrient needs. For Iowa swine producers, the distinction between liquid and solid manure broadly distinguishes manure management approaches. Handling a liquid or slurry manure poses different technical and operational requirements than piling and possibly composting more solid manure, which also may be mixed with bedding.

Considerable research has been done to show what farmers do to manage manure. But this information does not show why farmers make specific manure management choices. Little is known about the ways that multiple factors—economic, agronomic, technical, and cultural—inform farmers’ choices.

Research objectives for this project were to:
1) Specify how swine farmers with different types of operations see the place of manure—as a resource or a waste—within their overall farming system,
2) Clarify how swine farmers assess the different capital requirements, labor needs, and environmental and nutrient management implications of alternative manure handling approaches in choosing between them, and
3) Document swine farmers’ historical and current perceptions of the watershed where their farm is located, and assess how such perceptions are related, if at all, to their present on-farm manure management decisions.

Approach and methods

The project investigated the socio-technical and environmental dimensions of swine manure management decisions. Intensive, semi-structured field interviews were conducted in the spring of 1999 with 34 Iowa swine producers farming in either the Raccoon River or the Iowa River watershed. The sample included producers with swine operations of varying sizes and orientations, using the range of liq-
uid and solid manure management systems common in Iowa (i.e., pit or slurry storage, anaerobic lagoon, open lot, pasture system, or hoop structure). All interviews took place at the swine farms where the interviewers were able to observe the farm operations.

Interviews were tape-recorded, transcribed verbatim, and coded and analyzed using N-Vivo, a software program designed for use with qualitative data. Manure management system decisions were explored through more focused case studies on six of the 34 farmers.

Results and discussion

Twenty-five of the 34 farmers’ operations were characterized by the use of more than one manure handling and storage system, which differed from the initial expectations of the researchers. Eight of the farmers had strictly solid systems, 11 had strictly liquid systems, and 15 used both liquid and solid manure systems. The prevalence of sometimes complex system combinations on any given farm challenged researcher assumptions about the usefulness of an analytical or practical distinction between solid and liquid manure systems. It also cautions against design and education solutions based on assumptions that farms handle only solid or liquid manure.

Overall, the farmers’ attitudes towards and understanding of manure are multi-faceted and more contradictory than the simple waste vs. resource argument would suggest. Several farmers spoke about the internal economic benefits of substituting manure for commercial nitrogen fertilizer. However, other farmers viewed manure as an external economic resource permitting new exchange beyond the farm via the manure markets where specialized livestock farmers provide a commodity (manure) to specialized crop farmers.

A complex array of factors contribute to swine farmers’ decisions about which manure handling systems to employ. Among the factors are historical precedent on the farm, individual preferences and values, economic constraints, environmental concern, neighbor relations, integrator policies, and a changing regulatory climate. Farmers do not make manure management decisions in complete isolation from other aspects of their enterprise or lives.

When asked about specific practices used in manure handling to protect water quality, four themes emerged:
1) Attention to place, or where one applies manure
2) Attention to time, or when one applies manure,
3) Attention to how one applies manure (i.e., solid or liquid, incorporation or not) and
4) Attention to mitigation or monitoring systems (i.e. filter strips, tile sampling, etc.).

(The first three appeared irrespective of whether farmers used liquid or solid manure systems or both, while the fourth theme was only evident among farmers with partial or solely liquid manure systems.)

Overall, it appeared that the swine farmers in these two Iowa watersheds do not have homogeneous “mental models” of watersheds. There were three major patterns of thinking about watersheds that focused on 1) the engineered or bureaucratic aspects, 2) the hydrologic dimensions at either a farm or regional level, or 3) the socio-ecological facets. Farmers from all types of operations spoke about the growing importance of water quality protection in their agricultural practice. However, they were divided in their assessment of the actual environmental impacts of livestock agriculture.

This research suggests that education and regulation can motivate livestock farmers to incorporate societally valued environmental precepts in their operations. However, their abil-
ity to do so may be hampered by larger economic and social forces.

Conclusions

The investigators found that swine farmers are shifting from a waste to a resource perspective (albeit with some qualifications) regarding the place of manure on their farms. Their continuing ambivalence toward manure stems from positive appraisals of its nutrient value on farmland, tempered by misgivings about associated odors and labor requirements. Increased knowledge, new technical applications, and manure market development seem to be stimulating the transition to a qualified resource perspective. This emerging resource perspective has several potential dimensions, including emphasis on agronomic values, economic values, and input substitution. While the distinction between solid and liquid manure is important from a technological and management standpoint, it did not distinguish level or expression of environmental concern by the farmers.

Iowa swine farmers have a varied comprehension of the watershed concept, but farmers of all types and scales of operations express concern about water quality protection in their agricultural practices. They manage environmental risk in different ways, revealing active experimentation with the geographic placement of manure, the timing of application, methods of application, and use of mitigation or monitoring systems. They express frustration in reconciling contradictory environmental and management recommendations.

Impact of results

This study confirmed the ongoing tension between environmental protection and enterprise profitability, which constrains many farmers from pursuing options they might otherwise prefer. Solutions that satisfy both these imperatives must be promoted. Education about alternatives that offer environmental and economic benefits (or are at least price-neutral) should be emphasized in research, demonstration, and educational efforts.

The ideal manure management system must fit both the farm’s unique physical reality and the farmer’s unique personal preferences and motivations. In many respects, the choice of technology may be less important than the comfort and satisfaction the farmer feels with it.

Environmental regulations that will affect livestock farms must take a farming system perspective. One-size-fits-all solutions provide an attractive, seemingly rational approach for regulators, but are contrary to the realities of livestock production and manure management systems. Desirable environmental outcomes like clean air and water are unlikely to ensue from technological imperatives alone. Current requirements to certify operators of land manure application systems are a step in the right direction, and may need to be extended to those who manage manure prior to application to the land. Management training should be strongly emphasized, either through educational incentives or via the regulatory process. Farmers noted mixed reactions to manure education programs that had been used in the past.

Education and outreach

The principal investigators have made two presentations on the results of the project: one in April 2000 to the Mid-Central Conference of the American Society for Agricultural Engineers and one in Bellingham, Washington in June 2000.