Changes in Manure Management in the Hog Sector

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Abstract. In recent years, structural changes in the hog sector, including increasing farm size and regional shifts in production, have altered manure management practices. Over the same period, changes to the Clean Water Act, new state regulations, and increasing local conflicts over odor have influenced manure management decisions. This study uses data from two national surveys of hog farmers to examine how hog manure management practices vary with the scale of production and how these practices evolved between 1998 and 2004. The findings provide insights into the effects of structural changes and recent policies on manure management technologies and practices, the use of nutrient management plans, and manure application rates.

Key words: hog production, manure management, structural change, environmental regulation

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In recent years, economic competition has driven rapid changes in the hog industry: production has shifted to fewer and larger operations that increasingly specialize in a single phase of hog production and are organized under production contracts (Key and McBride, 2007). The changing farm structure is altering manure practices, as larger operations develop ways to manage nutrients on a relatively smaller cropland base. At the same time, recent changes to the Clean Water Act, State regulations, and local conflicts over odor are influencing manure management decisions.

This study uses data from two recent surveys of hog farmers to examine how hog manure management practices vary with the scale of production and how they changed from 1998 to 2004. The findings provide information about the effects of recent policies and structural changes on manure management technologies and practices, the use of nutrient management plans, and manure application rates.

Data are from detailed surveys of U.S. hog producers conducted in 1998 and 2004 as part of USDA's annual Agricultural Resource Management Survey (ARMS). The surveys cover a cross-section of U.S. hog operations and collect information on production costs, business arrangements, production facilities and practices, and farm operator and financial characteristics. The surveys also provide detailed information about manure storage and handling, fertilizer use, manure application techniques, Environmental Quality Incentives Program (EQIP) payments, the use of comprehensive nutrient management plans (CNMP), and manure application rates. The data document the current state of manure management and provide information about producers' emerging responses to existing and anticipated manure-related regulations.

The sample of hog farms was chosen from a list of operations maintained by USDA's National Agricultural Statistics Service (NASS). The target population of each survey was farms having 25 or more hogs at any time during the year. Each surveyed farm represents a number of similar farms in the population as indicated by the surveyed farm's expansion factor, or survey

weight. The sampling resulted in 1,633 responses from 22 States in 1998, and 1,198 responses from 19 States in 2004. The expanded samples in each survey represent more than 90 percent of the hog and pig inventory on U.S. farms in each survey year.

Estimates from the two surveys are comparable because of the consistent way in which the surveys were conducted and processed. Each survey had broad national coverage, represented the same target population, involved a complex sampling scheme designed to represent the target population, was conducted the same way (hand-enumerated) by the same organization, and collected much the same information in a similar format.

Table 1 presents some basic summary statistics broken out by farm size category. The table illustrates some key features of the structural changes that occurred in the hog sector between 1998 and 2004. Fewer and larger hog farms account for an increasing share of total output, as the number of operations fell by about 40 percent between 1998 and 2004, and the average inventory grew from 2,589 to 4,646 head.

Over the six years between surveys, specialized feeder pig-to-finish operations became increasingly common, while farrow-to-finish operations became less prevalent. The share of farms using a production contract almost doubled. There were also substantial regional shifts in production. From 1998 and 2004, feeder pig-to-finish farms in the Heartland doubled in size while those in the Southeast grew at a slower rate (though starting from a larger average size). As a result, the Heartland's share of feeder pig-to-finish hog output grew 10 percentage points while the Southeast's share declined by 7 points (Key and McBride, 2007).

The environmental implications of hog production depend primarily on the manure management decisions of operations having at least 50 animal units. These operations accounted for 96 percent of hog output in the sample frame in 1998 and 98 percent in 2004. For this reason, and to simplify the tabular presentations, statistics for operations with fewer than 50 animal units are not reported in tables 2 - 7.

Manure storage and handling

Table 2 summarizes changes in the use of manure storage systems. Lagoon use and scale of production have a strong positive association. Despite this fact and the trend toward larger operations, there was a shift between 1998 and 2004 toward the use of pit/tank systems. By 2004 56% of hogs were raised on farms using pit/tank systems (up from 37% in 1998); in 2004 39% were raised on farms using a lagoon system (down from 55% in 1998).[1] This shift can be attributed primarily to changes in the manure systems used by medium and large scale operations.

To some extent, the shift in manure system use reflects regional shifts in hog production and farm structure. Operations in the Southeast are more likely to use lagoon systems, while those in the Heartland are more likely to use a pit/tank system (McBride and Key, 2003). These regional shifts in production were partly a response to State-level environmental policies. The rapid growth of hog operations in the Southeast in the early 1990's slowed after 1998 partly because the North Carolina State legislature passed the Clean Water Responsibility and Environmentally Sound Policy Act in 1997. This law imposed a moratorium on the construction of new or expansion of existing hog operations with 250 or more head (North Carolina General Assembly, 1997). Exceptions to the moratorium included construction using "innovative animal waste management systems that do not employ an anaerobic lagoon." North Carolina extended the moratorium several times through 2007 and passed legislation that strictly regulates manure management systems.

Table 3 describes changes in the use of manure spreading technologies. Pit/tank systems generally use a solid or liquid spreader, while sprinkler irrigation technology is used to move and apply lagoon liquid. The method of applying manure can have important implications for air quality, affecting the level of odorous gases (ammonia and hydrogen sulfide), particulate

[1] In tables 2 – 7, "All farms, weighted by animal units", gives the mean values computed using a weight defined as the sample weight times the animal units on the operation. This weighted mean is the average for animals units (rather than for farms).

material (by-products of ammonia), and greenhouse gases (methane and nitrous oxide) (Aillery, et. al, 2005). Neither State nor Federal governments currently regulate nitrogen air emissions from animal feeding operations. However, ammonia nitrogen emissions could be regulated in the future under the PM2.5 particulate standard of Clean Air Act. According to the National Research Council, "Ammonia is regulated as a precursor for PM2.5, which is a criteria pollutant. Hence it may be considered a regulated air pollutant." The EPA is currently developing Federal PM2.5 rules for animal feeding operations (USEPA 2004; USEPA 2006).

Both solid and liquid manure can be incorporated into the soil, which reduces odor and nutrient volatilization (escape into the atmosphere) relative to spreading, making more nutrients available for plant uptake. Incorporation also reduces the risk of nutrient runoff. Sprinkler application also increases nitrogen volatilization, which reduces the nitrogen available for plant use. Lagoon/sprinkler systems allow producers to dispose of manure from a given operation on fewer acres when a nitrogen criterion is used to determine application levels.

There are clear relationships between the scale of production and the use of sprinkler irrigation versus solid or liquid spreaders. Among large farms that applied manure to crops, sprinkler irrigation was the most commonly used form of manure application, followed by injection of liquid manure. Between 1998 and 2004, there was an overall large decline in share of appliers who spread solid manure. Most of this change occurred because 1) there were fewer smaller farms, which are more likely to handle solid manure, and 2) there was a decline in the use of solid spreading on small operations.

There is some evidence that growers altered their spreading technologies to reduce odor, nutrient volatilization and runoff. There was a decline in the share of growers who applied liquid manure without injecting it (by 9 percentage points). There was also an increase in the share of large operations applying liquid manure with injection technologies (though this increase was not statistically significant at the 10% level).

Manure application and disposal

Table 4 summarizes the application rates of manure on the hog farm operation. There is a strong positive association between scale of production, total cropland available on the hog farm, and the number of acres on which manure is applied on the hog farm. Between 1998 and 2004, the average number of manure-applied acres and the average amount of cropland per farm did not change substantially.

Table 4 also illustrates the strong positive association between the scale of production and the manure application intensity (animal units per acre).[2] The higher application rates for larger operations reflect the relatively large amount of manure generated by larger hog operations compared to the cropland on these operations available for manure application. Different storage and handling techniques differentially affect the quantity of nutrients contained in applied manure, so the application intensity does not measure actual nutrient application rates.

Between 1998 and 2004, the increase in total animal units produced (table 1) outpaced the increase in crop acreage on which manure was applied, resulting in a 43 percent increase in the farm-average manure application intensity. However, this increase was driven mainly by the very small (not shown in table) and small operations. Larger operations, which are more likely to be subject to nutrient management restrictions, did not display an increase in application intensity. For medium operations, the application intensity remained about the same, and for large operations it actually decreased.

Table 5 describes the quantity and methods used for removing manure from an operation. There was a positive relationship between the scale of production and the quantity of manure removed from the farm, and this relationship grew stronger over time. In addition, between 1998 and 2004 there was a 50 percent increase in the share of farms removing manure from their farm. This increase is attributable mainly to increased removal from large operations. Most of the

[2] For the intensity ration, the denominator is the acres of land on the hog operation on which manure was applied. The numerator is the farm inventory (AU) adjusted for the removal of manure off the farm. For farms that moved manure off the operation the number of AU was reduced by the equivalent amount of manure removed. For example, if 50 percent of the manure was moved off a 1,000 AU operation, only 500 AU was used to compute the ratio.

manure removed from farms was given away – only a small share was sold or required the operator to pay someone to remove it. There is some evidence of an emerging market for manure – the share of farms selling manure increased in all sales categories, albeit from a very low level.

Nutrient management practices

Table 6 illustrates the evolution of manure management practices. Manure nutrient testing, a practice required as part of many State-mandated manure management plans, was positively associated with scale of production.[3] Larger operations are more likely to face State regulations that require nutrient management plans.

Between 1998 and 2004 there was a substantial increase in nutrient testing: the share of farms testing for N increased from 18% to 29% and the share of animals on farms that tested manure for nitrogen increased from 51% to 73%. Nitrogen testing rates increased for all farm-size categories, especially the medium-scale operations. The large operations did not have as much scope to increase their testing rate because 81% of these farms tested in 1998.

The table also reports the share of farms that applied both commercial fertilizer and manure. Commercial fertilizer is likely to be applied to crops in addition to manure if the manure-nutrients do not meet the nutritional needs of the crops. As would be expected, there is a strong negative association between scale of production and the application of supplemental commercial fertilizer. Larger operations are more likely to have a surplus of nutrients provided by the manure produced on their operations, and are therefore less likely to require supplemental commercial fertilizer.

Bermuda grass, which is grown primarily in the South and Southeast, is especially appealing to hog producers because it consumes large amounts of nitrogen per acre. Table 6

[3] The table reports the rate at which manure was tested for nitrogen content. For phosphorus content testing (not shown in the table) almost identical rates were reported.

shows a strong positive association between the scale of production and the application of manure to Bermuda grass in 2004.

Table 6 also illustrates the positive association between the scale of production and the use of a comprehensive nutrient management plan (CNMP) that requires growers to apply manure nitrogen at or below the agronomic rate. In 2004, about 30 percent of all farms followed a CNMP and 62% of animal units were raised on farms using a CNMP.

Microbial phytase is used as an additive in finishing hog diets to reduce phosphorus excretion in manure. Phytase use in feeding helps producers manage phosphorus levels in manure to comply with phosphorus-based nutrient management plans. As expected, there is a positive relationship between scale of production and phytase use. There were increases in the share of farms using phytase in all size categories, with the share of all farms using phytase more than tripling between 1998 and 2004 (from 4% to 13%). The share of hogs raised on farms using phytase increased from 12% to 30%.

Environmental policies affecting manure management

Recent policy initiatives may explain some of the changes in manure management practices. In recent years, Federal and State policies have been implemented with the goal of mitigating the over-application of manure nutrients and reducing the environmental harm caused by accidental spills from manure storage and holding facilities. New (2003) Clean Water Act regulations from EPA require that large animal feeding operations (known as Concentrated Animal Feeding Operations, or CAFOs) needing a National Pollutant Discharge Elimination System (NPDES) permit develop and implement a nutrient management plan. Such a plan sets a limit on the amount of nutrients that could be applied per acre of land. A number of states have also placed limits on manure application rates. Restricting application rates could help explain increases in the crop acreage receiving waste and the amount of waste moved off the farm, and the observed widespread adoption of nutrient management plans.

To help defray the costs of meeting the new regulations, producers can apply for financial assistance from the USDA's Environmental Quality Incentives Program (EQIP). Producers can receive up to $450,000 per farm during 2002-2007 to help them develop and implement a nutrient management plan, construct appropriate animal and manure handling and storage facilities, or to transfer and apply manure to land in an approved manner (Ribaudo, Cattaneo, and Agapoff). Table 7 shows that only 1.5% of operations received any EQIP payments related to hog production in 2004. However, 3.7% of medium and 3.9% of large operations received payments. Payments for the large operations were used primarily for defraying the costs of manure handling and storage facilities and costs associated with developing and maintaining a nutrient management plan. The small share of farms receiving payments in 2004 suggests that these payments do not explain the more widespread changes observed in the study, such as the movement away from lagoons toward pit/tank systems, the decline in the use of and non-injected liquid spreading, the increase removal of manure from the operation, or the increased use of manure nutrient testing or the use of microbial phytase in feed. However, on the margin, these payments may have facilitated these changes, especially for medium and large-scale operations.

While only large operations (CAFOs) needing a NPDES are required to have a nutrient management plan, the new Clean Water Act rules provide a strong incentive for smaller operations to also develop and implement a nutrient management plan. The Clean Water Act exempts nonpoint sources from the NPDES permit requirements through what is known as the stormwater exemption. Simply stated, if pollution occurs only during storm events, then a farm is exempt from the permitting requirements. EPA has proposed that all AFOs that wish to claim the stormwater exemption have a nutrient management plan to demonstrate that due care is being taken to minimize polluted runoff. If a waterway becomes polluted with animal waste and an AFO does not have a nutrient plan, it would be in violation of the Clean Water Act. This would likely increase the use of CNMPs by smaller AFOs in the future.

Agricultural-residential conflicts at the rural-urban fringe seem to be increasing as residential development expands further out into rural areas while market conditions push

farmers to intensify their production (Bergstrom and Centner, 1989; Centner, 2002; Duke and Malcolm, 2003; Jacobson et al., 2006). Conflicts over environmental concerns are most prevalent for animal operations (Duke and Malcom, 2003; Centner, 2002). Close interactions can result in citizen complaints to local authorities and actual and threatened lawsuits over perceived threats to health and environmental quality, even when no laws have been broken. Such actions may force farmers to modify their production practices. Adoption of "acceptable" or "qualifying" management practices is a way farmers can protect themselves from conflict over environmental quality (Centner, 2002).

The use of such practices, such as manure injection (to control odors) and a nutrient management plan (to demonstrate due care), have increased in recent years. Ribaudo and Johansson (2007) found evidence that nutrient management on farms is higher in areas closer to population centers than elsewhere, possibly in response to actual or perceived threats of lawsuits.

Conclusions

Findings from the analysis of the 1998 and 2004 hog surveys indicate important relationships between the scale of production and manure management practices and outcomes. Among other things, we find that the scale of production is positively associated with a:

1) greater likelihood of removing manure from the operation, especially by giving it away for free
2) smaller likelihood of applying both commercial fertilizer and manure to crops
3) greater likelihood of applying manure to Bermuda grass and of adding microbial phytase to feed
4) greater likelihood of testing manure for nutrients and of following a CNMP

These findings suggest that larger operations are substantially altering their behavior in response to binding nutrient application constraints.

This analysis also provides information about how manure management practices have changed over time. In the six years between 1998 and 2004, there has been:

1) an increase in the use of pit/tank manure systems and a decline in the use of lagoon systems.
2) a decline in the spreading of solid manure and in the spreading liquid manure without injection, for farms applying manure
3) an increase the average manure application intensity, for all farms applying manure
4) no change and a small decline in manure application intensity for medium and large operations, respectively
5) an increase in the share of farms removing manure from their operation
6) an increase in manure nutrient testing rates
7) an increase in the use of microbial phytase in feed

Some of these observed changes in manure management practices and outcome can be attributed to the pronounced structural changes that occurred over this time frame – particularly farm size and regional shifts in production. The relative growth in output share in the Heartland compared to the Southeast likely explains much of the shift from lagoons to pit/tank systems, despite lagoons being more prevalent among larger operations. As discussed above, however, this regional shift was partly a response to State regulations that sought to reduce negative environmental outcomes associated with large hog manure lagoons.

Some of the observed patterns of change also stem from changes in environmental policies. Between 1998 and 2004 there were an increasing number of Federal and State policies designed to reduce the over-application of manure nutrients. The survey shows that in 2004, 30% of farms representing 62% of animal units, followed a nutrient management plan. Nutrient application restrictions or the desire to avoid future liabilities and lawsuits could help explain the increasing share of operations moving waste off the farm, testing manure for nutrients, and using microbial phytase in feed. While the manure-nutrient application intensity generally increases with farm size, the fact that the application intensity rate declined on large operations between 1998 and 2004 suggests that environmental policies are achieving some positive outcomes.

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Table 1. Summary statistics, 1998 and 2004

	1998	2004
All farms		
Observations	1,633	1,198
Number of farms	61,971	40,940
Hog inventory (head)	2,589	4,646
Hog inventory (animal units)	194	294
Producer type: Farrow-to-finish (%)	49	31
Producer type: Feeder pig-to-finish (%)	31	40
Used a production contract (%)	15	28
Farm size category		
Very small (< 50 animal units)		
Observations	490	262
Number of farms	24,962	16,055
Percent of farms	40	39
Percent of production	4	2
Small (50 – 299 animal units)		
Observations	625	418
Number of farms	27,792	14,517
Percent of farms	45	35
Percent of production	29	16
Medium (300 – 999 animal units)		
Observations	368	351
Number of farms	7,153	7,421
Percent of farms	12	18
Percent of production	33	37
Large (> 1000 animal units)		
Observations	150	167
Number of farms	2,100	2,948
Percent of farms	3	7
Percent of production	34	46

Note: A farm is defined as operation having 25 or more hogs at any time during the year. Animal units are defined as 1,000 pounds of live animal weight. Farrow-to-finish operations are those on which pigs are farrowed and then finished to a slaughter weight of 200-275 pounds. Feeder pig-to-finish operations are those on which feeder pigs are obtained from outside the operation, either purchased or placed under contract, and then finished to a slaughter weight of 200-275 pounds.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 2. Hog manure system

	Percent	
	1998	2004
All farms		
Lagoon	23	17
Pit/tank	37	42
Other	40	41
All farms, weighted by animal units		
Lagoon	55	39**
Pit/tank	37	56**
Other	8	5**
Farm size category		
Small (50 – 299 animal units)		
Lagoon	23	16
Pit/tank	57	61
Other	20	23
Medium (300 – 999 animal units)		
Lagoon	51	32**
Pit/tank	46	65**
Other	3	2
Large (> 1000 animal units)		
Lagoon	80	55**
Pit/tank	19	45**
Other	1	0

Note: Asterisks indicate level of significance for the test of the null hypothesis of equal means: ** =5%, * = 10%.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 3. Hog manure spreading technology, manure appliers only

	Percent	
	1998	2004
All farms that apply manure		
Solid spreader	64	46**
Liquid spreader (no injection)	27	18**
Liquid spreader (injection)	20	21
Sprinkler irrigation	12	13
All farms that apply manure, weighted by animal units		
Solid spreader	36	19**
Liquid spreader (no injection)	25	17*
Liquid spreader (injection)	30	34
Sprinkler irrigation	34	36
Farm size category (farms that apply manure)		
Small (50 – 299 animal units)		
Solid spreader	66	40**
Liquid spreader (no injection)	40	28**
Liquid spreader (injection)	28	31
Sprinkler irrigation	9	10
Medium (300 – 999 animal units)		
Solid spreader	32	23
Liquid spreader (no injection)	28	19
Liquid spreader (injection)	42	37
Sprinkler irrigation	32	28
Large (> 1000 animal units)		
Solid spreader	10	10
Liquid spreader (no injection)	7	12
Liquid spreader (injection)	20	30
Sprinkler irrigation	58	57

Note: Asterisks indicate level of significance for the test of the null hypothesis of equal means: ** =5%, * = 10%. Some operations may have used more than one technology, or none of the technologies. Therefore the columns may add up to more than or less than 100%.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 4. Hog manure application, manure appliers only

	1998	2004
All farms that apply manure		
Acres with manure application	85	86
Acres of cropland	448	483
Percent of cropland with manure application	19.1	17.8
Application intensity (AU/acre applied)	2.1	3.0**
All farms that apply manure, weighted by animal units		
Acres with manure application	147	218**
Acres of cropland	596	855**
Percent of cropland with manure application	24.7	25.5
Application intensity (AU/acre applied)	7.2	7.4
Farm size category (farms that apply manure)		
Small (50 – 299 animal units)		
Acres with manure application	95	85
Acres of cropland	517	599
Percent of cropland with manure application	18.4	14.2*
Application intensity (AU/acre applied)	1.3	1.6
Medium (300 – 999 animal units)		
Acres with manure application	156	169
Acres of cropland	565	652
Percent of cropland with manure application	27.6	26.0
Application intensity (AU/acre applied)	2.9	3.0
Large (> 1000 animal units)		
Acres with manure application	159	224
Acres of cropland	643	1016*
Percent of cropland with manure application	25.0	22.0
Application intensity (AU/acre applied)	9.4	8.0

Note: Asterisks indicate level of significance for the test of the null hypothesis of equal means: ** =5%, * = 10%.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 5. Manure removal from farm

	Percent	
	1998	2004
All farms		
Removed manure from operation	14	21**
Sold manure	0	2*
Paid for manure removal	2	2
Manure given away free	12	18*
All farms, weighted by animal units		
Removed manure from operation	23	31
Sold manure	1	5
Paid for manure removal	4	4
Manure given away free	19	23
Farm size category		
Small (50 – 299 animal units)		
Removed manure from operation	16	14
Sold manure	0	2
Paid for manure removal	2	2
Manure given away free	14	11
Medium (300 – 999 animal units)		
Removed manure from operation	31	27
Sold manure	2	5
Paid for manure removal	8	5
Manure given away free	23	18
Large (> 1000 animal units)		
Removed manure from operation	26	38
Sold manure	1	3
Paid for manure removal	1	3
Manure given away free	24	31

Note: Asterisks indicate level of significance for the test of the null hypothesis of equal means: ** =5%, * = 10%.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 6. Nutrient management practices

	Percent	
	1998	2004
All farms		
Test manure for N content	18	29**
Apply commercial fertilizer and manure	61	58
Applied manure to Bermuda grass (appliers only)	n.a.	11
Followed Comp. Nutrient Management Plan	n.a.	30
Added microbial phytase to feed	4	13**
All farms, weighted by animal units		
Test manure for N content	51	73**
Apply commercial fertilizer and manure	48	39*
Applied manure to Bermuda grass (appliers only)	n.a.	23
Followed Comp. Nutrient Management Plan	n.a.	62
Added microbial phytase to feed	12	30**
Farm size category		
Small (50 – 299 animal units)		
Test manure for N content	17	24*
Apply commercial fertilizer and manure	69	67
Applied manure to Bermuda grass (appliers only)	n.a.	3
Followed Comp. Nutrient Management Plan	n.a.	31
Added microbial phytase to feed	4	11**
Medium (300 – 999 animal units)		
Test manure for N content	49	76**
Apply commercial fertilizer and manure	52	40
Applied manure to Bermuda grass (appliers only)	n.a.	16
Followed Comp. Nutrient Management Plan	n.a.	65
Added microbial phytase to feed	15	33**
Large (> 1000 animal units)		
Test manure for N content	81	89
Apply commercial fertilizer and manure	27	24
Applied manure to Bermuda grass (appliers only)	n.a.	32
Followed Comp. Nutrient Management Plan	n.a.	69
Added microbial phytase to feed	14	30

Note: Asterisks indicate level of significance for the test of the null hypothesis of equal means: ** =5%, * = 10%.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys

Table 7. Environmental Quality Incentive Program Payments Related to Hog Production

	Percent 2004
All farms	
Any hog-related EQIP payments	1.5
Manure handling and storage facilities	0.6
Nutrient management plan	0.8
Manure application	0.2
Other	0.4
All farms, weighted by animal units	
Any hog-related EQIP payments	3.2
Manure handling and storage facilities	1.5
Nutrient management plan	2.2
Manure application	0.6
Other	1.1
Farm size category	
Small (50 – 299 animal units)	
Any hog-related EQIP payments	1.6
Manure handling and storage facilities	0.9
Nutrient management plan	0.5
Manure application	0.3
Other	0.1
Medium (300 – 999 animal units)	
Any hog-related EQIP payments	3.7
Manure handling and storage facilities	0.6
Nutrient management plan	2.0
Manure application	0.4
Other	1.2
Large (> 1000 animal units)	
Any hog-related EQIP payments	3.9
Manure handling and storage facilities	2.4
Nutrient management plan	3.3
Manure application	0.4
Other	1.2

Note: "Other" includes animal facilities, waste hauling, and unspecified.

Source: USDA, ERS 1998 and 2004 Agricultural Resource Management Surveys