Can EQIP be Effective in Helping Farmers Meet Manure Management Goals?

Marc O. Ribaudo
Economic Research Service
1800 M St. NW
Washington, DC 20036
202-694-5488
mribaudo@ers.usda.gov

Jean Agapoff
Natural Resources Conservation Service

Andrea Cattaneo
Economic Research Service

Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal Canada, July 27-30, 2003

The views expressed in this paper are the authors' and do not reflect the views of the Economic Research Service or the U.S. Department of Agriculture.

Can EQIP be Effective in Helping Farmers Meet Manure Management Goals?

Livestock and poultry manure can provide valuable organic material and nutrients for crop and pasture growth. However, nutrients contained in animal manure can degrade water quality if they are overapplied to land and enter water resources. The nutrients of greatest water quality concern are nitrogen and phosphorus. Animal waste is a source of both.

Animal waste has become a major focal point of environmental policy, and hogs provide a good example of why. A shift in the industry over the past decade towards fewer, larger, spatially concentrated operations has resulted in concerns over the utilization and disposal of animal waste. In 1982, there were 175,284 farms with confined hogs in the U.S., totaling 6.3 million animals (USDA, ERS, 2002b). In 1997, the number of farms had shrunk to 63,723 (down 64 percent), while the number of hogs had increased to 8.2 million (USDA, ERS, 2002b) with many more hogs on large facilities. An estimated 51 percent of the recoverable nitrogen (nitrogen remaining after collection and storage) in hog manure in 1997 and 64 percent of the recoverable phosphorus was in excess of crop needs at the farm level (Gollehon et al., 2001). Nutrient application standards for animal feeding operations are intended to address these excess nutrients.

In response to increased environmental concerns, EPA has increased regulatory controls for concentrated animal feeding operations (CAFO) under the Clean Water Act. One of the changes is to require CAFOs that apply manure to land to meet application limits defined by a nutrient standard (U.S. EPA, 2003). The goal of the nutrient standard is to minimize nutrient loss from fields receiving manure. Farms meet this standard by applying manure nutrients at a rate consistent with the agronomic needs of crops receiving manure. Nutrient standards can be nitrogen- or phosphorus-based, depending on the nutrient content of the soil. USDA is encouraging the voluntary adoption of nutrient standards on all animal feeding operations (AFO) not subject to EPA regulation (USDA, NRCS, 1999).

Land application of manure to meet a nutrient standard may be costly if significant amounts of additional land are needed to prevent over-application of nutrients and if manure must be hauled off the farm. To help mitigate the costs of meeting a nutrient application standard USDA's Environmental Quality Incentive Program (EQIP) offers financial assistance for several conservation practices that help farmers utilize manure more efficiently. In this paper we assess the costs of Federal manure management goals on the hog sector, and whether financial assistance from EQIP can be reasonably expected to cover these costs.

EQIP and Manure Management

The Environmental Quality Incentive Program (EQIP) provides technical assistance, cost-share payments, and incentive payments to operators of working farms for implementing conservation practices. The program is managed by the USDA's Natural Resource Conservation Service (NRCS). Assistance can be in the form of a cost share payment (percentage of implementation cost) or incentive payment (per-acre payment based on activity). EQIP was initiated in the 1996 Federal Agriculture Improvement and Reform Act (1996 Farm Act) and amended by the 2002 Farm Security and Rural Investment Act (2002 Farm Act). Animal feeding operations can receive financial assistance for waste management structures and various waste management handling and application practices. Contracts for financial assistance are for 1 to 10 years, with a maximum of $450,000 per farm over FY2002-2007 (USDA, ERS, 2002). By statute, 60 percent of the available funding for the program is earmarked for practices related to livestock production. EQIP was funded at about $200 million per year from 1996 through

2000. Funding is authorized to increase incrementally from $400 million in 2002 to $1.3 billion in 2007. All farmers are eligible for EQIP on a first-come, first-served basis. Currently (2003), the demand for EQIP funds is greater than the supply. It is unclear whether the proposed increase in the EQIP budget will alleviate this backlog.

The specific practices farmers can use to meet manure nutrient standards include:

Nutrient Management (code 590) - Nutrient management is managing the amount, source, placement, form and timing of the application of nutrients and soil amendments (USDA, NRCS, 1999a). One of its purposes is to “properly utilize manure or organic by-products as a plant nutrient source” (USDA, NRCS, 1999a). A payment is made on a per-acre basis to cover the costs of developing and implementing a nutrient management plan. Activities undertaken by a farmer covered by this practice include all the components of a nutrient management plan, including the development of the plan by a certified specialist, soil testing, plant tissue testing, nutrient application timing, nutrient application rates, field risk assessment, and heavy metals monitoring.

Waste Utilization (code 633) - Waste Utilization is using agricultural wastes, such as manure and wastewater from livestock and poultry operations, as a nutrient source and to improve soil tilth (USDA, NRCS, 2001). The payment is on a per-acre basis for lands receiving waste in an approved manner, and is intended to cover the development of a waste management plan, the application of waste according to that plan, and recordkeeping. Where wastes are utilized to provide nutrients to crops, the practice Nutrient Management must also be followed.

Manure Transfer (code 634) - Manure Transfer refers to a conveyance system using structures, conduits, or equipment for moving manure (USDA, NRCS, 1997). The purpose of manure transfer is to transfer animal manure to a manure storage/treatment facility, a loading area, and to agricultural land for final utilization. Manure transfer is a part of a planned agricultural manure management system. Payments for manure transfer are typically 50 percent of hauling costs for manure moved off the farm.

We based our nutrient application standards on NRCS nutrient management policy. Nutrient management criteria are established by the NRCS conservation practice standard to provide adequate nutrients for crop growth and to minimize the potential for adverse environmental effects. NRCS's nutrient management policy and conservation practice standard criteria are implemented by animal feeding operations through the development and implementation of site-specific nutrient management plans, as defined in the NRCS General Manual, Title 190, Part 402, and the NRCS Conservation Practice Standard, Nutrient Management (Code 590) (USDA, NRCS, 1999a). The primary criteria within these policy documents are that land application rates of nutrients be based upon Land Grant University nutrient application recommendations.

NRCS policy permits manure application rates that are determined using either a nitrogen or phosphorus standard. Manure application rates that are based on a nitrogen standard supply all the nitrogen recommended for the crop. Manure applied at a nitrogen standard will usually result in over-application of phosphorus. NRCS policy permits use of the nitrogen standard on sites for which there is a recommendation to apply phosphorus, or when the use of a risk assessment tool has determined that the site has acceptable risk for off-site transport of phosphorus. (The Phosphorus Index is currently the most widely used risk assessment tool for this purpose.)

Manure application rates that are based on a phosphorus standard supply only the amount of phosphorus that is recommended based on current soil tests or a function of the phosphorus content of plant biomass removed at harvest. Manure applied based on the phosphorus standard will not usually supply the recommended amount of nitrogen, necessitating the application of additional nitrogen from other sources. When using the phosphorus standard, NRCS policy permits an application of phosphorus equal to the amount of phosphorus contained in the biomass of multiple years of crops grown on the site, provided that the nitrogen recommendation rate for the first year is not exceeded. In our analysis we assume a strict P-standard that does not allow overapplication of P in any year.

Estimating the costs of meeting nutrient standards

Meeting a nutrient standard introduces several costs to manure management, including the costs of developing a nutrient management plan, testing the nutrient content of manure, testing the nutrient content of soil, hauling manure to more fields (some off the farm), and recordkeeping. We first estimated a nutrient application standard for each farm. We then determined the amount of land each farm needed to meet the standard, and then the cost of moving manure to this amount of land.

We used data from the 1998 hog Agricultural Resource Management Survey (ARMS) to obtain farm-level data on operation size, manure management and storage technology, application strategy, land used for spreading manure, cropland base, and crop yields across five regions (Eastern Cornbelt, Western Cornbelt, Mid-Atlantic, South, and West). Calculating the maximum nutrient application rate for each farm starts with the nutrients contained in the harvested portion of the crops grown. The amount of a nutrient, nitrogen (N) or phosphorus (P), removed by harvest for each of 24 crops was calculated using an average nutrient content per unit of crop output and the production level as outlined in Kellogg et al. (2000). The amount of P removed by harvest becomes the P application standard that farmers are assumed to meet. To account for unavoidable losses in the soil that make some nitrogen unavailable to plants, a "nutrient recommendation" was calculated by multiplying nitrogen removed in harvest by 1.43 (Kellogg et al., 2000). This becomes the N application standard.

The maximum nutrient application rate and the manure nutrients generated on the farm determined the amount of land needed for spreading manure. We estimated recoverable nutrients (nutrients available after collection and storage) in the manure generated on the farm using coefficients reported by Kellogg et al. (2000). Even though the survey data are for hog farms, they include information on other types of animals raised on the farm as well. A nutrient standard will apply to all the manure on the farm, not just the manure from hogs, so we made our calculations using the total amount of manure generated on the farm.

We compared this estimate of needed land with the amount of land each farm reported in ARMS as receiving manure. We assumed that all manure produced on each farm was applied to its land. The survey indicated that some farms sold or gave away some of the manure they produced, but we could not ascertain whether it was hog manure, or what percentage of total manure produced it represented.

Less than half the farms in any one size class were estimated to be meeting an N-based standard in 1998 (table 1). Only 18 percent of large farms were spreading on enough land to meet the standard, while 42 percent of smaller hog farms were doing so. This relationship was consistent across all five regions. The two Cornbelt regions had the highest percentage of farms meeting the standard in each size class. These results imply that most large farms will have to alter their manure disposal practices in order to comply with the new EPA regulations. Large farms in the Cornbelt regions would be somewhat better off than large farms elsewhere, but more than three-quarters of the large farms in these two regions would have to make adjustments. While most smaller farms are not directly affected by the EPA regulations, more than half might benefit from a more efficient use of the nutrient resources they have available to them. Apparent "wasting" of manure nutrients on these farms may be due to incomplete information on the nutrient value of manure, or costs of spreading manure on additional land that outweigh the potential savings in commercial fertilizer costs.

Fewer farms are spreading manure on enough cropland to meet a phosphorus (P)-based standard, since the high P content of manure relative to crop needs significantly reduces the quantity of manure that can be applied on an acre of land (Mullins, 2000). No large farms in the Eastern Cornbelt, Mid-Atlantic, or West met the P-based standard, and only 11.1 percent of all smaller farms did so. Given baseline manure application rates, a P-based standard would affect many more farms than an N-based standard. These estimates take into account the fact that some farms currently use the enzyme phytase to reduce manure's phosphorus content (obtained from ARMS). We assumed phytase reduces hog manure P by 30 percent (Harper).

Assuming no other technologies are implemented for reducing the amount of surplus manure nutrients on the farm, the costs would include developing a nutrient plan to meet the standard, testing manure for its nutrient content, testing the soil on fields receiving manure, and transporting and applying manure to the necessary land base. Since animal manure has value as a crop fertilizer, the extent to which animal manure replaces commercial fertilizer on cropland constitutes a cost saving from land application. Hog farmers were assumed to pay transportation and application costs to crop farms receiving manure, and to receive a payment from crop farmers equal to the effective nutrient content of manure (nutrients in excess of crop needs were assumed to have no value). We assume that hog producers do not pay a fee for being able to spread manure on cropland operators' fields. Total costs minus nutrient benefits are the net costs to hog farms of spreading manure on land.

We used a model developed by Fleming et al. (1998) to estimate the costs of moving manure to the amount of land necessary for meeting a nutrient standard (Fleming et al., 1998; Ribaudo et al. 2003). This model estimates the net costs of spreading manure while accounting for the economic benefit of replacing commercial fertilizer with manure nutrients and for the availability of suitable land in the surrounding countryside. We first estimated a baseline net cost, using the acreage reported in the survey as receiving manure. We then estimated the net cost of applying manure to the land required by an N- or P-based standard. To this we added the costs of developing a nutrient management plan, testing manure, and testing the soil receiving manure. The difference between the net cost of spreading on required acreage and net cost of spreading on baseline acreage is the net cost of meeting the nutrient standard. The net costs we report are only those attributable to hogs. Net costs of handling manure from other animal types on the farm are factored out, based on their share of total farm manure nutrients. It is important to note that all hog farms bear the cost of developing a nutrient management plan and conducting nutrient tests, even if they were spreading on an adequate amount of land in the baseline. Our analysis does not consider the costs that may be incurred by changing manure handling, storage, labor, or other organizational factors required to spread manure to meet a nutrient standard.

A particularly attractive feature of the model is that it accounts for land use in the surrounding area and the willingness of cropland operators to use manure as a source of crop nutrients. Both are factors that influence the distance that manure must be hauled to reach an adequate amount of land. We assumed the farm itself was a contiguous block. The percentage of land on the farm suitable for receiving manure was obtained from the ARMs survey. Data on "spreadable" land (cropland and pasture land suitable for receiving manure) off the farm was obtained from the 1997 National Resources Inventory.

There are several potential drawbacks to land application of manure that could discourage greater use on cropland. These factors include uncertainty associated with the nutrient content and availability, high transportation and handling costs relative to commercial fertilizer, soil compaction from spreading equipment, dispersion of weed seeds, concerns for added regulatory oversight, and public perception regarding odor and pathogen issues (Risse et al., 2001).

There is little empirical basis for choosing a level of willingness-to-accept-manure (WTAM). In 1998, crop operators supplemented commercial fertilizer with manure as part of their crop fertilization regime on approximately 17 percent of corn acreage and between 2 and 9 percent of soybean acreage (USDA, ERS 2000a, p. 36). (We could not determine whether manure was generated on these farms or not). Based on this, we assume a baseline WTAM of 10 percent. We assumed that manure was spread first on the land controlled by the operation (where the willingness to accept was 100 percent), then to surrounding land that was suitable for spreading and controlled by landowners who were willing to take it. We do not know how crop operators will respond to requests from CAFOs to spread manure on land. Thus, to bracket the possible outcomes, we examined net costs with a WTAM of 10 percent, and 80 percent.

Net costs for meeting a nutrient standard were estimated with and without financial assistance from EQIP. We assume that all hog farms receive EQIP funds. Per-acre EQIP payments for Nutrient Management and Waste Utilization, and cost-share rates for Manure Transfer were obtained from 1997-2000 EQIP program data (table 2). Average payments for Nutrient Management ranged from \$4.35 - \$11.51 per acre across USDA Farm Production Regions. Average per-acre payments for waste utilization range from \$4.83 - \$10.60 per acre. These values were assigned to each hog farm based on the State in which it is located. Manure transfer rates were assumed to be 50 percent of the cost of hauling manure off the farm. We limited annual payments to each farm to \$90,000 in order to model the 5-year program maximum of \$450,000.

Results

We found that the impact of meeting nutrient standards on CAFOs varied widely between regions. A little more than half of all large operations had higher net costs from land-applying manure to meet a nitrogen standard, assuming a WTA of only 10 percent (table 3). Around 40 percent of the large farms in the two Cornbelt regions had higher costs. In contrast, more than three-quarters of large farms in other regions did so. In the Cornbelt, large farms tend to have more land per animal unit, so a smaller percentage of manure must be moved off the farm. In addition, crop production is a more pervasive land use in these regions, meaning that manure does not have to be hauled as far, on average, to reach suitable fields for spreading.

EQIP will not fully cover the costs of meeting an N-standard for most of the large farms that experience an increase in net costs in meeting the standard. Part of the reason is that EQIP payment limitations (\$450,000 over 5 years), are constraining for some large operations in all regions. Only in the Cornbelt regions will some large farms be able to recoup their full costs through EQIP. (Some farms are able to recoup their losses because payments for nutrient management and waste utilization are not cost share, but incentive payments.) Nationally, 46 percent of large farms will find that meeting an N-standard raises production costs, even with EQIP payments. Average annual payments ranged from $20,039 per farm in the Eastern Cornbelt to $47,360 in the Mid-Atlantic. Payments per farm in the Cornbelt regions are about half those in the other regions because the integrated crop-livestock production characteristic of the regions requires less manure to be moved off the farm. Also, manure does not have to be transported as far to find additional spreadable land in the crop-rich region.

Willingness-to-accept manure has important implications on the costs of meeting a standard. A higher WTAM reduces the cost of moving manure off the farm. This is reflected by the reduced number of farms experiencing higher costs from meeting the N-standard (without EQIP), across all regions (27 percent vs. 55 percent, nationally). However, for those farms that still have higher costs, only 20 percent can recoup them through EQIP. Again, the farms that benefit most fully from EQIP, in that manure management costs are covered, are in the Cornbelt regions. Average payments per farm are reduced by about 12 percent, nationally, due to reduced hauling costs (acreage receiving manure remains the same).

Small confined hog operations that are not designated CAFOs are more likely to sustain higher production costs from meeting an N-standard, with a WTAM of 10 percent. Nationally, about 61 percent of non-CAFO hog farms would experience higher costs. Many smaller farms were spreading on nearly enough land to meet an N standard, so there is little benefit from replacing commercial fertilizer. However, farms must still absorb quasi-fixed costs of nutrient testing, soil testing, and plan development. Smaller hog farms benefit significantly from EQIP only in the Cornbelt regions. Fifty-seven percent can cover the costs of meeting a standard through EQIP, a much higher percentage than for large farms. With EQIP, only 26 percent of all small farms experience higher production costs. Average EQIP payments for non-CAFOs average only $3,998, about 13 percent of the payments to large farms.

A higher WTAM of 80 percent has little impact on smaller farms because most have enough land to spread all their manure, so they do not have to move manure off the farm. Largest beneficiaries are again farms in the two Cornbelt regions. Average EQIP payments per farm are little changed in most regions. In the Mid-Atlantic and West, where smaller farms are similar to large farms in that they have little land under their control, a higher WTAM is more beneficial. The percentage of farms with higher production costs decreases significantly simply because of reduced manure hauling costs. The proportionately larger reduction in average EQIP payments in these regions reflects this.

Requiring farms to meet a phosphorus-based plan increases the compliance costs for large farms (table 4). More land is needed, which generally means that more manure has to move off the farm. With a WTAM of 10 percent, 87 percent of large farms realize an increase in net costs, ranging from 77 percent of large farms in the Eastern Cornbelt to 100 percent of farms in the West. EQIP can cover the costs for 39 percent of these farms. As with N-based plans, EQIP covers the costs of higher percentage of large farms in the Cornbelt regions than farms in the other regions. EQIP cannot overcome the costs associated with the relative lack of land, both onfarm and off, in regions other than the Eastern and Western Cornbelt. Average payments per farm are $43,906, a 45 percent increase over the average payment under an N-based standard.

A WTAM of 80 percent would greatly benefit large farms. The number of large farms with higher costs drops to 36 percent because hauling costs are reduced. In particular, large farms in the two Cornbelt regions benefit from a higher WTAM. Nationally, EQIP can cover the costs of only 16 percent of those large farms that realize higher costs in this scenario, but most farms will not see an increase in manure application costs (70 percent). Average EQIP payments would be about 17 percent less than if WTAM was 10 percent.

Many smaller hog AFOs can actually benefit from meeting a P-based standard, because they have enough land to handle all the manure. By meeting a P-based standard, none of the manure nutrients are applied in excess of crop needs, so all are valued. Meeting an N-based standard overapplies P, and any nutrient in excess of crop needs has no value. Sixty-one percent of smaller farms have higher net costs, down from 87 percent for large farms, with a WTAM of 10 percent. EQIP payments can cover the cost of about two-thirds of these farms. Again, farms in the Cornbelt benefit the most. With EQIP, only 23 percent of smaller farms see increased costs. Average EQIP payments are $7,225, about 81 percent greater than those under an N-based standard.

A willingness-to-accept-manure of 80 percent significantly decreases the number of smaller farms with higher net costs, particularly in the Mid-Atlantic and West where many of these farms must move manure off the farm. Nationally, only 45 percent of non-CAFOs would have higher costs under this scenario, and EQIP could cover the costs for 58 percent of these farms. Average EQIP payments per farm are about 10 percent lower with the more restrictive WTAM.

Summary and conclusions

Financial assistance from EQIP can cover the costs of some large animal feeding operations that meet nutrient application standards by spreading manure at agronomic rates, and of the majority of smaller operations. After receiving financial assistance from EQIP, about half of large operations will find the transition costly if crop operators' willingness to accept manure is only 10 percent. Under an N-based standard, EQIP can defray costs for some large producers only in the Cornbelt regions. Under a P-based standard, EQIP can defray the costs for a greater number of farms, but because a P-based plan is generally more costly, more farms overall face increased production costs. The higher cost of P-based plans is reflected in the higher EQIP payments per farm (50 percent higher).

Smaller farms are helped significantly by EQIP. Without EQIP, 61 percent of smaller farms would find meeting an N-based plan costly if WTAM is 10 percent. With EQIP, the number drops to 26 percent. As with large farms, most of the smaller farms benefiting from EQIP are in the two Cornbelt regions (where most small hog AFOs are located). These results imply that at least 26 percent of smaller farms would not find it in their interest to voluntarily meet an N-based standard, even with EQIP funding. Percentages are much higher in the Mid-Atlantic, South, and West. Most would find it costly, and EQIP funds are insufficient to cover costs on most of these farms. Farms in the Eastern Cornbelt and Western Cornbelt are more likely to voluntarily adopt N-based plans, with or without EQIP.

Meeting a P-based plan is costly to about the same number of smaller farms as meeting an N-based standard, with WTAM at 10 percent. EQIP can defray the costs of more of these in meeting a P-based standard, however, so that fewer farms overall would see an increase in production costs. EQIP payments per farm are about twice those paid under the N scenario, reflecting the generally higher costs of meeting a P-based standard.

A very important factor affecting the cost of large farms meeting a nutrient standard is the willingness of crop operators to accept manure on their farms as a nutrient source. If WTAM is high, the number of large farms that find meeting an N-standard costly is significantly reduced in most regions, even without EQIP. With EQIP, 78 percent of large farms could meet an N-based standard without increasing production costs, and 70 percent a P-based standard. In addition, average EQIP payments are reduced between 12 and 15 percent (depending on the standard). However, a higher WTAM has little effect on smaller farms, especially in the Cornbelt, primarily because many have enough land to meet either an N- or P-based standard. An implication of these findings is that NRCS could help large operations meet EPA regulations by encouraging crop operators to accept manure, as well as by providing EQIP to CAFOs. A high WTAM would not only help AFOs, but would decrease the amount of EQIP funds each farm needs, providing more resources for other conservation issues.

This analysis does not consider potential changes in hog prices that might result from an increase in production costs. If higher manure management costs reduce hog production and increase prices, less financial assistance from EQIP might be needed to cover the higher production costs.

Table 1 – Land used for spreading manure, baseline and scenarios, by region and size.

Region	Farms with confined hogs	Farms meeting N-based standard	Farms meeting P-based standard	Farms with adequate land for N-based standard	Farms with adequate land for P-based standard
	Number	Percent			
Eastern Corn Belt					
<1,000 AU	8,549	41.5	13.6	84.9	64.3
>1,000 AU	1,110	20.1	0	56.1	25.1
Western Corn Belt					
<1,000 AU	18,647	45.0	11.0	87.9	62.5
>1,000 AU	2,025	26.9	8.8	66.5	31.0
Mid-Atlantic					
<1,000 AU	1,005	14.6	0.5	36.4	26.0
>1,000 AU	1,214	4.5	0	17.3	2.4
South					
<1,000 AU	1,724	29.4	9.7	77.6	61.6
>1,000 AU	177	13.3	7.9	32.0	16.6
West					
<1,000 AU	501	15.1	6.0	22.1	19.9
>1,000 AU	174	0	0	29.4	0
Nation					
<1,000 AU	30,426	41.7	11.1	83.7	61.1
>1,000 AU	4,700	18.0	4.1	48.8	20.6

Source: 1998 Hog Agriculture and Resource Management Survey.

Table 2 - Mean EQIP payments for nutrient management and waste utilization, by Farm Production Region, 1997-2000.

Region	Nutrient management	Waste Utilization
	$/acre	
Appalachian	9.82	10.60
Cornbelt	7.32	5.50
Delta	4.73	9.10
Lake States	4.35	4.83
Mountain	8.67	7.25
Northeast	6.88	7.49
Northern Plains	5.43	6.39
Pacific	8.05	4.85
Southeast	9.64	7.96
Southern Plains	11.51	7.25

Source: 1997-2000 EQIP program data.

Table 3 – Farms with increased costs for meeting an N-based plan, with and without EQIP payments, by size, region, and willingness-to-accept manure.

CAFOs (>1000 animal units)

	WTAM = 10 percent				WTAM = 80 percent			
Region	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment
	percent			$/farm	Percent			$/farm
Eastern Cornbelt	39	49	20	20,039	25	37	16	18,520
Western Cornbelt	42	24	32	23,528	21	32	14	21,546
Mid-Atlantic	85	0	85	47,360	34	2	33	39,336
South	80	0	80	44,297	69	0	69	35,835
West	76	0	76	44,834	15	0	15	37,963
U.S.	55	16	46	30,252	27	20	22	26,454

1out of all farms

Non-CAFOs (<1000 animal units)

	WTAM = 10 percent				WTAM = 80 percent			
Region	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment
	percent			$/farm	Percent			$/farm
Eastern Cornbelt	59	65	21	3,184	57	64	20	3,117
Western Cornbelt	60	63	22	3,867	59	63	22	3,796
Mid-Atlantic	82	3	80	7,942	43	3	42	6,934
South	68	18	56	6,019	61	19	49	5,647
West	86	9	78	9,946	38	9	34	8,137
U.S.	61	57	26	3,998	58	59	24	3,858

1out of all farms

Eastern Corn Belt includes IL, IN, MI, OH, WI; Western Corn Belt includes IA, KS, MN, MO, NE, SD; Mid-Atlantic includes NC, SC, VA; South includes AL, AR, GA, KY, TN; West includes CO, OK, UT.

Table 4 – Farms with increased costs for meeting an P-based plan, with and without EQIP payments, by size, region, and willingness-to-accept manure.

CAFOs (>1000 animal units)

	WTAM = 10 percent				WTAM = 80 percent			
Region	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment	Farms with higher costs	Farms with higher costs covered, by EQIP	Farms with higher costs after EQIP[1]	Payment
	percent			$/farm	percent			$/farm
Eastern Cornbelt	77	62	29	33,426	26	35	17	28,322
Western Cornbelt	84	59	34	37,814	20	13	17	31,381
Mid-Atlantic	99	2	97	60,232	62	16	52	50,182
South	85	4	82	49,170	74	5	70	38,977
West	100	0	100	65,476	78	0	78	50,317
U.S.	87	39	53	43,906	36	16	30	36,377

1out of all farms

Non-CAFOs (<1000 animal units)

	WTAM = 10 percent				WTAM = 80 percent			
Region	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment	Farms with higher costs	Farms with higher costs, covered by EQIP	Farms with higher costs after EQIP[1]	Payment
	percent			$/farm	percent			
Eastern Cornbelt	58	67	19	6,088	43	58	18	5,605
Western Cornbelt	59	69	18	7,348	44	62	17	6,660
Mid-Atlantic	93	14	80	11,399	57	26	42	9,492
South	76	27	55	8,655	60	30	42	7,885
West	87	7	81	10,979	51	8	47	8,906
U.S.	61	62	23	7,225	45	58	19	6,536

1out of all farms

Eastern Corn Belt includes IL, IN, MI, OH, WI; Western Corn Belt includes IA, KS, MN, MO, NE, SD; Mid-Atlantic includes NC, SC, VA; South includes AL, AR, GA, KY, TN; West includes CO, OK, UT.

References

Fleming, R., B. Babcock, and E. Wang. 1998. "Resource or Waste? The Economics of Swine Manure Storage and Management." Review of Agricultural Economics. 20(1):96-113.

Gollehon, N., M. Caswell, M. Ribaudo, R. Kellogg, C. Lander, and D. Letson. 2001. *Confined Animal Production and Manure Nutrients.* AIB 771, U.S. Department of Agriculture, Economic Research Service, Washington, DC, June.

Harper, A.F. 2000. "Managing Swine Feeding to Minimize Manure Nutrients." Natural Resoruce, Agriculture, and Engineering Service, *Managing Nutrients and Pathogens from Animal Agriculture.* Proceedings of a conference, Camp Hill, PA, March 28-30.

Kellogg, R.L., C.H. Lander, D. Moffitt, and N. Gollehon. 2000. *Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the U.S.* U.S. Department of Agriculture, Natural Resources Conservation Service, Washington, DC.

Mullins, G.L. 2000. "Nutrient Management Plans - Poultry." In Natural Resource, Agriculture, and Engineering Service, *Managing Nutrients and Pathogens from Animal Agriculture*, NRAES-130, Ithaca, NY.

U.S. Department of Agriculture, Economic Research Service. 2000a. *Agricultural Resources and Environmental Indicators, 2000*. "Chapter 4 .4 Nutrient Management." http://www/ers.usda.gov/emphases/harmony/issues/arei2000/

U.S. Department of Agriculture, Economic Research Service. 2002. ERS Analysis: Conservation Programs. June. http://www.ers.usda.gov/Features/farmbill/analysis/conservationoverview.htm

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. "Manure Transfer." NRCS Conservation Practice Standard 634, July.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1999a. "Nutrient Management." NRCS Conservation Practice Standard 590, April.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1999b. "Nutrient Management Policy," NRCS General Manual, Title 190, Part 402. http://www.nrcs.usda.gov/technical/ECS/nutrient/gm-190.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2001. "Waste Utilization." NRCS Conservation Practice Standard 633, September.

U.S. Environmental Protection Agency. 2003. "National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations; Final Rule." *Federal Register.* 68(29):7175-7274. Feb.