Importance of Cost Offsets for Dairy Farms Meeting a Nutrient Application Standard

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Abstract

The Environmental Protection Agency requires concentrated animal feeding operations to develop and implement a comprehensive nutrient management plan. Changes in manure management to meet nutrient application standards will generally increase production costs. Some of these costs can be offset by savings from replacing commercial fertilizer with manure nutrients, and through financial assistance programs such as the U.S. Department of Agriculture's Environmental Quality Incentives Program (EQIP). A manure application cost model was used to examine the costs to confined dairy farms of meeting nutrient application standards, and the ability of fertilizer offsets and EQIP to reduce these costs.

Key words: animal feeding operations, Environmental Quality Incentive Program, dairy, manure nutrients

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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. Both can promote excessive algal growth that degrades ecosystem health. Nitrogen (in the form of nitrate) is also a human health concern in drinking water. Animal waste is a source of both.

Animal waste has become a major focal point of environmental policy. A shift in the livestock and poultry industry over the past decade towards fewer, larger, spatially concentrated operations has prompted concerns over the utilization and disposal of animal waste. In 1982, the Census of Agriculture indicated there were 161,563 farms with confined dairy in the U.S., totaling 9.9 million animals (USDA, ERS, 2002a). By 1997, the number of dairy farms had shrunk to 86,354 (down 47 percent), while the number of dairy cows had decreased only 13 percent (USDA, ERS, 2002a), with many more cows on large facilities. An estimated 22 percent of the recoverable nitrogen (nitrogen remaining after manure collection and storage) in dairy manure and 34 percent of the recoverable phosphorus was in excess of crop nutrient needs at the farm level in 1997 (Gollehon et al., 2001). Excess nutrients are prone to leaving the field and polluting water resources. Of the total excess nutrients generated by dairy, swine, beef, and poultry, dairy generates about 9 percent of the excess nitrogen and 8 percent of the excess phosphorus (Gollehon et al., 2001).

In response to increased environmental concerns over livestock and poultry production, EPA introduced new regulations in 2003 for concentrated animal feeding operations (CAFOs) under the Clean Water Act. One of the changes is to require that CAFOs applying manure to land meet nutrient application standards defined by an approved Comprehensive Nutrient Management Plan (CNMP) (U.S. EPA, 2003). Nutrient standards can be nitrogen- or phosphorus-based, depending on the nutrient content of the soil. In addition, USDA is encouraging the voluntary adoption of CNMPs by all animal feeding operations (AFOs), not just the ones regulated by EPA (USDA, NRCS, 1999b).

Developing and implementing a nutrient management plan imposes additional production costs on the producer, including plan development, soil testing, manure nutrient testing, manure hauling and application, and recordkeeping. Land application of manure to meet a nutrient standard may be particularly costly if large amounts of additional land are needed to prevent over-application of nutrients and if manure must be hauled off the farm. Costs can be reduced through two types of offsets. A commercial fertilizer offset occurs when manure has been over applied on some cropland and meeting a nutrient application standard results in more cropland receiving manure. Manure nutrients can replace commercial fertilizer on the additional land. A second potential source of cost offset is USDA's Environmental Quality Incentive Program (EQIP). EQIP offers financial assistance for several conservation practices that help farmers utilize manure more efficiently. In the final CAFO rule, EPA specifically identifies EQIP as a source of funds for helping CAFOs implement a CNMP (U.S. EPA, 2003). In this paper we assess the costs to dairy operations of meeting nutrient standards and the potential for offsets to defray these costs. We focus on dairy primarily because of the availability of a farm level survey.

EQIP and Manure Management

The Environmental Quality Incentive Program provides technical assistance, cost-share payments, and incentive payments to operators of working farms for implementing conservation practices. EQIP was introduced in the 1996 Federal Agriculture Improvement and Reform Act and amended by the 2002 Farm Security and Rural Investment Act. 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). Incentive payments are not strictly based on implementation costs, but on what it takes for an operator to adopt the practice, expressed in the form of a bid by the farmer. 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, 2002b). By statute, 60 percent of the available funding for the program is earmarked for practices related to animal 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. Prior to 2002, large animal operations were ineligible for EQIP funds. This was changed in 2002 to assist large operations to meet EPA's regulations.

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

Nutrient Management - Nutrient management involves 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 for developing and implementing a nutrient management plan. Activities covered by this practice include 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 - 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 on the dairy farm 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 - 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, or to agricultural land for final utilization. Manure transfer is 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.

Other EQIP-supported practices that might complement manure nutrient management, such as soil erosion control, fencing, vegetative buffers, and manure storage handling structures, are not considered in this paper.

Nutrient application standards

We based our manure nutrient application standards on NRCS nutrient management policy. The CAFO final rule states that permitting authorities may use the NRCS Nutrient Management Conservation Practice Standard as guidance for developing applicable nutrient application standards (U.S. EPA, 2003). 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 (USDA, NRCS, 1999a). The primary criterion established by NRCS is that land application rates for nutrients be based upon Land Grant University nutrient application recommendations.

A nutrient application standard can be either nitrogen (N) based or phosphorus (P) based. A manure application rate based on a nitrogen standard supplies all the nitrogen needed by crops, but it also generally over-applies phosphorus. The ratio of phosphorus to nitrogen in manure is generally higher than the ratio of phosphorus to nitrogen crops require to grow (Mullins, 2000). NRCS policy permits use of the nitrogen standard on sites for which supplemental phosphorus is recommended, or when a risk assessment tool has determined that the risk for off-site transport of phosphorus is acceptable. (The Phosphorus Index is currently the most widely used risk assessment tool for this purpose). Otherwise, the P standard must be followed. Following a P standard often requires supplemental nitrogen from commercial fertilizer.

What the literature says about manure use as a nutrient source

The literature suggests that animal feeding operations might treat manure as a waste rather than a source of nutrients, and therefore over apply it to land primarily as a means of disposal. Henry and Seagraves (1960) presented the basic economics of hauling and spreading animal waste on land. They recognized the potential environmental problems from poultry litter as that sector was moving toward larger production facilities. The two most important factors that determine the net value of manure are its nutrient content and the distance it needs to be hauled before it is used. Nutrient content enhances manure's value, while transportation distance reduces it. The authors concluded that the unprofitability of moving litter long distances (because of an unfavorable weight-to-nutrient ratio) leads to over-application on land near the production houses. With higher application rates that exceed crop needs, the value of manure drops because crops cannot utilize the extra nutrients.

Roka and Hoag (1996) looked for evidence that swine producers factor the value of manure into their livestock management decisions. In their estimation, a farmer makes three decisions that affect the onfarm value of manure: choice of a treatment system, choice of area receiving effluent, and choice of crops grown. The authors found that the value of pork dominates a producer's hog production decisions, and that producers are relatively insensitive to the value of manure. Under the most favorable conditions, their estimated manure value is negative (-2.94/head). Production cycles or other management options were not changed to increase manure's value. Manure’s negative value may prompt farmers to view it as a waste rather than a resource, leading to over-application on land nearest the production facility.

Feinerman et al. (2004) studied manure demand for crop nutrient application under alternative regulatory standards. Model estimates for Virginia found that manure nutrient standards greatly reduce excess nitrogen and phosphorus, but with a 5 to 15 percent reduction in economic welfare to the farm (excluding environmental benefits).

Innes (2000) developed a conceptual model of livestock/poultry production and regulation to illuminate the issues of manure generation and management. The model represents the waste management decisions of private animal producers, manure impacts on the environment, the effect of market forces, and implications for the design of efficient government regulatory policies. The model includes spills from animal waste storage (lagoons), nutrient leaching and runoff from fields, and direct ambient pollution from animal operations, including odors, pests, and ammonia gases.

Innes used the model to evaluate how various regulations on animal production affect economic efficiency, and found that the externalities associated with animal production (e.g. water and air pollution) result in too many large facilities - from a social welfare perspective - that are also inefficiently large. Innes contends that when manure applications are not regulated, producers will always choose to spread more manure nutrients to nearby cropland than crops can use. In this instance, regulating observable producer choices that affect manure-spreading practices might enhance economic efficiency.

Estimating the costs of meeting nutrient standards

We used a simulation model developed by Fleming, Babcock, and Wang (1998) (hereafter referred to as the Fleming model) to estimate the net cost of meeting a nutrient application standard on dairy farms. The model uses costs of hauling and applying manure, fertilizer prices, manure nutrients, type of manure storage system, crop mix of receiving land, local land use, and assumptions about landowner willingness to accept manure to estimate the net hauling and applications costs of meeting a nutrient application standard (Ribaudo et al., 2003). Given a nutrient application rate, the model estimates the amount of land needed for spreading and the distance required to reach this land, taking into account the availability of land for spreading manure. We estimated a more complete cost of meeting a standard by adding to the Fleming model the costs of developing and implementing a nutrient management plan (recordkeeping, soil testing, manure testing, and plan development). The costs of all dairy farms meeting a nitrogen standard and a phosphorus standard were estimated.

We used data from the 2000 dairy Agricultural Resource Management Survey (ARMS) to obtain farm-level data on operation size, manure storage technology, manure application technology, land used for spreading manure, cropland base, and crop yields for farms with confined dairy cows. The ARMS survey obtained more than 870 responses from dairy farms with 10 or more milk cows from 22 states. The survey sample represents about 90 percent of U.S. milk production in 2000. We divided the sample between two regions, North and South (figure 1). We looked at three size classes based on EPA's definitions: small (<200 mature dairy cows), medium (200 – 699 mature dairy cows), and large (>700 mature dairy cows). Large operations are CAFOs under the new Clean Water Act regulations, and must meet nutrient application standards. Smaller operations can also be designated as CAFOs on a case-by-case basis if they discharge directly into a stream. There is no way of predicting *a priori* how many operations will be so designated.

Calculating the maximum permissible 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 crop yields, as outlined in Kellogg et al. (2000). The amount of P removed by harvest becomes the on-farm P application standard that diary farms 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 on-farm N application standard.

The recoverable manure nutrients (nutrients available after manure collection and storage) generated on the farm were estimated using procedures outlined in Kellogg et al. (2000). Recoverable nutrients divided by the maximum nutrient application rate (for N and for P) determined the amount of land needed for spreading manure under an N-based standard and a P-based standard. Even though the survey data are for dairy 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 milk cows, so we made our calculations using the total amount of manure generated on the farm, and then allocated the costs to dairy operations based on the percentage of manure from dairy cows.

When land requirements were compared with the amount of land reported as receiving manure, we found that most large and medium farms were not spreading on enough land to meet a nitrogen standard, and few farms were spreading on enough land to meet a phosphorus standard (table 1). Farms not spreading on enough land would incur additional hauling and application costs in order to meet a nutrient application standard. Most small dairy farms have enough land to meet an N-standard (90 percent), but only about a quarter of large farms do. A majority of small farms still have enough land to meet a P standard (65 percent), but few medium (18 percent) or large farms (2 percent) do. Farms needing to move manure off the farm could incur substantial hauling costs to reach enough suitable land, more so than if they had enough land of their own. Small and medium farms in the North generally have more land available per animal than in the South. For example, while 90 percent of small farms in the North have enough land to meet an N standard, only 33 percent of small farms in the South do.

An important factor in the Fleming model for determining how far manure must be moved to reach enough suitable land is the willingness of crop operators to accept manure. The smaller the willingness-to-accept manure (WTAM), the smaller the available land base and the further manure must be hauled. Not much is known about the demand for manure nutrients by crop producers that do not raise animals. Demand is not simply a function of the nutrient value. There are several potential drawbacks to land application of manure that could discourage use on cropland. These factors include uncertainty associated with manure 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). 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 2000). While this does not necessarily represent willingness-to-accept, it provides a baseline assumption of the percentage of cropland "willing" to accept manure. We estimated costs with WTAM at 10 percent and 80 percent to bracket potential outcomes.

To estimate the costs of meeting a nutrient standard, we first estimated a baseline net cost of spreading manure with the Fleming model, using the acreage reported in the survey as actually receiving manure. Baseline costs consisted only of hauling and application costs. For the purpose of estimating hauling distance, we assumed that all fields on a farm are in a unified block with the production facility in the center. Fertilizer offsets are considered a benefit in the Fleming model and subtracted from baseline hauling and application costs. Commercial fertilizer prices were used to value manure nutrients. However, nutrient applications in excess of crop needs were given a value of 0, since they are assumed not to contribute to yields.

Supplemental commercial fertilizer was provided if manure nutrients were less than estimated crop needs.

We then estimated the net cost of applying manure to the land required by an N- or P-based standard. Manure was assumed to be spread on the farm first (where WTAM is assumed to be 100 percent), then to spreadable land off the farm. As in Fleming et al., the percentage of land off the farm that is suitable for receiving manure is the product of the percentage of land in agricultural uses, percentage of agriculture land in pasture and manure-receiving crops (we assumed fruits and vegetables did not receive manure), and WTAM. Data on acreage in various land uses for counties containing dairy farms were obtained from the 1997 National Resources Inventory (NRI). We assumed that the dairy operator pays all the costs associated with moving manure off the farm: soil testing for receiving acres, transportation, and application. The difference between the cost of spreading on required acreage and net cost of spreading on baseline acreage is the cost of meeting the nutrient standard, without offsets. Our analysis does not consider the costs that may be incurred by changing manure handling technology, storage, labor, or other organizational factors that could be taken to meet a nutrient standard.

Estimating cost offsets

The fertilizer offset is realized when cropland not receiving manure in the baseline receives manure after the nutrient plan is implemented. We assumed that cropland not previously receiving manure had been receiving recommended levels of commercial fertilizer, and that manure nutrients would replace commercial fertilizer on a 1 for 1 basis. We assumed that manure nutrient testing eliminates uncertainty about the nutrients in manure that would lead to “insurance” overapplications. For manure moved off the farm, we assumed that the dairy operator received a payment from the crop producer equal to the nutrient value of the manure (equivalent to the costs of the commercial fertilizer being replaced). No benefit was given for manure nutrients applied in excess of crop needs. If a manure nutrient was insufficient to meet crop needs, supplemental commercial fertilizer was also applied. This occurred for nitrogen when a phosphorus-based standard was imposed. It is possible that crop producers would receive manure for free. If so, they would receive a windfall offset that we are crediting to the manure producer.

The second offset involves financial assistance from EQIP. 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 survey States. Average per-acre payments for waste utilization range from $4.83 - $10.60 per acre. Farm-level payment calculations for these practices were based on acres of land on the dairy farm receiving manure, and not on land off the farm receiving manure. Manure transfer costs-shares were assumed to be 50 percent of the cost of hauling manure on and off the farm. We assumed that all dairy farmers would receive the maximum EQIP payment they are eligible for. We limited annual payments to each farm to $90,000 in order to model the 5-year program maximum of $450,000 specified in the 2002 Farm Act. Farms receiving manure may also receive EQIP payments, but these were not considered in the analysis.

Results

The estimated cost of meeting a nitrogen-based nutrient application standard ranges from about $1,700 per small farm in the North to over $105 thousand per large farm in the South, assuming a WTAM of 10 percent (table 3). Differences in costs reflect the amount of land available on the farm for spreading manure and the percentage of land off the farm that can be used for spreading.

Fertilizer offsets cover only a portion of the costs of meeting a nitrogen standard. It seems clear that adopting a nutrient management plan does not pay for itself for any size dairy in any region. Farms that are already spreading on enough land to meet a standard do not realize any fertilizer offset because no commercial fertilizer is displaced due to the policy (e.g. many small farms in the North). Farms that must spread manure on the most additional land would receive the greatest fertilizer offset (generally large farms), but fertilizer offsets do not cover nutrient plan development and implementation costs. On average, fertilizer offsets covered about 22 percent of the costs of meeting the standard on large dairies that must implement such plans under the Clean Water Act.

Comparing net cost of meeting the nitrogen application standard (cost minus fertilizer offset) with total baseline production costs (variable costs and allocated overhead) gives some indication of the impact of the standard on a farm's economic performance (figure 2). Meeting the nitrogen standard increases production costs for large dairies between 2.5 percent (North) and 3.3 percent (South), assuming a WTAM of 10 percent. The impact on medium sized operations is about the same. Small operations would experience much smaller cost increases (between 0.5 and 1.7 percent). Over 70 percent of small operations were already spreading on enough land to meet a nitrogen standard, and the only additional costs for these farms were those associated with developing a nitrogen plan, soil testing, and recordkeeping.

Meeting a more stringent phosphorus-based standard increases the costs for most farms (table 3). With a lower manure application rate required to meet a phosphorus standard, a larger land base is needed for spreading. This results in generally more manure having to be moved off the farm. Costs increase most for large farms, where the average cost is about twice that of meeting the N-standard. Fertilizer offsets are also higher because manure nutrients are applied on a larger land base and no nutrients are applied in excess (unlike under an N-based standard, where P is usually in excess of plant needs). However, the additional fertilizer offsets are insufficient to cover the additional hauling and spreading costs, so the increase in production costs is greater than under the N-based standard. Production costs for large dairies under the P standard were estimated to increase between 5.5 and 6.7 percent above the baseline, compared to 2.4 to 3.2 percent under the N standard (figure 2).

Financial assistance from EQIP is a significant economic benefit to animal operations that receive it. Estimated EQIP payments more than cover the full costs of meeting the nitrogen standard for most dairy farms (after accounting for the fertilizer offset). Large farms in the South are the only ones that still bear a net cost after receiving the maximum EQIP payment, on average. There are two reasons why EQIP payments can be more than the net cost of implementing a nutrient management plan. One is that the cost of meeting the standard is calculated as the change in cost from the baseline costs, while EQIP payments are based on total manure spreading and handling costs, including those on baseline acres. Second, payments for Nutrient Management and Waste Utilization are incentive payments that are not based directly on implementation costs (as a cost-share payment would be). Incentive payments could be greater than the actual cost to a farm of implementing a practice. Average EQIP payments for large farms ranged between $68,143 and $72,343 per year.

Because more manure must be transported off the farm, and for longer distances, potential EQIP payments are about 18 percent greater under the P-based standard than under the

N-standard. Fertilizer and EQIP offsets are able to cover the costs of meeting a P standard for fewer farms than for meeting an N standard. Large and medium farms in the South and large farms in the North would face higher production costs even with the EQIP offset.

Willingness-to-accept manure has important implications for the costs of meeting a nutrient application standard. A higher WTAM reduces the cost of moving manure off the farm by reducing the distance that must be traveled to reach spreadable land (table 3). Increasing WTAM from 10 percent to 80 percent reduces the cost of meeting a nitrogen standard significantly for most operations, particularly large ones. For example, additional costs on large farms in the South are 71 percent lower if WTAM is 80 percent rather than 10 percent. Potential EQIP offsets are reduced about 10 percent overall because of reduced hauling costs, but the acreage-based payments are unaffected since acres receiving manure remain the same. Fertilizer and EQIP offsets are sufficient to cover the costs of meeting either an N-based or P-based nutrient application standard for all farms when WTAM is as high as 80 percent.

Implications for USDA

Meeting nutrient application standards increases the production costs of large dairies designated as CAFOs by the Clean Water Act. Fertilizer offsets mitigate some of these costs, but not all. Production costs increase under all scenarios examined unless additional cost offsets such as financial assistance through EQIP are received. Whether EQIP can cover all nutrient plan implementation costs depends on the type of standard, farm characteristics, and the willingness of other land owners to accept manure. We assumed that dairy farms would receive the maximum EQIP payment. Whether an individual farm receives the maximum depends on the EQIP budget relative to total demand, and the ranking of the farm's bid for funds relative to other bids.

EQIP contracts for nutrient management are generally for 4 years. Some large farms might need to consider additional adjustments in production practices, changes in farm size, or relocation to an area where land is more readily available for spreading manure when EQIP payments end or if budget considerations greatly reduce potential payment rates.

Smaller operations that are expected by NRCS to adopt nutrient management plans voluntarily would not appear to be willing to do so without financial assistance. Fertilizer offsets were not estimated to be sufficient to cover the costs of implementing a nutrient management plan. However, EQIP was estimated to be able to cover costs in most scenarios. For nutrient management to become profitable over the long-term, changes would need to be made to reduce the overall costs so there is no loss in net returns even without financial assistance.

This analysis does not consider potential changes in milk production and prices that might result from an increase in production costs. Since the CAFO regulations are national in scope, impacts on dairy prices are possible (Ribaudo et al., 2003). If higher manure management costs increase prices, less financial assistance from EQIP might be needed to cover the higher production costs because of price offsets.

The results suggest that the need for offsets could be greatly reduced if more crop producers are willing to use manure as a nutrient source. Increasing willingness to accept manure greatly reduced manure management costs for dairies meeting a nutrient application standard. The results suggest that a potentially effective approach for assisting dairies and other livestock and poultry operations would include education, technical assistance, and financial assistance to potential users of manure nutrients, and support for the development of community-based programs for fostering cooperation between animal producers and crop producers.

Table 1 – Percentage of dairy farms meeting N-based and P-based application standards, by region and size, 2000.

Region and size (AU)	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
South	percent			
<300	19.5	4.8	33.2	18.4
300-1000	5.7	0	8.5	1.1
>1,000	21.3	1.0	26.6	2.6
North				
<300	72.1	27.3	91.2	66.4
300-1,000	46.4	10.9	86.2	31.6
>1,000	26.5	0	26.5	0
Nation				
<300	70.8	26.7	89.8	65.3
300-1,000	27.5	5.8	39.4	17.5
>1,000	23.0	0.7	26.6	1.8

Source of data: 2000 dairy ARMS

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

State	Nutrient management	Waste Utilization
	$/acre	
Arizona	8.67	7.25
California	8.05	4.85
Florida	9.64	7.96
Georgia	9.64	7.96
Idaho	8.67	7.25
Illinois	7.32	5.50
Indiana	7.32	5.50
Iowa	7.32	5.50
Kentucky	9.82	10.60
Michigan	4.35	4.83
Minnesota	4.35	4.83
Missouri	7.32	5.50
New Mexico	8.67	7.25
New York	6.88	7.49
Ohio	7.32	5.50
Pennsylvania	6.88	7.49
Tennessee	9.82	10.60
Texas	11.51	7.25
Vermont	6.88	7.49
Virginia	9.82	10.60
Washington	8.05	4.85
Wisconsin	4.35	4.83

Source: 1997-2000 EQIP program data

Table 3 – Costs of meeting a nutrient standard assuming a willingness-to-accept-manure of 10 percent and potential offsets, by operation size and region.

	N-based standard				P-based standard			
Region and size (AU)	Cost of meeting a nutrient standard	Fertilizer offset	Potential EQIP payment	Potential net cost	Cost of meeting a nutrient standard	Fertilizer offset	Potential EQIP payment	Potential net cost
10 percent willingness to accept manure								
South	$/farm							
<300	9,371	2,316	10,298	-3,243	12,690	2,774	12,079	-2,163
300-1000	44,443	8,817	42,637	-7,011	67,881	10,985	49,720	7,176
>1,000	105,711	22,970	68,143	14,598	190,830	30,758	79,559	80,513
North								
<300	1,715	60	7,777	-6,122	2,593	271	8,831	-6,509
300-1,000	25,848	2,502	40,360	-17,014	41,869	3,999	48,132	-10,262
>1,000	83,888	18,110	72,343	-6,565	162,367	26,796	89,336	46,235
80 percent willingness to accept manure								
South	$/farm							
<300	3,004	2,316	7,789	-7,101	4,133	2,774	8,351	-6,992
300-1,000	12,870	8,817	29,913	-25,860	21,228	10,985	34,048	-23,805
>1,000	30,326	22,970	54,773	-47,417	60,699	30,758	62,050	-32,109
North								
<300	726	60	7,272	-6,606	982	271	8,025	-7,314
300-1,000	6,618	2,502	31,710	-27,594	12,213	3,999	35,853	-27,639
>1,000	20,114	18,110	57,767	-52,763	48,000	26,796	67,440	-46,236

Figure 1 - Dairy production regions.

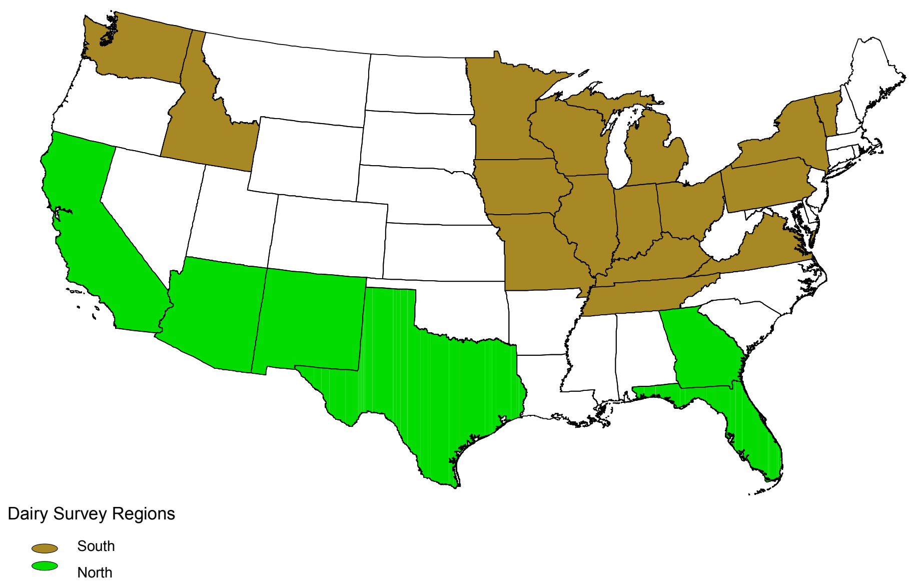
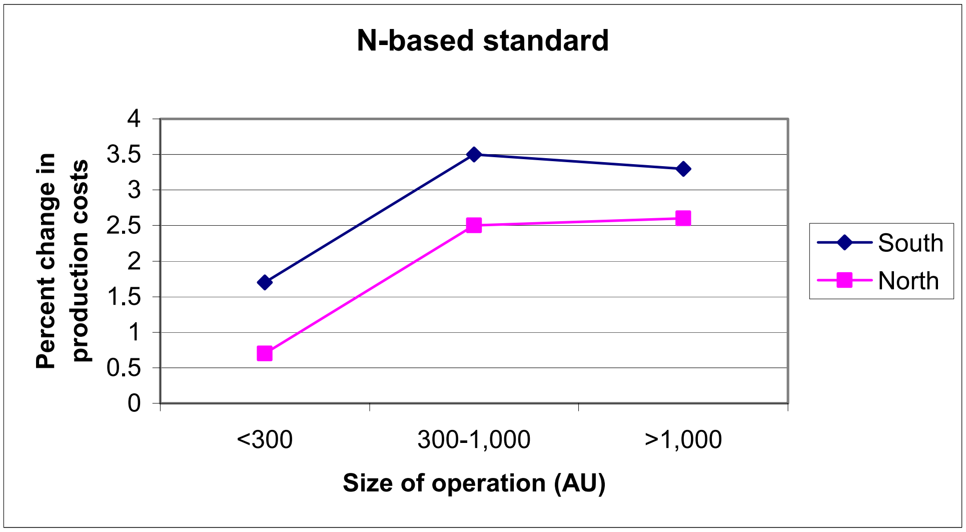
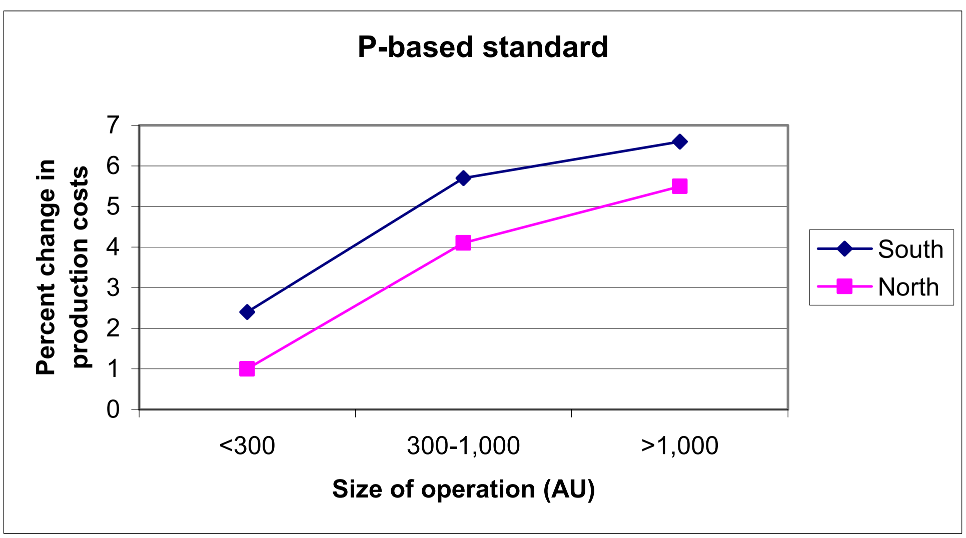


Figure 2 - Cost of meeting nutrient standard as percentage of production costs, by size class and region, assuming willingness to accept manure of 10 percent.





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