Manure Management Systems-Iowa Dairy Producer Surveys

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Nutrients present in manure are increasingly receiving attention for environmental, production, and financial reasons. Dairy producers continue to strive for better ways and educational opportunities to improve profits by evaluating fertilizer and value of manure to their operation and to protect the environment. These farming decisions which help producers stay economically viable also support and stimulate their local economy, which promotes a more vital rural community. This project encompassed surveys of manure management systems and nutrient management practices on 22 Iowa Dairy Farms, including economic costs and returns. The results served a large educational role by providing industry benchmarks as well as an "Economics of Manure Management" spreadsheet tool to determine cost of handling, storing and applying manure, less the cost of the nutrients gained in the manure for other dairy producers and dairy professionals.

Introduction

With the Iowa Department of Natural Resources increasing the number of farm inspections of all sizes of operations in the next few years due to environmental concerns from manure nutrients, it is becoming imperative that producers understand how to control risks from an environmental liability aspect.

The 2012 Iowa Dairy Survey showed 46% of producers planned to upgrade nutrient storage, with ½ of these doing it within 5 years. After recent DNR-EPA inspection announcements, discussions have shown many producers were seeking proactive on-farm assessment tools and strategies. The ISU Dairy Team embarked on a long term educational project to assist dairy producers better assess manure management options for handling, storing, and applying dairy manure. This initial part was to develop, validate, and then conduct surveys on Iowa dairy farms to categorize and characterize different farm systems and practices as well as assess economic costs and returns.

Programmatic Response

Iowa State University Extension & Outreach Dairy team developed an "Economics of Manure Management" spreadsheet tool to determine cost of handling, storing and applying manure, less the cost of the nutrients gained in the manure. They conducted a survey in 2014 of current manure management practices on dairy farms in NE/SE Iowa. Twenty-two producers responded to the survey.

Result and Discussion

The year the manure storage was constructed on farms ranged from early construction in the late 1970-80's with updates made in the late 90's to early 2000's, with newer constructions taking place in the last 6-7 years. Herd size of producers surveyed averaged 188 cows with 14% less than 100 cows, 55% with 100-200 cows, and 32% with 200-700 cows. Five producers responded that not all dairy stock are on the farm, however all milking cows and a variety of heifer ages and dry cows are being raised on the farm.

Milking Herd Housing and Management

The majority housed the milking herd in freestalls, with the remaining in a combination of loose housing, stanchion or tiestalls, and pasture when available. For herds utilizing freestalls for milk cows, one or more stall types were used with main use being a deep sand system or mattresses. Remaining herds used concrete with mats, dried manure solids, and waterbeds. For those not using sand or dried manure solids; straw, sawdust, or cornstalks was used. Depending on the bedding source used, fresh bedding was added to the milking herd on half the farms one time per week, with others adding daily, two times per week or every other day. Manure alleys were cleaned two times per day (43%) or multiple times with an auto-scraper system (33%). Others were cleaned 1-3 times per day or as needed with a bedded pack system. The stalls were cleaned mainly based on number of milkings; with 57% of stalls cleaned two times per day, 29% three times per day, or 14% from one time a day cleaning to no cleaning done in stalls.

Milk Cow Housing Type	**% Usage**
Freestalls	81%
Loose Housing	19%
Stanchion or Tiestalls	14%
Pasture *when available*	5%
Freestall Covering	
Deep Bed Sand	55%
Mattresses	35%
Concrete with mats	15%
Deep Dried Manure Solids	10%
Waterbeds	5%
Bedding Type (excluding sand/DMS)	
Straw	23%
Sawdust	18%
Cornstalks	5%
Pasture	5%

Dry Cow Housing and Management

Sixty-four percent housed dry cows in loose housing, 41% in freestalls, and 9% in stanchions or tie-stalls. More than one housing type may have been used for dry cows when available, and 23% housed dry cows out on pasture. Over half the herds bedded dry cows two times per week, 23% one-time per week, with the remaining adding daily as needed, depending on season and where dry cows were housed throughout the year.

Youngstock Housing and Management

Youngstock were mainly housed in loose housing, with varying ages of heifers housed on pasture. Springing heifers were most commonly raised in freestalls, along with breeding age and growing heifers. Custom-raised heifers were minimal, at less than 5%. Most common bedding source for youngstock was cornstalks. Other bedding sources included combinations of straw, sand, reclaimed sand, sawdust, or dried manure solids. Most of the youngstock was bedded one to two times per week, with the remaining ranging from daily to as needed.

Youngstock	Post-weaning	Growing	Breeding Age	Springing
Loose Housing	100%	79%	64%	54%
Tie-Stall				
Freestall		5%	11%	25%
Pasture		13%	25%	18%
Custom Raised		5%		

Manure Handling and Storage

When manure exited the barn, 64% of the manure was skid loader scraped into storage, 27% utilized an auto-scraper system, and others utilized a tractor/loader or barn cleaner in tie-stall barn. Manure from the milking herd housing was stored a few different ways; single storage structure including steel and concrete or an earthen lagoon, 2 stage settling system, or directly into manure spreader. Two producers utilized a dried manure solids system and one producer utilized a sand lane system prior to manure going into main structure. Forty-percent of the herds utilized main structure for youngstock manure or dry cow manure storage. Those without a structure utilized a stacking pad or daily hauled. Milkhouse wastewater mainly went into the main storage structure; others utilized a grass filter strip, settling pond, tile drainage system or 1st stage storage.

Manure Storage Structure	% Usage
Single Storage Structure	50%
2 Stage Settling System	23%
Directly into manure spreader	23%
Dried Manure Solids System	9%
Sand Lanes	5%

Storage capacity was variable depending on type of structure and number of cows. The majority of farms emptied the manure storage with the farm operator or farm staff and 43% hired a custom applicator. Custom applicator rates for sand laden manure ranged from .007/gallon to .02/gallon. Application rates when sand was not used were reported between 0.008/gallon to 0.017/gallon. Additional charges for fuel and mileage applied to both applications.

Storage Capacity	
<1week or daily hauled	28%
1-3 months	10%
3-6 months	48%
Up to a year	14%
Adequate storage	40%
Sometimes not quite enough	35%
Usually not adequate	5%
Never adequate	20%

Managing Sand Bedded Systems

Herds that utilized sand were asked a set of questions regarding management and handling of sand. Although most responded there were some increased expense with wear and tear on equipment, the returns of cow comfort and milk quality and production were worth the added expense. Producers handled sand a few different ways. The majority left the sand in the manure and dealt with increased equipment wear. Some pumped off the liquid on top of the storage and removed solids later, while others scraped out the bottom of the pit every fall to remove sand buildup. One had issues with sand buildup in the tanker, so hog manure was utilized to get the sand manure out. A few were able to reclaim nearly 90% of the sand using a sand lane system. Others utilized a two-stage settling system or those with no storage daily hauled.

Dried Manure Solids Used for Bedding

Though still a fairly new practice, two producers in the study used dried manure solids for bedding. The average dry matter content was between 35%-40% on these operations (usually 30 – 35 on most systems)and although the systems seem expensive to invest in, financial surveys of these farms show that it can be very cost competitive with other systems for handling manure to cheapen bedding costs on dairy farms. Dried manure solids can be used as bedding on mattresses or like sand, used in a deep bedded fashion. Since dried manure solids still have fairly high moisture levels, thin layers spread over mattresses seem to be preferred from a quality bedding standpoint, but deep bedded dried manure systems, if managed well, can be very effective in both cow comfort and milk quality concerns. Deep bedded stalls can be tined or raked (like a compost barn but only 2-3") to help dry materials as well as avoid packing and hardness. Tining deeper than this should be avoided since one wants a good pack below the bedding

surface and lower levels may have higher bacterial loads. Dried manure solids have the perception of being high in bacterial load, and they can be if not properly managed. Dried manure solids are feed waste or mostly undigested feed or fiber (comprise 70-80% of bedding), for the most part, that passes through the digestive system. Because of both high moisture and high organic content, bacteria can grow quickly if stored more than a day or so before use. Since the bedding contains organic matter, controlling moisture through proper stall maintenance and ventilation is critical and the top priority. Overall, for producers considering a new system, these two producers feel they made a very good choice and investment by using dried manure solids for bedding.

Manure Nutrient Usage and Value

Almost all of the farms surveyed soil tested their fields at least once every four years for nutrient needs. Then manure nutrient levels applied to the field were determined in a few ways; own judgment (33%), annual results sent to a testing lab (33%), and standard manure nutrient book values (14%), or used assistance from the local co-op agronomist or consultant to determine values (19%). Ten producers had a Nutrient Management Plan or MMP. Common nutrients producers used to determine crop fertilizer requirements included Nitrogen, Phosphorous, Potassium, with a few using Sulfur and Micronutrients. Some used additives such as phosphate, boron, and/or manganese.

Manure application methods included one or more types on the 22 farms surveyed.

Manure Application Methods	% usage
Drag hose and injected	18%
Surface applied only with tankers	9%
Surface applied as solid manure/incorporated	32%
Surface applied as solid manure and not incorporated	36%
Liquid tankers and injected/incorporated	23%

Nutrient Values and Future Plans

All respondents felt there was some value of the manure applied to their crop ground.

Value of manure to the producer	
$10 - $15/ton	32%
$10 - $15/1000 gallons	23%
> than $20/1000 gallons	45%

Half of those surveyed have worked with the NRCS and their EQUIP program, including assistance with construction of a manure pit, settling basin, filtered grass strips, and a few with pasture renovation for grazing.

Over half of the respondents commented they would like to add more capacity to their manure storage. Other changes included changing the manure transfer method from housing to storage, upgrade current manure system and adding solids or sand settling/removal capability.

Summary

In sum, this survey of manure management practices has given the dairy industry a good base of thought in how dairy producers manage their manure and nutrient systems. For more information on manure, nutrient management, and other dairy concerns visit:
www.extension.iastate.edu/dairyteam

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