Liquid Manure Application Initiative

Producer Survey Report

Alberta Government

Results compiled by Trevor Wallace & Heather Landiak

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EXECUTIVE SUMMARY

Alberta Agriculture & Rural Development (ARD) looked at increasing the adoption of liquid manure injection or surface-banding. They worked with industry partners such as Alberta Milk and the former Reduced Tillage Linkages (RTL) as well as three municipalities in central Alberta: Leduc County, County of Wetaskiwin and Red Deer County. This initiative focused on the dairy operations and custom application businesses operating within these three counties to identify the barriers and challenges faced when switching from a broadcast system to injection or surface-banding technologies as well as increasing the adoption of these practices.

One component of the initiative was to survey all of the dairy operations within the municipalities to identify the types of manure produced, application methods, storage facilities and agronomic management practices that were taking place. This information will be used to guide future initiatives within ARD to identify and address the barriers and challenges. The majority of this report only focuses on the information gathered from the dairy operations that deal with liquid manure, though the first section of the report does include information from both the liquid and solid manure producers. We had excellent participation in the survey with 109 of the 117 dairies operating within the three municipalities participating in the survey, a response rate of 93%.

Key Findings:

- Average size of the operations interviewed was 119 head of milking and dry cows.
- About half of the farms (52%) managed between 161 to 640 acres and 41% of the operations manage over 640 acres, which was mainly in annual crop production (59%).
- The most common production system was a free-stall system.
- The average number of acres that solid manure was applied to was 137, with a minimum number of 10 and the maximum was 1500.
- The average number of acres that liquid manure was applied to was 247, with a minimum number of 35 and a maximum of 750.
- Of the operations that participated in the survey, 82% soil sample with the majority sampling annually.
- Only 10% sampled manure to determine nutrient content.
- Approximately 40% of operations had a nutrient management plan; of that 40%, about 73% had a consultant develop the plan.
- About half of the dairy operations managed liquid or slurry manure.
- Of the operations that dealt with liquid manure, about 77% broadcast their liquid manure.
- Regardless of whether the operation broadcast or injected, 90% of them used custom applicators to apply the manure.
- Some of the barriers identified with liquid manure injection or surface-banding were costs, unawareness of the benefits of injection, the time it takes to inject, lack of available equipment and the need for bigger equipment.



SURVEY INTRODUCTION

The purpose of the LMAI was to increase the successful adoption of liquid manure injection or surface-banding technology. This initiative was a collaborative effort between ARD, Red Deer County, Leduc County and the County of Wetaskiwin AESA programs, Alberta Milk, RTL, dairy producers and custom manure applicators. The reason for changing from the current practice of broadcast liquid manure application to injection or surface-banding is to increase the capture and retention of manure applied nitrogen and to mitigate the odour impact of broadcasting liquid manure.

The LMAI was initiated in late summer of 2008. This multi-year project focused its audience scope to dairy operations and custom applicators in Red Deer, Wetaskiwin and Leduc Counties. The reason for focusing on dairy operations is that liquid dairy manure has the highest concentration of volatile ammonia-nitrogen and therefore has the greatest opportunity to benefit from application technology that can reduce volatilization losses. The build-up of nutrients from over-application can be costly both in terms of dollars and the environment. Soil accumulation of nutrients such as potassium, can lead to potassium accumulation in the plants and result in the development of Tetany or Milk Fever which can negatively impacting dairy production. Nutrient management planning combined with a reduction in nitrogen losses can reduce the risk of nutrient build-up in the soil.

One of the first steps taken in this initiative was to survey the dairy operations and custom manure applicators operating within each county to determine their current manure management practices.

The purpose of the survey was to:

1. Provide the project team with an understanding of basic manure management practices being practiced in the target region
2. Identify dairy operations using liquid manure systems
3. Identify the level of interest and operations that would be interested in different manure application practices
4. Identify barriers preventing the adoption or use of injection or surface-banding liquid manure application
5. Identify custom manure applicators operating in the counties of Red Deer, Leduc and Wetaskiwin
6. Use the information collected to guide project development and to meet the needs of the target audience

This report will focus on the dairy producers that were surveyed and that dealt with liquid manure.



MATERIALS AND METHODS

Target Population

The target population of the project and the survey was dairy producers operating in Red Deer, Leduc and Wetaskiwin Counties. The survey targeted all dairy operations in these counties that, according to Alberta Milk, were operating and receiving funds for sale of milk. It was determined, using Alberta Milk regional data, that there are approximately 39 dairies operating in Red Deer County, 24 dairies operating within the County of Wetaskiwin and 54 dairies operating in Leduc County.

Survey Design

Two surveys were developed and delivered in the target area. One survey, which is discussed in this document, targeted dairy producers. The other survey targeted custom applicators working in the 3 municipalities. The custom applicator survey will not be discussed in this document.

The LMAI producer survey was developed by members of the project team, which was made up of staff from ARD, Alberta Milk, Leduc County, Red Deer County, County of Wetaskiwin and RTL. Once a draft questionnaire was designed, technical specialists were consulted to provide input. In the fall of 2008, one-on-one interviews with 3 dairy producers from outside the target area (Lacombe County) were used to test the draft questionnaire. The questionnaire was then revised based on the testing and feedback from technical specialists. The surveys were a combination of multiple choice and open-ended questions.
To reduce response burden, the producer survey was divided into nine modules:

1. General Operations
2. Solid Manure Storage
3. Solid Manure, Self Application
4. Solid Manure, Custom Application
5. Liquid Manure Storage
6. Liquid Manure, Currently Injecting or Surface-banding, Self-Application
7. Liquid Manure, Currently Injecting or Surface-banding, Custom Application
8. Liquid Manure, NOT Currently Injecting or Surface-banding, Self-Application
9. Liquid Manure, NOT Currently Injecting or Surface-banding, Custom Application

General Operations

The first module was completed with all dairy operations. This section included general operational and manure management questions. Subsequent modules answered by each respondent depended on the operation. Different sets of modules were developed for both solid and liquid manure managers. Operations that managed one form of manure more than another were encouraged to respond to questions related to that form of manure, i.e. solid or liquid. Operations managing equal portions of solid or liquid manure did have the option to answer questions related to both forms of manure. In almost all situations, the respondent answered questions referring to only one type of manure.



Solid Manure Storage / Application

Three modules were designed for solid manure managers. The first module, Solid Manure Storage, asked questions on the storage and management of their solid manure. Solid manure application was then broken down further into two modules:

- Operations that applied their own solid manure.
- Operations that hired a custom operator to apply their solid manure.

These modules asked questions about current application practices including timing, management and method. Operations that applied their manure themselves and on occasion hired a custom applicator were given the option to answer the module that reflected their most frequent choice of manure application.

Data from the solid manure modules was not the focus of this report. The LMAI focused on liquid manure application. The management and application of solid manure is not within the scope of this initiative. The information from this initiative will be used to develop targeted programming for solid manure management in the future.

Liquid Manure Storage / Application

Five modules were designed for liquid manure managers. The first module, Liquid Manure Storage, asked questions on the storage and management of their liquid manure. The liquid manure application was then further broken down into four modules:

- Operations that are currently injecting or surface-banding their manure themselves.
- Operations that are currently injecting or surface-banding their manure using a custom applicator.
- Operations that are currently broadcasting their manure themselves.
- Operations that are currently broadcasting their manure using a custom applicator.

Operations that are currently broadcasting liquid manure were the target audience of the initiative. These modules asked questions about the current application practices including timing, management and method. Operations that applied their manure themselves and on occasion hired a custom applicator were given the option to answer the module of questions that reflected their most frequent choice of manure application practice.

The population of respondents to each module therefore differed based on the manure management practices performed by each operation interviewed.



SURVEY DELIVERY

Response to the survey was voluntary. Data was collected by one-on-one interviews with each producer. The survey was conducted between mid-September 2008 to the end of January, 2009. As suggested by the project team and by participants in the test survey, this period was chosen for data collection because it had the least effect on farming operations. The survey response rate was expected to be around 70%.

The project team hired one staff member, Murray Warnke, to conduct the interviews with the 117 dairies identified in the target counties. The project team decided that two individuals should be present for each interview.

The two person format was used to facilitate discussion during the interview and assist with information collection. With two people present, it allowed for one person to focus on asking the questions and the other person to focus on the collection of data. This approach was strongly recommended by technical specialists that provided input to the survey. The second person accompanying Murray to the interview was Robbin Nikiforuk with Leduc and Wetaskiwin Counties, Ken Lewis or Katie Roxburgh with Red Deer County, or Stephanie Kosinski or Diana Bingham with ARD.

Producers were contacted by phone and a meeting was set with them at a convenient time.

DATA REVIEW

The data collected was entered into a Microsoft Excel spreadsheet. Banister Research and Consulting Inc. was contracted to compile and analyze the data.

Missing responses to questions were not interpreted or substituted and they were removed from the population.

Analyzed response data from Banister Research and Consulting Inc. was then interpreted by the project team. The analyzed data was compared to other comparable published data when possible and analyzed by subject matter experts.

RESULTS AND DISCUSSION

1.0 General Survey Questions

A. General Operations

Out of an estimated 117 dairy operations in the Counties of Leduc, Red Deer and Wetaskiwin, 109 operations were interviewed as part of the survey, a response rate of 93%. Fifty-one operations from Leduc County, 38 operations from Red Deer County and 20 operations from the County of Wetaskiwin participated in the survey. According to the Statistics Canada 2005 Livestock Farm Practices Survey reported that there were 755 dairies operating in Alberta. The survey completed for the LMAI surveyed more than 14% of the total operations in Alberta.



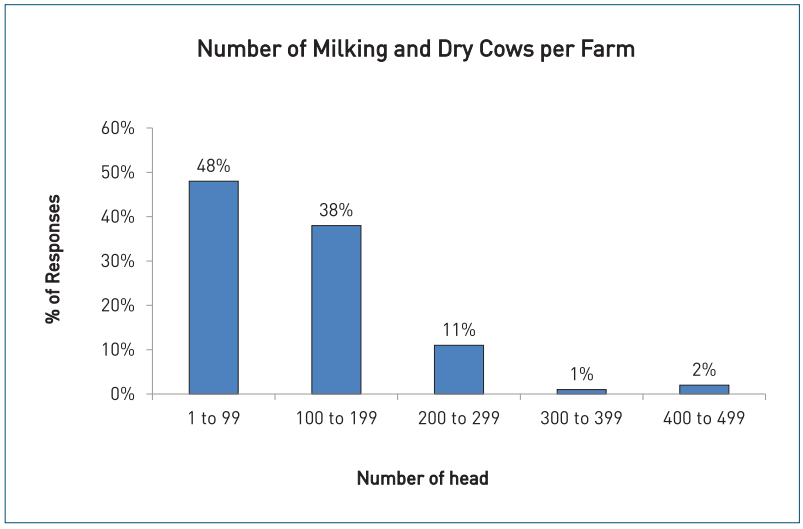
Number and Type of Animals

Each operation was asked to report the number of animals managed by the operation. The survey divided the animal populations into eight categories;

1) Milking and dry cows
2) Replacements (→1 year)
3) Bulls
4) Calves (←1 year)
5) Beef animals
6) Poultry
7) Swine
8) Other

Based on 108 responses, the average number of milking or dry cows on an operation was reported to be 119 head. The maximum number of reported milking and dry cows was 440 head and the minimum reported was 30 head.

Table 1.0 Number of Milking & Dry Cows per Farm

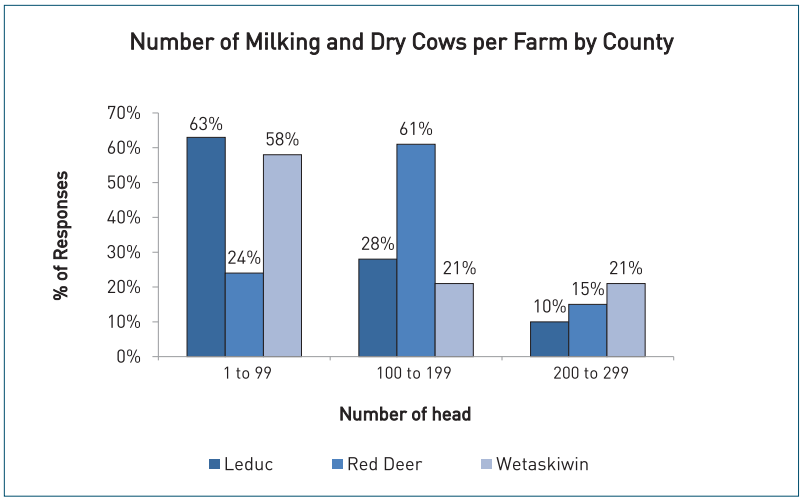


* Based on 108 responses

Table 1.0 reports the number of milking and dry cows reported by each farming operation. Of the 109 operations surveyed, 108 responded to this question. Approximately 48% of the operations interviewed managed less than 99 milking and dry cows. Approximately 38% of operations interviewed managed between 100 and 199 head of milking and dry cows. The remaining number of operations managed more than 200 head of milking and dry cows.



Table 2.0 Number of Milking & Dry Cows per Farm by County



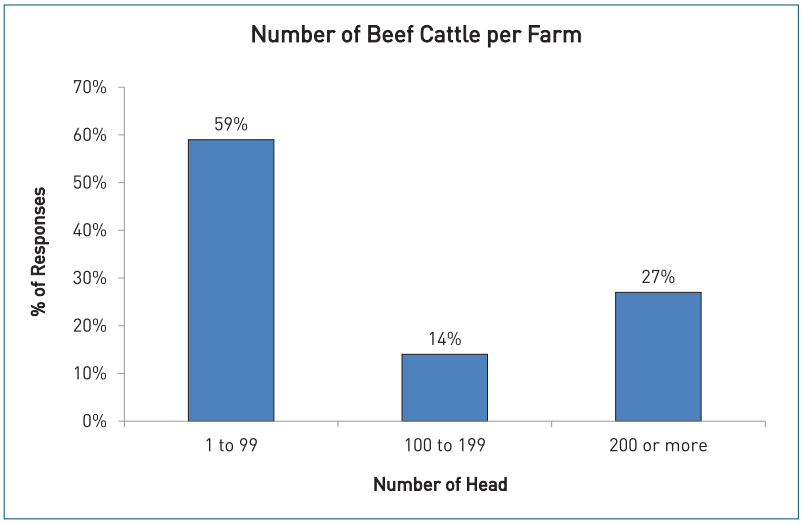
*Based on 108 responses

Table 2.0 reports the number of milking and dry cows reported by each farming operation separated by municipality. Data on the number of operations reporting more than 300 head was not reported due to the limited number of reporting operations. The size of operations based on number of milking and dry cows was very similar in Leduc and Wetaskiwin Counties. Red Deer County was found to have a smaller percentage (24%) of operations managing 1 to 99 head and a larger percentage (61%) managing between 100 and 199 head of milking and dry cows.

The average number of replacement (→1 year) cows on an operation was reported to be 45 head based on 106 responses. The maximum number of reported replacements was 175 head and the minimum reported was 0 head.
The average number of bulls on an operation was reported to be 3 head based on 53 responses. The maximum number of reported was 30 head and the minimum reported was 0 head.

The average number of calves (←1 year) on an operation was reported to be 45 head based on 107 responses. The maximum number of reported was 170 head and the minimum reported was 2 head.

Table 3.0 Number of Beef Cattle per Farm



* Based on 29 responses



Operations were asked to report how many beef, poultry, swine or 'other' livestock types were managed in addition to their dairy herd (Table 3.0). Of the total operations that were surveyed, 29 operations reported managing beef animals in addition to their dairy herd. The average number of beef animals on responding operations was reported to be 231 head. The maximum number reported was 2500 head and the minimum reported was 2 head.

Out of the 109 surveyed, only 4 operations managed poultry and 5 operations managed swine in addition to their dairy herd. Data is not presented due to the low number of respondents.

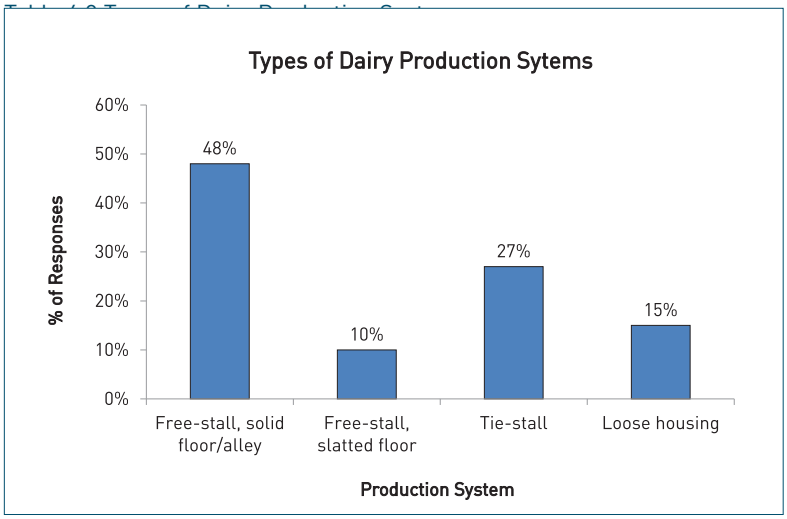
Producers that managed other livestock in addition to their dairy herd were asked if they managed the manure from the other livestock separately from their dairy manure or if it was combined with their dairy manure. The majority, 70% of the 26 respondents, managed their dairy manure separately from other livestock manure and 30% of respondents combined the manure.

Production System

Operations were asked to identify their general dairy production system from five different options:

1) Free-stall with solid floor and alley
2) Free-stall with slatted floor and manure pit
3) Tie-stall
4) Loose housing
5) Other

Operations could have multiple facilities that included two or more general production systems. There were a total of 109 interviews and 114 responses to this question due to the fact there are operations that may have more than one type of production system.

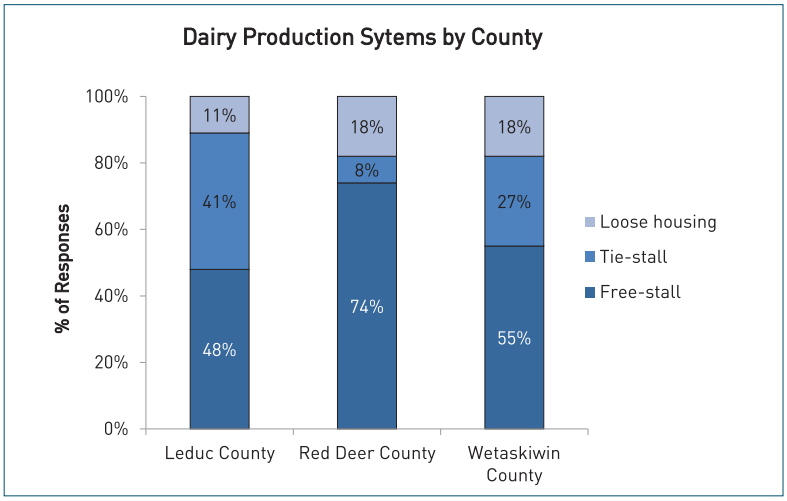


* Based on 114 responses, 109 interviews

The most common production system identified was free-stall with a solid floor and alley with 48% of operations using this system (Table 4.0). The second most popular system was a tie-stall at 27%. The loose housing system was next at 15% and ten percent of operations used a free-stall system with a slatted floor. No operations responded as having an "other" production system.



Table 5.0 Dairy Production Systems by County



*Based on 114 responses, 109 interviews

In Leduc County, the number of operations using free-stall production was 48%, slightly lower than the survey average of 58%. Red Deer County reported that 74% of respondents used one of the two types of free-stall production which was above the survey average of 58%. Responses from Wetaskiwin County closely mirrored the average of the general survey results.

Bedding

Operations were asked if they used bedding material for their milking or dry cows. Based on 108 responses for milking cows and 106 responses for dry cows, 99% of respondents used some kind of bedding material for their cows.

Operations were then asked to identify the type of material used for bedding. Operations could use several different types of bedding material so two or more responses were possible from each operation. There were a total of 107 interviews and 145 responses to this question. The majority (98%) of responses used straw, wood chips, shavings or sawdust for bedding material and the remaining 2% of respondents used mats or sand for bedding.

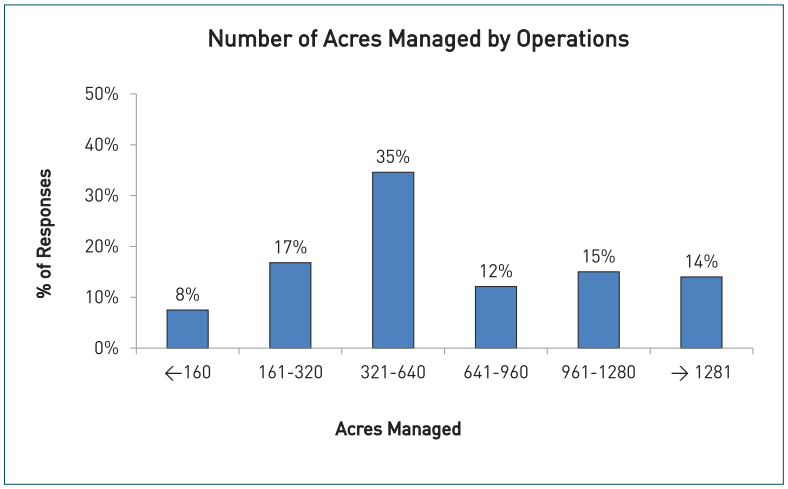
Acres Managed

Each operation was asked how many acres (owned or leased) they managed in annual crops, perennial crops and pasture. The average number of acres managed by the operations surveyed was 1081 acres based on 107 responses. The maximum number of acres reported for a farm was 11,500 and the minimum number of acres reported was 122.

The average number of acres reported per county was: Leduc County 970 acres, Red Deer County 1223 acres and Wetaskiwin County 1103 acres.



Table 6.0 Number of Acres Being Managed by Operations



*Based on 107 responses

Just over half of the operations interviewed (52%), operated between 161 and 640 acres based on 107 responses (Table 6.0). About 8% of reporting operations manage less than 160 acres and 41% of the interviewed operations operate on more than 640 acres.

Number of Animals per Acre Being Managed

The total number of acres being managed was then divided by the number of milking/dry cows for each operation. This figure would give us the number of acres per animal being managed which in turn gave us the number of available acres for manure application.

Table 7.0: Number of Acres per Milking or Dry Cow

Average	10.8 acres/milking or dry cow
Maximum	88 acres/milking or dry cow
Minimum	1 acres/milking or dry cow

*Based on 106 responses

The average number of acres per farm divided by the number of milking and dry cows per farm was 10.8 acres per animal based on 106 responses (Table 7.0). The lower the value, the fewer acres of annual crop, perennial forage and pasture acres per cow.

Table 8.0: Number of Acres per Head of Livestock

Average	5.3 acres/head of livestock
Maximum	25 acres/ head of livestock
Minimum	0.6 acres/ head of livestock

The number of milking and dry cows was then added to the number of bulls, replacement heifers (→1 year of age) and beef cattle to determine the number of acres per head of livestock. The number of poultry, swine and other livestock was not added due to the low number of operations



managing these other livestock types. The additional animals reduced the average number of acres per head to 5.3 (Table 8.0).

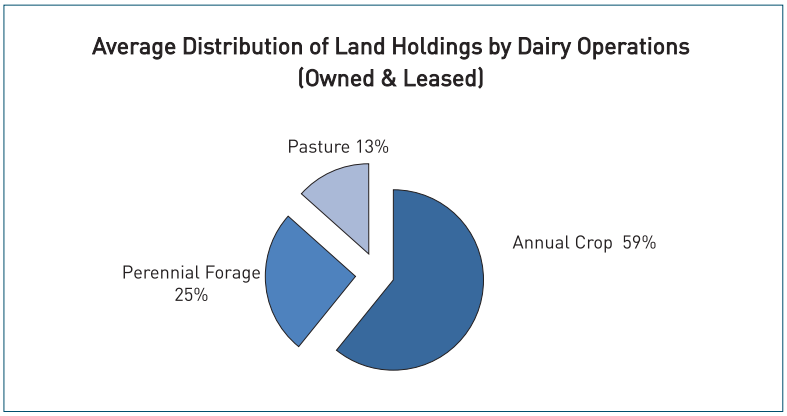
The lower value of acres per head of livestock results in fewer numbers of available acres for manure application. A very low value (for example less than one acre per head of livestock) would suggest an increased risk for nutrient accumulation in the soil from manure application. Manure production values for one dairy animal, including wash water, range from 25 to 27 tons per year (Source ARD's 2006 Manure Characteristics and Land Base Code). The fewer available acres would suggest the need for more frequent manure application per acre in order to manage the manure produced. Accumulation of nutrients in the soil would result if manure applications provided more nutrients than a crop could either require or remove.

Acres Owned or Leased

Of the 108 respondents to the question on acres owned or leased, all operations owned land. Only 17 operations leased additional land.

Crops Managed

Table 9.0 Average Distribution of Land Holdings by Dairy Operations (Owned or Leased)



*Based on 108 responses

The majority (59%), of all land being managed by dairy operations was in annual crop production (Table 9.0). Approximately 25% of the land being managed was in perennial forage in 2008 and the remaining 13% of the land being reported was in pasture.

All 107 respondents to this question reported having some annual crop acreage. The average number of annual crop acres was 688. The maximum number of reported acres in annual crop production was 7500 acres and the minimum number of acres was 30 acres.

Eighty-six respondents reported having perennial forage acreage. The average number of perennial crop acres reported was 203. The maximum reported number of perennial crop acres was 750 and the minimum number of acres was 40.

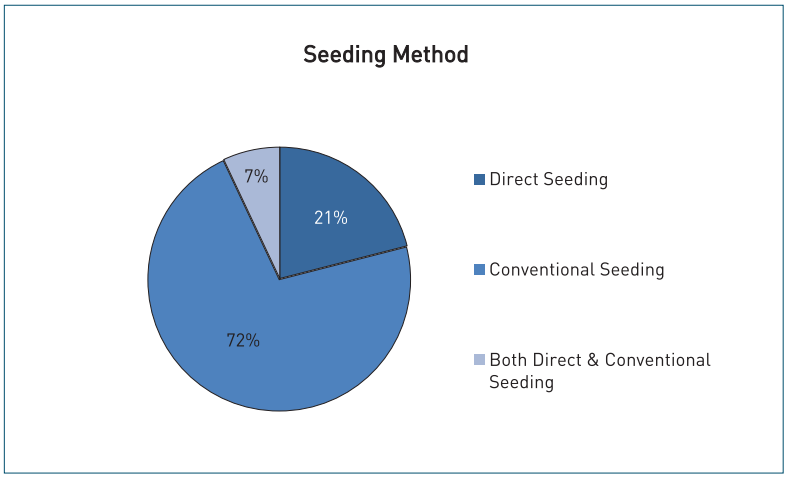
Ninety respondents reported having pasture acreage. The average number of pasture acres reported by respondents that had pasture was 189. The maximum reported number of pasture acres was 2000 and the minimum number of acres was 10.



B. Seeding & Crop Growth

Seeding Systems

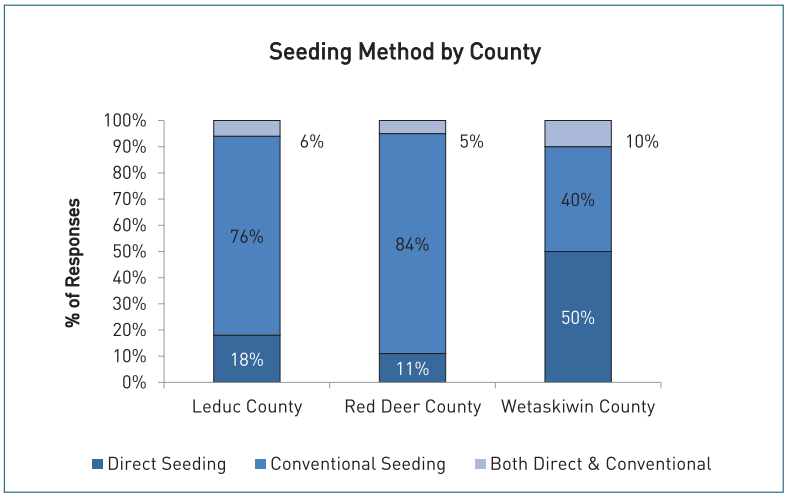
Table 10.0: Seeding Method



*Based on 107 responses

Out of the 107 responses, 72% of dairy operations surveyed seed conventionally. Approximately 21% of operations surveyed consider themselves direct seeders and about 7% of respondents report using both seeding methods on their operation. For operations that responded to using both seeding methods, it was determined that the selection of seeding method (direct or conventional) was determined by the type of crop being seeded. For example, it was found that one pre tillage pass was used for cereal crops but canola was direct seeded.

Table 11.0: Seeding Method by County



The County of Wetaskiwin had the highest number of operations that direct seed at 50% followed by Leduc County and then Red Deer County. The survey average was about 28% that direct seeded. The method of seeding, direct seeding or conventional seeding, did change slightly with the number of milking and dry cows on each operation. Generally, the percentage of operations that seeded at least some of their land using direct seeding increased as the number of milking and



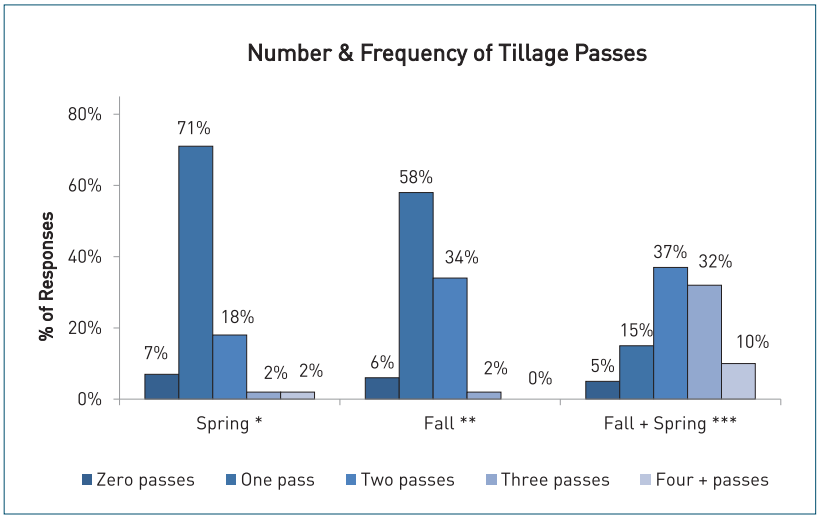
dry cows increased. Also, the method of seeding did change slightly with an increased number of acres. Of those operations managing more than 962 acres, 40% used direct seeding practices compared to the survey average of 24%. This trend holds true with other agricultural sectors. The 2007 Environmentally Sustainable Agriculture Tracking Survey reported a higher rate of adoption of direct seeding practices with an increased number of acres.

The majority, 76% of 103 respondents, used a seeder with a shank opening system. The remaining 24% used a seeder with a disc opening system.

The majority of respondents 62% used seeding systems with 7"-10" spacing. About 21% of interviewed dairy operations are using seeders with openers spaced between 4"-7". A smaller percentage of operators (16%) were using seeders with openers spaced more than 10" apart. Some operations used two different seeding units, ones with larger row spacing for corn production and ones with smaller row spacing for cereal crops.

Number & Frequency of Tillage Passes

Table 12.0: Number & Frequency of Tillage Passes



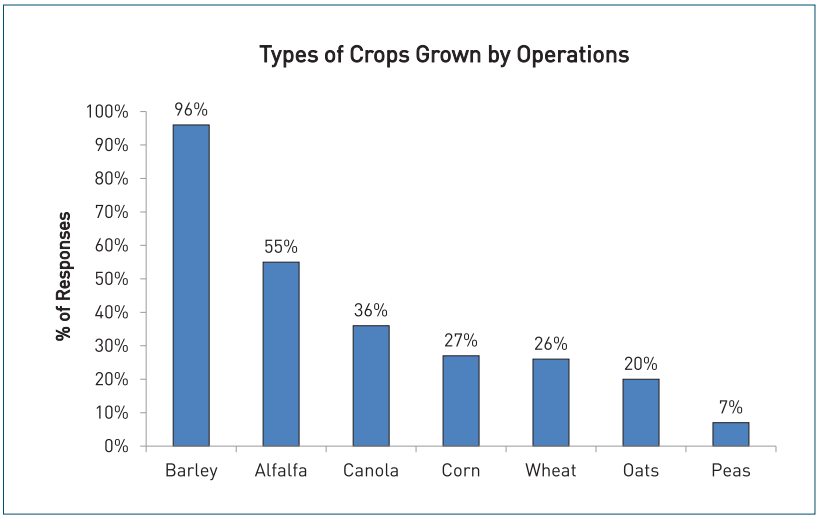
* Based on 85 Respondents
** Based on 94 Respondents
*** Based on 99 Respondents

The majority of operations (71%) completed at least one pass prior to seeding with 58% completing one pass in the fall (Table 12.0). At least one tillage operation was completed in the fall and spring prior to seeding.



Crops Grown

Table 13.0: Types of Crops Grown by Operations.

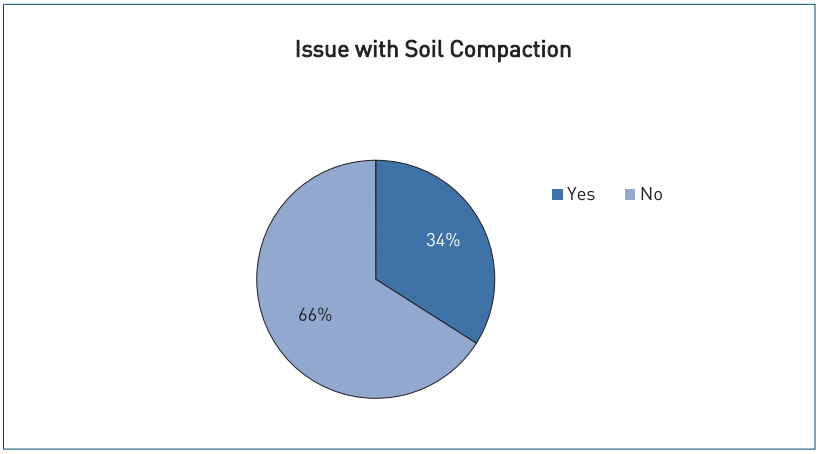


* Based on 108 responses

Almost all dairy operations interviewed (96%) reported growing barley (Table 13.0). The next most commonly produced crops included alfalfa, canola, corn and wheat. Other crops grown by a small percentage of operations (←5%) were triticale, rye, brome grass, orchid grass, red clover, timothy and millet. The distribution of crops grown did not vary dramatically between counties with the exception of corn and oat production. Dairy producers in Wetaskiwin County reportedly grew less corn than producers in Red Deer or Leduc Counties. Dairy producers in Red Deer County grew significantly less oats than producers in Leduc or Wetaskiwin Counties.

Soil Compaction

Table 14.0: Issue with Soil Compaction



*Based on 108 responses

Survey participants were asked if they had issues with soil compaction, 65% of 107 respondents said compaction was not an issue (Table 14.0). Only 34% of dairy operations surveyed felt compaction was an issue for at least some of their operation. Responses were not affected by county.



Operations that reported having issues with compaction were asked to identify the areas where compaction was occurring. Operations identified 3 main areas or conditions resulting in compaction:

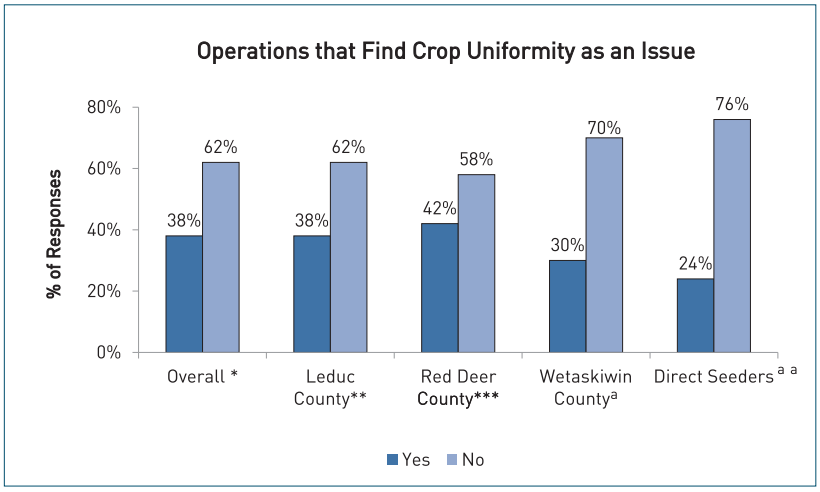
- Areas where application equipment travelled repeatedly such as gate ways and application tracks (71%)
- Wet soils during spring (32%)
- Areas where clay or heavy soils are present (21%)

When asked how they addressed compaction issues, the most popular suggestions from the 34 respondents were:

- Using deeper tillage to break up the compaction
- Working the affected area more times
- Spreading the manure in the fall verses in the spring
- Leaving the solid manure to sit so the moisture content decreases

Crop Uniformity

Table 15.0: Operations that Find Crop Uniformity as an Issue



* Based on 105 Responses
** Based on 47 Responses
*** Based on 38 Responses
[a] Based on 20 Responses
[aa] Based on 30 Responses

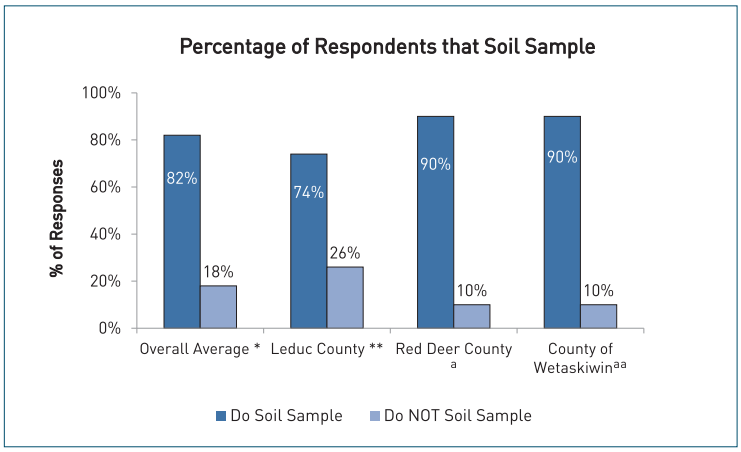
Dairy operations were asked if they experienced any problems with uneven crop development or yield. Of the respondents, 62% reported having no problems with crop uniformity (Table 15.0). Fewer operations, 30% in the County of Wetaskiwin compared to Leduc County (38%) or Red Deer County (42%) identified uniformity as an issue. Interestingly, of the 30 respondents that direct seeded some or all of their land, only 24% felt that they had problems with crop uniformity.

C. General Agronomics



Soil Sampling

Table 16.0: Percentage of Respondents that Soil Sample

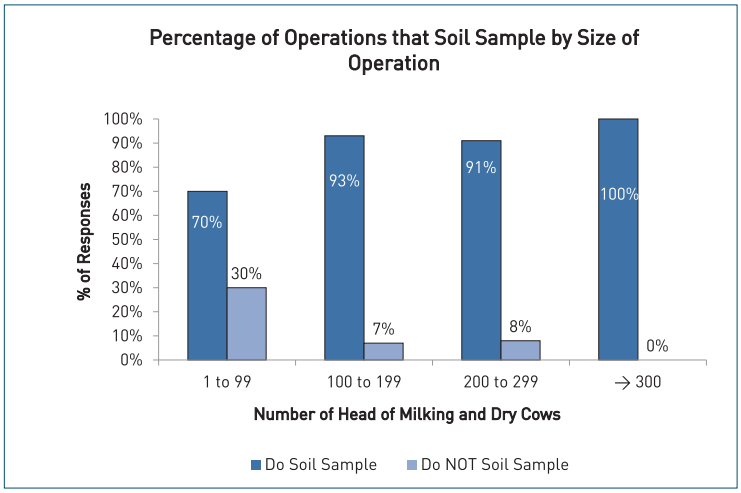


* Based on 107 Responses
** Based on 50 Responses
[a] Based on 38 Responses
[aa] Based on 19 Responses

When asked if the operation soil sampled, 82% of 107 respondents said they did soil sample (Table 16.0). The number of operations reporting that they soil sampled is higher than previously reported estimates of 40% of producers stating they soil sampled (personal conversations). The difference may lie in the fact that the estimated frequency was for the whole agricultural sector and was not representative of any one particular segment of the industry such as dairy.

The number of operations soil sampling in Red Deer County and the County of Wetaskiwin was found to be 90%. This is higher than the overall survey average of 82% and Leduc County's average of 74% (Table 16.0).

Table 17.0: Percentage of Operations that Soil Sample by Size of Operation



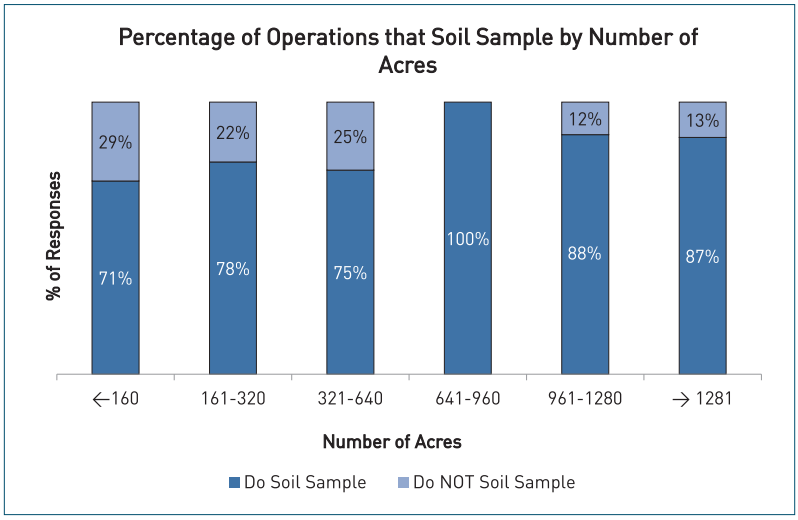
* Based on 106 responses

The adoption of soil sampling as a practice seems to be influenced by the size of the operation. The percentage of operations with less than 99 milking and dry cows that soil sample was only 70%,



lower than the survey average of 83%. The higher the number of milking and dry cows, the higher the percentage of operations that soil sampled (Table 17.0).

Table 18.0: Percentage of Operations that Soil Sample by Number of Acres

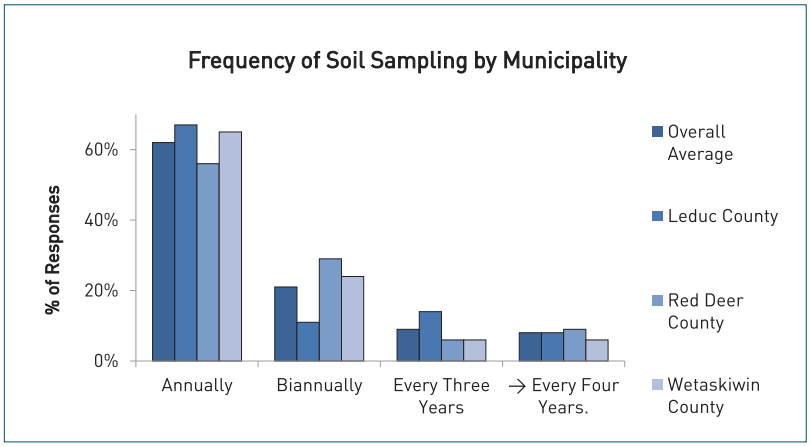


* Based on 105 responses

The percentage of operations that soil sampled was lower than the overall survey average on operations with less than 640 acres (Table 18.0). As the number of acres per operation increased, the adoption of soil sampling increased. The data suggests that the practice of soil sampling is not an activity adopted by some of the smaller dairy operations.

Of the 25 respondents that seeded some of their land using direct seeding methods 92% of them have adopted soil sampling practices. This is a slightly higher rate of adoption than the survey average of 82%. Of the population of respondents that seeded some of their land using conventional seeding methods, the percentage of soil sampling is almost the same as the overall survey population of 81%.

Table 19.0: Frequency of Soil Sampling by Municipality



* Based on 87 responses

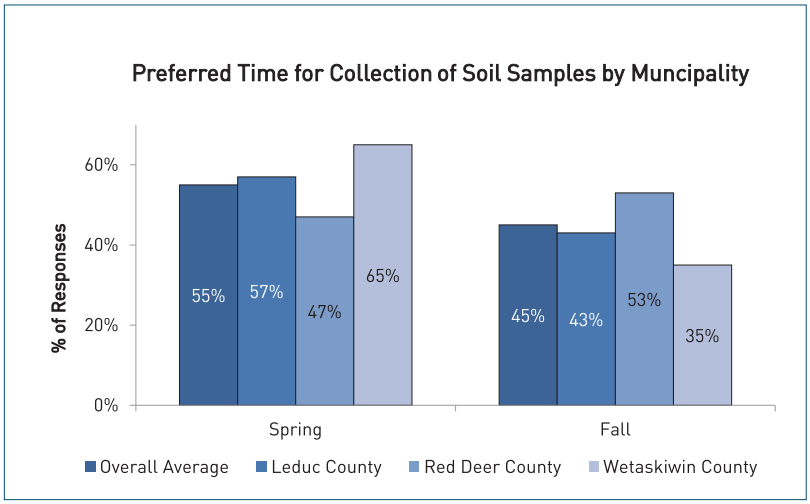
When asked about the frequency of soil sampling, 62% of the 87 respondents reported that they soil sampled annually (Table 19.0). About 92% of the operations soil sample at least every three



years, which means they are meeting Agricultural Operations Practices Act (AOPA) soil sampling requirements.

Frequency of soil sampling changed slightly between counties (Table 19.0). There was less annual soil sampling in Red Deer County than either Leduc or Wetaskiwin counties. Biannual soil sampling was more common in Red Deer County than in the other two counties.

Table 20.0: Preferred Time for Collection of Soil Samples by Municipality



* Based on 86 responses

Interviewees were asked what time of year they preferred to collect soil samples; spring (February through April), summer (May through July) or fall (August through October). No one selected summer as a preferred time to soil sample. The population of 86 respondents was split with 55% selecting spring and 45% selecting fall to collect soil samples (Table 20.0). The method of seeding did not appear to affect the preferred timing of soil sampling.

D. Manure Production and Application

Manure Managed

Interviewees were asked how the manure was managed on their operation:

1) Spread on land owned and managed by operation
2) Spread on land owned or managed by another
3) Removed by a contractor

Having the manure removed by a contractor is a very uncommon practice. No operations interviewed in the target area reported that their manure was removed by a contractor. Approximately 98% of respondents reported that the manure they produced was spread on land managed by their operations. Only 2% of operations reported that manure was exported and spread on land managed by another party.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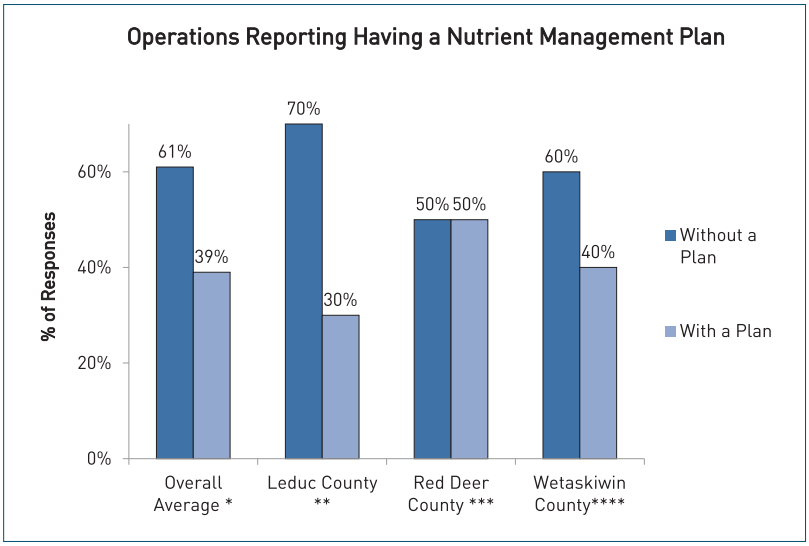
Nutrient Management Plans

Table 21: Percentage of Operations Reporting a Nutrient Management Plan by Municipality



* Based on 105 Responses
** Based on 47 Responses
*** Based on 38 Responses
**** Based on 20 Responses

The survey asked interviewees if they had a nutrient management plan. Approximately 39% of the 105 respondents reported having a nutrient management plan (Table 21.0).

It was discovered that fewer operations in Leduc County reported having a nutrient management plan compared to the survey average. The percentage of producers with a plan was higher in Red Deer County.

Of the 40 respondents that reported having a nutrient management plan, 95% also report they soil sampled.

Of the producers that currently indicated that they inject or surface-band their manure, 80% of respondents (n=10) had a nutrient management plan.

Producers were asked if consultants helped develop their nutrient management plans. Of the 40 respondents that said they have a nutrient management plan, 73% stated they had a consultant help develop the plan. Of the producers that have a nutrient management plan and use a consultant to develop the plan, 100% (n= 41) of them soil sampled.

Volume of Solid Manure Produced by Operation

Interviewees were asked to estimate the volume of manure produced by their operation. Fifty-three producers estimated the average volume of solid manure produced by their operation to be about 1900 tons. The amount of solid manure produced ranged from a low of 110 tons to a high of 8,600 tons.

When compared to the number of dairy animals on the operation the average amount of manure produced per head was 13 tons per year. The amount of solid manure produced per head ranged



from a low of 1 ton per year per head to a high of 60 tons per head. The amount of manure produced varied from operation to operation depending on the feeding system, production system, amount of bedding and wash water used.

The average estimate of 13 tons of manure per head is approximately half of the book value. The estimated book value amount of manure produced per head is 25 to 27 tons of manure per milking cow. The amount of manure produced often differs with the volume of manure collected. Many operations do not confine the herd 100% of the time. Manure may not be collected from animals while they are grazing or in loafing lots so the volume produced by the operation may actually reflect the volume of manure collected rather than produced.

Volume of Liquid Manure Produced by Operation

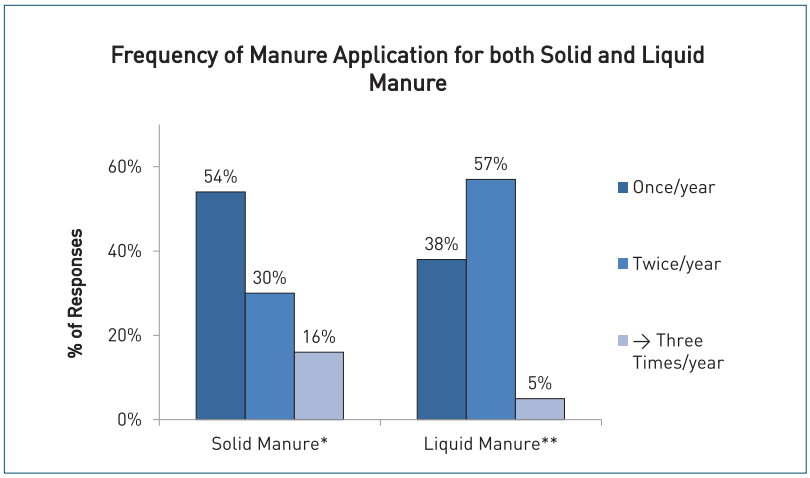
Fifty-three producers estimated on average the volume of liquid manure produced by their operation to be 1.4 million gallons. The amount of liquid manure produced ranged from a low of 100,000 gallons to a high of 4 million gallons.

When compared to the number of milking and dry cows on the operation the average amount of liquid manure produced per head was 6850 gallons per year. The amount of liquid manure produced per head ranged from a low of 454 gallons per year to a high of 16,700 gallons per year. The average estimate of 6850 gallons of liquid manure per head per year is very close to the book value of 5000 gallons per head per year.

Thirty-two operations responded that they managed both solid and liquid manure. The majority of manure they managed was liquid manure with 44% managing less than 25% solid manure.

Manure Application

Table 22.0 Frequency of Manure Application for Both Solid & Liquid Manure



* Based on 78 Responses
** Based on 63 Responses

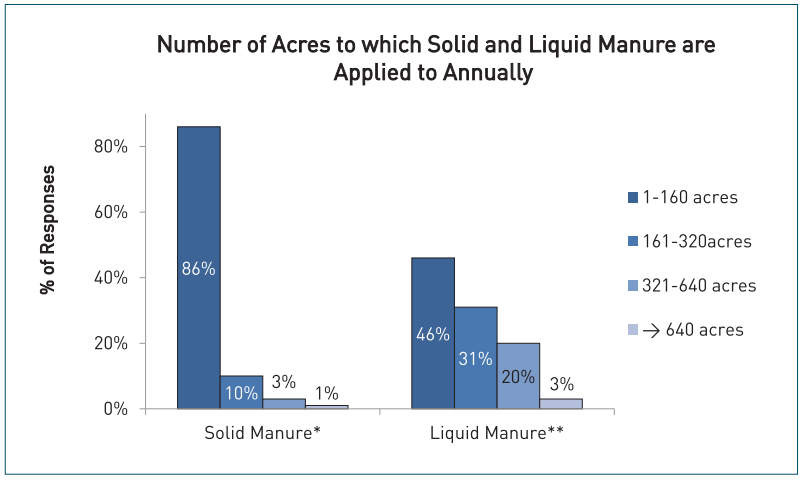
Of the 78 respondents that answered how many times per year they applied solid manure, 54% said once per year (Table 22.0). An additional 30% said two times per year. A smaller percentage (16%) of responding producers applied their solid manure more frequently than twice per year.



The majority of liquid manure managers (57%) reported applying their liquid manure twice per year (Table 22.0). Only 38% of respondents applied their manure once per year. The remaining 5% of respondents applied their manure more frequently than twice per year. The frequency of solid and liquid manure application did not change based on county.

Solid & Liquid Manure Application

Table 23.0: Number of Acres to Which Solid & Liquid Manure are Applied Annually



* Based on 77 Responses
** Based on 61 Responses

Each operation was asked to report on how many acres solid manure was applied annually. Of the 77 respondents, 86% reported applying manure to 1- 160 acres annually (Table 23.0). Approximately 10% of respondents applied the solid manure to between 161 and 320 acres.

Each operation was asked to report on how many acres liquid manure was applied annually. Of the 61 respondents, 46% reported applying manure to less than 160 acres annually (Table 23.0). Approximately 30% of respondents applied the liquid manure to between 161 and 320 acres annually. Overall, 20% reported applying liquid manure to 321 – 640 acres annually.

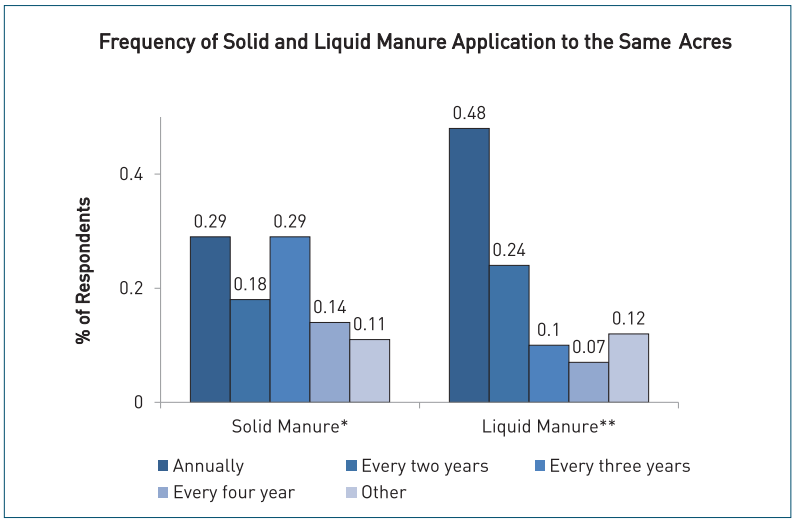
Solid & Liquid Manure Application Rotation

Operations were asked to outline if their solid and liquid manure application followed a particular rotation. The survey divided responses into five categories:

1) Applied annually to the same acres
2) Applied once every two years same to the field
3) Applied once every three years to the same field
4) Applied once every four or more years to the same field
5) Other



Table 24.0 Frequency of Solid & Liquid Manure Application to the Same Acres



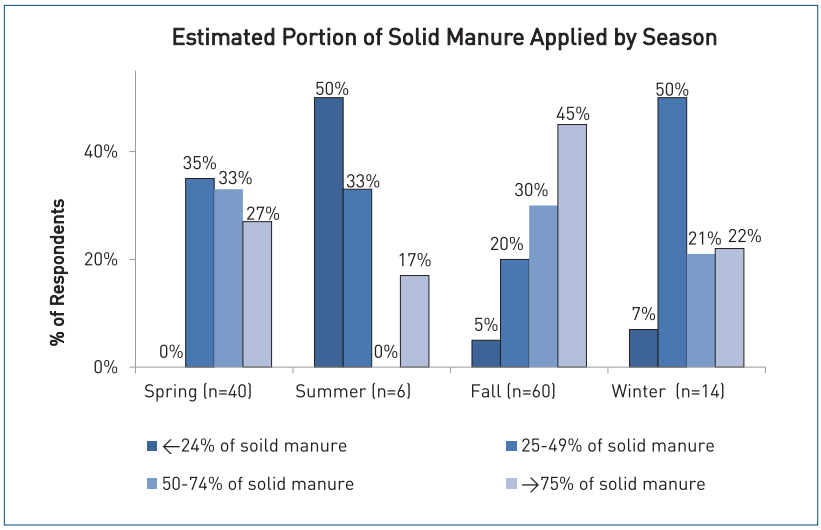
* Based on 73 Responses
** Based on 59 Responses

Approximately 29% of respondents applied their solid manure annually to the same acres (Table 28.0). Only 20% of respondents reported applying solid manure to the same acres every two years. About 29% of respondents reported applying solid manure to the same acres every three years. An additional 14% of respondents reported applying solid manure to the same acres every four years.

About 48% of respondents reported applying their liquid manure annually to the same acres. Twenty-four percent of respondents reported applying their liquid manure once every two years to the same acres. Only 10% of respondents reported applying their liquid manure once every three years to the same acres and 7% of respondents reported applying their liquid manure once every four years to the same acres.

Amount of Manure Applied per Season

Table 25.0: Estimated Portion of Solid Manure Applied by Season

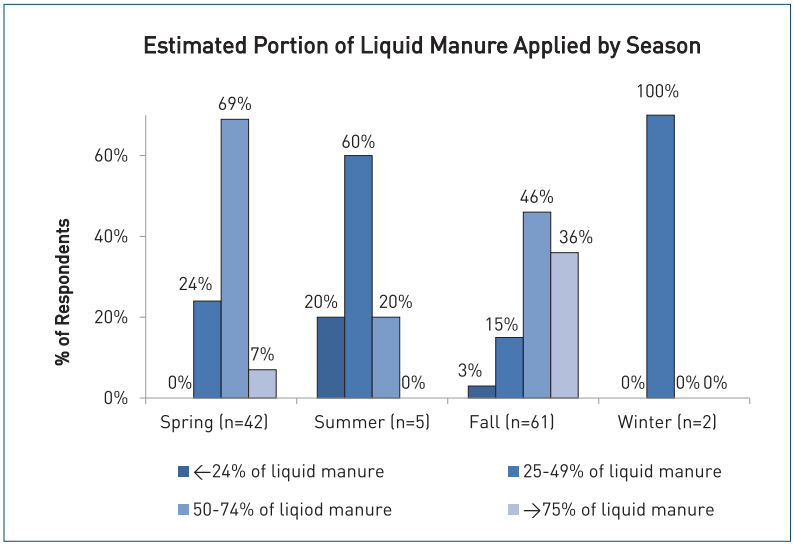




Of the 40 respondents that applied solid manure in the spring, 35% applied between 25- 49% of their total volume of manure in the spring, 33% applied between 50-74% of their total volume of manure in the spring and 27% of them applied more than 75% of their total volume of manure at this time (Table 29.0).

Of the 60 Respondents that applied solid manure in the fall, 45% of them applied more than 75% of their total volume of manure at this time. Thirty percent of respondents applied between 50- 74% of their total volume of manure in the fall. Approximately 20% applied between 25- 49% of their manure in the fall (Table 29.0).

Table 26.0: Estimated Portion of Liquid Manure Applied by Season



Of the 42 respondents that applied liquid manure in the spring, 69% applied between 50- 74% of their total volume of manure in the spring. Twenty-four percent applied between 25-49% of their manure in the spring and only 7% of them applied more than 75% of their total volume of manure at this time (Table 30.0).

Of the 61 respondents that applied liquid manure in the fall, 46% applied between 50- 74% of their total volume of manure in the fall. Another 36% of them applied more than 75% of their total volume of manure at this time. Fifteen percent applied between 25- 49% of their manure in the fall (Table 30.0).

Based on the number of responses to the questions on timing of manure application, the majority of operations surveyed applied their manure in either the spring or fall (Tables 29 & 30). Only a few producers applied some portion of their solid (n=6) or liquid (n=5) manure during the summer. A larger number of producers applied solid manure (n=14) in the winter than managers of liquid manure (n=2).

For 90% of respondents that applied manure in more than one season, the method of application did not change from one season to the next. For the 10% of respondents that said the method of application changed between seasons, the most common difference reported was the use of custom applicators in one season and self-application in the other season.

When asked if they had in the past applied manure at a different time of the year, approximately 63% of respondents managing liquid and solid manure said no. About 37% of respondents (n=35) had applied manure at a different time of the year in the past compared to now.

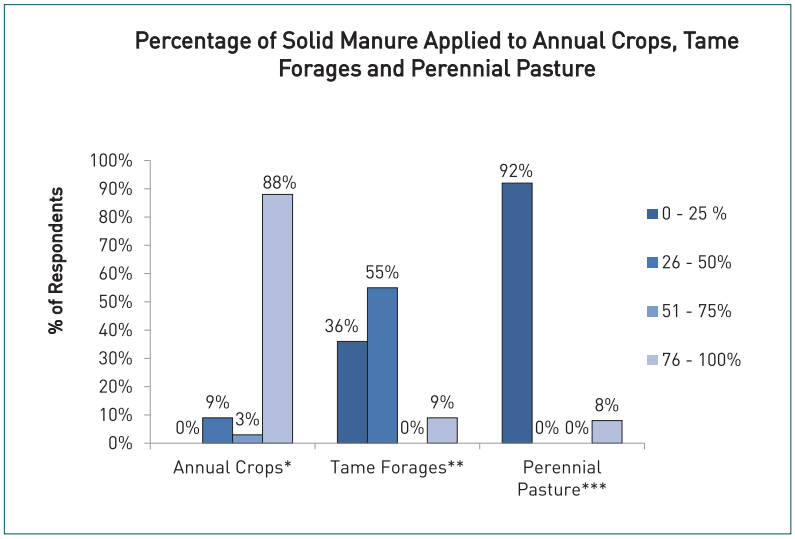


The majority of the 35 respondents (69%) who reported that in the past they applied manure at a different time of the year than they do now said they tried to apply manure in the spring. The main issue associated with spring application was compaction due to spring soil moisture levels. Other issues identified were custom applicator not being available, manure freezing in the wagon and timing. There is too small of an application window in the spring.

Amount of Solid & Liquid Manure Applied by Season

Survey participants were asked to estimate how much of their total volume of solid or liquid manure they applied to annual crops, tame forages and perennial pastures.

Table 27.0: Percentage of Solid Manure Applied to Annual Crops, Tame Forage & Perennial Forages



* Based on 67 out of 69 respondents
** Based on 11 out of 69 Respondents
*** Based on 12 out of 69 Respondents

Annual Crops

Out of the 69 responses for solid manure, 67 producers (97%) reported applying at least a portion of their solid manure onto annual crops grown for either for silage or crop production. The majority (88%) spread most of their manure (76-100%) on annual crops (Table 31.0).

Tame Forages

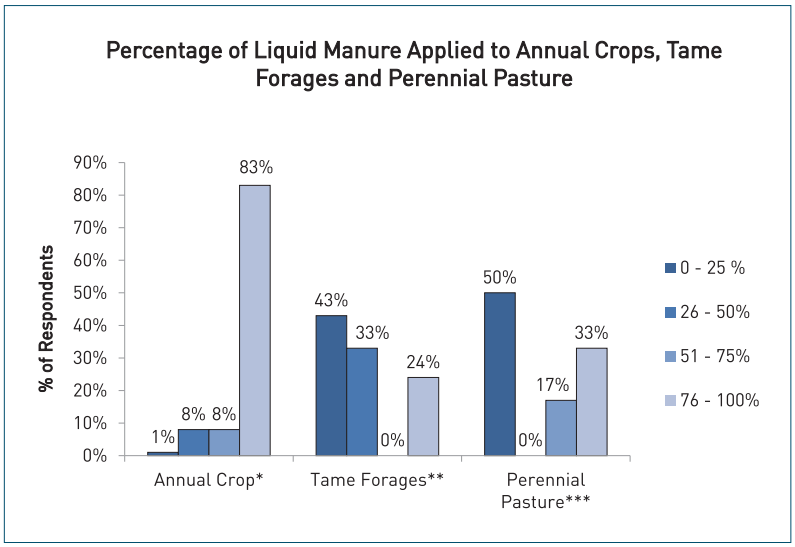
Only 11 of the 69 producers reported applying at least a portion of their solid manure to tame forages, grown for either for silage or for grazing. On average the 11 operations applied about 41% of their total solid manure to tame forages.

Perennial Forages

Twelve of the 69 responses for solid manure reported applying at least a portion of their solid manure to perennial pasture crops. On average, the 12 operations apply about 24% of their total solid manure to perennial pasture.



Table 28.0: Percentage of Liquid Manure Spread on Annual Crops, Tame Forages & Perennial Pasture



* Based on 53 out of 60 respondents
** Based on 21 out of 60 Respondents
*** Based on 6 out of 60 Respondents

Annual Crops

Out of the 60 responses, 53 producers (88%) reported applying at least a portion of their liquid manure to annual crops (Table 32.0). Eighty-three percent of the 60 operations applied more than 76% of their manure onto annual crops. On average operations applied about 90% of their total liquid manure to annual crops. A greater number of operations applied liquid manure to silage crops than to seed crops.

Tame Forages

Twenty-one of the 60 respondents reported applying at least a portion of their liquid manure to tame forages. The majority, 76% apply less than 50% of their manure to tame forages. On average, operations applied about 43% of their total liquid manure to tame forages.

Perennial Forages

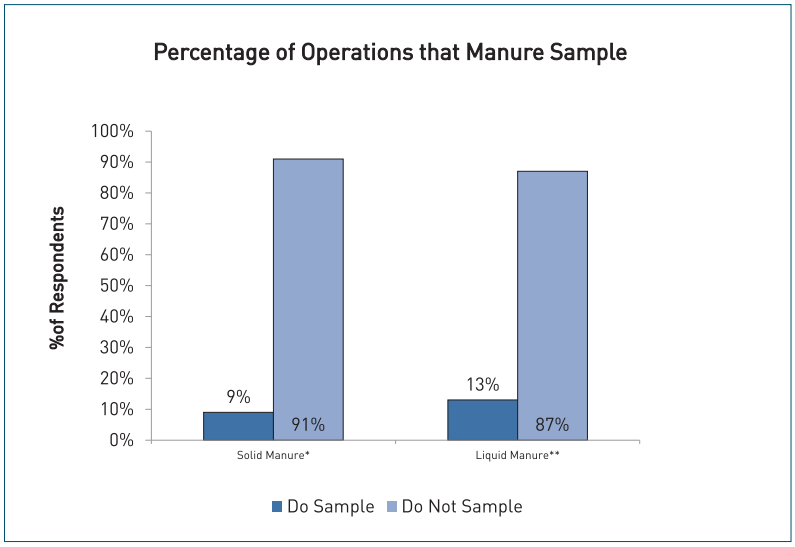
Only 6 operations reported that they apply at least a portion of their liquid manure to perennial pasture crops. On average, the 6 operations responding to liquid manure application to perennial forage apply about 56% of their total liquid manure to perennial pasture.

In general, more liquid manure is applied to tame forage and pasture than solid manure. Forages provide a good opportunity for manure application. They create timing windows for application during summer months when annual crops are growing and forages can use significant amount of nutrients.



Manure Sampling

Table 29.0: Percentage of Operations that Manure Sample



* Based on 87 responses
** Based on 69 responses

Operations were asked if they sampled and analyzed their manure to determine its nutrient content. Ninety-one percent of the 87 solid manure respondents and 87% of the 69 liquid manure respondents said they do not sample and analyze their manure (Table 33.0). The number of respondents that manure sampled did not change between counties.

All respondents for both solid and liquid manure that do sample their manure also said they soil sampled. Of the population of producers that reported sampling their manure about 72% have a nutrient management plan. This is higher than the overall survey average of 39% that reported having a nutrient management plan.

The majority (81%) of the 11 responding producers that reportedly sampled their manure have done so only once. The remaining 19% of respondents have sampled their manure more than once. When asked when the samples were collected, the majority responded either in the spring or in the fall. Most of the respondents reported collecting the solid manure sample directly from the manure pile or storage. The second most common practice for the collection of solid manure and the most common practice for liquid manure was the collection of manure throughout the application process. The majority of respondents reported being happy with the lab turn-around results for sample analysis.

Manure Application Rates

Survey participants were asked if they checked or measured application rates either while the manure was being spread or after the manure was applied. Approximately 90% of the 61 solid manure respondents and 80% of the 56 liquid manure respondents said they did not double check application rates.

Of the respondents that said they did double check application rates, the rates were checked by knowing the size of the load and the number of loads per acre. Many of the respondents said the custom applicator calculated or took care of this. One respondent reported that the custom



applicator spread out a tarp to determine spread volume and weighed out each truck load to confirm application rate.

The average application rate from the 45 responses for solid manure was 14 tons per acre. Application rates of solid manure ranged from 1.5 to 40 tons per acre. Some interviewees did not know the exact application rate used for their solid manure.

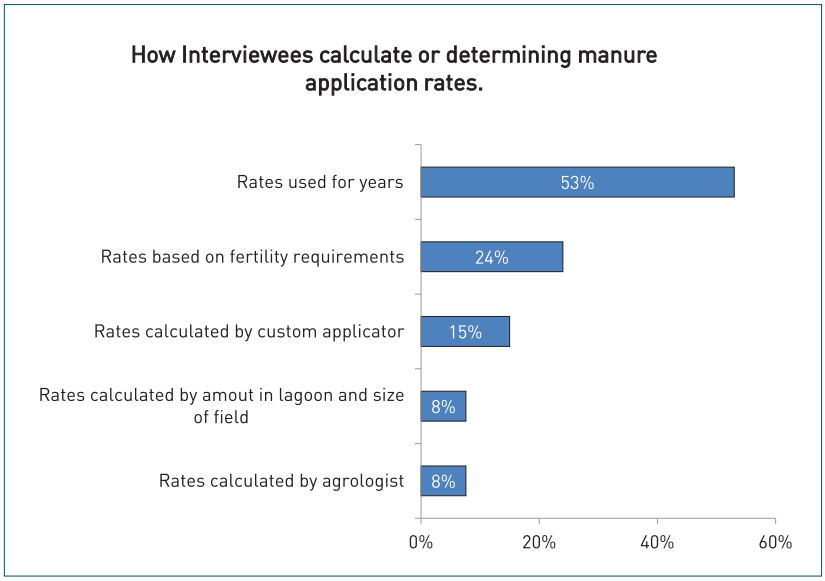
The average application rate from the 52 responses for liquid manure was 5700 gallons per acre. Application rates of liquid manure ranged from 500 to 10,000 gallons per acre. Again, some interviewees did not know the exact application rate used for their liquid manure.

Respondents were asked if their application rates changed for each crop or field. Fifty-nine percent of the 56 respondents with solid manure and 36% of the 61 respondents with liquid manure stated that application rates did not change for each crop or field.

Of operations that reported that application rates of solid and liquid manure changed with each crop or field, a higher number reported having a nutrient management plan. When asked how their manure application rates changed, respondents reported that they applied:

- Higher rates of manure to corn than barley or alfalfa
- Higher rates of manure to annual crops than forage
- Higher rates of manure on poor soil or to field that had not received frequent manure application
- Application rates were determined by crop nutrient requirements

Table 30.0: How Interviewees Calculate or Determine Manure Application Rates



* Based on 87 responses

When asked how manure application rates were calculated or determined, the majority of the respondents 53% said they have used these same rates for years (Table 34.0). Approximately 24% of respondents calculate application rates based on crop fertility requirements. About 15% stated that their manure application rates are calculated by the custom applicator. A few respondents (8%) calculated the manure application rate based on the amount of available manure and the size of the target field and another 8% reported that application rates were determined by a consultant or

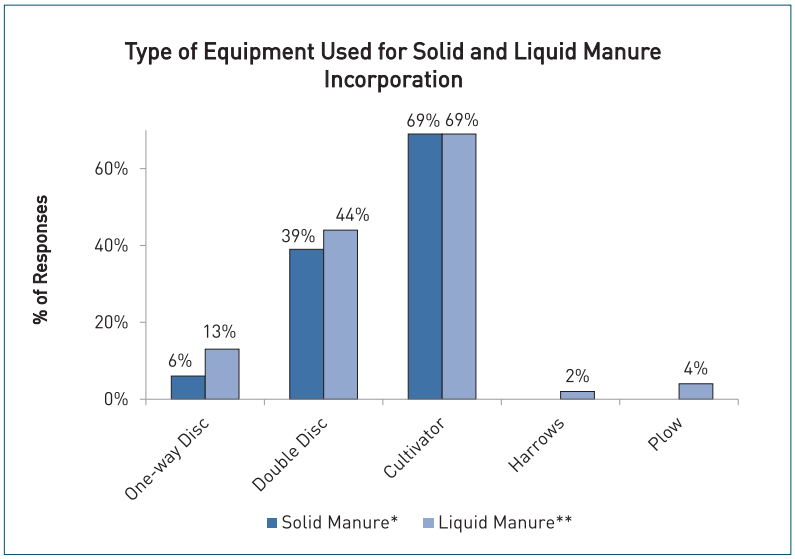


specialist.

Incorporation of Manure

Approximately 93% of the 68 responding to solid manure application reported incorporating at least some of their manure. About 86% of the 55 responding to liquid manure application reported incorporating at least some of their manure.

Table 31.0: Type of Equipment Used for Solid and Liquid Manure Incorporation



* Based on 49 responses
** Based on 45 responses

The majority of respondents 69% use a cultivator for incorporating some or all of their liquid and/or solid manure (Table 35.0). The next most frequently used piece of equipment was the double disk, followed by the one-way disc. Harrows and a plow were reported to be used to incorporate only liquid manure by a very small number of interviewees.

Sixty-three percent of the 51 respondents reported that they complete one pass when incorporating their solid manure and another 35% report that they completed 2 passes. The remaining 2% completed more than 2 passes when incorporating solid manure.
Eighty-six percent of the 42 respondents reported that they completed one pass when incorporating liquid manure and the remaining 14% reported that they complete two passes.

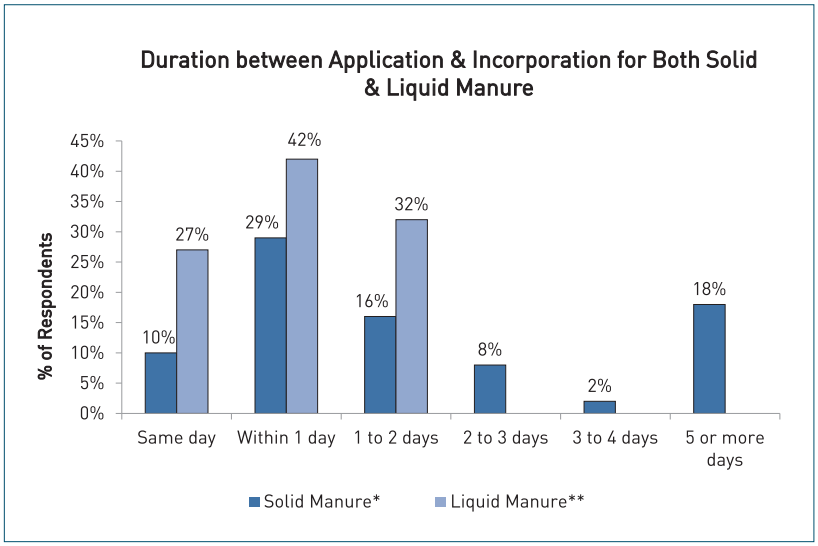
The majority (71%) of the 52 respondents reported that they completed the application of solid manure or empty the storage before starting to incorporate the manure. Only 53% of the 40 respondents that applied liquid manure completed the application or emptied the storage before beginning incorporation.

Approximately 32% of the 50 solid manure application respondents applied manure to one field then incorporate it before moving on to the next field. About 39% of the 33 liquid manure respondents



applied manure to one field and then incorporated it before moving on to the next field.

Table 32.0: Duration Between Application and Incorporation of Both Solid and Liquid Manure



* Based on 48 responses
** Based on 41 responses

Based on the 48 responses, 39% of respondents incorporated the solid manure either the same day or within 24 hours (Table 36.0). Approximately 58% of respondents incorporated the solid manure in less than 48 hours.

Of the 41 responses for liquid manure application, 69% reported that the manure is incorporated either the same day or within 24 hours (Table 36.0). All respondents reported having the liquid manure incorporated within 48 hours.

Operations that apply manure at multiple times of the year were asked if their incorporation methods changed based on the different application timings. For 81% of the 33 solid responses and 86% of the 22 liquid responses, incorporation methods did not change. The remaining 18% of solid responses and 14% of liquid responses reported that the method of incorporation changed with timing of application. Some reported that they made two incorporation passes in the spring and only one pass in the fall. Winter applications were not incorporated until spring. Finally, the method of incorporation depended on the availability of equipment at time of application.

E. Manure Brought in and/or Exported

The majority (82%) of the 107 responding producers reported that they did not spread or move manure to land managed by other operations or neighbours. Of the 16 respondents that did move manure to others, 75% reported transferring manure to other operations. The manure was moved to grain operations with no livestock. The remaining respondents reported that the manure was transferred to mixed operations including one other dairy operation.
The 18% of respondents that reported moving manure to others moved it about 1.2 miles. The distance the manure was moved ranged from ¼ to 3 miles.

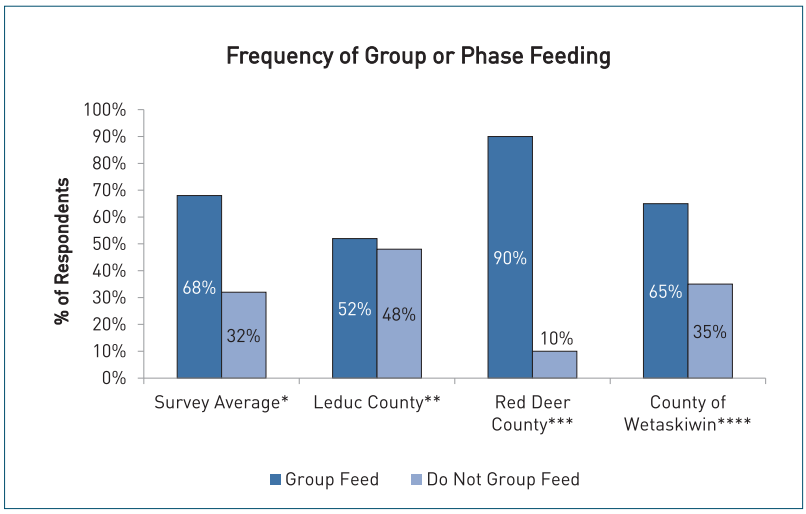


Approximately 94% of the 18 respondents reported that they received compensation in return for the manure they transferred to other operations. The most commonly reported form of compensation for the transferred manure was in trade for feed grain, silage or straw. The second most common form of compensation was the receiving operation paid for the transportation and application costs. A few operations reported the manure was in trade for custom work, reduced land rent or cash.

Of the 102 responding operations interviewed, 92% did not import additional manure to their operation. The few operations that reported bringing in manure brought it in from poultry, hog and beef operations. The most frequently reported type of manure imported to the operation was poultry. The majority of the operations that reported importing manure from other operations were in Leduc County.

F. Feed Management

Table 33.0: Frequency of Group or Phase Feeding



* Based on 108 responses
** Based on 50 responses
*** Based on 28 responses
**** Based on 20 responses

Sixty-eight percent of the 108 respondents feed their dairy herd in groups (i.e. phase feedings). This leaves 32% of respondents that do not feed their herd in groups. The same feed or ration is fed to all animals. Group or phase feeding was most commonly reported by dairy operations in Red Deer County.

The majority (88%) of respondents that fed their dairy herd in groups fed based on stage of lactation or milk production levels. A few respondents did not feed their animals in groups but instead rations were developed for each individual animal, thereby targeting for individual differences in feeding requirements.
The majority of the 108 respondents reported that they did not add any additives into the ration to manipulate nutrient absorption and nutrient content of the manure. For those that did add products



to the ration, products were added to balance the ration or to benefit animal performance not to manipulate the nutrient content of the manure. The main product added to the ration was Rumensin ™.

2.0 Liquid Manure Storage and Management

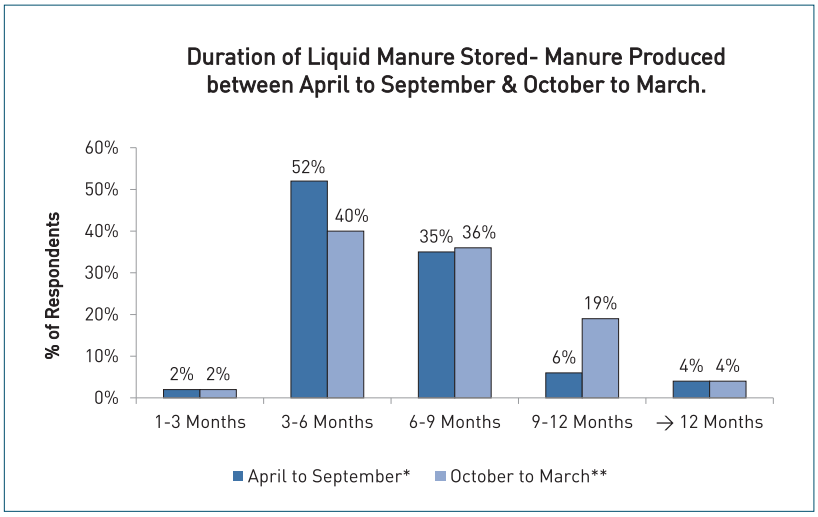
All of dairy operations interviewed that manage liquid manure had some kind of manure storage facility. In total, 56 producers answered questions about their liquid manure storage and storage management practices.

Liquid Manure Content

Based on 55 responses, on average it was reported that liquid manure contained about 12% solids. The solid content ranged from a low of 5% to a high of 20%. The majority (67%) of interviewees described their manure like pea soup and one third of the interviewees reported that their manure was runny like water. No respondents felt their manure was like toothpaste.

Length of Liquid Manure Storage

Table 34.0: Duration of Liquid Manure Stored - Manure Produced Between April to September and October to March



* Based on 48 responses
** Based on 53 responses

Operations were asked how long they stored manure that was produced between April to September (Table 38.0). The majority of producers (52%) reported that they stored their manure for 3 to 6 months and 35% of operations reported storing the manure collected in this time frame between 6 and 9 months. Few producers stored it for less than 1-3 months or for more than 9 months.

Operations were then asked how long they stored manure that was produced between October to March (Table 38.0). Forty percent reported that they stored the manure collected between October and March for 3-6 months and 36% of operations stored the manure between 6-9 months. Very few producers stored solid manure for less than 3 months or longer than 9 months, similar to storage from April to September.

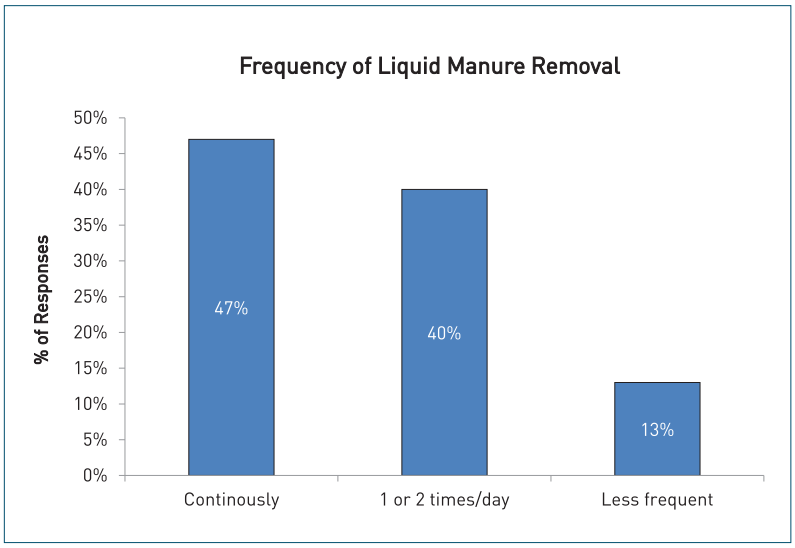


Together these findings support earlier data on page 30 that reported that the majority of liquid manure managers (57%) applied manure twice per year.

Liquid Manure Storage Facility

The primary storage used by the 56 responding dairy producers managing liquid manure was an anaerobic treatment lagoon. About 89% of respondents used this type of facility.

Table 35.0: Frequency of Liquid Manure Removal



* Based on 55 responses

Operations were asked how frequently manure was moved from the barn to the storage (Table 39.0). Of the 55 respondents, 47% reported that manure was continuously removed from the barn via a slatted floor or by a continuous scrape system. About 40% of respondents reported that manure was removed one or two times per day. Few operations (13%) reported that the manure was removed on a less frequent basis such as every two to four days, weekly or less frequently.

Survey participants were asked to report their capacity of the main liquid manure storage. The average capacity was 1.4 million gallons for the 55 responding dairy operations. The size of the liquid manure storage ranged from a high of 9.6 million gallons to a low of 100,000 gallons.

Ninety-eight percent of the 54 interviewed producers reported having a single stage manure storage facility. The remaining respondents have multiple stage facilities or containment areas.
The majority (89%) of the 56 respondents use a natural clay liner in the liquid manure storage facilities. The remaining 11% of respondents have a synthetic liner.

Most operations (96%) indicated that their liquid manure storage facility is not covered so precipitation can enter the facility. Only 4% of operations reported having storage facilities with covers.

Approximately 96% of the 56 responding producers reported that there is a floating crust formed by the manure while in storage.

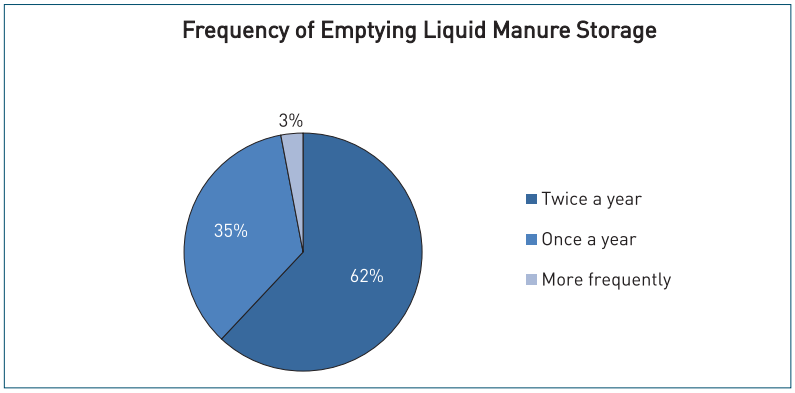
When asked how they managed the manure in storage, 73% of the 56 respondents reported that



their manure storage was not aerated or agitated ever. Approximately 27% of respondents reported that their storage was aerated or agitated until just before removal of the manure from the storage. These results are almost the opposite of those reported by the Statistics Canada 2005 Livestock Farm Practices Survey in which 97% of survey respondents from across Canada and the majority of respondents from Alberta stated that the liquid manure was not aerated while in storage until just before the manure was taken out. The results of the LMAI survey may not have been recorded correctly so the interpretation of the question may not be accurate. Producers may have answered the first answer in the list for this question responding that they did not agitate the storage without getting to the answer of not agitated until just before removal of the manure.

This observation is further supported by the responses for a subsequent question which found that 95% of the 56 respondents agitated their storage facility every time manure was removed from the facility. Only 5% of respondents did not agitate their storage facility each time they removed manure from the facility.

Table 36.0: Frequency of Emptying Liquid Manure Storage



* Based on 56 responses

The majority (62%) of the 56 survey respondents emptied their manure storage twice per year (Table 40.0). The remaining 35% of respondents emptied their manure storage only once per year and only 3% are emptied more frequently. The majority of operations would apply manure at two different times per year, likely spring and fall, as they emptied their storage twice per year.

Producers were asked if they added any compounds to the manure while in storage to modify pH or manipulate nutrient retention. Approximately 75% of the 56 respondents do not add any compounds to their manure. About 25% reported that they added a compound to their manure to modify pH or manipulate nutrient retention. The additives identified in the survey are listed in Table 41.0. The most commonly reported additive was SOP lagoon corrective.

Table 37.0: Additives reported to be added to the manure.

SOP Lagoon Corrective
Natural Enzyme to break down solids
Zap Manufacturing um
pH balancer detergent
Additive to help bacteria / Microbial grow
Yakka, help keep ammonia down
Bedcide

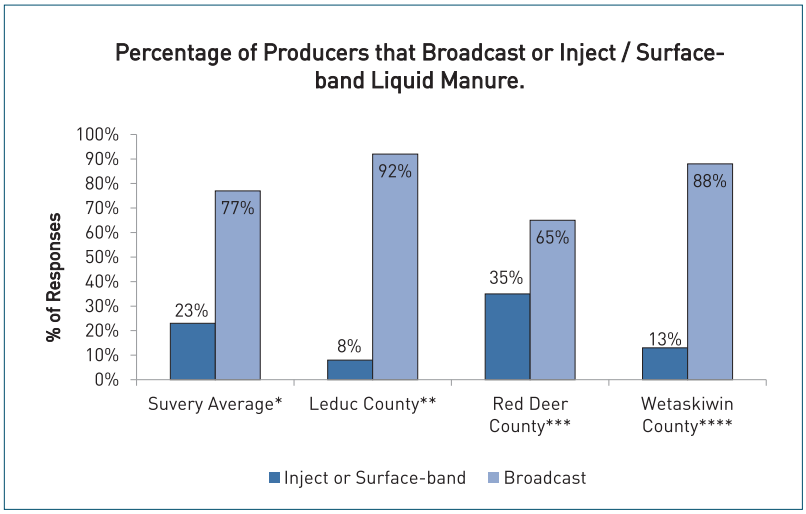


No interviewed operations are currently completing either solid-liquid separation or anaerobic digestion on the manure they manage.

Method of Manure Application

Operations that answered the liquid manure storage questions were then asked if they currently injected or surface banded their liquid manure and if they currently use a custom applicator to apply their manure or if they apply it themselves.

Table 38.0: Percentage of Producers that Broadcast or Inject/Surface-band Liquid Manure



* Based on 47 responses
** Based on 13 responses
*** Based on 26 responses
**** Based on 8 responses

Only 23% of the 47 respondents reported that they currently inject or surface band liquid manure (Table 42.0). The majority (77%) currently broadcast their liquid manure. The injection or surface-banding was found to be more frequently practiced in Red Deer County compared to Leduc or Wetaskiwin Counties.

Regardless of whether or not the operation broadcast or injects / surface-band their liquid manure, approximately 90% of the 41 respondents reported using custom manure applicators to apply their liquid manure. Only 10% of interviewed producers applied their own liquid manure.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3.0 Liquid Manure Application - Injection / Surface-banding Liquid Manure

The respondents of the dairy operations that managed liquid manure were asked a series of questions in regard to their liquid manure application practices. This population was divided into two sub-groups based on who performed the actual application. The two sub-groups were:

- Use custom applicators
- Self-apply

The number of questions did differ between the two sub-group surveys. Operations that injected or surface-banded their liquid manure using their own equipment were asked 18 survey questions. Operations that injected or surface-banded their liquid manure using a custom applicator were asked 24 survey questions. The focus of the questions in the two sub-surveys was very similar in nature.

Once the survey was completed it was discovered that of the 109 interviewed operations, only one managed liquid manure and injected the manure themselves. To simplify the discussion and retain anonymity, the responses for this sole operation will be combined with results from the producers that inject/surface-band liquid manure using a custom applicator when possible.
In the other sub-group of questions targeting operations that currently inject or surface-band their liquid manure using custom operators, there were only 9 survey respondents. The following discussion will identify if the question was asked to both sub-groups or if it was only applicable to one of the groups. If the responses from the two sub-groups were distinctly different this difference will be noted and possibly explained. Questions that are clearly unique to the sub-group will be discussed separately as needed.

Why use Custom Applicators?

Operations currently using a custom applicator to inject or surface-band their liquid manure were asked an open ended question to provide reasons as to why they use custom operators. Responses were as follows:

- Do not own or do not feel it is feasible to own their own equipment
- Do not have the time to perform the application themselves
- Do not have the manpower or labour to perform the application

All operations currently using a custom applicator to inject or surface-band their liquid manure responded that they have always used a custom operator to apply their manure.
Operations currently using a custom applicator to inject or surface-band their liquid manure were asked why they use the applicators that they do. The reasons were as follows:

- They do a good job
- They use injection equipment or they have trail hose equipment
- They are close in proximity to the farm
- They keep all the records
- They have floatation tires
- They have good equipment



Why Self-Apply?

Operations currently injecting or surface-banding their liquid manure themselves were asked an open ended question to provide reasons as to why they applied the manure themselves instead of using a custom operator. Reasons provided included:

- Custom operators are not careful enough with lagoons
- Cost of application, cheaper to do it themselves
- Concerns about potentially spreading diseases

The respondent that currently injects or surface-bands his own manure has, in the past, used a custom applicator to perform this task. The reasons provided for stopping using a custom applicator were:

- Elimination of financial risk
- Elimination of the risk of disease spread to the operation

Both operators that use custom applicators and operators that apply the manure themselves were asked if they had always injected or surface-banded their liquid manure. Approximately 40% of the 10 combined respondents have always injected or surface-banded their liquid manure. The remaining 60% have not always used injection or surface-banding.

Benefits of Injection / Surface-Banding

Of the 6 respondents that had switched to injection or surface-banding, 50% have made the transition in the last four years. Approximately 33% have switched in the last 5 to 9 years. The remaining 17% made the switch more than 10 years ago. The reasons for moving to injection or surface-banding were as follows:

- Decreased odour
- Maintain neighbour relations
- Making better use of nutrients in the manure

Barriers to Injection

Producers were asked to identify some of the barriers that prevented other producers from moving to injection or surface-banding liquid manure application. Barriers identified were:

- Cost (100% of responses)
- Don't understand the benefits of injection or the cost vs. the benefits (50% of responses)
- Lack of time, i.e. injection takes longer
- Harder to inject into zero till cropping systems

Both sub-groups of producers were asked to identify some of the barriers they experienced moving to injection or surface-banding liquid manure application.

- Of the 6 responses, 67% felt there were no barriers to moving to injection or surface-banding
- Thirty-three percent felt that cost was a barrier they had to overcome to move to injection or surface-banding
- Distance between the lagoon and some of the fields were a barrier to moving the umbilical hose system. The umbilical system only reached for 2.5 miles

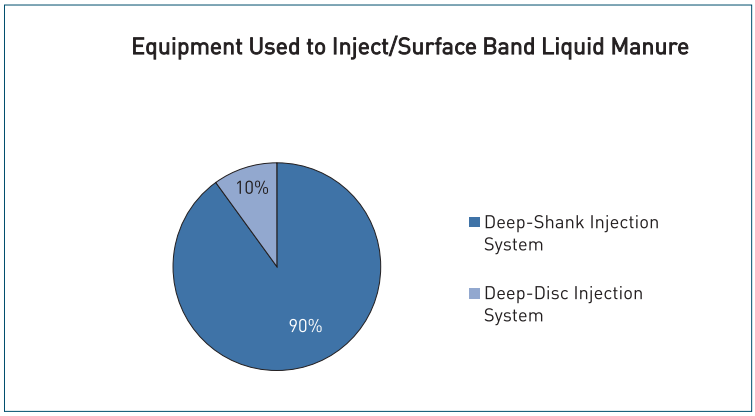

3070



Those respondents that had to overcome some barriers were asked how they overcame the barriers. Respondents cited the reduction in fertilizer costs helped to compensate the higher application costs. It was mentioned that working together with county and neighbours addressed the barriers.

Equipment

Table 39.0: Equipment Used to Injection/Surface-Band Liquid Manure



* Based on 10 responses

Nine out of 10 respondents from both sub-groups have, in the past, used a deep shank injection system (Table 43.0). One respondent used a deep disc injection system. Currently, 90% of respondents are still using deep, shank injection application systems. The remaining 10% are using a trail-hose, surface-banding application system. The data suggests that the majority of respondents have been using the same type of manure application system since they began injecting or surface-banding their manure.

The majority, 9 of the 10 respondents, were very satisfied with the system currently being used, either by their custom applicator or by themselves. The remaining respondents identified themselves as being somewhat satisfied with the equipment currently being used. Producers were asked to identify what about the application equipment they were currently using were most pleased with. Responses included:

- Equipment does a good job, good application and accurate rates
- Nutrients get to where they are needed
- Custom applicators come on time and the producer does not have to apply the manure themselves
- Trailing hoses is less hassle than injection

Producers using custom applicators and operators that apply the manure themselves were asked if they or the custom applicator made any aftermarket modifications to the application equipment. Only 2 respondents were aware of or made any modifications to the equipment. The two identified modifications included:

- Modifications to the distributor
- Addition of a disc opener in front of the shank

Producers were asked to identify what they were least pleased with about the application equipment currently being used. Responses included:



- Cost
- Fields are rough after injection
- Hoses trap and carry trash
- Communication and scheduling custom applicator

When asked how they felt the equipment could be improved it, was suggested to:

- Try different harrows, maybe phoenix harrows to reduce roughness
- Add a control to set desired application rate.

Equipment limitations identified by the producers included rocks and that the drag-line hose can only go a few miles from the lagoon.

All 9 responding producers that use custom applicators to inject or surface-band their manure reported that they directed the application rates used by the custom applicator.

Respondents in both sub-groups were asked if they used Global Positioning System equipment on their operation. Only 3 of the 9 responding operations are using GPS technology on their farm. All operations reporting that they use GPS equipment were also found to soil sample and have nutrient management plans.

Producers were asked if GPS equipment was being used either by them or by the custom applicator when manure was being spread. Six of the 10 respondents said that GPS technology was not used when spreading manure, either by them or by the custom applicator. Two respondents reported that GPS equipment was being used during spreading and the remaining 2 respondents did not know if GPS technology was being used. Of the 3 operations using GPS equipment, only one operation responded as having yield mapping capability in their combines.

Operations that use either a custom applicator to apply their manure or apply the manure themselves were asked if manure application rates were measured. Of the 9 respondents, 6 reported that manure application rates were measured. This was generally determined using volume, speed and area covered per tank.
Respondents in both sub-groups were asked if they or the custom applicator calibrated the manure application equipment. Only 1 of the 10 responding operations reported that the manure application equipment was being calibrated. The majority of respondents reported that to their knowledge the manure application equipment was not calibrated.

Only 1 respondent from 10 responding to questions in both sub-groups reported they were familiar with ARD's Custom Manure Applicators Directory. None of the interviewed producers have used the Directory.



4.0 Liquid Manure Application- Not Currently Injecting or Surface-Banding

The survey participants were asked to identify if they do not inject or surface-apply, do they apply the liquid manure themselves or have a custom applicator apply the manure. The population was then divided depending on who completes the application of the manure:

- Liquid Manure Don't Inject or Surface-Band, that apply themselves
- Liquid Manure Don't Inject or Surface-Band, that use Custom Applicators

Questions asked to both sub-groups were similar in nature. There are also similarities in the responses from this group as the producers that inject or surface-band their liquid manure.

A. Not Currently Injecting or Surface-Banding - Apply Themselves

There were a total of 7 interviewees, with the majority (57%) of the responses coming from Red Deer County stating that they do not inject their liquid manure and they apply it themselves.

Twenty-five percent of the respondents stated that the reason they do not use custom applicators is that they have their own equipment. Nineteen percent of the producers stated that increased costs of having manure custom applied as a reason to do it themselves. Another 19% stated they have the manpower capabilities to self-apply manure and the remaining producers stated that waiting for a custom applicator and time savings were the reasons for not using custom applicators. Other responses from the question were:

- Custom applicator is not careful enough with lagoons
- The producer can apply the manure when it is convenient for them
- Concerns about the potential of disease spreading
- The producer needs to apply often due to lack of storage

Of the 7 responses, 29% stated that they have always spread their own manure and 71% stated that they have not always spread their own manure.
Of those that answered no to not always self-applying their manure, all have previously used custom applicators to spread their manure. Four producers responded to the question "Why did you stop using custom applicators? The reasons were:

- They don't have to wait for the custom applicator, they can apply as they have time
- Eliminate financial risk
- Eliminate disease risk
- Costs too much
- Bought own application equipment
- Family wanted to apply the manure

Participants were asked if they have ever considered using injection or surface-banding technology to apply manure. There were 6 responses and the answers were split. Fifty percent stated yes, they would consider using injection or surface-banding and 50% stated no they would not consider switching to injection or surface-banding. The respondents that considered changing gave the following reasons for switching to an injection or surface-banding application method:



- More even spread
- Crop input increase
- One pass done in one day
- Cost savings
- No smell
- Best use of manure

Two respondents indicated they have been considering this technology for the past 1-5 years.

Operations were asked "What are some of the barriers producers face when moving to injection or surface-banding?" The main barrier identified was cost. Other reasons were:

- Older men want to do it the old way
- Convenience
- Doubt regarding how much nutrients are lost when liquid is not injected

Operations were asked "What are some of the barriers you face when moving to injection or surface-banding technology?" Responses were as follows:

- Takes more horsepower (fuel) to inject
- Lack of available custom operations / timing of application
- Cost
- Timing of application (frost)

There were no responses to the question "How do you think these barriers can be addressed".

Producers were asked what type of application system/equipment they use. Fifty percent of the producers stated they use a high discharge, broadcast system and the other half use a low discharge, broadcast system.

Producers have used 3 different types of systems in the past from what they are using now. Those were high discharge broadcast system, low discharge broadcast system and one producer has used a trail-hose applicator.

Of the 6 respondents, 5 producers were very satisfied or somewhat satisfied with their current equipment. Only 1 producer (16.7%) was very dissatisfied with their current equipment.

Four producers responded to the question "What are you most pleased with when it comes to their current application equipment?" Producers stated:

- It gets the job done / done in a timely manner
- High volume / high capacity, system is efficient
- Feels their way is just as good as injection
- It's inexpensive

Producers were asked if they have made any modifications to their equipment. Sixty percent of the producers stated no, they have not while 40% of the producers have made modifications. When asked how or what modifications were done:



- One producer added a tank on gravity fed system
- One producer tried adding drop hoses

When asked what they were least pleased with when it came to their equipment, 2 producers responded. One disliked the way their equipment spread and wanted more even application. The other producer would prefer to go to aeration or small disc injection system.

The responses to the next question were combined due to similar answers. The questions asked "What were the limitations to their current equipment and how they think the equipment can be improved"? Both questions saw similar answers:

- Bigger and better tires
- Larger or bigger tank
- Difficulty to get an even application
- Find drop hoses that work and don't clog

None of the producers in this section (self-apply, do not inject) calibrated their manure application equipment. With that, there were no responses to the following question of how they calibrated their application equipment.

Of the 6 responses to the question, "Do you measure application rates during or after application?" 4 producers stated yes, they measured application rates and 2 of the producers did not. Producers responded that they calibrate their equipment the following ways:

- Volume / tanks per spread area
- Flow valve on tank
- Uses an agronomist who measures the rate

Only 2 of the respondents (n=6) used GPS in any of their operation. None of the participants in this section used GPS to apply manure and only 1 producer had yield-mapping capabilities in their combine.

Eighty percent of the respondents were not familiar with the Custom Manure Applicators Directory and none of the producers questioned had used the Directory. These questions were asked to determine and gauge awareness and feedback on the Directory.

B. Not Currently Injecting or Surface-Banding - Using Custom Application

There were a total of 43 interviewees in this sub-section, with the majority coming from Leduc County at 44% followed very closely by Red Deer County at 40% and the Wetaskiwin County at 16%.

There were 84 responses to the question on why they have chosen a custom applicator to apply their manure, as producers provided more than one answer to the question. They are as follows:

- Producers stated that they don't have the time or it was quicker for a custom applicator to apply the manure (33%)
- They don't have the equipment (25%)
- Cost of the equipment was a factor (24%)
- Not having the manpower available to apply manure and it being too much work were other reasons for using custom applicators



There was no significant difference based on the different municipalities involved.

The majority (83%) of operators have always used custom applicators to apply their manure. Of those who haven't always used custom applicators, all of them used to apply it themselves. Some of the reasoning that the operators moved to custom application is as follows:

- Equipment was getting old and breaking down
- Did not have necessary equipment
- Took to long to apply myself
- Lack of manpower

Of the producers that had moved to custom application, the majority have done so in the past year or so.

The operations that were surveyed (n=43) listed about 8 different companies that offer custom application services within Leduc, Red Deer & Wetaskiwin counties.

When asked why they used these companies, the dairy operations surveyed gave the following reasons:

- They do other custom work for the operation and they had used them in the past
- They were experienced and knew what they are doing.
- They used those companies that are available
- They were local or the only company around
- They had the equipment
- They were reasonably priced
- They were efficient
- They were suggested by neighbours, previous owners, etc.

Seventy-eight dairy operations that don't inject or surface-band had considered switching technology for the following reasons:

- Majority of operations (60%) considered switching to injection or surface-banding to capture more nutrients.
- Fifteen percent of the operations liked the idea of injection or surface-banding.
- Fifteen percent stated it would help with neighbour relations.

There were 61 responses to the question "What are some of the barriers other producers face when adopting injection or surface-banded technology?" Producers provided more than one answer to the question:

- Cost was stated as being the number one barrier to adoption
- Technology takes too much time and lack of available equipment
- Custom applicators availability
- Land compaction, application tracks in field
- Hard on equipment
- It is status quo
- Hilly and rocky ground



- No regulations requiring injection
- Do not see the advantage of injection
- Other equipment issues

A similar question was asked regarding what are the barriers producers faced when moving to injection or surface-banding technology:

- Cost was a major factor to adoption of injection/surface-band technology
- Lack of equipment or custom applicators
- Efficiency and time commitment
- Manure will be placed too deep
- Leaves field too rough
- Concerned about forage damage
- Compaction
- Lack of information related to cost vs. benefits

Nineteen operations that do not currently inject responded to the question regarding how the barriers mentioned above can be addressed:

- Lower prices and make the practice more economical (42%)
- Find a quicker way of injection (21%)
- Improve injection equipment technology (11%)
- Increasing the availability of custom applicators (11%)

A large majority (98%) of producers that responded used a high discharge, broadcast system in the past to spread their liquid manure.

Almost all of the respondents were familiar with the type of manure application equipment used by their custom applicator. Ninety-seven percent of the equipment used is a high discharge broadcast unit and only 3% used a low discharge broadcast system.

Ninety-eight percent of the 41 respondents are very satisfied or somewhat satisfied with the equipment used by their custom applicator.

Survey respondents were asked what they were most pleased with. They answered the question about the application of the manure or the applicator rather than the equipment. There were 34 interviews with 52 responses. Producers responded with more than 1 answer to the question.

- Respondents were most pleased with how efficient and quick the application is (31%)
- Respondents also felt that their custom applicator was very careful and did a good job (21%)
- They had the equipment to complete the job (floatation tires, large tanks, horse-power)
- They applied the manure accurately and evenly
- They come when they say they would
- They drove slowly, resulting in no ruts and less soil compaction



When asked if they were aware of any modifications made to the custom applicators equipment, 92% stated no. Those that responded to being aware of modifications reported that the injection equipment was taken off.

Producers were then asked what they were most displeased with or what could be improved when applying manure by custom applicator. Twenty-one producers were interviewed with 27 responses, as they may have responded with more than 1 answer to the question. They were most displeased with the following:

- Inexperienced or careless drivers (22%)
- Cost (19%)
- Timing when an applicator can show up as they can be very busy at certain times of the year (15%)
- Producers would like to see more injection equipment available (15%)
- Other responses were odour control, ability for the custom applicator to incorporate the manure, having to travel twice as far, more hose applicator systems and disliking having to fill the injector tank in the field

Interviewees were asked what they felt were the limitations to the custom applicators equipment. There were 4 responses as follows:

- Ability to inject economically
- Capacity
- The operators of the equipment
- Equipment was effected by wind

The majority of producers do direct the application rate that the manure is applied at. One producer stated the custom applicator determines the application rate because they have experience with the equipment and their fields.

When asked if they and/or the custom applicator measure the application rate, 65% of the operations interviewed stated yes, they do (n=37). Thirty-five percent stated no, neither the custom applicator nor they themselves measure application rates. Eighty percent of respondents that do measure application rates mentioned that application rates were determined by speed per volume, speed per acre or volume per acre. Ten percent said they determined rates by experience.

Of the 35 responses, 54% did not know if the custom applicator calibrated their application equipment. Forty-three percent stated no, the custom applicator does not calibrate equipment. The remaining 3% said yes. The respondents that mentioned yes to calibrating custom application equipment did not say how it was calibrated.

Operations (n=40) were asked if GPS technology was used when spreading liquid manure. Fifty-three percent stated no, GPS was not being used, 30% didn't know and 17% answered yes, they were using GPS to spread manure.
Dairy operations participating in this section of the survey were also asked if they used GPS in any of there operations. Eighty-four percent of the producers said no, they did not use GPS. Of the 6 producers using GPS, only 2 had yield mapping capabilities in their combine.

Ninety-three percent of producers surveyed (n=40) stated they were not aware of ARD's Custom Manure Application Directory. Of those that were aware of the directory, none of them have used it in the past.



CONCLUSIONS:

Lessons Learned from Process:

- One-on-one survey method was a very useful tool in collecting information from the producers and engaging them
- The two-person approach worked the best, one to ask to the questions and the other to record the information and keep things on track
- Ensured the surveyors know exactly why they were asking certain questions
- Producers were willing to provide feedback and input and appreciated being asked their opinions. They seemed very engaged in the process

Key Points

- Excellent participation in the survey. One hundred and nine of the 117 dairies operating within the three counties participated in the survey, a response rate of 93%.
- Average size of the operations interviewed was 119 head of milking and dry cows.
- The majority of the farms (52%) managed between 161 to 640 acres and 41% of the operations managed over 640 acres which was mainly in annual crop production with 59%.
- Most common production system was a free-stall system
- The average number of acres that solid manure was applied to was 137 acres, with a minimum number of acres of 10 and the maximum 1500
- The average number of acres that liquid manure was applied to was 247 acres, with a minimum number of acres being 35 and a maximum of 750
- Of the operations that participated in the survey, 82% did soil sample with the majority of operations sampling annually
- Only 10% sampled their manure to determine nutrient content
- Approximately 40% of operations had a nutrient management plan, with 73% having a consultant develop the plan
- Fifty-one percent of the dairy operations primarily managed liquid or slurry manure
- Seventy-seven percent of the operations dealing with liquid manure broadcast their manure
- Regardless of whether the operation broadcast or injected, 90% of them used custom applicators to apply the manure
- Some of the barriers identified with liquid manure injection or surface-banding were costs, unaware of the benefits of injection, the time it took to inject, lack of available equipment, and the need for bigger equipment



ACKNOWLEDGEMENTS

The LMAI project team would like to thank the producers and custom applicators who participated in the survey, the producers who allowed us to establish small and large scale plots on their farms, the survey project team, and Bannister Research & Consulting for compiling the survey results.

Partners:

- Alberta Agriculture & Rural Development
- Alberta Milk
- County of Leduc
- County of Wetaskiwin
- Red Deer County
- Dairy Producers
- Custom Manure Applicators