Second Annual Dairy Info Day

January 11, 2013

SaskMilk*, *Ministry of Agriculture and the University of Saskatchewan

University of Saskatchewan

Ministry of Agriculture

Saskmilk

Second Annual Dairy Info Day

Friday January 11 2013
Brian King Centre Warman, SK

9:00 Registration, Trade Show and Coffee
10:00 Welcome and opening comments by Blaine McLeod

Forages
10:15 New developments in forage breeding. Bruce Coulman – page 5
10:40 Evaluation of corn and barley varieties for silage. Dave Christensen – page 6

Manure
11:05 What is the agronomical value of manure? Jeff Schonau – page 11
11:25 Manure value streams. Terry Fonstad – page 30
11:45 Nutrient management. Bryce Sundbo, Ministry of Agriculture – page 38

12:10 to 1:10 Lunch provided by SaskMilk.

Dairy Health
1:10 Update on hairy heel wart. Chris Luby – page 12
1:25 An update on the bulk tank disease screening project - What's in your bulk tank? Steve Hendrick - page 14
1:45 Update on somatic cell counts. Chris Luby – page 17

Dairy Feeding
2:00 Use of glycerol and high fat canola meal in dairy rations. Vern Racz and Bernard Laarveld – page 20
2:20 Opportunities and challenges for feeding low crude protein diets to dairy cows. Tim Mutsvangwa – page 25
2:40 Feeding for omega three fatty acids in meat and milk. Janna Moats, O&T Farms and Dave Christensen – page 27

3:00 **General Discussion and Questions**

3:15 **Closing comments**. Jack Ford

After closing comments, speakers will be present and the Trade Show will be open until 4:00 pm. Remember to fill out and hand in the evaluation form.

Sources of Dairy Research Support

Grants and other forms of support

Government of Saskatchewan
Saskatchewan Agriculture Development Fund
Government of Canada
Natural Science and Engineering Research Council
Agriculture and Agrifood Canada
Canadian Foundation for Innovation
Western Economic Diversification
Agriculture Council of Saskatchewan - CAAP
Alberta Livestock and Meat Agency
Canola Council of Canada
Saskatchewan Canola Development Commission
Pioneer Hi-Bred
Hyland Seed
O&T Farms
Saskatoon Colostrum Company
Alta Genetics
Westgen
Milligan Bio-Tech
Cargill Animal Nutrition
InfraReady Products (1998) Limited
Agricore United
Northwest Terminal
North West Bio Fuels
Husky Energy Inc.
NorAmera Bioenergy Corp.
Scothorn Consulting, Nova Scotia
Terra Grain Fuels
Dairysmart Nutrition, Warman Veterinary Clinic
R-Way Ag
JEFO
Canada-Saskatchewan Irrigation Diversification Centre, Outlook
Dairy Farmers of Canada
SaskMilk
Crop Development Centre
Animal and Poultry Science, University of Saskatchewan
University of Saskatchewan Scholarship Funds
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New Developments in Forage Breeding

Bruce Coulman
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Tame forage grass breeding is carried out at four locations across Canada, with two in western Canada, Lethbridge and Saskatoon. To test new varieties there is a regional network of testing in the prairie provinces, including Saskatchewan sites at Melfort, Saskatoon, Outlook and Swift Current. Alfalfa breeding is carried out at the Agriculture and Agri-Food Canada (AAFC) Centres in Lethbridge and Ste-Foy, Quebec and varieties with improved winter hardiness, disease resistance and tolerance to saline soils have been recently released. There is considerable alfalfa breeding effort in private companies in the U.S. Many new varieties with improvements in a number of characteristics are developed each year and Canadian seed companies are marketing a number of them. In 2005, the first roundup ready® alfalfa varieties were released in the U.S. Following a court-ordered suspension of sales in 2007 to prepare an environmental impact statement, sales resumed in 2011. Although roundup ready® alfalfa has regulatory approval in Canada, it is not presently sold. Trials are underway in Eastern Canada, however, as most alfalfa in western Canada is planted in mixtures, there appears to be little interest in this technology. Alfalfa with lower lignin content, and alfalfa expressing condensed tannins in leaves for bloat-safeness and increased bypass protein are presently under development. Perennial grass breeding is carried out at the University of Saskatchewan and AAFC. Recent releases include improved varieties of hybrid bromegrass, meadow bromegrass, crested wheatgrass, and orchardgrass. Development of new higher yielding, higher quality forage varieties of barley and oats is underway at the University of Saskatchewan. Recent releases include CDC Maverick barley and CDC Haymaker oat.

Barley and Corn Silage Varieties for Dairy Cattle
In Saskatchewan: 2013 Dairy Info Day

David Christensen, Peiqiang Yu, John McKinnon and others.

With the support and encouragement of dairy and beef producers in cooperation with the Saskatchewan Forage Council, AAFC, Dairysmart Nutrition and dairy producers, several projects have been undertaken to identify suitable barley and corn silage varieties for dairy cows and for swath grazing.

One of the problems in evaluating silage varieties is the variation in growing conditions from farm to farm and year to year. Table 1 illustrates the variation found in this year's barley silage samples. Starch averaged 19.6% in the 79 samples, however, 17% were less than 13.6% and 17% more than 25.6% starch. Those outside this range are more than one Standard Deviation away from the mean.

The ADOPT Project administered by the Saskatchewan Forage Council provided important information on four barley cultivars. The four cultivars (Table 2) were all smooth awned. Based on average composition from the two participating farms Sundre provided the lowest TDN and starch and the highest NDF percentages. The other three cultivars, Falcon, Legacy and Ranger were very similar (Table 3). However, the variation that can occur in one field on one farm is shown in Table 4. Dalmeny samples ranged from 14.4 to 19.6% starch and also varied in ash, iron and DCAD indicating soil variation or soil contamination of the sample. Dairysmart Nutrition made analyses of their client forage analyses available under a SADF project. These same cultivars (Table 5) also showed lower TDN and higher NDF in Sundre, and similar composition for Ranger, with higher energy and lower NDF in Falcon and Legacy. One of the unknowns in this work is the extent of rumen fermentation of NDF. Other samples analyzed by Cumberland Valley Analytical Services (CVAS) shows variation from 40 to 80% NDF rumen fermentation in small grain silage. The difference in fermentability of NDF being 40% rather than 50% could reduce milk yield by 1.5 L per cow daily. The U of S – ADF, AAFC, Beef Cattle Research Council projects (administered by John McKinnon) will include measurement of NDF fermentability. This research will include samples from Dairysmart Nutrition (Table 6) and AAFC samples from Alberta. The characteristics and CVAS composition of some of these samples is shown in Tables 7 and 8. All except Cowboy supplied more than 64% TDN and more than 18% starch. Although corn (varieties unknown) had the highest TDN, much of this difference may be associated with lower ash content.

Corn samples were supplied by AAFC at Outlook SK, with seed supplied by the companies shown in Table 9. This corn was grown under irrigation with optimum fertility. One Pioneer and one Hyland variety yielded 6.6 tonnes per acre or more compared to the average of 6.2 tonnes. TDN averaged 68%. These samples will be added to the Outlook AAFC plots that were part of the Alberta Corn Committee Project for NDF fermentation. Analyses of 2011 corn samples was in the Animal and Poultry Science Lab with support from an ADF project held by Peiqiang Yu and David Christensen. Samples from the cultivars shown in Table 10 will be analyzed in the coming year, including NDF fermentability. However, analyses by CVAS has shown less variation than for small grain silage. Table 11 shows a comparison of forage composition based on CVAS samples supplied by Dairysmart Nutrition, with corn analyses from Dairy One, Ithaca, NY.

In conclusion, although some indication of variety differences have been found, for accurate dairy ration formulation, frequent detailed analyses are required.

Table 1. Variation in Barley Silage Composition

Item **CVAS, 2012 Crop**	**Average** **79** **samples**	**17% less** **Than**	**17 % more** **Than**
Dry matter, %	**37.4**	**32.4**	**42.4**
Crude Protein, %	**11.4**	**9.9**	**12.9**
Soluble CP, % of CP	**60**	**52**	**69**
NDF, % of DM	**46.2**	**41.5**	**50.8**
Starch, % of DM	**19.6**	**13.6**	**25.6**
TDN, % of DM	**64.8**	**62.2**	**67.4**
Iron, ppm	**183**	**43**	**323**
Ash, %	**7.4**	**6.1**	**9.6**
DCAD, meq/kg DM	**447**	**306**	**588**

Table 2. Cultivar Characteristics ADOPT Project, 2012

Characteristic	Falcon	Legacy	Ranger	Sundre
Row	6	6 Malt	6 GP	6
Awn	smooth	smooth	smooth	smooth
Height, cm	68	84	75	88
Hull	loose	tight	tight	tight
Disease	F to G	P to G	VP to G	P to VG
Maturity	early	medium	+ 2 days	late
Grain Yield	low	101-104%	above Ave	116 - 120%

Table 3. ADOPT- Saskatchewan Forage Council Project, 2012

	Variety			
Item	Falcon	Legacy	Ranger	Sundre
Dry matter, %	33.1	33.8	33.8	37
Crude protein, %	14.3	13.0	13.1	10.3
Soluble CP, % CP	65.4	63.4	64.8	61.9
ADF, %	25.9	27.1	29.5	34.6
ND Residue	42.5	45.0	47.2	51.4
Sugar, %	3.8	2.2	2.5	2.6
Starch, %	17.1	19.6	15.6	13.0
TDN, %	64.9	64.6	63.9	58.3
pH	4.05	3.97	4.03	4.05
Iron, ppm	131	87	90	221

Table 4 Falcon Barley Silage Variation

ADOPT Sask Forage Council Project

Analysis	Dalmeny 1	Dalmeny 2	Osler 1	Average
Dry matter, %	36.2	33.1	30.1	33.1
Crude protein, %	12.7	15.3	14.8	14.3
Soluble CP, % CP	61.6	68.8	65.8	65.4
ADF, %	26.3	26.3	25	25.9
NDF,%	40.9	43.6	42.7	42.4
Starch. %	19.6	14.4	17.3	17.1
Potassium, %	1.82	2.12	1.92	1.95
Ash	7.8	8.2	8.3	8.1
Iron	105	146	141	131
DCAD, meq	206	280	180	222
TDN, %	65.1	64.4	65.1	64.9
pH	4.11	4.06	3.97	4.05
Acetic acid, %	0.93	2.04	1.31	1.43

Table 5. Cumberland Valley Analyses (Dairysmart Nutrition), ADF project

Item	Falcon,2	Legacy,3	Ranger,3	Sundre,3
Dry matter, %	34.9	40	39.7	35.6
Crude protein, %	11.3	12.3	10.5	10.9
Soluble CP, % CP	60.9	58.9	50.7	63.2
ADF, %	26.4	25.7	30.6	29.7
ND Residue	41.5	39.2	48.4	46.5
Sugar, %	1.6	2.3	5.1	1.2
Starch, %	23.6	26.3	17.2	20.6
TDN, %	66.8	66.8	63.4	63.8
pH	NA	4.13	NA	4.32
Iron, ppm	171	118	139	159

Table 6. Barley Silage Samples, 2012 Crop Year

SADF, Dairysmart Nutrition, CVAS

Total samples with analysis, 84

Identified Cultivars to Dec 24, 2012; 64

Cultivar	number	Cultivar	number
Metcalfe	13	Ranger	3
Copeland	8	Legacy	3
Xena	8	Sundre	3
Conlon	7	Virden	3
Cowboy	4	Champion	2
Newdale	4	Falcon	2
Rosser	4		

Table 7. Cultivar Characteristics ADF-Dairysmart Project, 2012

Characteristic	Copeland	Conlon	Cowboy	Metcalfe	Xena
Row	2 Malt	2 GP	2 feed	2 malt	2 GP
Awn	rough	smooth	rough	rough	rough
Height, cm	83	82	105	82	79
Hull	tight	tight	tight	tight	tight
Disease	P to G	VP to G	P to G	VP to VG	VP to G
Maturity	medium	2 day early	late	medium	1 day late
Grain Yield	107-108%	low	99- 105%	100%	109-166%

Table 8 Cumberland Valley Analyses (Dairysmart Nutrition) ADF Project+I63

Item	Copeland	Conlon	Cowboy	Metcalfe	Xena	Corn, Sk
Number of samples	6	5	8	14	10	10
Dry matter, %	33.9	34.8	36.5	38.1	36.8	39.4
Crude protein, %	11.3	11.1	11.8	12.0	10.9	8.0
Soluble CP, % CP	66.0	65.4	62.9	59.7	57.7	40.9
ADF, %	28.9	28.0	31.6	29.7	28.0	28.0
ND Residue	45.5	43.1	49.0	47.0	45.7	46.2
Sugar, %	2.87	1.98	3.48	2.08	2.39	2.23
Starch, %	18.4	24.5	12.1	19.3	23.5	25.2
TDN, %	66.3	64.8	63.2	64.2	65.2	67.3
pH	4.02	4.02	4.24	4.16	4.05	4.03
Iron, ppm	266	301	134	177	145	157
Ash	6.73	8.4	8.3	7.49	6.67	4.98

Table 9 AAFC Outlook Corn Green Chop Composition, 2011

Item	**Hyland HL SR06**	**Hyland HL SR 22**	**Hyland BAXXOSRR**	**Pioneer P7213R**	**Pioneer 7443R**	**Pioneer 7535R**	**Average**
Target Crop Heat Units	2250	2525	2250	2050	2100	2100	
DM Yield Tonnes/acre	5.9	6.7	6.1	**6.6**	5.9	5.9	6.2
Crude Protein, % DM	8.95	7.07	6.16	6.90	7.25	6.40	7.12
Soluble CP, % CP	42.5	44.4	51.1	45.4	42.5	46.7	45.4
ADF, % DM	26.9	31.2	28.5	26.5	28.9	28.2	28.4
NDF, %DM	46.9	54.0	48.9	47.2	49.8	49.8	49.4
NDF % rumen fermented	53	59.0	52	**63**	53	49	55
Starch, % DM	25.2	16	22.2	27.5	25.8	24.6	23.6
Ash, % DM	5.4	5.0	5.2	4.6	4.7	4.5	4.9
TDN, % DM (NRC 2001)	68.7	66.1	67.1	**69.8**	67.9	68.6	68.0
NEL 1x, Mcal/kg DM	1.60	1.53	1.54	**1.62**	1.58	1.59	1.58

Table 10 Alberta Corn Committee Corn Green Chop Yields, 2012

Yield LSD, 1.1 Company	Hybrid	Silking Date	Yield/acre Tonnes
Hyland	3093	Aug 9	7.20
Hyland	R219	Aug 8	7.85
Hyland	3085	Aug 9	7.12
Hyland	BaxxosRR	Aug 6	5.91
Hyland	3120	Aug 12	7.08
Pickseed	2262RR	Au8 8	6.39
Pickseed	SilExBtRR	Au8 8	7.24
Pickseed	22248VT2P	Aug 11	7.04
Seeds 2000	2791RR	Aug 9	7.77
Syngenta	NO4F-3000GT	Aug 10	7.20
Syngenta	N12R-3000GT	Aug 12	8.05
Syngenta	N20Y-3000GY	Aug 12	7.97
Syngenta	N08N-GT/CB/LL	13-Aug	7.04

Least significant difference, LSD. Differences between means
If more than 1.1 they are 95% likely to be different.

Table 11. Silage and Hay Composition, 2011 Crop

	Corn USA 10 year Ave	Corn Sk,CVAS 2011	Barley silage Sask, CVAS 2011	Alfalfa Hay 2011	Alfalfa Silage 2011
Number of samples	191,500	45	105	82	35
Dry Matter	33.8	36.8	34.8	86.4	40.4
Crude Protein	8.23	8.49	11.3	18.8	18.0
Soluble CP, % of CP	53.4	50.3	62.8	35.8	65.5
ADF, % in DM	26.1	28.4	30.5	36.0	38.2
ADF Protein, (ADICP) % in DM	0.62	0.79	0.91	1.56	1.63
NDF, % in DM	44.1	49.4	52.2	46.5	45.3
NDF Protein (NDFICP) % in DM	1.25	1.20	1.19	3.80	2.13
Lignin, %DM	3.36	3.19	4.52	8.52	8.57
Fat (EE), % DM	3.31	2.61	3.18	1.82	3.13
Ash, % DM	4.24	4.85	7.74	8.42	10.82
Sugar, % DM	2.12	2.06	2.87	7.08	2.23
Starch, %DM	31.3	23.6	18.4	2.58	2.13
Calcium, % DM	0.25	0.21	0.39	1.49	1.62
Phosphorus, % DM	0.24	0.25	0.29	0.21	0.24
Magnesium, % DM	0.17	0.19	0.19	0.31	0.32
Potassium, % DM	1.10	1.25	1.77	2.40	2.52
Chloride, % DM	0.26	0.21	0.45	0.28	0.32
TDN, % DM	70.4	68.3	63.9	58.0	56.8
NEL, Mcal/kg DM	1.59	1.56	1.45	1.30	1.28

Manure as a Source of Plant Nutrients: Use ‘em, don’t lose ‘em!

J.J. Schoenau and T.N. King, Department of Soil Science, University of Saskatchewan

S.S. Malhi, Agriculture and Agri-Food Canada Melfort Research Station, Melfort, SK

Summary

Short and long-term application of manure to Saskatchewan soils at agronomic rates of nutrient that balance crop removal over time contribute to significant yield and protein benefits in the crop while minimizing nutrient loading and risk of escape to soils and water. By adding nutrients and organic matter, manure addition at agronomic rates has a positive effect on plant growth and economic return. Nutrient loading and escape issues to not appear to be a concern at agronomic rates: rate of nutrient applied (example phosphorus) is in balance with that needed and removed by crops over the years. Water quality can be protected by recognizing the potential for nutrient transport with water in soils that are overloaded with manure nutrient, and reduce nutrient load through rate adjustment.

Recommendations

Manage manure like a fertilizer. Test manure to determine nutrient content and availability. Soil test to determine how much manure nutrient is required to meet crop demand and ensure manure nutrients are applied that match crop nutrient demand. Monitor changes in soil properties over time. Ensure proper balance of available nutrients in manured soil, supplement with commercial fertilizer if necessary. Use application practices that will get manure into the soil to reduce volatile ammonia gas losses and odor, ensure manure nutrient is close to roots for plant uptake.

Update on Heel Warts

Christopher Luby
Assistant Professor, Dairy Field Service
Western College of Veterinary Medicine

Take Home Points

- Heel warts are characterized by erosion between the heel bulbs
- Heel warts are caused by bacteria
- Heel wart control focuses on maintaining a clean environment and the appropriate use of footbaths
- Foot trimming is important to identify and treat the disease

Introduction

Heel warts are also known as digital dermatitis, hairy heel warts, hairy hoof warts, strawberry footrot, Mortellaro's disease and Italian footrot. It is a skin disease causing erosions between the heel bulbs. It is an extremely painful condition. Heel warts are caused by bacteria of the *Treponema* group. The Alberta Dairy Hoof Health project has shown that heel warts are by far the most common cause of lameness on dairy operations.

Control Measures

Maintaining a clean, comfortable cow environment and appropriate use of footbaths are crucial to control heel warts. Comfortable stalls are important since a cow should spend 12 hours a day lying. Alleyways must provide a clean environment for the cow's feet. One thing to bear in mind is that automated alley scrapers may wash the animal's feet with manure, increasing the risk for heel warts.

The purposes of footbaths are to clean the foot and disinfect the space between the digits. Footbaths are effective in control but not treatment of heel warts. Several compounds have been used including copper sulphate, formalin, zinc compounds, other disinfectants and plain soap. The frequency of footbath use depends on the cleanliness of cow's hooves and legs. When a footbath is not being used cows should be able to bypass it to ensure that they do not walk through accumulated manure. Cows that have moderately dirty legs are those with at least distinct plaques of manure on the foot that progress up the leg.

Recommendations for footbath frequency

Proportion of cows with moderately dirty legs	Suggested footbath frequency
Less than 25%	As required
25 – 50%	2 days/week
51 – 75%	5 days/week
Over 75%	7 days/week

A water only bath immediately before the chemical footbath is not recommended as the solution will be diluted by the water. The treatment bath should contain solution at least 5 inches deep, should ideally be 10 feet long and should be as wide as the alley. The solution must be labeled specifically for the control of heel warts. If antibiotics are to be used in footbaths they must be used under the supervision of a licensed veterinarian as these uses are off label.

Treatment

Prompt identification and treatment of heel warts is crucial. Many treatments have been attempted including antibiotics and non-antibiotic compounds. Treatments have been applied using wraps, pastes or sprays. A lot of these treatments have not been studied in depth. Oxytetracycline applied through a wrap or paste is commonly used and generally effective. This is off-label antibiotic use so should be used as directed by a veterinarian and milk must be tested before addition to the bulk tank.

Acknowledgements

Dr. Chris Clark (WCVM) and Dr. Andy Potter (VIDO) were involved in putting together this presentation. The table of recommended footbath frequency is from Dr. Nigel Cook at the University of Wisconsin.

Saskatchewan Dairy Herd Health and Screening Initiative:

What's in your bulk tank?

Steve Hendrick[1], Deb Haupstein[2], Wendy Wikins[3]

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Take Home Points:

- Johne's disease, bovine leukosis virus and *Staphylococcus aureus* are common infections on Saskatchewan dairy farms.
- While bovine viral diarrhea virus, *Streptococcus agalactiae* and *Mycoplasma bovis* are less commonly found in bulk tank milk samples.
- A negative test result doesn't mean your herd is free of that particular disease!

Background:

Johne's disease, bovine leukosis virus (BLV), bovine viral diarrhea virus (BVDV) and contagious mastitis are all considered production limiting diseases in Canadian dairy herds.

Johne's disease is a bacterial infection cause by *Mycobacterium avium* subsp. *paratuberculosis* (MAP). Infection with MAP causes abnormal thickening of the lining of the intestinal tract in infected animals, restricting the absorption of nutrients. It is spread through the shedding of the bacteria in manure, which can contaminate feed or water, and also can be transmitted to calves through colostrum or milk from infected cows. Clinical symptoms include long lasting diarrhea and weight loss despite maintaining a relatively normal appetite. These symptoms often appear between 3 to 6 years of age. The impact on profitability of a herd includes reduced milk production, increased involuntary culling, loss of heifer sales and reduced beef production. The bigger concern at this time is its questioned link to Crohn's disease in people. Johne's disease can't be treated and vaccination is not available in Canada because it causes a cross reaction with tuberculosis (TB) tests. Recent estimates suggest that up to 60% of dairy herds have MAP present on their farm. Controlling MAP focuses on preventing exposure of calves to contaminated manure, milk and colostrum.

Bovine leukosis virus is a blood borne retrovirus that causes tumours in the lymph nodes, uterus, heart, abomasum, spleen, kidneys and brain. BLV is spread by the transfer of blood cells from infected animals via re-use of contaminated equipment, colostrum and waste milk and transmission to the calf before it is born. Infection with BLV is common in Canadian dairy herds. Production loss is difficult to measure as only 5% of infected cattle ever show clinical disease. Clinical symptoms caused by resulting tumours include weight loss, decreased milk production and immobility. Impact on profitability of a herd includes reduced milk production in infected cows and condemned meat at slaughter, as well as potential costs associated with lost marketing opportunities such as the sale of replacement stock, bulls to AI or embryos, domestically and to international markets.

Bovine Viral Diarrhea (BVD) is a viral infection in cattle and can result in significant economic losses. Infections are either transient infections (TI) or persistent infections (PI). TI's are the result of exposure to the virus and in most cases a healthy animal will mount a natural immune response and the infection will take its course in a few days, with no clinical signs of disease. However, ongoing exposure and TI's passing from animal to animal results in a decline in herd performance. Common signs of infection include respiratory problems, infertility, and abortions. Infections eventually lead to reduced milk production and early culling. On the other hand, PI animals are permanently infected, shed the virus for their entire life and will be a continuous source of BVD virus, thereby becoming an important cause of TI's and herd performance problems. PI animals are generated by infection of unborn calves (between 40 and 120 days of pregnancy), when the dam is exposed to the BVD virus. PI calves most often do not survive to breeding age or enter the herd due to their compromised immune system, but when they do, they become a main source of BVD exposure and infection for herd mates.

The major contagious mastitis bacteria are *Streptococcus agalactiae* (Strep ag), *Staphylococcus aureus* (Staph aureus), and Mycoplasma species. With the exception of some mycoplasmal infections that may originate in other body sites and spread systemically, these three organisms gain entrance into the mammary gland through the teat canal. Contagious organisms are well adapted to survival and growth in the mammary gland and frequently cause infections lasting weeks, months or years. The infected gland is the main source of these organisms in a dairy herd and transmission of contagious pathogens to uninfected quarters and cows occurs mainly during milking time.

Objectives:

The objective of this study was to determine the occurrence of these production limiting diseases in Saskatchewan dairy herds and to assist producers and veterinarians develop management strategies to address these diseases.

Methods:

In July 2012, bulk tank milk samples from 171 herds in Saskatchewan were submitted to the CanWest DHI laboratory in Guelph, ON. The samples were tested for Johne's disease and BLV using indirect ELISA tests, and for BVDV and contagious mastitis using PCR.

Results & Discussion:

The results of the testing are summarized below:

Pathogen	Result		Number	%	Total Positive	%
Johne's	High		6	4		
Disease	Pos		51	30	88	51
	Susp		31	18		
	Neg		83	49		
BLV	Pos		168	98	168	98
	Neg		3	2		
BVD	Pos		3	2	3	2
	Neg		168	98		
Staph aureus	Pos	+++	1	1		
		++	8	5	114	67
		+	105	61		
	Neg		57	33		
Strep ag.	Pos	+++	0	0		
		++	1	1	1	1
		+	0	0		
	Neg		170	99		
M. bovis	Pos	+++	0	0		
		++	2	1	4	2
		+	2	1		
	Neg		167	98		

Screening bulk tank milk samples is a convenient way to assess the disease status of a dairy herd. However, there are limitations to this approach. It is possible that infected or exposed cattle may be dry at the time of sampling and may not be included in the testing. Some bacteria like *Staph aureus* are not continuously passed into the milk. Testing for Johne's disease is difficult because the bacteria remain in the intestinal tissue of infected cattle until late in the disease, meaning that measurable antibodies in the blood or milk are unpredictable. Repeated testing would give more confidence in negative results.

In 2005 it was reported by VanLeeuwen *et al*. that herd prevalence of BLV in Saskatchewan dairy herds was 89% (81-97%), 43% (27-59%) for Johne's disease (1 or more cows positive) and 29% (13-45%) for BVDV. These findings are similar to results of this project. Our goal is to create awareness regarding these diseases and start discussion with industry on their control.

Update on Somatic Cell Counts

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Take Home Points

- Clinical mastitis is only the tip of the iceberg – subclinical cases may occur that are not noticed
- Several proven mastitis control strategies exist
- You cannot treat your way out of a mastitis problem
- Almost all somatic cell count problems can be controlled with good advice, teamwork and motivation
- Mastitis control is an active research area at the University of Saskatchewan
- Your veterinarian should be your major resource for advice about mastitis control

Introduction

Mastitis is primarily a bacterial syndrome which causes inflammation of the mammary gland. It is thought to cause losses to the Canadian Dairy Industry of $300 - $400 million each year. Cows with mastitis produce less milk than those without mastitis. Mastitis is the most common reason for antibiotic use on dairies. The mastitis situation on a dairy is monitored by determining bulk tank somatic cell count (SCC). The legal SCC limit is Canada is 400,000 cells/ml. This article will give a brief overview of the causes of mastitis and some proven control strategies.

Causes of Mastitis

Mastitis is most commonly caused by bacterial infection. Bacteria that cause mastitis are classified by their source. Contagious bacteria survive in the udder and are transmitted between cows during milking. Common examples of contagious bacteria include *Staph aureus*, *Strep agalactiae* and Mycoplasma. Environmental bacteria survive in the environment (e.g. bedding, alleys) and are transmitted between milkings. Common examples of environmental bacteria include *E coli*, *Strep uberis* and *Pseudomonas*.

Some bacteria that cause mastitis can act in both contagious and environmental ways. The most common example is *Strep dysgalactiae*. Coagulase-negative staphylococci (CNS) are a group of bacteria that are thought to cause mild mastitis.

Proven Control Measures

Correct milking order
High-risk cows should be separated from healthy cows so that the milking machine is not contaminated. The ideal order should be: (1) healthy cows, (2) suspect cows (e.g. new arrivals, fresh cows, cows that have finished treatment), (3) chronic mastitis or chronic high cell count cows and (4) contagious cows (e.g. Staph cows). The ideal milking order may be difficult to achieve depending on the size of the dairy and the number of pens.

Milking time hygiene
Wearing gloves during milking can reduce the transmission of bacteria between cows by up to 50%. Gloves should ideally be non-latex and be cleaned frequently during the milking process. Milkers should only touch the teats and the milking machine. New gloves should be worn for each milking.

Teat dipping
Dipping teats before and after milking (pre- and post- dipping) is a crucial part of mastitis control. The pre-dip should be on teats for at least 30 seconds. Teats should be thoroughly dried using a single use towel before the unit is attached. All dips should cover the entire teat. This is more frequently achieved using a dip rather than a spray. All teat dips should be approved by Health Canada and have a DIN number.

Other milking procedures
Foremilk should always be checked before milking. Milk letdown is stimulated from touching the udder (e.g. stripping and dipping). Following stimulation, 60-90s should be allowed before unit attachment. Well-adjusted automatic takeoffs should be used to avoid overmilking.

Milking system
Teat cup liners should be replaced according to manufacturer's recommendations. The whole milking system should be checked once to twice a year by an expert. This check should include a complete written report. Recommended changes should be carried out as soon as possible.

Dry cow treatment
Your veterinarian will be able to help in establishing the details of dry cow treatment. The antibiotic used must be labeled for dry cow treatment and the labeled withhold period must be followed. Internal teat sealants may be used depending on the advice of your veterinarian. Treatments must all be recorded. First test cell count should be monitored to identify if cows are freshening with mastitis.

Culling problem cows

Cows to consider culling are those infected with contagious or incurable bacteria (e.g. *Staph aureus*), those with consistently high cell count and those with multiple clinical flareups.

Clean cows and environment
Frequent stall cleaning and bedding management will help cows and the environment remain clean.

Summary

Teamwork between the producer, veterinarian and other advisors is crucial to control cell count. Good mastitis control programs do exist with research that demonstrates their effectiveness. The most important part of mastitis control is to implement these programs on the farm. We have the techniques to control mastitis – all that we need to do is use them!

The following resources may help in mastitis control. However, nothing can replace a herd visit by a veterinarian.

1. The Canadian Bovine Mastitis Research Network: this is a network that brings together mastitis experts from around Canada to find solutions to mastitis. It has several on-line resources that are accessible to you and your veterinarian. Their website is: http://www.medvet.umontreal.ca/rcrmb/en/index.php
2. National Mastitis Council: this is a global, not-for-profit professional organization devoted to reducing mastitis and enhancing milk quality. It also has several on-line resources. Their website is: http://www.nmconline.org

Mastitis Research at the University of Saskatchewan

We are currently researching coagulase-negative staphylococci on Saskatchewan dairy farms. These bacteria seem to be more of a problem in herds with low cell count. Currently we do not know how much of a problem they are or how they can be controlled. We have a project in conjunction with the University of Calgary funded through Alberta Milk which aims to answer some of these questions. If you are interested in your herd being included in this research, please contact Dr. Chris Luby at the University of Saskatchewan Western College of Veterinary Medicine. We will provide a free mastitis consultation including herd cultures, milking system and environmental evaluations for all participating herds.

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Use of Glycerol and High Oil Canola Meal in Dairy Rations

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With the drive towards renewable fuels it is estimated that significant quantities of not only distillers by-products will become available, but also as bio diesel production increases to meet demand, glycerol and protein meals will be available. Approximately 10% of the original oil processed for bio diesel results in glycerol as a by-product. Glycerol as a substance is a highly viscous liquid that can readily mix with water and exists as a sugar alcohol. Unfortunately in the trans-esterification process, methanol used to purify the biodiesel may remain in the glycerol as residue along with salts which must be removed for use in a variety of situations. Glycerol by itself is a sweet tasting high energy (glucogenic) substance, with valued use in cosmetics, food and a variety of special uses owing to its special properties.

Glycerol use as a feed has interest in both the US, Europe and Canada, with several feeding trials having been done in the US and Europe with different species. These trials mainly used pharmaceutical grade glycerin as raw glycerol is not licensed as a feedstuff for use due to its higher methanol and salt content. The glycerol used for most of these trials in the US was from a bio diesel plant in the Midwestern United States that further processes the glycerol for specialized uses with higher returns. The feeding trials have been most encouraging illustrating potential opportunities of the use of glycerol as a specialized feed stuff having an energy content similar to corn. It is highly digestible with almost all rapidly fermented to propionate in the rumen. The following table is a summary of glycerol analysis from a paper by Schroder, A. and K. Sudekum, University of Kiel, Germany titled "Glycerol By-product of Bio Diesel Production for Ruminants". It should be noted that many in the industry in the US are purifying their glycerol below 2% methanol to have a saleable product.

Table 1: Glycerol Analysis (variable, depends on source)

Variable/Purity	**Low**	**Medium**	**High**
Water%	25 - 28	10 - 12	2.0 – 3.0
Glycerol (% of DM)	60 - 65	85 - 90	98 – 99
Ether Extract %	0.8 - 6	0.4 – 0.7	?
Phosphorus %	0.9 – 1.5	2.0 – 2.5	?
Sodium %	0.11	0.09	?
Methanol %	24 - 27	0.04 – 1.0	-----

Currently in the US, FDA allows the use of glycerol that contains less than 0.15% methanol at levels up to 10% of monogastric diets or 15% of ruminant diets or of a level that has been demonstrated to be safe for the animals and product produced. The European expert committee suggests less than 0.5% methanol in the glycerol and use up to 10% of diets for ruminants. In Canada, CFIA has been contacted and a working relationship has been established with them as to how feeding trials could proceed utilizing glycerol as a feed stuff. Glycerol use in feeds in Canada has not been allowed in the past unless the glycerol is of pharmaceutical grade. Currently CFIA has made allowances under a temporary use permit, for use of glycerol with less than 0.15% methanol and use up to 5% of dry matter in beef diets. It is expected use in dairy will follow.

A second problem exists in the industry, as most bio diesel producers are looking for higher value use for some of their glycerol other than as a strict feed source to replace grains with lower value. The special properties of glycerol however, do lend themselves to creating specialized feed stuffs with much higher value that could be cost competitive. In light of the past investigations and indirect advice from industry this was the avenue pursued in our research as the most practical and economically innovative means to help deal with glycerol.

The second by-product available from bio diesel production is canola meal that comes from extracting oil from distressed canola seed. Many of these meals arise from cold press extrusion with no solvent extraction and are different and should be recognized for their differences from regular canola meal. Cold press meals are higher in oil (10 – 12%) and therefore energy (82 – 84% TDN) and similar in protein and mineral content. But because of processing they may behave differently in supplying nutrients to the animal. Table 2 shows the effect of different canola meals on nutrient and rumen behavior as given by Gozho et al. 2009, Canadian Journal of Animal Science.

Table 2: Comparing Canola Meal Types

Item	RCM	RCMO	CPC	RUCMO
Total Tract Dig.				
OM.	76.3	75.7	76.5	74.9(a)
NDF	50.5	48.6(a)	50.6	46.3(a)
ADF	48.1	44.6(a)	46.2	42.7(a)
Flow to Duodenum				
Total N g/day	138	132	135	135
Ammonia N g/day	2.40	1.65	1.76	1.79
Microbial N % of intake	80.1	79.3	78.0	79.7
Amino Acids g/day				
Lysine	54.9	50.4	56.0	56.0
Methionine	11.0	11.1	12.3	13.2

This trial compared RCM (regular canola meal), RCMO (regular canola meal with 1.8% oil), CPC (canola press cake (MBio meal)) and RUMCO (rumen undegradeable canola meal with 1.8% oil). Values with the same subscript are not statistically different (P<0.01). Items to note is the effect on fibre digestibility from the free added oil, yet the CPC diet with the same oil content did not interfere with fibre digestibility, but was still digested and available. Secondly the protein quality is such that the amino acid flow to the duodenum was superior to regular canola meal for the CPC and RUCMO. These characteristics give added value to the high oil meal.

We performed several feeding trials to evaluate these biofuel byproducts. In a first feeding trial glycerol was fed to lactating dairy cows at levels of 0.6 Kg, 1.2 Kg and 2.4 Kg per cow per day. The glycerol was included at the 0.6 Kg level in a pelleted concentrate and the added glycerol was top dressed. The control and supplemental concentrate was also pelleted and contained no glycerol. We used 8 cows in two 4 X 4 Latin square feeding trial. Milk production, feed intake and milk composition were measured. The results are given in Table 3 and are both revealing and encouraging. Literature had indicated a problem with decreased feed intakes; however we did not encounter any problems with equal feed intakes to controls. There is need for an adaptation period of 7 to 10 days for the cows to adjust to glycerol. The glycerol was well accepted and cows actually sought out glycerol containing feed, more on this aspect follows later in this paper where a preference trial with cows was done. From the table it can be seen that milk yield increased along with fat corrected milk and energy corrected milk yield. There were lower butterfats and occurred on all four treatments and likely due to the feeding of a pelleted concentrate and failure to adjust the effective fibre content of the concentrate. The levels of 0.6 to 1.2 Kg of glycerol per day were from this data and the feed rations used in this case were our best performing diets. The weight gains observed on the cows suggest increased energy intake over and above that needed for milk production.

There was an overall increase in milk yield of at least 1.5 Kg. per day per cow that could be attributed to a 1 Kg feeding level of glycerol. The return of $0.80 per liter of milk certainly would put glycerol in that area of a cost competitive specialized feed source. We discovered several aspects related to the feeding of glycerol. Glycerol can be top-dressed and is well accepted by the cows over and above their regular diet. There is needed a 7 to 10 day adjustment period. Lastly and most importantly glycerol must be added to diets in a pre-planned manner to be able to capture the added near instant energy available from glycerol. This means adjustment in form as well as nutrient content (protein, etc.).

With these thoughts in mind a second feeding trial was started using transition dairy cows in that period 14 days prior to calving to 42 days after calving. Because cow nutrition in this period is a moving target and is over laid with a variable feed intake it was decided to feed 1.0 Kg of glycerol per cow per day and a diet of 1Kg glycerol plus 1 Kg of high oil canola meal to replace the 1 Kg of canola meal regularly used, compared to the standard diet as a control. There were 24 cows fed in a randomized block design fed one of three diets through this transition period.

An important part of the evaluation of the trial with the transition cows is the change in physiological parameters which indicate metabolic status of the cows particularly as related to energy metabolism. This trial has emphasized the capability of transition cows to maintain milk production from their body stores regardless of modest changes in their diet and thus the greater importance of physiological data. The blood plasma levels of glucose, insulin, NEFA, and BHBA all point to a better energy balance for the glycerol groups in particularly that with high oil canola meal added. Milk yield data show higher FCM and ECM yields for the glycerol groups due to milk fat and protein particularly for the glycerol canola meal group. We did not observe a lowered butterfat in this trial and it should be pointed out that the yield potential in the glycerol canola meal fed cows more than meets energy needs and energy was available to increase butterfat. The substitution of high oil canola meal for the regular canola meal not only contributed more energy but a more efficient protein source was matched to the available energy. This is evidenced by the higher milk protein and lower MUN.

The cows readily accepted their feed particularly that which had glycerol top dressed and mixed into the TMR. Three of the eight control cows and one of the eight on the glycerol alone had to be treated for ketosis with glycol, while the other cows did not require treatment. All cows treated were in that day 7 to day 14 period. Data was collected at day 7, 14, 21, 28, 35 and day 42. Statistical analysis showed significantly different treatment effects for the items in the table above. The combination of glycerol and high oil canola meal had by observation of a number of parameters a more suitable feeding program. The effect on reproduction will be summarized when it comes available.

These results show a 1.5 Kg FCM and ECM yield advantage for the glycerol groups which at present milk prices again places these feeds in a very strong competitive situation as a specialized feed source. In addition the healthier cows observed in this trial for glycerol groups are a major plus. Transition cows are difficult at best to feed, however the success of this trial is attributable to providing feeds that have higher target yields and is the only way of accommodating a moving target. The next research initiative led by the SaskMilk and co supported by North West Bio Fuels and Milligan Bio Tech recognizes this aspect and is the next step in development of high value supplements based on bio fuel by-products. This trial will be one of the first in the new dairy facility.

Table 3: Glycerol Lactating Cow Project data (statistical analysis and Cow Response)

Effect of glycerol level (T0 = Control, T1 = 0.6 kg, T2 = 1.2 kg, and T3 = 2.4 kg) on dry matter intake (DMI), weight gain (WG), milk and individual nutrient yield and milk compositions of lactating dairy cows[1]

Items	Glycerol Level (Unequally Spacing TRTs)				SEM[2]	Polynomial contrast[3] P value			P value			
	T0 Control	T1 0.6 kg	T2 1.2 kg	T3 2.4 kg		Linear	Quadratic	Cubic	Trt	Square	Period	Cow
Dry matter intake (DMI)												
DMI (kg/d)	26.16	26.88	26.63	26.75	0.284	0.2985	0.3140	0.2500	0.3348	<.0001	0.0012	0.0001
Weight gain (WG)												
WG (kg/cow/d)	-32	310	166	408	163.5	0.1265	0.7186	0.2651	0.2917	0.9667	0.0593	0.7700
Milk yield												
Total Milk (kg/d)	43.56	45.92	46.06	46.86	1.339	0.1350	0.4485	0.6172	0.3720	0.0091	0.0081	<0.0001
FCM (kg/d)	39.21	42.25	40.18	40.70	1.758	0.8028	0.5755	0.2958	0.6737	0.0002	0.0790	0.0164
ECM[4] (kg/d)	40.05	41.90	42.34	42.65	1.480	0.2688	0.5002	0.8165	0.6144	0.0002	0.0090	0.0018
Protein (kg/d)	1.39	1.46	1.47	1.52	0.039	0.0394	0.5124	0.6476	0.1698	0.0204	0.0031	<.0001
Fat (kg/d)	1.26	1.30	1.32	1.30	0.069	0.6615	0.5776	0.9742	0.9117	<.0001	0.0166	0.0061
Lactose (kg/d)	2.01	2.12	2.14	2.20	0.064	0.0704	0.5179	0.6404	0.2585	0.0172	0.0055	<.0001
Solids-not-fat (SNF[5], kg/d)	1.45	1.20	1.34	1.15	0.078	0.0384	0.7195	0.0698	0.0620	0.538	0.4657	0.1003
Efficiency												
Ratio of DMI to FCM yield	0.69	0.64	0.69	0.66	0.030	0.7150	0.7074	0.2124	0.5891	0.0371	0.6425	0.2125
Milk composition												
Fat (%)	2.88	2.89	2.87	2.82	0.107	0.6776	0.8443	0.9643	0.9731	<.0001	0.1147	<.0001
Protein (%)	3.18	3.20	3.20	3.24	0.035	0.2785	0.9257	0.7970	0.7229	0.3255	0.1213	<.0001
Lactose (%)	4.61	4.63	4.64	4.70	0.022	0.0097	0.7792	0.9286	0.0665	0.1722	0.0450	<.0001
Solids-not-fat (SNF, %)	8.77	8.81	8.83	8.91	0.036	0.0113	0.7943	0.7627	0.0736	0.0837	0.0861	<.0001
Total solid	11.57	11.63	11.63	11.69	0.083	0.3320	0.9337	0.7961	0.7824	<.0001	0.0132	<.0001
MUN[6] (mmol/L)	16.5	13.7	15.2	12.8	0.86	0.0196	0.7520	0.0556	0.0344	0.5936	0.3952	0.2030
SCC[7] (10^3 cells /ml)	24	40	30	28	6.8	0.9684	0.2974	0.2057	0.4316	0.0756	0.1955	0.0408

[1] Experimental Design: a double 4×4 LSD. Two Latin squares: each with four dairy cattle in four periods of one month.
[2] Means with different letters in the same row differ (P<0.05). SEM = standard error of mean.
[3] Coefficients for polynomial contrast: [L: -0.591608 -0.253546 0.0845154 0.7606388]; [Q: 0.5640761 -0.322329 -0.644658 0.4029115]; {C:-0.286039 0.7627701 -0.572078 0.0953463}
[4] ECM = Energy corrected milk. [5] SNF =Solids-non-fat (SNF); [6] MUN = Milk urea nitrogen. [7] SCC = Somatic cell count.

Table 5: Transition Cow Feeding Trial Results (24 cows; 3 test groups; for Day 21 and Day 42 after parturition)

	Control		**1 Kg Glycerol**		**1.0 Kg Glyc+1.0 Kg CM**	
Item/Day	**21**	**42**	**21**	**42**	**21**	**42**
Cow Av Weight Kg	726.8	714.5	696.8	690.22	738.0	735.12
DM Intake Kg/day/cow	26.76	30.05	25.83	29.9	26.83	30.11
Plasma						
Glucose mmol/L	3.10	3.11	3.25	3.2	2.99	3.2
Insulin uU/ml	0.975	1.3	1.35	3.0	2.44	3.01
NEFA mmol/L	0.27	0.092	0.13	0.059	0.012	0.074
BHBA mmol/L	0.56	0.69	0.65	0.72	0.748	0.716
Milk						
Yield Kg	52.76	57.72	52.97	56.08	49.27	51.47
3.5% FCM	51.1	55.47	52.45	56.99	53.79	56.15
ECM Kg	56.26	57.43	55.88	59.92	57.64	59.88
Fat %	3.57	3.26	3.44	3.6	3.94	4.06
Protein %	3.05	2.93	3.06	2.88	3.28	3.1
MUN %	12.76	14.19	12.11	13.16	10.53	13.06
Lactose %	4.58	4.6	4.52	4.48	4.73	4.75

Note: Data points are average of 8 cows; NEFA = non-esterified fatty acids; BHBA = Beta hydroxyl butyric acid (a ketone from lipolysis); FCM = fat corrected milk; ECM = energy corrected milk; MUN = milk urea nitrogen.

Preference Trials: The last step in this research series on glycerol was to evaluate the feed acceptance influence of glycerol, its ability to bind feed particles and prevent sorting and evaluate it as a preservative. During the summer of2012 a preference trial was done. Justine DeNure a summer assistant was hired to feed and accumulate data. Her help was much appreciated.

Results: Table 6 summarizes the results of the preference trials. Both the alternating and side by side comparisons show a very strong preference for the feed containing glycerol. The high oil canola meal and WDDGS as a mix was of sufficient quality to provide a response although less than when glycerol is included. It should be concluded that cows show a very strong preference for glycerol containing feed. It is strong enough to initiate a learned behavior as evidenced by having to discontinue the alternating comparisons. Further no reliable evaluations could be done on particle size to test binding capability of glycerol to prevent sorting as the glycerol tubs had little or no weigh backs. Weigh backs could only be done on the non-glycerol feeds. The strong preference for glycerol suggests that glycerol may be used to prevent feed sorting in the TMR and thus may promote improved rumen health. There is recent evidence for this in the literature. As an explanation the side by side comparison is offering the feed in two tubs and placed beside each other so the animal has a choice. The tubs in this case were changed around every 5 minutes from left to right for a total of 40 minutes of feeding time. In the alternating method only one tub at a time is placed for five minutes and a total feeding time of 40 minutes. Learned behavior was a problem with the alternating method as the cows learned to wait. The animals were allowed access to both tubs after the 40 minutes which had 10% daily overage in quantity. There were little or no weigh backs with the glycerol containing feeds and thus negating particle size evaluation.

These feeding trials indicate that glycerol is a preferred feed high in energy and digestibility capable of offering dairy diets traits, that are not available in other feed sources. It can be used as a valued competitive feed source however rations should be balanced to capture the added energy potential that is available from glycerol by adjusting the degradation rates of both the carbohydrate and protein fractions.

We acknowledge the funding and assistance of the following groups and look forward to their continued cooperation in the next series of experiments for diet evaluation.
ACS-CAAP Saskatchewan
ADF Saskatchewan
Cargill Animal Nutrition
Milligan Bio Tech
North West Bio Fuels
Saskatchewan Canola Development Commission
Canola Council of Canada

Table 6 Preference Trial

(amount remaining after 40 minutes feeding Kg/cow/day (5 day Av)

	1.2 Kg Glycerol				0.6Kg Gly		CM+WDDG+Gly		CM+WDDG	
	Side by side		Alternating		Side by side		SXS (1+1+1)		SXS (1+1)	
	Glycerol	**No Gly**	**Gly**	**No Gly**	**Gly**	**No Gly**	**B of B**	**No B of B**	**CM+WD**	**No CMW**
Mean	**6.92**	**11.77**	**8.93**	**10.78**	**8.29**	**11.79**	**8.26**	**12.72**	**8.96**	**13.43**
SE	0.58	0.60	0.42	0.43	0.51	0.38	0.66	0.40	0.56	0.23

Opportunities and Challenges for Feeding Low Crude Protein Rations to Dairy Cows

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- **Take-Home Messages**

  - If your ration crude protein content is 17-18% or higher, then feeding a lower CP ration (15-16% CP) might be a viable strategy to improve the efficiency of milk production, lower feeding costs, and decrease N excretion into the environment

  - Before implementing a lower CP ration on your farm, an in-depth evaluation of your current ration and feeding management practices needs to be done by you and your nutritionist to determine if your farm is a good candidate for feeding a lower CP ration

  - If your farm is a good candidate, you and your nutritionist will need to identify goals and objectives of switching to a lower CP ration, and then develop a plan before any ration changes are implemented

  - When you start feeding a properly-balanced lower CP ration, close monitoring of your herd's production variables (e.g., feed intake, milk yield, MUN) is very important.

Feed crude protein (CP) contains nitrogen (N) in the form of amino acids that are required for growth and milk production in dairy cows. Amino acids are the building blocks of milk protein. Optimizing dietary CP utilization in dairy cows has always been a major challenge for dairy producers and dairy nutritionists. Milk N efficiency (MNE) is a commonly-used index for assessing the efficiency of conversion of feed N into milk N, and it is calculated as the quantity of N secreted in milk expressed as a proportion of feed N intake. Under field conditions, MNE values in dairy cows range from 20 to 35%. What this means is that most of the feed N (65 to 80%) that a dairy cow consumes is excreted in the manure, thus reducing air quality and contaminating surface and underground water resources. For this reason, the dairy industry is under increasing public pressure to reduce N excretion into the environment and to more efficiently utilize feed resources. Feeding low CP rations is a viable nutritional strategy that dairy producers and their nutritionists can explore in order to optimize N utilization in dairy cows, with the additional benefits of: 1) improving profitability by lowering feed costs; 2) improving reproductive performance; and 3) reducing the amount of N that goes into the environment, thus improving on-farm nutrient management and environmental stewardship.

Milking dairy cows are generally fed to meet CP requirements based on recommendations that were developed more than 10 years ago. Under these recommendations, it is common for high-yielding dairy cows to be fed rations containing 18% or more CP. Based on recent evidence from controlled research experiments and on-farm data, new thinking is emerging that even high-yielding dairy cows can maintain milk production when ration CP is reduced to 15-16%. A research trial was recently conducted in the United States to assess the effects of 5 levels of ration CP (i.e., 13.5, 15.0, 16.5, 17.9, and 19.4%) on milk production and N utilization in dairy cows fed rations based on alfalfa and corn silages. Milk yields in this study ranged from 36.3 to 38.3 kg/d and were not affected by ration CP level. Although N intake increased as ration CP level increased, milk N yield changed very little for all levels of ration CP (thus MNE decreased sharply) and most of the additional N intake as ration CP level increased was excreted in manure. It was concluded from that study that a ration CP level of around 16%

was sufficient for maximizing milk and milk protein yields, while minimizing manure N excretion. What this research tells us is that, on many dairy farms that are feeding as much as 18% ration CP, there is a real opportunity to reduce lactating cow dietary CP concentration by 0.5 to 2.5 percentage units without necessarily sacrificing milk production or animal health. Although reducing the amount of ration CP fed to dairy cows has been shown to increase MNE, and to reduce N excretion and feeding costs, there are feeding situations when ration CP reduction can decrease milk and milk protein yields. Under these feeding situations where reducing ration CP level might compromise milk production responses, your nutritionist can try balancing your rations for limiting amino acids to determine if that can eliminate the decrease in milk production, but the cost-effectiveness of such an approach would need to be carefully considered.

If you are risk-tolerant and you believe that the “more is better approach” is not true for ration CP, there is opportunity to save on feeding costs by reducing your ration CP content while maintaining milk production. Before making any ration changes, talk to your nutritionist and develop a plan. Step 1 in this process is to conduct an in-depth analysis of the current rations (your nutritionist can do this using computer-based ration evaluation programs) and feeding management practices by assessing variations in daily milk yield and feed intake per cow, and in feed ingredient composition (particularly forages) over several weeks. This information can be used to determine if your herd is a good candidate to implement low CP ration feeding. If this evaluation reveals that there are deficiencies in the current feeding program, then those deficiencies will need to be corrected before lower CP rations can be fed. If your farm is a good candidate, then Step 2 will be to obtain representative samples of all feed ingredients and have them analyzed for chemical composition in a reputable laboratory. This chemical analysis will be used by your nutritionist as model inputs to develop a lower CP ration (Step 3). In Step 4, you and your nutritionist will need to clearly define what production variables you will monitor (e.g., daily feed intake and milk yields, MUN etc.) in order to assess the impact of the ration CP change. In Step 5, you start feeding the adjusted lower CP ration to your dairy herd with very close monitoring of the agreed-upon production variables during the next several weeks and months after that. It is important that feed ingredient composition is monitored on a regular basis (particularly when source of feed ingredients or forages changes) and then the lower CP ration is reformulated (if necessary) in order to avoid inconsistencies in ration composition.

Clearly, the tools are currently available to lower ration CP while maintaining high levels of milk production and minimizing N wastage, and it is up to dairy producers and their nutritionists to implement these tools on-farm. Any risk of production losses than could arise when feeding low CP rations can be avoided by proper balancing of rations, regular testing of feed ingredients, and close monitoring of production variables like feed intake and milk yield.

Omega-3 Fatty Acids and Functional Foods:
Dairy Info Day 2013

Janna Moats, O&T Farms, Regina, and
David Christensen, Department of Animal and Poultry Science, U of S

Modern day consumers have become increasingly concerned about the food they eat; viewing it not only as a means of nutrition but as a potential strategy for disease prevention. Therefore, opportunities exist in the functional feeding of livestock to enhance not only the health and productivity of the animal but for the development of functional food products for human consumption. Through extensive research and product development O&T farms Ltd. has designed a patented dry extrusion process to maximize the benefits of omega-3 fatty acids in oilseeds to produce a value added product that is beneficial for livestock and for functional food development.

Company Overview

O&T farms Ltd. is based in Regina, Saskatchewan, the heart of the prairies, to ensure access to some of the best crops and agricultural expertise in the world. The primary business is the manufacturing of healthy animal feeds while other areas include commodity sales, pullet production, and farm land. Throughout the company's 45 years of business it has evolved from a layer operation to a value added livestock feed manufacture with two plant facilities located on the outskirts of Regina. The product line includes top dress feeds for Poultry, Swine, Beef, Equine, and Dairy. All products offer excellent digestibility, palatability, health benefits to animals and the potential to develop functional food products.

LinPRO® & Dry Extrusion

Years of research led O&T Farms Ltd. to patent the process for manufacturing lin**PRO**®(Table1). Our unique process blends flax seed & pulses which are processed under high temperature and pressure to produce extremely digestible feed products with high energy and protein. The dry extrusion process results in:

1. Oilseeds rupture
2. Cell walls break down
3. Pulses carry oil
4. All Anti-Flavours, Anti-Toxins, & Anti-Nutritional factors are dissipated
5. All Aflatoxin, Ureases and Trypsin inhibitors are neutralized

Flax seed is the main ingredient used in the Lin**PRO**® formulation. The oil content of this seed is what provides the source of omega-3 in meat, eggs and dairy. Unlike fish, which can leave an undesirable aftertaste or nuts, which pose allergen risks, flax seed leaves no aftertaste as it crosses into the functional food chain.

Table 1. Nutritional Specification of linPRO-R®

Nutrient Analysis*,1			
Nutrient	**Value**	**Nutrient**	**Value**
Dry Matter, %	94.0	Ash % DM	4.60
Crude Protein, % DM	20.0	Calcium, % DM	0.31
RUP, % of CP	50.8	Phosphorus, % DM	0.48
Crude Fat % DM	20.0	Magnesium, % DM	0.31
ADF, % DM	9.61	Potassium, % DM	1.11
NDF % DM	23.2	Sodium, % DM	0.04
Sugar % DM	4.86	Iron, mg/kg	169
TDN, % DM	104	Copper, mg/kg	14.4
NEL, Mcal/kg	2.60	Manganese, mg/kg	34.01
		Zinc, mg/kg	46.26
Amino Acid Profile 2			
Amino Acid			**% of Crude Protein**
Lysine			6.85
Methionine			1.70
Cystine			1.90
Threonine			4.95
Tryptophan			1.45
Fatty Acid Profile 3			
Factor	**% of Fatty Acids**	**Factor**	**% of Fatty Acids**
C14:0	0.05	C18:2, LA	17.6
C16:0	5.68	C18:3, ALA	50.3
C16:1	0.08	Omega-3 PUFA	52.3
C18:0	3.29	Omega-6 PUFA	18.1
C18:1T	1.01	Other	0.03
C18:1C	20.9		
References			
1. Cumberland Valley Analytical Services		2. University of Saskatchewan	
3. SunWest Food Laboratory Ltd.			

*Results based on average of 11 samples over 12 month period.

Current Success in Functional Food Market

O&T Farms Ltd.'s lin**PRO®** product has already achieved success in producing functional foods found in the food retail marketplace. The product is used as the feed of choice in the Canadian omega-3 egg market, supplying over 60% of omega-3 egg producers; the product is also used in the United States. Other products such as beef and cheese with elevated omega-3 levels have entered the U.S. food retail market through the use of this product, and can be found in several retail stores in Kansas and Wisconsin.

Research

Research at the University of Saskatchewan, AAFC at Lennoxville, University of Kansas and many other organizations have demonstrated the transfer of alpha-linolenic acid (an omega-3) in feed to meat and milk. Health and reproduction benefits have been suggested such as reduced embryo mortality in dairy cows (Petit, AAFC Lennoxville). There is also conversion of ALA to EPA and DHA in some tissues, especially liver. Flax seed also contains beneficial lignans and cyclolinopeptides, both of which have antioxidant and phytoestrogen properties.

O&T Farms Ltd. have supported a number of projects at the University of Saskatchewan. The objective of this research is to produce dairy products and meat that supply a substantial level of omega-3 fatty acids. Canadian food regulations require a supply of 300 mg of Omega-3 per serving for a label claim of being a good source. However, lower levels may be stated on the label without a beneficial claim. In order to meet label requirements of 300 mg per serving total omega-3 content must reach 1.2 to 1.6 percent of fatty acids. Meeting minimum label levels also depends on the fat content of the product.

In one trial in 2010 crossbred steers were fed a 35% flax LinPro product at 15% of the ration for 56 days. The loin fatty acids averaged 0.9% ALA compared to 0.34% with the control ration. Loin fatty acids increased from 0.36 to 0.72% ALA. However, liver ALA increased from 0.71% to 2.28% and EPA from 0.71% to 1.61% and DPA from 1.74% to 2.0%. Heart ALA increased from 0.56% to 2.05% of fatty acids.

In a 2012 milk production trial at the University of Saskatchewan, cows were fed a 55% flax extruded LinPro product at 7% of ration dry matter for 28 days. Milk composition and yield were maintained and total omega-3 fatty acids increased from 0.73% to 1.26% of fat. The Saskatchewan Food Centre is evaluating characteristics of cheese made from control and Linpro milk. In an upcoming trial the TMR will be reformulated so that a revised LinPro product can be fed at 11% of the TMR dry matter. The current projects are funded by O&T Farms and a Canadian Agricultural Adaptation (CAAP) grant to support extruded product development by O&T Farms, milk and meat fatty acid transfer at the U of S and milk product production and quality by The Food Centre.

There is worldwide interest in producing milk and meat products with increased omega-3 content. Marine products can be used but fish and related products are expensive and supply is limited. Research based on flax and other high ALA is ongoing in Europe, Israel, USA, and Australia. O&T Farms have worked closely with Insta-Pro International and other technical advisors to develop two extrusion facilities near Regina and have access to an abundant supply of flax and other ingredients to support their patented production system.

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Manure: A Value-Added Approach?

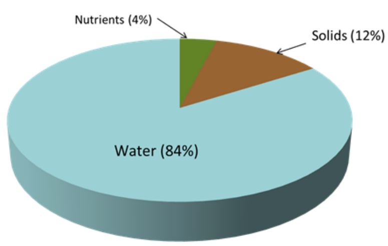
Dr. T.A. (Terry) Fonstad, P.Eng. and Dyan Pratt, M.Sc., P.Eng.

Dairy Info Day

January 11, 2013

UNIVERSITY OF SASKATCHEWAN

Flushed Dairy Manure Composition



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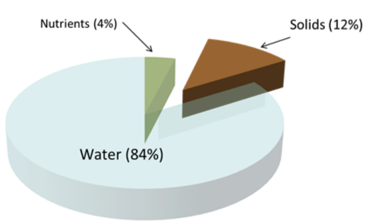
Solids Recovery



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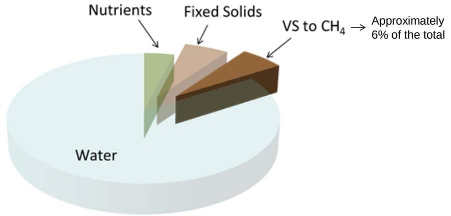
Convert the Volatile Solids to Natural Gas



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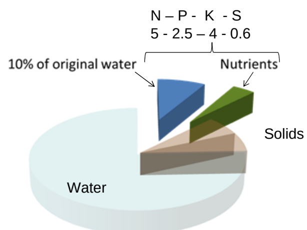
Recover the nutrients with some water for a fertilizer concentrate



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Storage and Field application

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- Solid Separation

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Where can we add value???

- Solid Separation
  - Solids?
    - Compost
    - Bedding
    - Biogas
    - Gasification

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Where can we add value???

- Liquid Separation
  - Nutrient concentrate
  - Land application
  - Biogas
  - Clean up for water reuse

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Adding Value?

- Biogas or Syngas production
  - Offset heating and electricity costs
  - Anaerobic digestion generally feasible for farms larger than 400 head with government incentives
    - Electrical grid buyback programs
    - Green Energy grants, etc
    - Supplemental feedstocks from other industries nearby

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Biogas/Energy Production Technologies

- Anaerobic Digestion
  - Liquid
  - Solid
- Gasification
  - Solids
- Yields approx. $0.20 to $0.40 per cow per day

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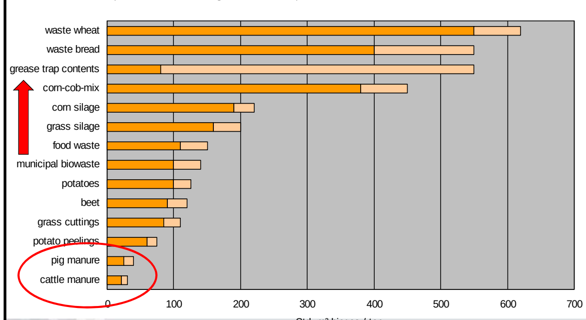
Biogas Yields of Various Feedstocks

This slide courtesy of Martin Schneider, Biogas Mission to Europe



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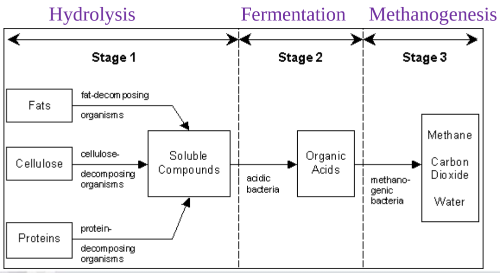
Stages of Anaerobic Digestion



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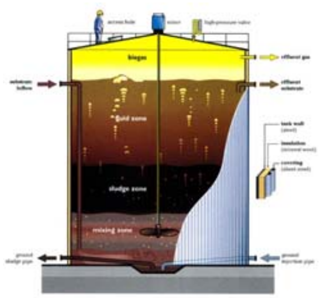
Anaerobic Digestion



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Gasification

- Combustion of biomass with little to no oxygen to yield H_2 and CO (Syngas)

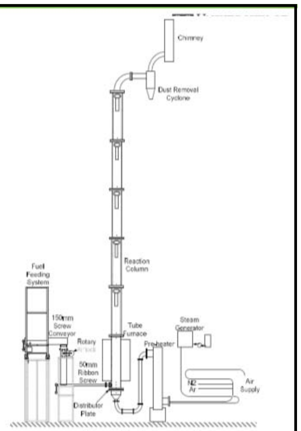

Figure 2: FBG pilot plant schematic

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Bakerview Eco Dairy, Abbotsford, BC

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Farm Power, Lynden, WA

500 Cow Dairy

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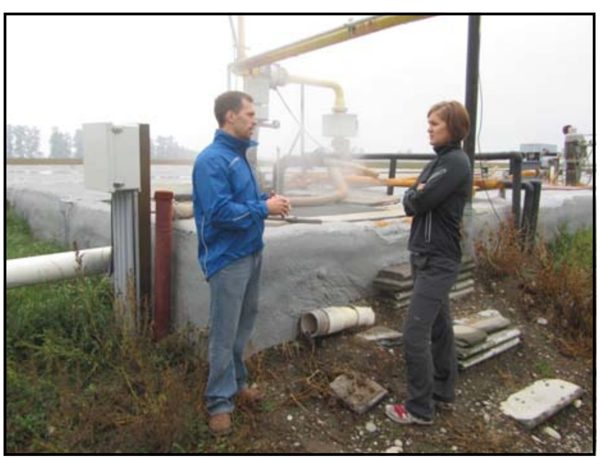

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Farm Power, Lynden, WA

2000 Cow Dairy

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Solids Separation for Bedding, Saskatchewan Dairy
500 Cow Dairy (?)
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JAMESWAY


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Economics

(Equipment (Yes), Systems (Maybe), O&M (No))

- Storage and Field Application (Yes)
- Solids Separation for Bedding (Maybe)
- Anaerobic Digestion or Gasification (No)
- Liquid Fertilizer Concentrate (No)
- Impact of outside materials (No)

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How can we help?

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Economics of Liquid/Solid Separation

- Liquid-solid separation systems
  - Gravity (settling ponds)
  - Mechanical
    - Screw press
    - Screens
    - Membrane filters
- Chemical

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Estimated Capital Costs of Separation Systems (Fleming & MacAlpine 2003)

Costs not including shelter and maintenance for each system

		L per kW-hr
SWECO Vibrating Screen	$22,000	3000
SEI Screw Press	$27,000	4800
Rotating Drum Screen	$40,000	4300
Vibrating Screen + hydrocyclones	$100,000	10500
VSEP Reverse Osmosis	$400,000	95

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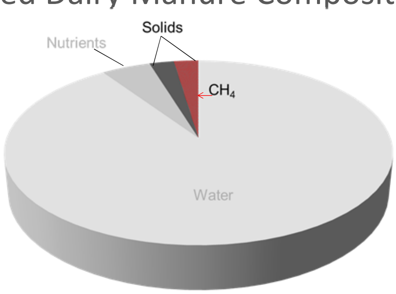
Flushed Dairy Manure Composition



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Saskatchewan Ministry of Agriculture

Nutrient Management

Agricultural Operations
Jan. 2013
Bryce Sundbo,
Regional Engineer

Saskatchewan Ministry of Agriculture

Agricultural Operations Mandate

- Provide administration of *The Agricultural Operations Act (1995),* including enforcement if necessary, to ensure water resources are protected from the development and operation of intensive livestock facilities.

Saskatchewan
Ministry of
Agriculture

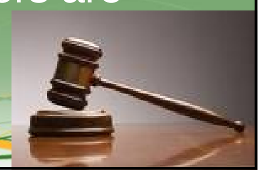
Why is Nutrient Management Important?

- Nutrient management is important in order to ensure land utilization of manure is done in a sustainable manner.
- It is part of good stewardship and environmental protection.

Saskatchewan Ministry of Agriculture

Nutrient Management Plan

- This is a plan that is submitted by the livestock developer to the Ministry of Agriculture as part of a larger application for approval of the livestock operation.
- Other components of the application include a manure storage and a mortality management plan
- Once approved livestock operators are required to follow their plan!



Saskatchewan Ministry of Agriculture

Main Components of a Nutrient Management Plan

Nutrients

- Nutrient Management plans are based on agronomic utilization of nutrients.
- Manure application rates are calculated to meet the planned crop nitrogen requirements under average climatic conditions.
- Variables: soil type, irrigation, method of manure application, return rate, cropping rotation, and method of manure storage.

Saskatchewan Ministry of Agriculture

Main Components of a Nutrient Management Plan

Land for Manure Spreading

- Sufficient land area is required to utilize nutrients in the manure produced.
- If you do not own enough land, manure spreading agreements are required.

Saskatchewan Ministry of Agriculture

Components of a Nutrient Management Plan

- The nutrient management plan will specify:
  - Annual volume of manure produced
  - Nutrient levels of N, P and K in manure
  - The form of the manure (Liquid or Solid)
  - The method and season of application
  - Crop rotation and nutrient requirements
  - Annual rate and frequency of manure application
  - Provide written agreements where needed
  - Map to identify the location of lands to be used for manure spreading

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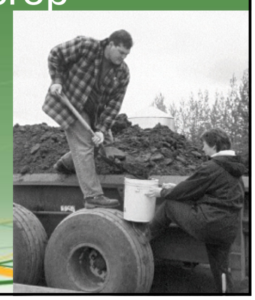
Book Values vs Testing

- Our plans are based on conservative values to ensure environmental protection
- Producers are advised to test their soil and manure for nutrient concentrations and customize their plans to ensure crop needs are met for all nutrients.



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Separation Distances

- Good management practice recommends that reasonable separation be maintained between manure application and water resources.
  - How and when manure is applied
  - Slope
  - Riparian area

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Separation Distances

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Considerations

- Stockpile manure in environmentally sound areas.
- When receiving manure be prepared to spread it as soon as possible to minimize stockpiling for extended periods of time.
- Winter spreading is not recommended.

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Communication

- Communication policies to ensure the community and neighbours are aware of manure activities is beneficial:
  - Manages nuisance complaints.
  - Minimizes transportation complaints by managing expectations regarding road damage, traffic, dust and safety concerns.

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Communication

Could this have been prevented?

MAGNOLIA HALL LAWN CEREMONY

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Record Keeping

- Keep records of manure spreading. Document where, when and how much is spread. This information can prove you are operating according to your approved management plans.
  - We have record keeping forms to assist producers.

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Inspections

- At any point in time we can come an inspect a livestock operation to ensure they are following their management plans.
  - Re-inspection policy or
  - triggered by a complaint
    note: livestock production is under scrutiny
- At the time of the inspection nutrient management plan records will be requested for audit.