Final Report

Tackling Lameness on Organic Dairy Farms

This project was started in 2015 and data collection was completed in May 2017. The project had the following objectives:

1. Describe the incidence of lameness and different types of foot lesions on organic dairy farms in Minnesota
2. Assess seasonal risk factors for lameness and foot lesions on organic dairy farms in Minnesota.
3. Evaluate the association between lameness and productivity (milk yield, culling and reproduction) on organic dairy farms.
4. Develop educational materials about lameness prevention strategies targeted at organic and pasture-based dairy farms in the Upper Midwest.

To complete our objectives 17 herds (10 in 2015 and 8 in 2016, 1 herd was included in both years) were enrolled based on a stratified random sample form Organic Valley farms. Herd sizes ranged from 12-300 cows and represented a wide spectrum of organic management styles. Specifically related to lameness management practices only 3/17 herds used a footbath at least once during our study period. Similarly, the use of routine hoof trimming was limited and only 9/17 herds had a hoof trimming visit during our study period.

To accomplish objectives, we visited each herd 6 times to collect data. At each visit starting in March-May of each study year all cows were scored for locomotion, hygiene, body condition score, and hock lesions. Every 2nd visit cows, 25 cows that were randomly selected were evaluated in a hoof trimming chute for hoof lesions and sole thickness evaluation. Unfortunately, due to an accident it was not possible to complete the chute evaluation on 3 herds enrolled in 2016. In addition to collecting data from cow and hoof lesions scoring systems, 3 cows per herd had activity monitors placed on them to act as sentinel animals and give us a sense of the number of steps and lying times of cows in each herd.

Results

Lesion data from each year is summarized in table 1. From this table it is clear that the major lesion affecting cows in our study are infectious lesions. While heel horn erosion was the most common lesion this lesion is typically considered a minor lesion. Typically, digital dermatitis, sole ulcers and white line lesions are the most common and important lesions. Lesions such as hemorrhage and heel horn erosion are considered minor lesions and usually precursors of more severe lesions such as ulcers and digital dermatitis. Both heel horn erosion and hemorrhage are also lesions that come and go depending on conditions such as hygiene and hardness of the cows standing surface. As illustrated in table 1 both these lesions seem to increase during the winter with peak occurrence in the spring. During the pasture season these lesions then decrease. This same pattern is not true for digital dermatitis.

Digital dermatitis is a lesion that is easily controlled with regular foot bathing and treatment of painful lesions. The use of a foot bath was not a routine practice in our herds and neither was regular foot trimming visits to identify and treat active painful lesions. Since copper sulfate and other commercial footbath compounds are listed as allowable substances on the OMRI website there are options to both

treat and prevent digital dermatitis. Based on the results of this study it is clear that regular foot bathing needs to become a regular practice on organic dairy farms. With regular foot bathing the prevalence of infectious foot lesions would be greatly reduced. This in turn would greatly reduce the total number of lesions and improve lameness in organic herds. The specific amount of foot bathing that is required is farm specific but general recommendations would be to use a 10-foot-long by 18-24 inches wide footbath with 3-4 inches of footbath solution. This footbath should be run 3-5 times per week with approved products. Once digital dermatitis is under control the frequency of active product use can be decreased and replaced with products such as salt or detergents to clean feet. Treatment of active painful lesions with approved compounds such as copper sulfate should be done as soon as the lesion is diagnosed.

Table 1: Lesion prevalences from 25 cows per herd followed through 3 different time periods and overal in 2015 (n=10 herds) and 2016 (n=8)

	2015								2016							
	Visit								Visit							
	Spring (n=246)		Fall (n=225)		Winter (n=189)		Total (n=277)		Spring (n=177)		Fall (n=156)		Winter (n=67)		Total (n=225)	
Lesion	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*
Any Lesion	43	*83*	83	*37*	148	*78*	247	*89*	144	*81*	44	*28*	37	*55*	157	*70*
Hoof Horn Lesion	7	*3*	5	*3*	47	*25*	59	*21*	10	*6*	5	*3*	7	*10*	19	*8*
Hemorrahge	6	*2*	2	*1*	38	*20*	46	*17*	6	*3*	4	*3*	3	*5*	12	*5*
Sole Ulcer	0	*0*	0	*0*	5	*3*	5	*2*	0	*0*	1	*1*	4	*6*	5	*2*
White Line	1	*1*	5	*2*	6	*3*	11	*4*	4	*2*	0	*0*	1	*2*	5	*2*
Toe Lesion	0	*0*	0	*0*	1	*1*	1	*1*	3	*2*	0	*0*	1	*2*	4	*2*
Infectious Lesion	203	*83*	83	*37*	134	*71*	242	*87*	142	*80*	40	*26*	27	*40*	152	*68*
Digital Dermatitis	34	*14*	24	*11*	34	*18*	68	*25*	29	*16*	23	*15*	11	*16*	45	*20*
Heel Horn Erosion	198	*81*	65	*29*	128	*68*	237	*86*	136	*77*	30	*19*	16	*24*	144	*64*

Locomotion scoring data is shown in figure 1. Lameness was defined as a locomotion score greater than 2 using a 5-point scale. Overall, the majority of the cows were score 3, with all farms staying below the 5% severe cow in the FARM program scoring system. The locomotion scoring data has some interesting trends and shows that the peak in lameness prevalence is not at the same time as the peak in lesion prevalence. In 2015 there is a consistent trend in all herds that during the pasture season more cows showed signs of lameness. In 2016 this is not as consistent and likely reflects the more diverse herds participating in 2016. What is interesting is that there is a large variation between in both years reflecting differences in environment and management.

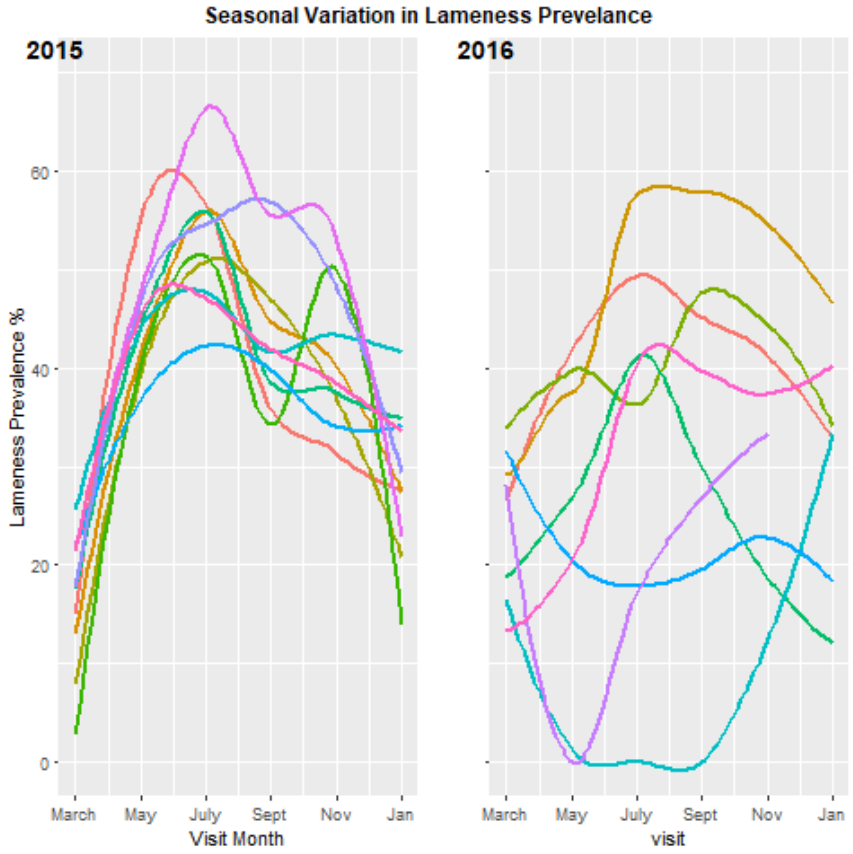

Figure 1: Lameness prevalence by visit month for 10 herds (2015) an 8 herds (2016).

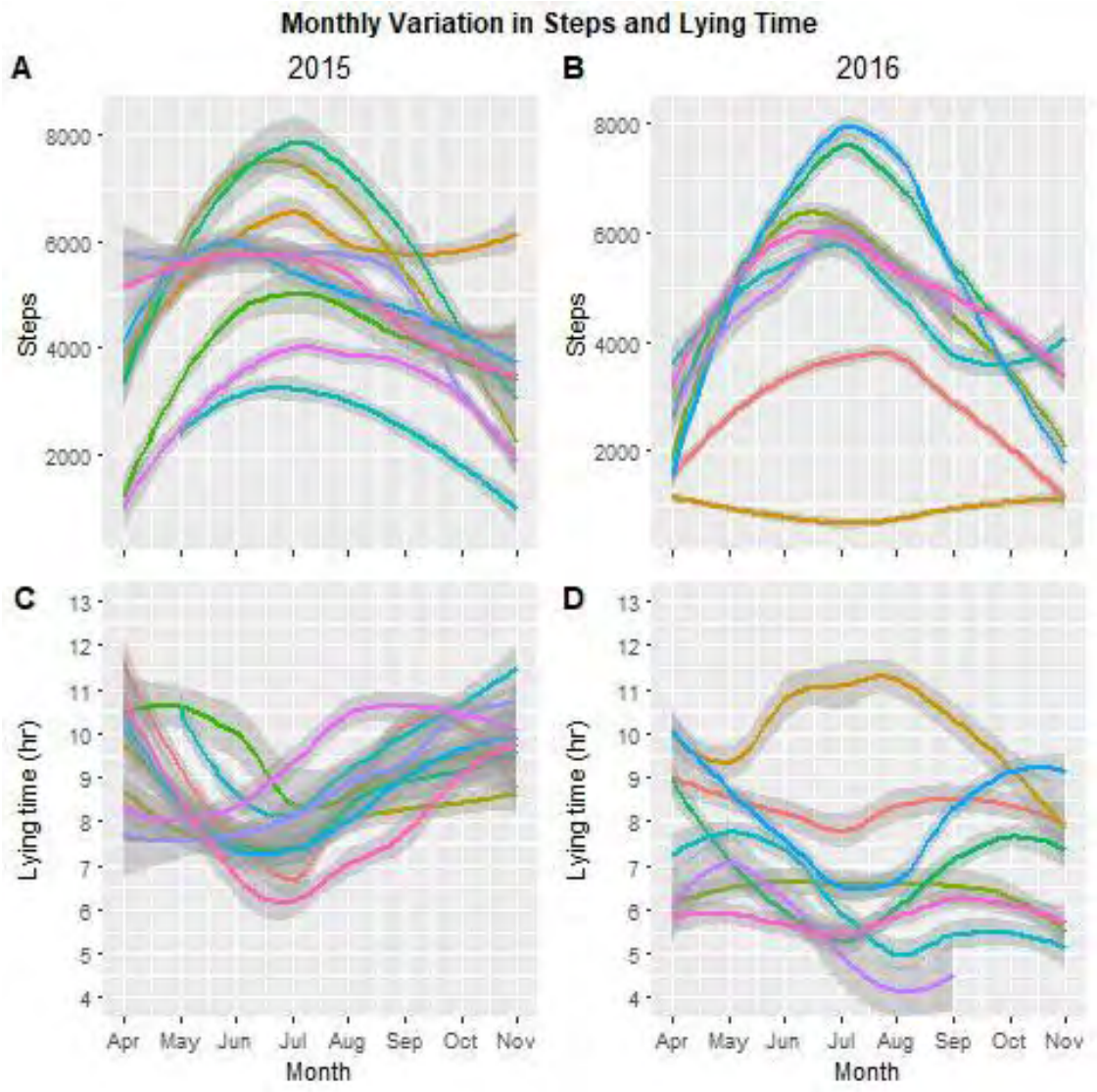

Figure 2: Monthly variation in steps and lying time from 3 cows on 10 farms (2015) and 8 farms (2016)

An explanation for the increase in lameness prevalence during the pasture season might the increase steps and associated decrease in lying time. Figure 2 shows that in all farms except 1 the number of steps increased during the pasture season with a corresponding change in lying time. At the start of the study it was thought that the increased number steps during the pasture season combined with a lower lying time causes cows feet to become thinner. These thinner soles could then cause the cow to be painful and display more lameness. This hypothesis was necessarily supported by our data from our sole thickness measurements as shown in table 2. Sole thickness remained consisted throughout the pasture season. Since we also did not find a lot of toe soles in the cows evaluated for lesions (Table 1) it is likely that the increase in lameness during the pasture season is due to another mechanism.

Table 2: Sole thickness measured by ultrasounds at the tip of P3 in cows randomly selected from 10 farms (2015) and 8 farms (2016)

		Sole Thickness (mm)					
		2015			2016		
			95% Confidence Interval			95% Confidence Interval	
Visit	Leg	Average	Lower	Upper	Average	Lower	Upper
2	LH	3.96	3.73	4.19	6.21	6.03	6.39
2	RH	4.05	3.8	4.3	6.24	6.07	6.41
4	LH	4.01	3.89	4.13	6.41	6.2	6.62
4	RH	4.07	3.95	4.19	6.53	6.13	6.53
6	LH	4.24	4.08	4.4	5.68	4.78	5.68
6	RH	4.21	4.05	4.37	4.87	4.29	487

Another possibility is that the cows show changes in their locomotion due to their very low lying times. It has been shown that in housed cows lying time is a priority and restrictions in lying time result in decreased feed intake. It is possible that to meet their maintenance requirements the cows in our study could not prioritize lying time over feeding. In most studies lying time is expected to be around 10-12 hours. The majority of herd did not meet this during the summer months and it is possible that when cows cannot lie down as much as they desire they change their gait due to inflammation in their hooves. Typically, we would expect this to result in lesions such as hemorrhages and sole ulcers in 2-3 months. Since the cows in our study were mainly housed on pasture and not exposed to a lot of concrete this did not occur. The increase in hemorrhage lesion without a corresponding increase in sole ulcers in the winter visits is evidence that inflammatory changes were happing in the cow's foot in the 3-4 months prior to the visit. Whilst is likely not possible to decrease the number of steps a cow takes during the pasture season there might be feeding strategies such as pad feeding/supplementing in the parlor that allow cows to meet their maintenance requirements with less steps and allow for more lying time.

Additional data collected related to body condition, hygiene and hock lesions did not show obvious relationships with lameness and is attached in the appendix.

As described in addendum in 2015 it was necessary to relax the enrolment criteria of being enrolled in DHI. This resulted in only 9 herds in our study having participating in DHI services. This limited our ability to complete objective 3 as we did not have the required sample size to do meaningful statistical analysis. To illustrate, we only had reliable lesion information on 278 cows from these DHI herds. Additionally, lesions were concentrated on specific farms. For these reasons, we did not complete objective 3 as completion of this objective would have resulted in estimates that were unreliable and no generalizable to the larger populations of organic herds.

As far as objective 4. Dr Sorge presented of the study at the dairy field day of the West Central Research and Outreach Center in Morris. Additional educational resources target to lameness management were created related to this project and other lameness related projects and are published at http://dairyknow.umn.edu/topics/

Summary

From this project is it clear that digital dermatitis is the primary lameness issue that organic dairy farmers struggle to control. Fortunately, there is a lot that we know about prevention and control of digital dermatitis and by implementing a good foot bath program digital dermatitis can be easily controlled. The other main finding from this study is that lameness prevalence increases during the pasture season. The exact reasons for this are unclear but might be related to the cow's activity patterns and not necessarily due to thin soles. Further study is required to shed more light on this finding. One surprising finding was that cows in our study had relatively low lying times. The impacts of these low lying times are unclear under organic conditions but it is likely that finding ways to increase lying time of cows on pasture would improve both the welfare and productivity of the cow. Finally, the limited use of professional hoof trimmers means that the treatment of lame cows has to happen on farm and requires an on farm chute and appropriate training in lesion treatments.

Appendix

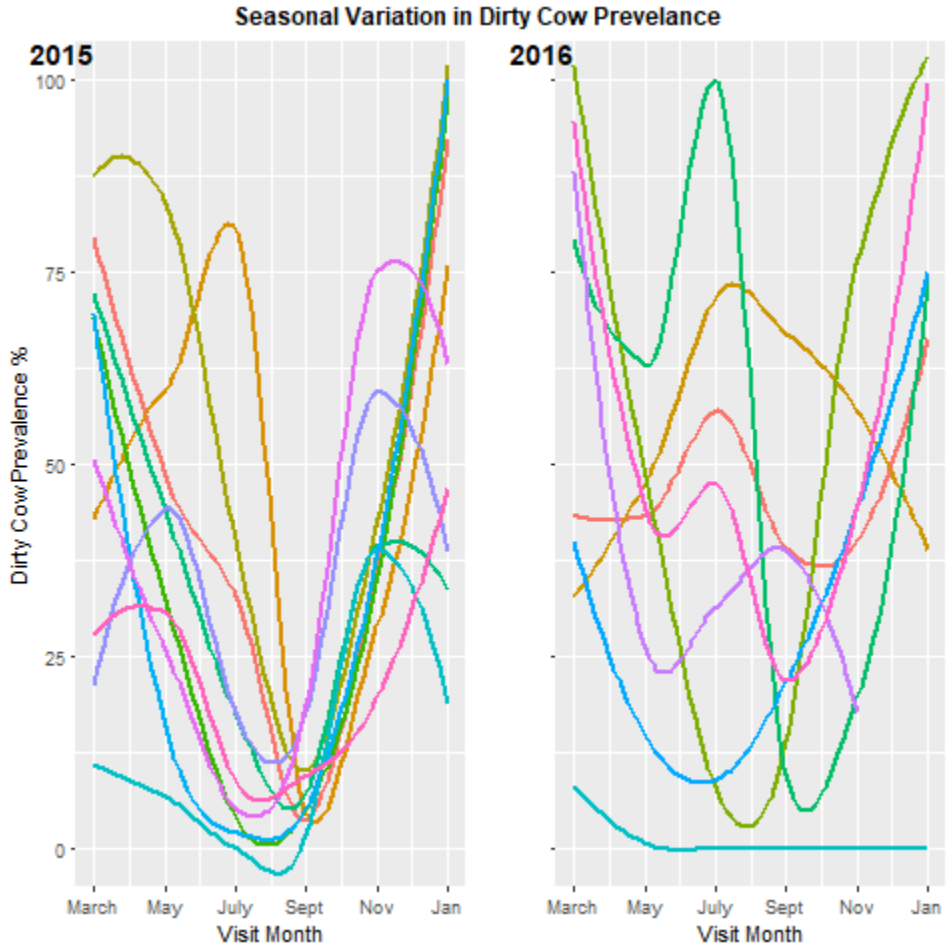

Figure 3: Prevalence of dirty cows (hygiene score >2) by visit month for 10 herds (2015) an 8 herds (2016).

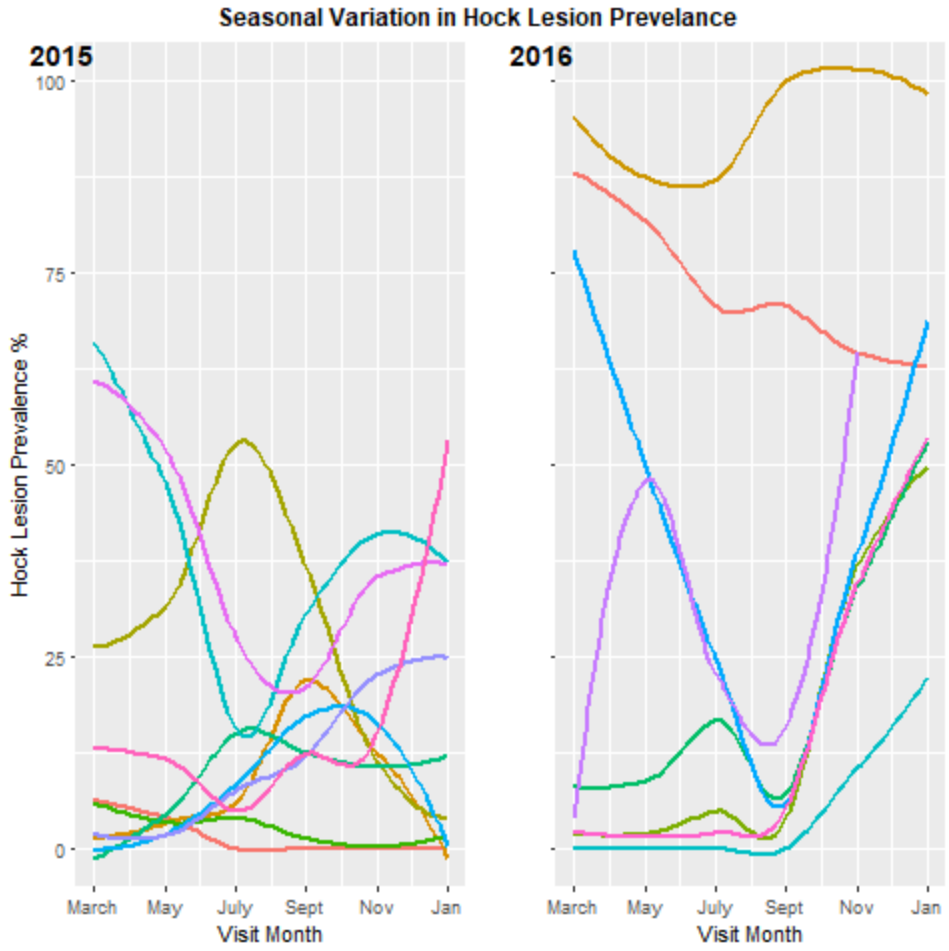

Figure 4: Prevalence of hock lesion cows (Hock score >1 = hairloss) by visit month for 10 herds (2015) an 8 herds (2016).