Animal Outcome Measurement Protocols

Injury, Cleanliness, Body Condition, and Lameness

Developed in the Dairy Research Cluster project:
Improving cow comfort to increase longevity in tie stalls and free stalls in Canadian Dairy herds
(*visit www.dairyresearch.ca for more information*)

Identified as a priority area of research by Dairy Farmers of Canada, the Canadian Agri-Science Clusters Initiative of AAFC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

In this Dairy Research Cluster project, we visited Canadian dairy farms to evaluate the incidence of lameness, injuries, Body Condition Score (BCS) and cleanliness. The Code of Practice for the Care and Handling of Dairy Cattle (http://www.dairyfarmers.ca/what-we-do/animal-health-and-welfare/code-of-practice-for-the-care-and-handling-of-dairy-cattle) includes best practices and requirements for these animal outcomes. At the end of our visits we gave dairy producers a report explaining how well the farm met the Code of Practice and discussed the results.

To ensure the quality of data from our study, we developed training and standard operating protocols (SOPs) for each animal-based measure we used. We say our protocols are standardized because we tested their feasability, the ease of learning them and because they are based on science. We also verified repeatability between observers for all of these measures. The protocols (SOPs) presented here are the results of many adjustements to ensure quality control. Publications about the work we did on developing or testing these measures on animals are cited where appropriate.

COLLABORATORS

The following pages include step-by-step instructions and scoring charts for the assessment of dairy cows for specific animal-based measures. These protocols are intended for use by researchers, or veterinarians, nutritionists, service providers or other qualified persons who have been asked by a dairy producer to conduct one or more animal outcome measure(s) to help identify strengths and areas of improvement on their farms. These protocols can also be used by producers themselves that want to get an idea of how they are doing with respect to these animal-based measures.

Training in the use of these animal outcome measurement protocols is needed in order to ensure consistency of assessments on farm and between assessors.

Assessment methods for the four key categories of animal based measurements are included in this document:

1. Injury Scores – hock, knee, and neck
2. Cleanliness Scores – leg, udder and flank
3. Body Condition Scores
4. Lameness Scores

The method used for assessing lameness is different in free stall and tie stall operations.

Sample Selection

- Animals to be assessed should be randomly chosen.
- If the cows are distributed amongst different pens, the animals selected for assessment should be proportional to the number of cows in each pen.
- A minimum of 40 cows per farm should be assessed.

Records

For those wanting to know how we recorded and calculated scores, a set of complete data entry sheets will be provided in another document. Some data recording sheets are provided at the end of this document. If you should want to record and discuss the results as was done in the Dairy Cluster 1 longevity project you can use the same tools. These will be posted at:

- www.dairyresearch.ca; and
- http://www.agrireseau.qc.ca/references/2/Proc_norm_bles_boit_LAIT.pdf

A collaborative project between:
AAFC, Université Laval, University of Guelph, University of Calgary and University of British Columbia as well as Valacta Inc.

1A. On Farm Measurement Protocols: HOCK INJURY SCORING

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

Objective: Score 40 cows for hock injuries. See General Protocols to determine cows to be scored.

Reference: Dairy Code of Practice Sections 1.1.2, 1.4 and 1.6

Background: Condition of the hocks can be an important indicator of the abrasiveness of stall bedding and cow comfort. Injury is usually the result of prolonged exposure to an abrasive stall surface. Skin breakage provides an opportunity for infection to occur, which can lead to swelling, discomfort, and possibly lameness.

Where: In the parlour **/**tie stall / feed bunk

Protocol:

1. Record the identification number of the cow as she stands in the tie stall or milking parlour.

2. Assess the condition of the left and right hocks (Hock L/Hock R) using the four-point ordinal scale **(See Table 1)**. When recording left and right it should be from the cow's left and right. Scoring is only carried out within the area of the leg as shown in **Figure 1** (score the tarsal joint but not the point of the hock). If it is too difficult to score both hocks in the herringbone parlours, score as they exit the parlour or at the feed bunk.

3. Record scores on the Data Recording Sheet – Free stall or Hock Injury Data Recording Sheet- Tie stall (**See Table 2 and the forms enclosed at the end of the document**).

4. Repeat for all cows in the sample size.

Figure 1. Area assessed during hock scoring.

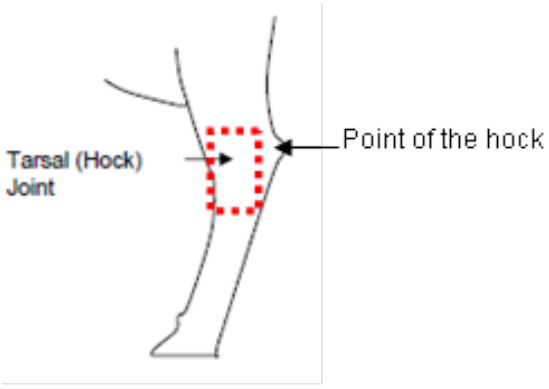


TABLE 1. GENERAL DESCRIPTION OF HOCK INJURY SCORES

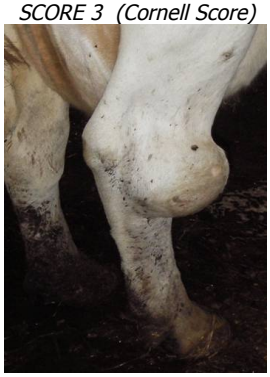
SCORE 0	*SCORE 1*	*SCORE 2*	*SCORE 3 (Cornell Score)*
			
No Swelling. No hair is missing, some hair loss or broken hair.	No Swelling or minor swelling (< 1 cm). Bald area on hock	Medium swelling (1-2.5 cm) **and/or** lesion on bald area.	Major swelling (> 2.5 cm). May have bald area/lesion.
		Considered injured	

Table 2: HOCK INJURY DATA RECORDING SHEET SAMPLE

Farm:_____ Date:_____

	Cow ID	Hock L	Hock R
1	*Sample 563*	*0*	*3*
2			
3			
4			

Reference:

Gibbons J., E. Vasseur, J. Rushen, A M de Passillé 2012. A training program to ensure high repeatability of injury of dairy cows. *Invited paper to Animal Welfare* 21:379-388

1B. On Farm Measurement Protocols: KNEE INJURY SCORING

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

Objective: Score 40 cows for knee injuries. See General Protocols to determine cows to be scored.

Reference: Dairy Code of Practice Sections 1.1.2, 1.4 and 1.6

Where: At the feed bunk, when cows are feeding / Tie stall

Background: Knee health is an important indicator of cow comfort and the hardness of the stall floor and. Injury is usually the result of prolonged exposure to a hard stall floor leading to swelling and skin breakage which provides an opportunity for infection to occur resulting in discomfort and possibly lameness.

Protocol:

1. Record the identification number of the cow. It is recommended to randomly choose sample a number of cows at the feed bunk when cows are feeding (ideally, shortly after feed delivery). If it is too difficult to score all cows at the feed bunk, cows can be scored in the stall. When the cow is lying encourage her to stand and score her knees.

2. Record the condition of the left and right knees (Knee L/Knee R) using the four-point ordinal scale. **When recording left and right it should be from the cow's left and right. (See Table 3)**

3. Scoring is only carried out within the area of the leg as shown in **Figure 2** (score the front of the carpal joint only).

4. Record scores on the Data Recording Sheet – Free stall or Data Recording Sheet – Tie stall. **(See Table 4 and the forms enclosed at the end of this appendix.)**

5. Repeat for each cow in the sample size.

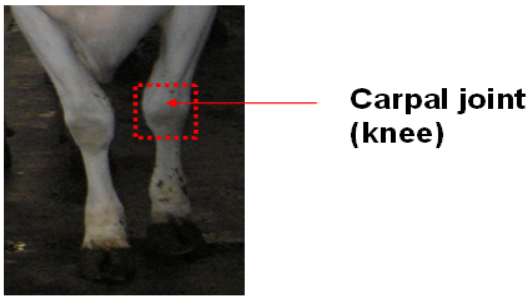


Fig 2: **Area assessed during knee scoring**

TABLE 3. GENERAL DESCRIPTION OF KNEE INJURY SCORES

SCORE 0	SCORE 1
	
No Swelling. No hair is missing, some hair loss or broken hair.	No Swelling. Bald area.
Considered injured	
SCORE 2	SCORE 3
	
Broken skin **or** scab **and/or** swelling (< 2.5 cm). May have bald area	Major swelling (≥ 2.5 cm). May have bald area/lesion.

TABLE 4. AN EXAMPLE KNEE INJURY DATA RECORDING SHEET

	Cow ID	KNEE L	KNEE R
1	563	0	2
2			
3			
4			

Reference:

Gibbons J., E. Vasseur, J. Rushen, A M de Passillé 2012. A training program to ensure high repeatability of injury of dairy cows. *Invited paper to Animal Welfare* 21:379-388

1C. On-Farm Measurement Protocols: NECK INJURY SCORING

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

Objective: Score 40 cows for neck injuries. See General Protocols to determine cows to be scored.

Reference: Dairy Code of Practice Sections 1.1.2 and 1.4

Where: At the feed bunk, when cows are feeding / Tie stall

Background: Neck injury is an important indicator of whether the neck rail/chain in the stalls and/or at the feed bunk is at the correct height or length (chain) and that the feed is well within easy reach for the animal. Neck injury is usually the result of prolonged exposure to rubbing or hitting against the neck rail/chain or feed bunk rail/chain.

Protocol:

1. Record the identification number of the cow to be scored on data recording sheet.

2. Score each cow at the feed bunk when cows are feeding or in the stall. (Ideal timing may be shortly after feed delivery as the majority of cows will be feeding).

3. Assess the condition of the neck using the three-point ordinal scale. (**See Table 5**). Scoring is only carried out within the area of the neck as shown in **Figure 3** (score only the part of the neck directly behind the ear up to the point directly above the shoulder. In general, this is the part of the neck, which comes into contact with the neck rail or chain (stall/feed bunk)**.**

4. Record scores on the Data Recording Sheet – Free stall or Data Recording Sheet – Tie stall. **(See Table 6 and the forms enclosed at the end of this appendix.)**

5. Repeat for all cows in the sample group.

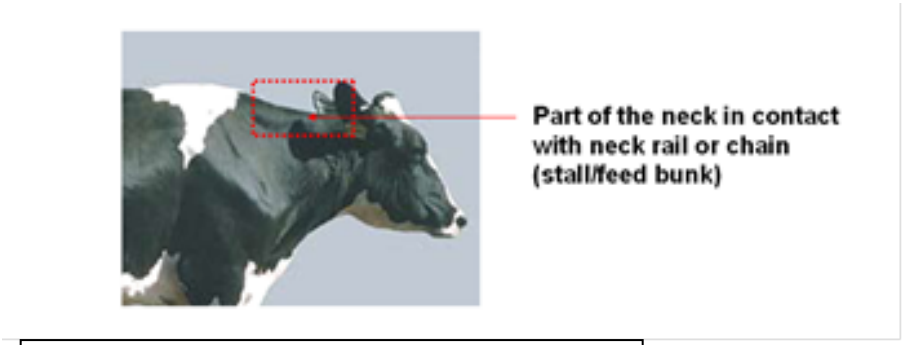


Figure 3: Area assessed during neck scoring

TABLE 5. GENERAL DESCRIPTION OF NECK INJURY SCORES

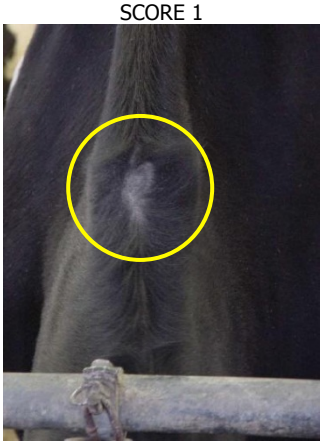
		Injured
SCORE 0	SCORE 1	SCORE 2
		
No swelling. No hair is missing, some hair loss or broken hair.	No swelling. Bald area visible	Broken skin **or** scab **and/or** swelling. May have bald area

TABLE 6. AN EXAMPLE NECK INJURY DATA RECORDING SHEET

	Cow ID	NECK
1	563	2
2		
3		
4		

Reference:

Gibbons J., E. Vasseur, J. Rushen, A M de Passillé 2012. A training program to ensure high repeatability of injury of dairy cows. *Invited paper to Animal Welfare* 21:379-388

2. On-Farm Measurement Protocols: COW CLEANLINESS SCORE

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

Objective: Score cleanliness of the lower leg, udder and flank of representative sample size of the herd. See General Protocols to determine cows to be scored.

Reference: Dairy Code of Practice Section 3.10

Where and when: In **free stalls**, recommend the lower leg and udder are scored during milking and flank scored at the feed bunk, when cows are feeding between milkings. In **tie stalls**, scoring will take place in the stall.

Background: Cow cleanliness is an important indicator of cow comfort. Frequent and strategic cleaning of the alleys and stalls will reduce the amount of manure on cows and reduce the amount of manure tracked into the stalls. On the other hand, dirty legs suggest manure splashing in the alleys. Dirty flanks and udders are a result of animals lying in dirty and/or poorly bedded stalls. When the lying area is wet, cows reduce their lying time. Large areas of dried caked manure on cows indicate a long-term build-up of manure and highlight weaknesses in the cleaning routine of the alleys and/or stalls.

Protocols:

Leg & Udder

1. Record the identification number of the cow as she stands in the parlour for milking.
2. Assign a cleanliness score to the **right** lower leg and udder using the four-point ordinal scale **(Table 8 and 9)**. Assess cleanliness of leg and udder. The lower leg is defined as from the top of the claw (coronary band) to the middle of the hock **(Table 7).** View the udder from the back, the zone to score for udder cleanliness is defined as the lower 50% of the udder excluding the 4 teats **(Table 7).**
3. Repeat for all 40 cows in the sample.

Flank

1. Record the identification number of the cow.
2. Assign a cleanliness score to the **right** flank using the 4 point scale (**Table 8 and 9**). The flank is defined as the middle tarsal joint to a virtual line between pin and hook bones (**Table 7**).
3. Cows with fresh splashes of manure are assigned a score of 1 or 2. A cow must have *dried caked* manure on ≥ 50% of the flank to receive cleanliness score of 3 or 4.
4. A sheet of letter size paper (21.5cm x 28cm) is to be used as an arbitrary cut-off point to indicate 50% of the flank. On the flank, locate the largest section that is covered in manure. Assess this area against the letter paper. Is it bigger or smaller than the paper? If it is smaller than the paper <50% of the flank is soiled. If it is bigger than the paper >50% of the flank is soiled (**Figure 4**).
5. On the flank, locate the largest section that is covered in manure. Assess this area against the letter paper. Is it bigger or smaller than the paper? If it is smaller than the paper then less than (<) 50% of the flank is soiled. If it is bigger than the paper then greater than (>) 50% of the flank is soiled (**Figure 4**).

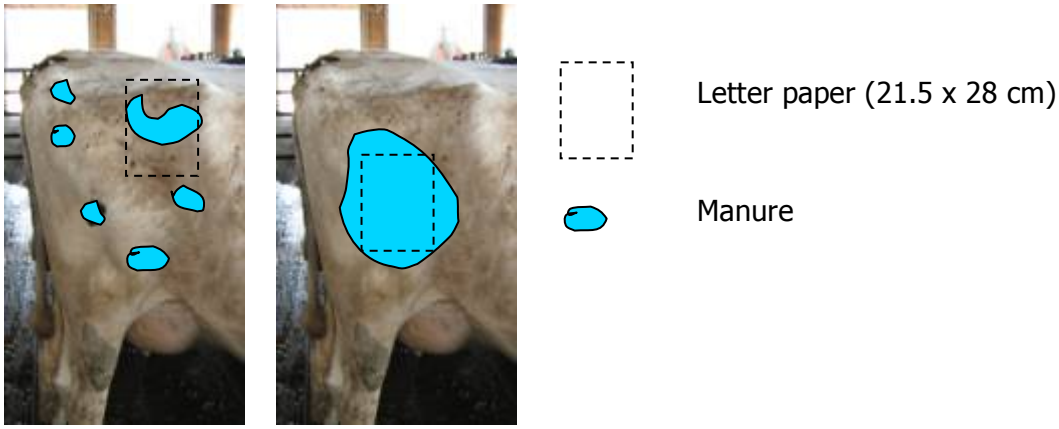


Figure 4. Diagram to show 50% cut-off point.
(a) Less than 50% of the flank is dirty
(b) Greater than 50% of the flank is dirty

TABLE 7. LOCATION AND DESCRIPTION OF AREAS TO BE SCORED

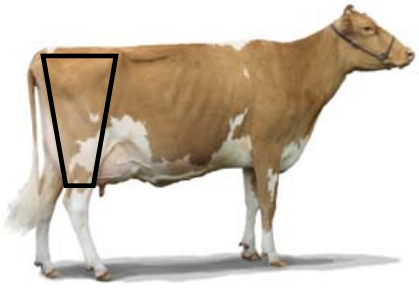
AREA	LOCATION	Description
LEG		The leg is defined as from the top of the claw (coronary band) to the middle of the hock.
UDDER		View the udder from the back, the udder is defined as the lower 50% of the udder **excluding** the 4 teats.
FLANK		Flank is defined from middle tarsal joint to a virtual line between pin and hook bones.

TABLE 8 GENERAL DESCRIPTION OF CLEANLINESS SCORE

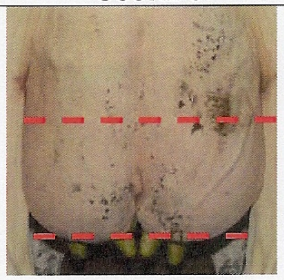
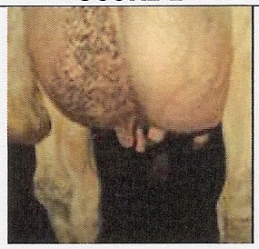
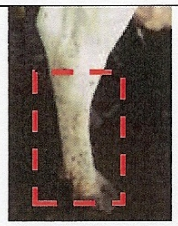
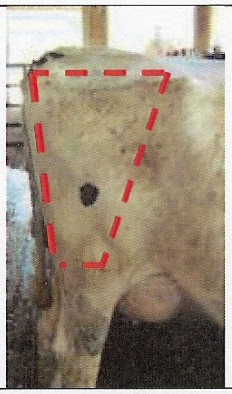
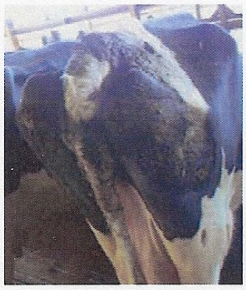
	SCORE 0	SCORE 1	SCORE 2	SCORE 3
UDDER				
	LIGHT Contamination of fresh **splashes of manure for <50%** of the area	**MODERATE** contamination of **fresh splashes of manure for >50%** of the area	**HEAVY** contamination of **dried caked and fresh manure for >50%** of the area	**VERY HEAVY** contamination of **entire area with dried caked manure**
LEG				
	LIGHT Contamination of fresh splashes of manure for <50% of the area	**MODERATE** contamination of **fresh splashes of manure for >50%** of the area	**HEAVY** contamination of **dried caked and fresh manure for >50%** of the area	**VERY HEAVY** contamination of **entire area with dried caked manure**
FLANK				
	LIGHT Contamination of fresh **splashes of manure for <50%** of the area	**MODERATE** contamination of **fresh splashes of manure for >50%** of the area (may have some caked spots)	**HEAVY** contamination of **dried caked manure for >50%** of the area	**VERY HEAVY** contamination of **entire flank area and belly with dried caked manure**

TABLE 9. DETAILED DESCRIPTION OF EACH OF THE FLANK CLEANLINESS SCORES.

Classification	Description
LIGHT **'1'**	Contamination of **fresh splashes of manure for <50%** of the area. The flank may have several areas of fresh manure, but each individual manure area is smaller than one sheet of letter paper.
MODERATE **'2'**	Contamination of **fresh splashes of manure for >50%** of the area. The flank has at least one area of fresh manure which is larger than one sheet of letter paper.
HEAVY **'3'**	Contamination of **dried caked and fresh manure for >50%** of the area. The flank has at least one area of dried caked manure which is larger than one sheet of letter paper.
VERY HEAVY **'4'**	Contamination of **entire flank area and belly with dried caked manure**

TABLE 10. EXAMPLE COW CLEANLINESS DATA RECORDING SHEET

	Cow ID	UDDER	LEG	FLANK
1	563	1	3	1
2				
3				
4				

3. On-Farm Measurement Protocols: BODY CONDITION SCORE (BCS)

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, MAPAQ and Novalait.

Objective: To identify cows in the dairy herd with a body condition score (BCS) ≤ 2.

Reference: Dairy Code of Practice: Section 2.1

Background: BCS is a tool for determining if an animal is too thin, too fat or in ideal condition. Ideal BCS is a range and will vary depending upon the stage of lactation.

Protocol:

1. Record the identification number of the cow on the data recording sheet
2. Assess body condition of the cow to determine if the cow is too thin (i.e., BCS ≤ 2). A cow is considered to be too thin if a) the thurl of the cow is prominent or b) when viewing the ribs of the cow: corrugations are visible ¾ of the way between the tips and short ribs. Refer to the BCS flowchart (Figure 1) to conduct the assessment. Only BCS of 3 and lower are illustrated on that flowchart.
3. Record body condition status on the Scoring Sheet- Tie stall or Data Scoring Sheet – Free stall as either unacceptable/ too thin (BCS ≤ 2) **OR** acceptable (BCS >2). Data Scoring Sheets are enclosed at the end of this document.

Figure 5: BCS flowchart:

Table explanation: First row = scores
First column = parts of the body to look at
Cell = description
Grey cell = what is changing between this score and the previous one

BCS	3.0	2.75	2.5	2.25	2.0	< 2.0
Pelvic area	V	V	V	V	V	V
Hook bones	rounded	angular	angular	angular	angular	angular
Pin bones	padded	padded	angular, fat palpable	angular, no fat palpable	angular, no fat palpable	angular, no fat palpable
Ribs	corrugations non visible	corrugations non visible	corrugations non visible	corrugations visible 1/2 way between tips and short ribs	corrugations visible 3/4 way between tips and short ribs	corrugations visible 3/4 way between tips and short ribs
					thurl non prominent	thurl prominent

Reference: Vasseur E, Gibbons J, Rushen J, et de Passillé A M, 2013. Development and implementation of a training program to ensure high repeatability of body condition score of dairy cow in animal welfare assessments. *J. Dairy Sci.* 96:4725-4737

4. On-Farm Measurement Protocols: LAMENESS SCORES (Free Stall and Tie Stall)

Based on protocols developed and validated by E. Vasseur, J. Gibbons, J. Rushen and A. M. de Passillé (Agriculture Agri-Food Canada), with funding from DFC and AAFC under the Dairy Science Cluster initiative and l'Entente de collaboration pour l'innovation en production en transformation laitière par AAC, le Fonds de recherche du Québec- Nature et Technologique, le MAPAQ and Novalait.

Objective: Observe and record either 1) gait of the sample cows or 2) behavioural indicators of lameness.

Reference: Dairy Code of Practice: Section 3.5

Background: Lameness in dairy cattle is a significant welfare problem indicating pain. Lame cows alter their behavior to reduce bearing weight on the affected limb.

The gait scoring method is the most accurate and preferred method for detecting lameness in dairy cattle. In tie stall systems where cows are routinely exercised, locomotion scoring is recommended. If walking and observation of cows is not practical, the stall lameness score system should be used.

GAIT OR LOCOMOTION SCORING PROTOCOLS

Method for gait scoring of cows

1. Establish a suitable location

Often the easiest location is the transfer alley between the parlour and the pen (particularly after a footbath as this will slow the cows down).

Criteria for choosing a location:

- Distance allows observation of cows walking for **four strides** (a minimum of two strides)
- Surface is smooth and flat
- Avoid slatted concrete surfaces if possible.
- Sloped flooring (downward or upward) and areas with steps should be avoided.

NOTE: If it is difficult to find a suitable alley to walk the cows, discuss other possibilities with the farmer (e.g. maybe re-route the cows or have them go down a walk- way to pasture used during the summer months).

2. Gait score sample cows

- Identify the cow
- If cows have been released from tie-stalls, habituate the cows to walking by walking up and down a passageway in a calm manner until the cows walk in a straight line at a steady pace.
- Observe **at least four strides** for each cow and record the presence or absence of limp on the data recording sheet (Table 11-12; Figure 6 and forms at the end of this appendix).

TABLE 11. GENERAL DESCRIPTION OF GAIT BEHAVIOURS.

Behaviour	Description
Head Bob	This refers to up and down head movement when walking. The head moves evenly as an animal walks, but lame animals will have exaggerated head movements when walking.
Asymmetric steps	This looks at the rhythm of the foot placement. An animal free from injuries would be expected to place her hooves in an even "1, 2, 3, 4" fashion but an animal with injuries may have an uneven rhythm of foot placement "1, 2…..3, 4". Not equal, a cow places her hooves in an uneven rhythm.
Limping	This looks at whether the animal is favouring one or more limbs. You would expect animals free from injury to bear weight evenly over the four limbs. An animal with an injury may not place all her weight on an affected limb.

TABLE 12. DESCRIPTION OF THE PRESENCE AND ABSENCE OF THE THREE GAIT BEHAVIOURS.

Behaviour	Absence	Presence
Head Bob	Even, gradual up and down head movement when walking.	Jerky or exaggerated up and down head movements when walking. Obvious when foot makes contact with ground.
Asymmetric steps	Hooves placement is in an even "1, 2, 3, 4" fashion	Uneven rhythm of foot placement "1, 2…..3, 4". Foot placement is not equal on both sides, cow places her hooves in an uneven rhythm.
Limping	All legs bear weight equally.	Walk with an uneven, irregular, jerky or awkward step as if favouring one leg.

FIGURE 6. DATA RECORDING SHEET FOR GAIT SCORING LIVE.

SCORE	GAIT
0	NO LIMP PRESENT
1	OBVIOUS LIMP

FARM:_____DATE: _____ OBSERVER:_____

	COW ID	LIMP
1	234	1
2		
3		
4		
5		
6		
7		

1. Encourage all cows to be assessed to stand.
   - All cows must be standing for at least 3 minutes before their assessment begins.
   - Encourage the cow to stand up by standing behind her while saying 'up up' in a stern voice. If she does not respond to this, a tap on the spine may be required.

2. Record the identification of the cow to be assessed in the data recording sheet

3. Observe the cow for lameness. Do not score if the cow urinates or defecates during the assessment. The assessment consists of two parts:
   a. Assessment of foot placement – Standing Pose
      i. Observe the foot position and placement of the cow for a full 10 seconds in each of the following three positions:
         - directly behind the cow such that both legs are visible (about 2-3 feet behind the stall)
         - Left of the cow for a side-view of both legs
         - Right of the cow
      ii. Record the presence of EDGE, SHIFT WEIGHT and REST indicators (Figure 9) for each position.

   b. Shifting of the cow from side to side
      i. Position yourself behind the cow with a view of both front and hind feet
      ii. Ask the producer to shift the cows from side to side.
      First walk from the right to the left behind the cow and then back to the right. If the cow does not respond to your movement, repeat this while tapping her hipbone, with your hand, on the side opposite to where you want her to move (i.e. If you want her to move left, tap her right hip bone). If this still does not work, poking gently with the tip of a pen may replace a tap.
      iii. Pay attention to how the cow shifts weight from foot to foot.
      Observe if the UNEVEN indicator (Table 13) is present. This can be identified as a reluctance to bear weight on a particular foot. Observe the foot position and placement and the presence of EDGE, SHIFT WEIGHT and REST indicators (Table 13) resumed after movement.
      iv. Record presence of behavioural indicators in the Data Recording Sheets.(Figure 8 and forms at the end of this appendix)

4. A cow will be scored as **obviously/severely lame** (unacceptable) if 2 or more indicators are recorded. Record either ' LAME' or 'NOT LAME'.

Reference:

Gibbons J., D. B. Haley, J. Higginson Cutler, C. Nash, J. Zaffino, D. Pellerin, S. Adam, A. Fournier, A. M. de Passillé, J. Rushen et E. Vasseur. (submitted) Technical Note: Reliability and Validity of a Method to Measure Lameness Prevalence of Cows in Tie-stalls. J. Dairy Sci.

TABLE 13. BEHAVIOURAL INDICATORS OF LAMENESS IN TIE STALLS

BEHAVIOUR INDICATOR	DESCRIPTION
Standing Pose (Voluntary movements)	
STAND ON EDGE	Placement of one or more hooves on the edge of the stall while standing stationary. Standing on the edge of a step when stationary, typically to relieve pressure on one part of the claw. (Fig 7) This does not refer to when both hind hooves are in the gutter or when cow briefly places her hoof on the edge during a movement/step.
WEIGHT SHIFT	Regular, **repeated** shifting of weight from one hoof to another. Repeated shifting is defined as lifting each hind hoof at least twice off the ground (L-R-L-R or vice versa). The hoof must be lifted and returned to the same location and does not include stepping forward or backward
UNEVEN WEIGHT **(REST)**	Repeated resting of one foot more than the other as indicated by the cow **raising** a part or the entire hoof off the ground. This does NOT include raising of the hoof to lick or during kicking (Fig 8).
Cow moved from side to side	
UNEVEN MOVEMENT	Uneven weight bearing between hooves when the cow was encouraged to move from side to side. This is demonstrated by greater **rapid movement** of one hoof relative to the other, or by an evident **reluctance to bear weight** on a particular foot.

FIG 7. EXAMPLES OF STANDING ON EDGE OF STALL

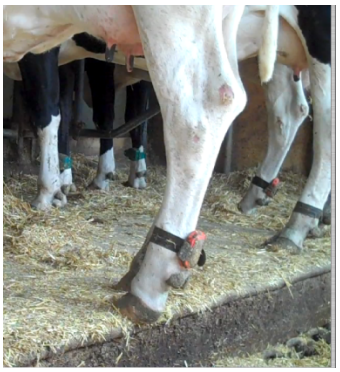


FIG 8. EXAMPLE OF FOOT RESTING

Reference: Gibbons J., D. B. Haley, J. Higginson Cutler, C. Nash, J. Zaffino, D. Pellerin, S. Adam, A. Fournier, A. M. de Passillé, J. Rushen and, E. Vasseur. (submitted) Technical Note: Reliability and Validity of a Method to Measure Lameness Prevalence of Cows in Tie-stalls. J. Dairy Sci.

FIGURE 8. DATA RECORDING SHEET FOR GAIT SCORING LIVE WITH COWS IN TIE-STALLS.

FARM:_____DATE: _____ OBSERVER:_____

	COW ID	LIMP
1	234	1
2		
3		
4		
5		
6		
7		
8		

Figure 9: STALL LAMENESS DATA RECORDING SHEET

Farm:_____ Date:_____ Observer:_____

#	Cow ID	Edge	Weight Shift	Uneven weight	Uneven Move.	Obviously / Severely Lame
1	493	1	1	1	1	
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
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