





## Ethology Program at the Prairie Swine Centre

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## Overview

- Components of Animal Welfare
- Sow Housing
  - Size of stalls
  - Social management in Electronic Sow Feeders
  - Loafing area use with Free Access Stalls
- Transport and Meat Quality
  - Seasons
  - Truck compartments
  - Length of transport

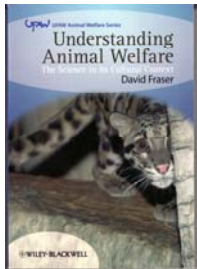


## Organizational Levels of Animal Welfare

- Welfare is a concern for individual producers
  - Eg. Decisions on health check protocols
- Welfare is a concern for the industry
  - Eg. Codes of Practice or Quality Assurance
- Welfare is a concern for the society (customer)
  - Eg. Humane slaughter laws and general housing practices



## Components of Animal Welfare

- Understanding Animal Welfare (2008)
  - David Fraser, NSERC Industrial Research Chair in Animal Behaviour, University of British Columbia


## Affective States

- Welfare . . . embraces both the physical and **mental well-being** of the animal.
  - (Brambell Report)
- Emphasis on practices that cause:
  - Pain
  - Fear
  - Frustration
  - Discomfort (or comfort)
- Balances both positive and negative feelings
- Practices may not be associated with physical damage- what is important is what the animal feels

## Function

- Animal welfare relates to an animal's **state of coping** with its environment. (Broom, 1991)
- Emphasis on measures of:
  - Productivity
  - Health
  - Stress
  - Disruption of behavior
- Often an assumption (sometimes incorrect) that if a production system is efficient (biologically and/or financially), then the welfare of the animals is good.



**Natural**

- Natural selection has resulted in animals that are best able to cope with natural conditions.
- Fit the farm to the animal, not the animal to the farm.
  - In the wild, a solitary boar joins a group of females which soon cycle in response to his presence.
    - The boar effect used in commercial mating.
  - Pigs have an innate drive to be familiar with their environment, and as such discover food sources and shelter.
    - Pigs housed in large groups will visit most feeders every day, rather than using only the nearest one.

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**Towards a Collective Approach**

Affective states      Function

Natural

- Animal functions well, feels well and can rely on its natural abilities to adjust.
- Within an efficient, and hopefully profitable, production system.

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**Gestation Stalls**

- The Brambell Report states:
  - In principle we disapprove of a degree of confinement of an animal which necessarily frustrates most of the major activities which make up its natural behaviour.
  - An animal should at least have sufficient freedom of movement to be able without difficulty, to turn round, groom itself, get up, lie down and stretch its limbs.

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**Gestation Stalls**

- The greatest concern about gestation stalls is their failure to provide freedom of movement
  - Until recently, as sow size has increased, the industry has adopted narrower stalls
  - Although ‘turn-around’ stalls were developed, they were not adopted by the industry

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**Stall Length and Width**

Anil et al. 2002:  
High injury scores were associated with low ratios of stall length to sow length, and stall width to sow height.  
*Smaller stalls result in more injuries.*

Marchant and Broom, 1996:  
The length of time taken to lie down was greater in short stalls (low length/weight ratio). Sows in groups took less time to lie down than those in stalls.  
*Sows in stalls had difficulty changing posture, particularly the larger sows.*

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**Bone Breaking Strength**

Bone	ESF Group	Stall
Humerus	~1100	~750
Femur	~1100	~750

Sows housed in respective systems through 8-9 pregnancies. (Marchant and Broom, 1996)

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**Towards a Resolution**

- Sows from group housing move more freely (natural), have better bone and muscle strength (function) and crush fewer piglets (function) than do sows from stalls (J. Dean).
- 'Natural' and 'Functional' criteria may agree on some systems

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**Stall Width: Basis for the Decision**

**National Pork Board:** Easily lie down in full lateral recumbency.

**Code of Practice:** Able to lie fully recumbent without the body touching both sides of the stall.

**FMI-NCCR:** Able to lie down on her side without her teats extending into the adjacent stall.

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**Stalls at Prairie Swine Centre: Objectives**

- Determine the effects of stall width and sow size on behavior.

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**Sow Size and Stall Width**

Stall widths: 55, 60, 65, 70

Sow sizes: Gilt (< 150), Small (< 200), Medium (200 - 230), Large (> 230)

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**Udder Extends into Adjacent Stall (% of Time While Lying Laterally; 14<sup>th</sup> week)**

Stall width (cm)	gilts	small	medium	large
70	~10	~15	~45	~45
65	~15	~40	~70	~75
60	~55	~70	~90	~95
55	~85	~90	~95	~100

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**Stall Width Required to Keep 'Sow in Stall' While Lying**

Sow weight (kg)	Code of Practice (cm)	Our results (cm)
140	~60	~60
165	~65	~65
190	~70	~70
215	~70	~70
240	~70	~70
265	~70	~70
290	~75	~75

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**Gestation Stalls: Summary**

What do we accomplish?



- Control aggression
- Control feed intake

How do we fail?

- Restricted movement
- Restricted posture



What can we do better?

- Increase the size of the stall



**Group Housing**

- Major concerns
  - Maintaining body condition
  - Controlling aggression
    - Aggression at re-grouping
    - Aggression at feeding
- Solutions
  - Controlling individual feed intake
  - Social management



**Options Within Group Gestation Systems**

Feeding	Floor	Grouping	Timing	Total
	Slat		Wean	
Trickle		Static		
	X Partial X		X Pre-Impl.	= 72
Feed-stall		Dynamic		
ESF	Bedded		Post-Impl.	



**Re-Grouping Aggression**

- Managed in different ways
  - Sows used to group living will adapt to new groups more quickly
  - Large groups will be more ‘tolerant’ of unfamiliar sows
  - Segregate by parity, particularly gilts
  - Keep familiar sows together in subsequent gestations

**Feed Intake and Aggression**


- Feeding levels are restricted for gestating sows
- When a resource, such as feed is restricted, competition leads to aggression and unequal use
- Use a feeding system in which competition is for **access** to feed, rather than for feed itself
- Make access to feed unlimited
- Prevent a sow from obtaining more feed through aggression

**Electronic Sow Feeders (ESF)**








## Static vs Dynamic Groups

- In static groups, all sows enter on the same day and remain until removed for farrowing (or rebreeding). There is only one day of aggression.
- In dynamic groups, small groups are added at different times. Each new addition results in another day of aggression.

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## Consecutive vs Staggered Dynamic Groups

- Consecutive
- Staggered

ABCD	AEIM
EFGH	BFJN
IJKL	CGKO
MNOP	DHLP

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## When to mix: Pre vs Post Implantation

### Farrowing Rate (% , 5 cycles)

	Stalls	Pre-implant		Post-implant	
		Static	Dynamic	Static	Dynamic
1 <sup>st</sup> parity	84.7	81.7	85.6	87.6	86.7
2 <sup>nd</sup> parity	83.8	81.4	81.7	80.0	89.2
Mature sows	87.8	83.7	79.5	86.1	88.3
Adjusted	86.0	82.6	81.6	85.1	88.1


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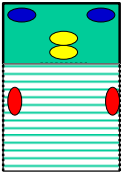
## Live Piglets/100 Sows Bred (5 cycles)

	Stalls	Pre-implant		Post-implant	
		Static	Dynamic	Static	Dynamic
1 <sup>st</sup> parity	898	874	865	929	910
2 <sup>nd</sup> parity	922	879	956	896	1008
Mature sows	948	898	890	982	980
Adjusted	928	886	899	947	968

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## Does Dominance Play a Role in ESF Systems?




- Older, larger sows
- Middle aged sows
- Younger, smaller sows

Dominant sows gained access to solid floors and walls. Subordinate sows had to rest on slats (PSCI).

In U. of Manitoba studies, in non-bedded ESF, the majority of culling for lameness was in the first two parities.

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## Does Dominance Play a Role in ESF Systems

- Older, larger sows gain access to the feeding station earlier in the cycle; younger, smaller sows later in the cycle (PSCI).
- Overstocking an ESF station will affect the younger, smaller sows more than the dominant ones.

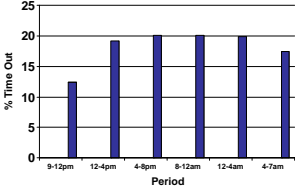
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**Feeding Stalls: Walk in-Lock in**




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**Time spent outside stalls**



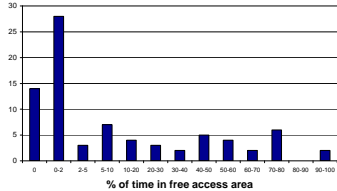
Period	% Time Out
9-12pm	12
12-4pm	19
4-8pm	20
8-12am	20
12-4am	20
4-7am	17



On average- sows spend 20% of the day out of stalls

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**Sows in the free access area over 24 hrs**

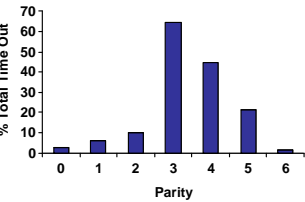


% of time in free access area	Count
0	14
0-2	28
2-5	3
5-10	7
10-15	4
15-20	3
20-25	2
25-30	4
30-35	3
35-40	2
40-45	4
45-50	2
50-55	1
55-60	2
60-65	1
65-70	2
70-75	1
75-80	4
80-85	1
85-90	1
90-100	2


- Approx. 14% of sows never exit stalls
- Approx. 28% spend less than 2% of time out

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**Parity of sows in free access space**



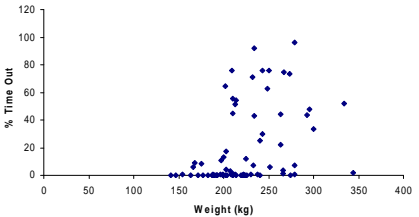
Parity	% Total Time Out
0	2
1	5
2	10
3	65
4	45
5	20
6	2



Older sows spend more time in free access space

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**Size of sows in free access space**



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**Why do Older, Larger Sows use the Loafing Area?**

- Three hypotheses:
  - It's a preferred area, and they are the dominant sows
  - The stalls are only 65 cm (26 in), and they are too small and uncomfortable for larger animals
  - Smaller sows have difficulty opening the self-locking gates

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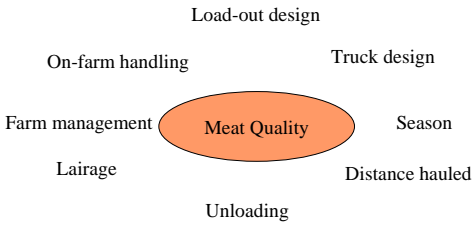
**Gestating Sows: Future research**

- Improve management in group housing
  - Grouping by parity
  - Addition of rubber mats
- Longevity, including lameness and competitiveness



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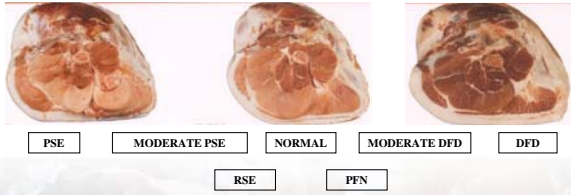
**Factors Affecting Meat Quality**



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**MEAT QUALITY**

Quality categories



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**Meat Quality During Study**

	Loin	Ham
Normal	63.5%	74.5%
PSE	28.0%	18.0%
DFD	6.5%	8.0%

Approx. 35% of loin and 25% of ham scored outside of 'normal' range

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**Phase 1: Design**

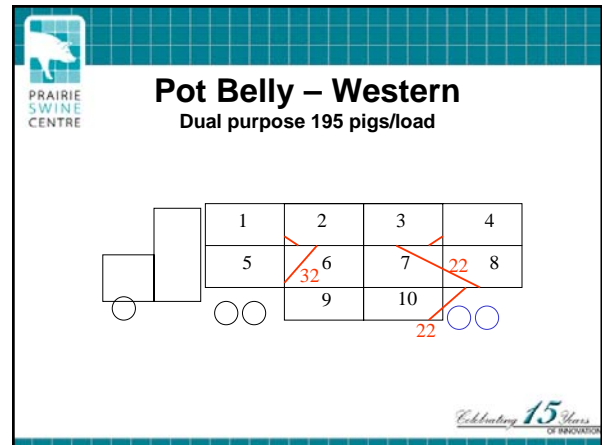
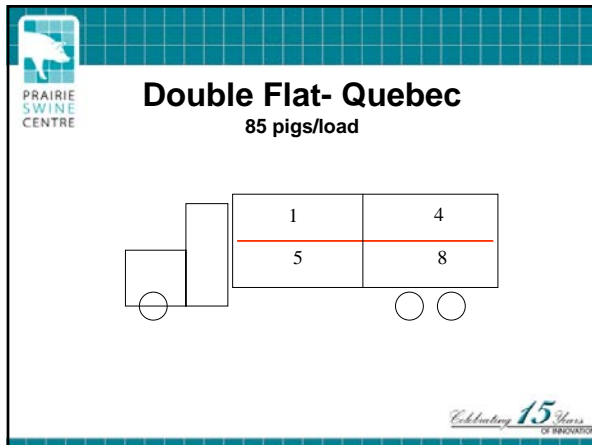
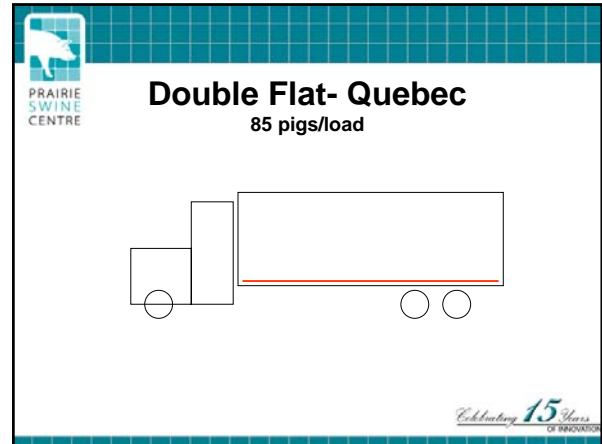
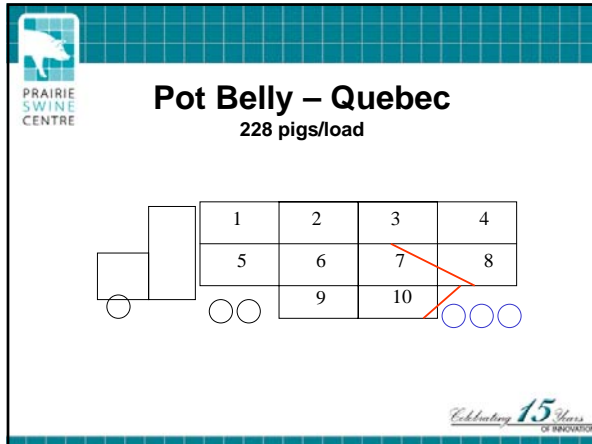
Quebec	Western
Short haul (1.5 hr)	Long haul (8 hrs)
1-2 hr lairage	1-2 hr lairage
Two truck types	Single truck type
Use of Paylean	No Paylean
No electric prods	Prods at loading only
CO2 stunning	Electrical stunning

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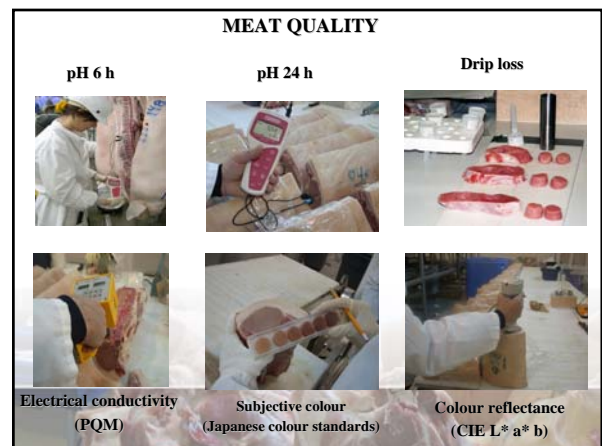
**Seasons**

- Studies conducted at both locations:
  - Summer
  - Winter
- Six transport days during each season at each location (36 loads of pigs)
- Three vehicle types

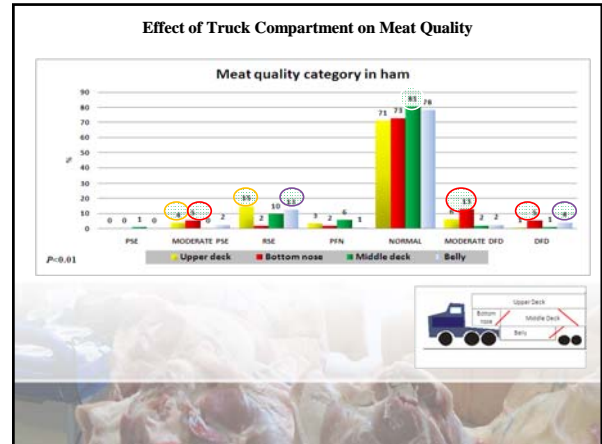
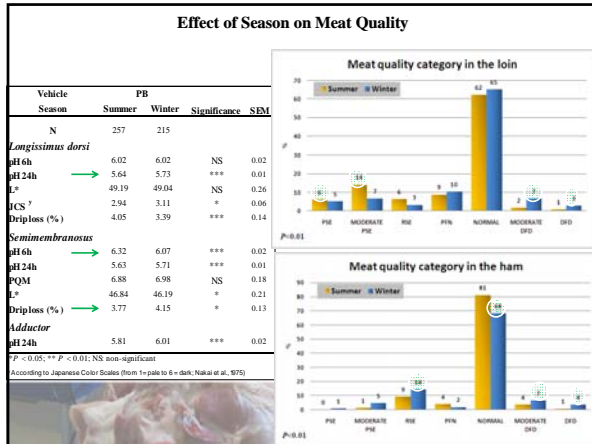
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- 
- What We Measured**
- Heart rate
  - Blood
    - CPK and lactate
  - Carcass quality
    - Surface damage, bruising
  - Meat Quality
    - Ham and loin
    - 24 hr post-mortem
      - pH, colour, light reflectance, conductivity
      - Drip loss after 48 hours
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### Overcoming Compartment Differences

- Use of hydraulic lifts rather than ramps
- Reducing slope of internal ramps
- Use of low-slope external ramps to access each level
- Familiarize pigs with ramps before loading?

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### Challenges of Loading Density

- Meat quality issues relate to upper and lower decks
- DOAs are most common in middle rear compartment
- Attributed to hot weather, loading of subject hogs
- Does over-crowding contribute to losses?

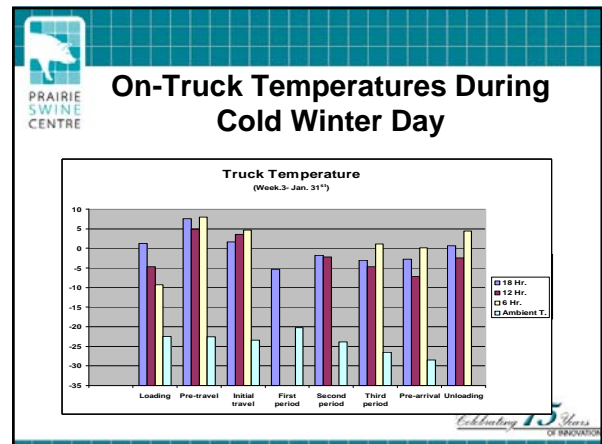
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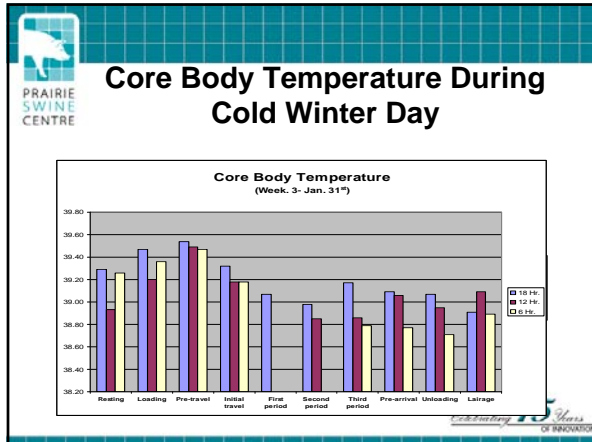
### Sources of Over-Crowding

	Area	Pigs	Area /pig	Area /100kg
Standard density (.36m/100kg)	12.5 sqm	31	.396	.360
Increase to balance	12.5	33	.379	.344
Increase to 120 kg	12.5	33	.379	.316
Increase to 130 kg	12.5	33	.379	.292
Reduce in hot weather	12.5	30	.417	.321

Adjust load size for pig weight and load truck uniformly.

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- ### Length of Transport
- Approximately 2 hours of travel is needed to recover from loading
  - Nutrient absorption is minimal due to feed withdrawal (20 hrs before scheduled slaughter)
  - Energy expenditure during transport will reduce stored energy
  - **At what point does energy depletion affect meat quality (higher DFD)?**

- ### Sprinkling During Hot Weather
- Project this summer in southern Ontario
  - **At what temperature (15 vs 25 C) does sprinkling after loading improve meat quality?**

- ### Acknowledgements
- |  |   |
|--|---|
| <p><b>Collaborators:</b></p> <ul style="list-style-type: none"> <li>• Alberta Agriculture</li> <li>• University of Saskatchewan</li> <li>• University of Manitoba</li> <li>• University of Guelph</li> <li>• Laval University</li> <li>• AAFC</li> </ul> | <p><b>Funding agencies:</b></p> <ul style="list-style-type: none"> <li>• Alberta Pork</li> <li>• Sask Pork</li> <li>• Manitoba Pork</li> <li>• Ontario Pork</li> <li>• Maple Leaf Foods</li> <li>• F Menard</li> <li>• NSERC</li> <li>• AAFC</li> </ul> |
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