

Feeds Opportunities from the Biofuels Industries (FOBI)

An Agriculture and AgriFood Canada funded
Agriculture BioProducts Innovation Program
(ABIP) grant.

March 12, 2010
Winschoten, the Netherlands
Crops 2 Industry Workshop

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Agriculture and Agrifood Canada

- Agricultural Bioproducts Innovation Program (ABIP) = 9 Networks
- \$145 million CDN = 145 Euro
- 3 years, finishing March 31, 2011



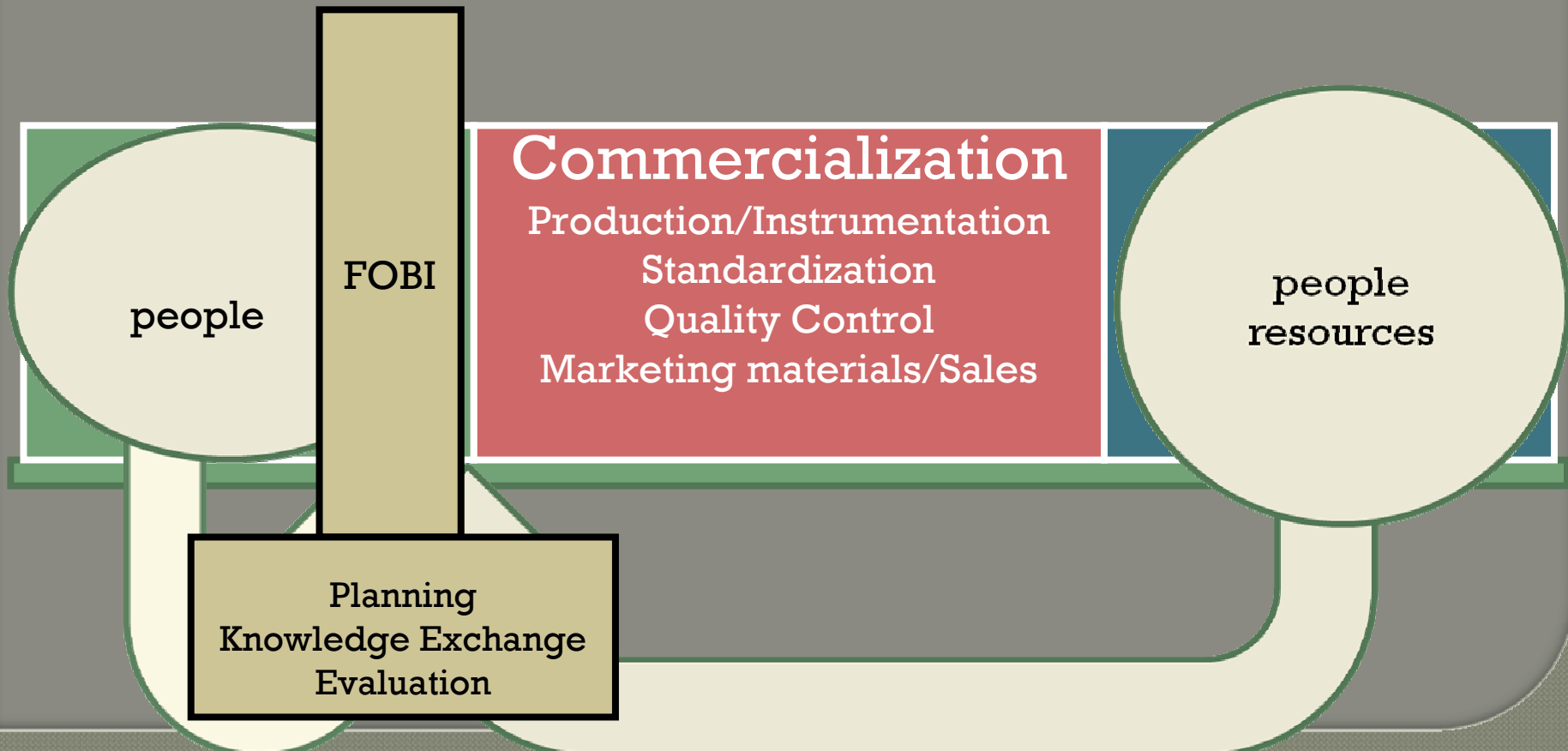
Pisa Italy
June 2009

FOBI

- Mandate of “FOBI network” is to improve the value of the co-products of the wheat bioethanol industry to further develop a sustainable bioethanol industry
- An initiative of Feed Innovation Institute (FII)
- Total value: \$6,180,202

Discovery and Commercialization of a New Product or Technology

Time



Research Network Participants

- **Network Lead:** University of Saskatchewan
- **56** researchers from Alberta and Saskatchewan
- **9** Participating research institutions
 1. Agriculture and Agri-food Canada
Lacombe, Lethbridge, Swift Current
 2. Ministry of Agriculture and Rural Development, Alberta
 3. Feedlot Health Management Services Ltd, Alberta
 4. University of Alberta
 5. University of Calgary
 6. Saskatchewan Research Council
 7. Western Beef Development Centre, Lanigan, SK
 8. Prairie Swine Centre, Saskatchewan
 9. University of Saskatchewan

Industrial Partners

5 bio-ethanol companies in Alberta and Saskatchewan

2 “integrated” facilities

(Capacity: 30,000 head at each)



3 “stand alone” facilities



- Total nameplate capacity/year: **210+ million litres**
- Total production of all co-products/year: **200+** thousand MT
- Total feedstock utilization/yr: **550+** thousand MT

FOBI Industrial Partners



- Wheat and wheat/corn based bioethanol plants

Nutrient	Dried Corn Distillers Grains*	Dried Wheat Distillers Grains
Moisture	10	8 to 10
<u>Crude protein</u>	30.9	34.9
UIP (bypass) % of CP	44 to 52	45 to 54
TDN % (ruminant)	86.0	82.0
D.E. (Swine) Kcal/kg	4075	3500
<u>Crude fibre %</u>	7.2	12.6
Total ash %	6.0	3.3
<u>Fat (E.E.)%</u>	10.8	6.6
ADF %	12.2	16.4
NDF %	44.0	43.0
Calcium %	0.07	0.12
Phosphorus %	0.77	0.63
Avail. Phosphorus % (swine)	0.18	0.20
Lysine%	0.91	0.87
Threonine%	1.14	0.97
Methionine + cystine%	1.30	0.95
Tryptophan%	0.24	0.22

Average Nutritive Analyses Values for DDGS

on average, wheat DDGS has higher protein and crude fiber and lower fat than corn DDGS, corn has higher energy

* From University of Minnesota Website / Hoards Dairyman

**From Feeds Innovation Institute data 2006



Wheat DDGS is substituted for barley in livestock rations

% DM Basis	100% Wheat DDGS	Barley
Crude Protein	37.7	14.3
Ash	5.4	3.5
Crude Fat	5.7	3.5
Acid Detergent Fiber	15.2	10.1
Neutral Detergent Fiber	49.9	24.1
Starch	5.9	55.3
Sulfur	0.44	0.16
Phosphorus	0.87	0.45
Calcium	0.12	0.07

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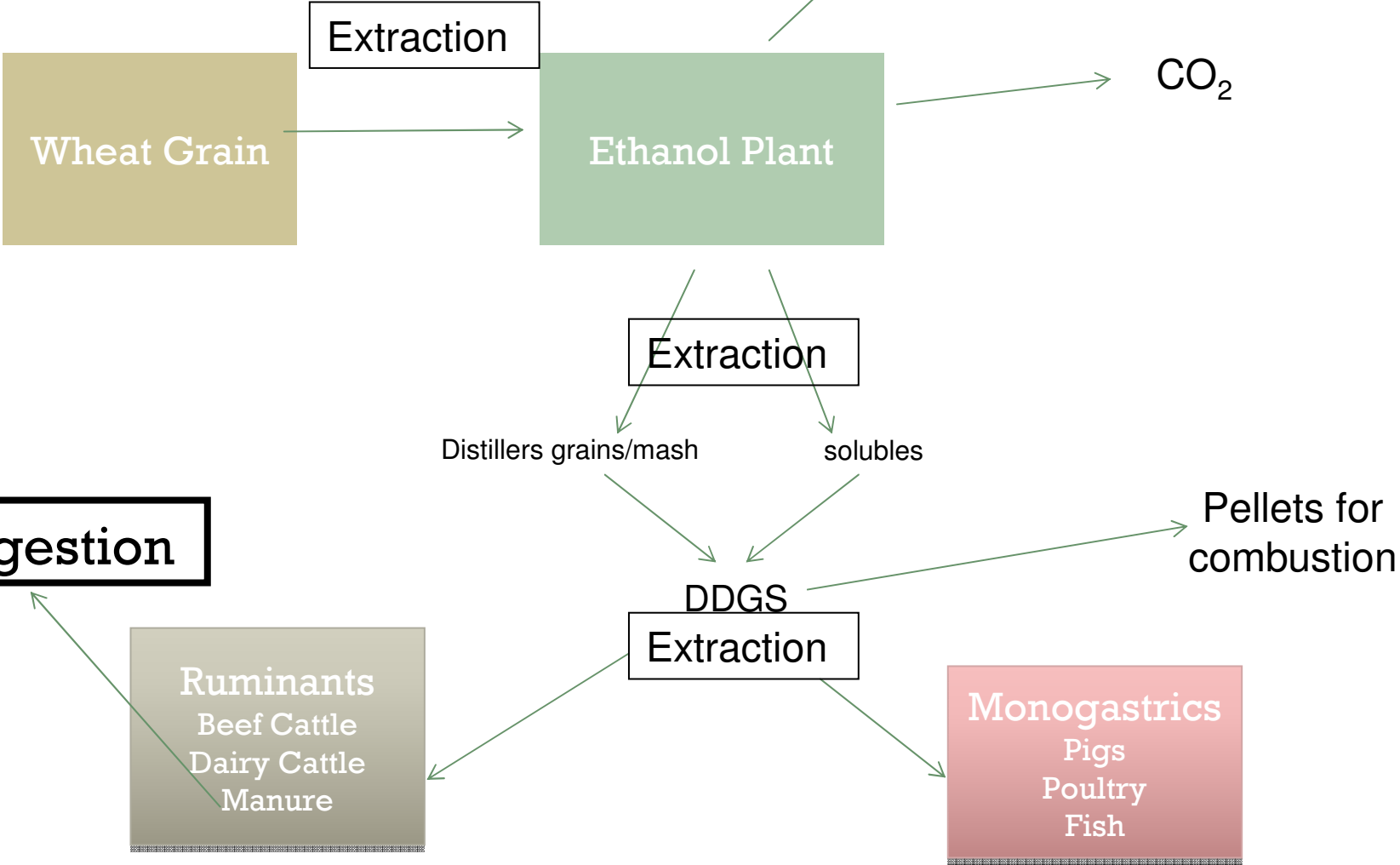
Starch, protein, fiber and mineral content differ between DDGS and barley. Research and Education are necessary so that DDGS is used correctly as a Ration Ingredient

- minimize waste to environment
- maximize nutrient value
- maximize price to EtOH producer

Research Programs

- 5 research groups (24 projects with 43 research studies)
 1. Ruminant Nutrition (Beef, Dairy)
 - 5 projects / 12 research studies
 2. Monogastric Nutrition (Swine, Poultry, Fish)
 - 4 projects / 10 research studies
 3. Added Value
 - 10 projects / 14 research studies
 4. Germplasm
 - 3 projects
 5. Economics and Policies
 - 2 projects / 4 research studies
- Commercially relevant Research projects
- Training opportunities for ~30 highly qualified personnel (HQP)

Overview of Ethanol and Livestock Industries



Multidisciplinary approach

- **Group 1: Ruminant Utilization** (Tim McAlister AAFC, John McKinnon UofS)
 - Nutrient analyses, small pen/carcass quality, large pen commercial trial, dairy, pasture grazing, manure management
- **Group 2: Monogastric Utilization** (Ruurd Zijlstra UofA, Andrew Van Kessel UofS)
 - Nutrient analyses, growth performance/carcass quality for DDGS and byproduct fractions, intestinal health
- **Group 3: Value Added** (Darren Anweiller SRC, Terry Fonstad UofS)
 - Advanced nutrient analyses, fraction, extraction, pelleting, modelling, drying technologies, LCA
- **Group 4: Spring Wheat Germplasm Enhancement** (Curtis Pozniak UofS)
 - Characterization of core wheat varieties, breeding to maximize grain and starch yield, breeding to maximize ethanol yield while reducing fermentation time and viscosity
- **Group 5: Economics and Policy** (Jill Hobbs UofS, Stuart Smyth UofS)
 - Government policy analyses, KT/impact of FOBI, production economics, supply chain analyses, spatial analyses

Summary: Ruminant Nutrition

- No impact of replacing barley with DDGS in back grounding diets.
- No negative impact on carcass quality
- Linear increase in DMI with increasing levels of DDGS in finishing diets.
- When fed at 20% of DM in finishing diets, DDGS is worth ~10% more than rolled barley
- Nutritional and economic value of DDGS declines with increasing levels of inclusion

Conclusions: Swine Trials

- Increased ADFI, reduced ADG, G:F with increasing wheat DDGS inclusion
- NE value of wheat DDGS >2.4 Mcal (Noblet Eq.4)
- Days to market increased only at 30% inclusion
- No effect on backfat, loin depth, yield or index
- Dressing % was reduced 0.45%-unit for every 7.5% wheat DDGS inclusion
- Pork quality work in progress at AAFC Lacombe



Why Biogas at Feedlot/Ethanol Facilities?

- Close the loop
- Reduce energy costs
- Reuse water
- Waste treatment

Feedlot

Energy
Waste

Grain
Water

Biogas

Energy
Waste

Ethanol



Why Biogas at Feedlot/Ethanol Facilities?

- **Substrate options at feedlot/ethanol facilities**
 - Manure – 45m³/fresh tonne
 - Cereal Straw – 150 to 300 m³/dry tonne
 - WDG, DDGS and thin stillage (not known)
- **Improved energy balance for ethanol production (Energy out : Fossil Energy in)**
 - Conventional Ethanol (DDGs) – 1.1 : 1
 - Feedlot/Ethanol (WDGs) – 1.45 : 1
 - Feedlot/Ethanol/Biogas – 7.6 : 1
- **Reduced risk**
 - energy, grain, DDGS market variability
- **Additional revenue potential**
 - Fertilizer, excess energy

Genetic Enhancement

Core Variety
Characterization



Variety Development



Improve EtOH Yield
/ Fermentation Time

What we have already

A better "Feedstock"

Science: What can we do?

Field Testing

Collab. Field Testing

Appropriate genetic stocks

Proximate Analysis

Selection

Field Testing

Disease

Yiel

Maturity

Pentosans/Viscosity

Fermentation /Viscosity

Proximate analysis/
Fermentation Testing

Fermentation testing

Samples available to the Network

Assessment of bilateral dependencies for ethanol plants

Objective: Assess supply chain development strategies that will maximize industry development

- Examine supply chain relationships between ethanol plants and key markets
- Determine how hold-ups can be mitigated

Outcome: identification of strategic supply chain issues

Spatial Economics of the Ethanol- Livestock Feeding Sectors

**Objective: examine the spatial distribution of
ethanol plants and livestock density**

- Examine co-location synergies
- Examine constraints from transportation

**Outcome: MSc thesis based on the economic
modeling data**



The Feed Opportunity from the BioFuels Industries (FOBI) Network is a collaborative and multidisciplinary research network which is composed of researchers from Agriculture and Agri-Food Canada, Alberta Ministry of Agriculture and Rural Development, Feedlot Health Management Services Ltd, University of Alberta, University of Calgary, Saskatchewan Research Council, Prairie Swine Centre, Western Beef Development Centre and University of Saskatchewan. The FOBI Network has partnered with 5 bio-ethanol producers in both Alberta and Saskatchewan provinces; Terra Grain Fuels Inc., Belle Plain, SK; NorAmeria BioEnergy, Weyburn, SK; Pound-Maker Agventures Ltd., Lanigan, SK; North West Bio-Energy Ltd., Unity SK; and Highland Feeders Ltd., Vegreville, AB.

FOBI is an initiative of Feeds Innovation Institute, a commercialization entity of the University of Saskatchewan. The vision of FOBI is to stimulate the sustainable growth of the bio-ethanol and livestock sectors, leading to a stimulation of economic activities in rural Canada. FOBI will focus on optimization of the overall feed value chain of wheat DDGS as well as on value addition to bio-ethanol co-products.

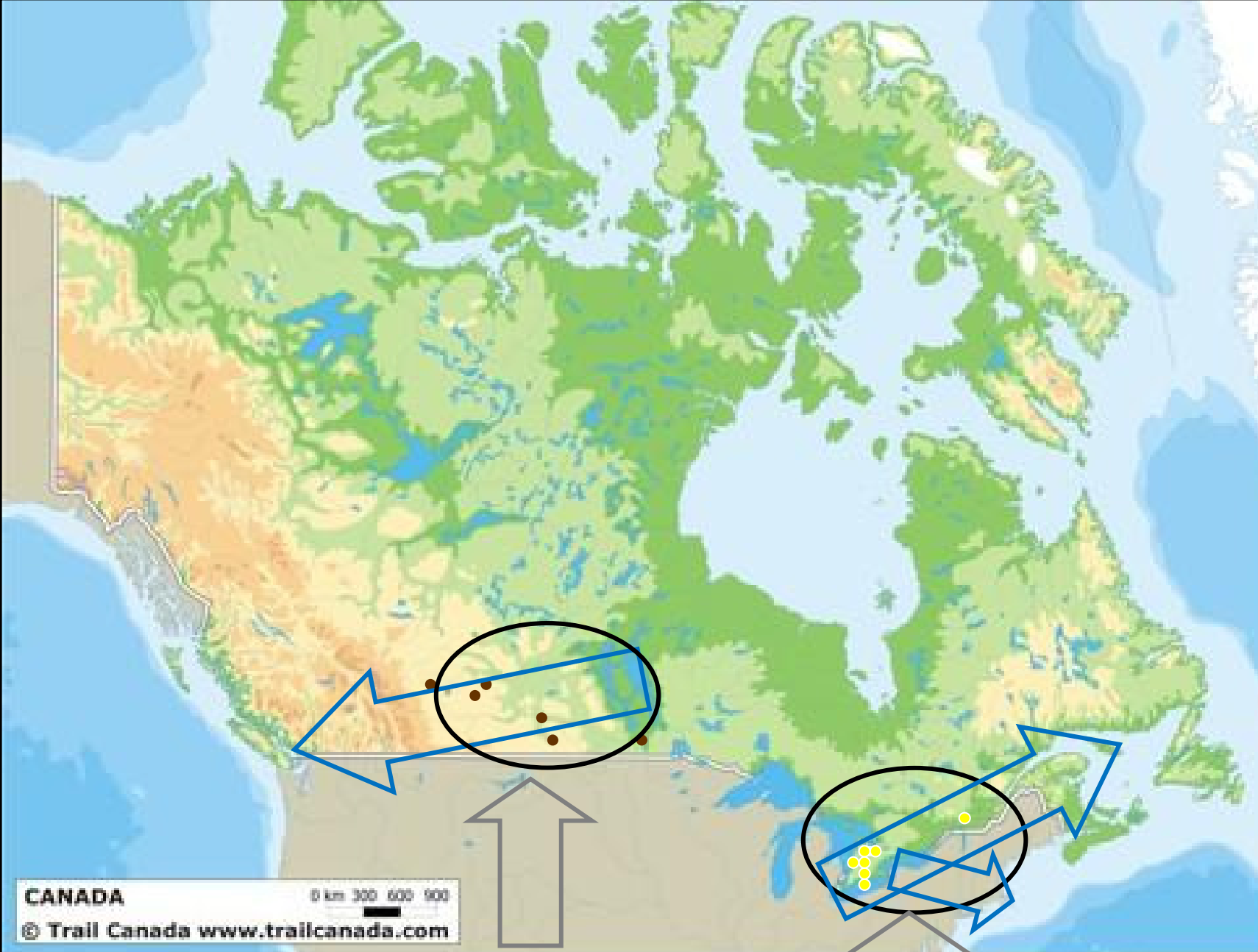
FOBI is funded through Agriculture and Agri-Food Canada, Agriculture and Bioproducts Innovation Program. A contribution of \$5,580,853 will be provided by the Ministry of Agriculture and Agri-Food where the total value of the FOBI research program amounts to \$6,180,202.

[University of Saskatchewan Research News](#)

Network Members

	Agriculture and Agri-Food Canada	Agriculture et Agroalimentaire Canada	
	UNIVERSITY OF SASKATCHEWAN		UNIVERSITY OF ALBERTA
			
		Western Beef Development Centre <small>Division of PAMI</small>	

DDGS – Product Flow



Economics

- ◉ Steps in supply chain
- ◉ Actors in the supply chain
- ◉ Cost Drivers
- ◉ Regulatory Barriers