Canola Meal and its Uses and Opportunities to Increase Value

USCA Canola End Uses Symposium

November 2, 2010
Long Beach, California

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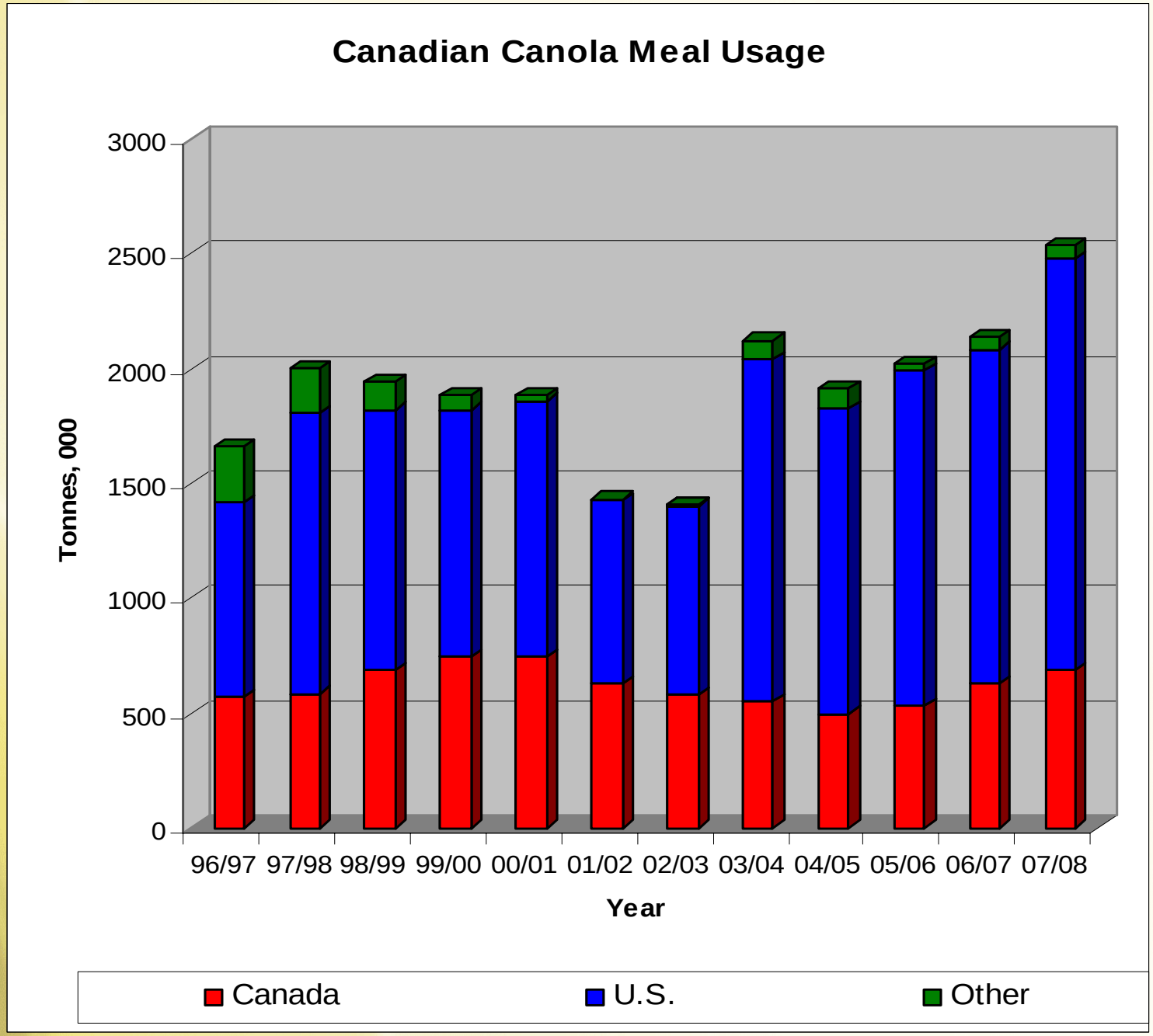
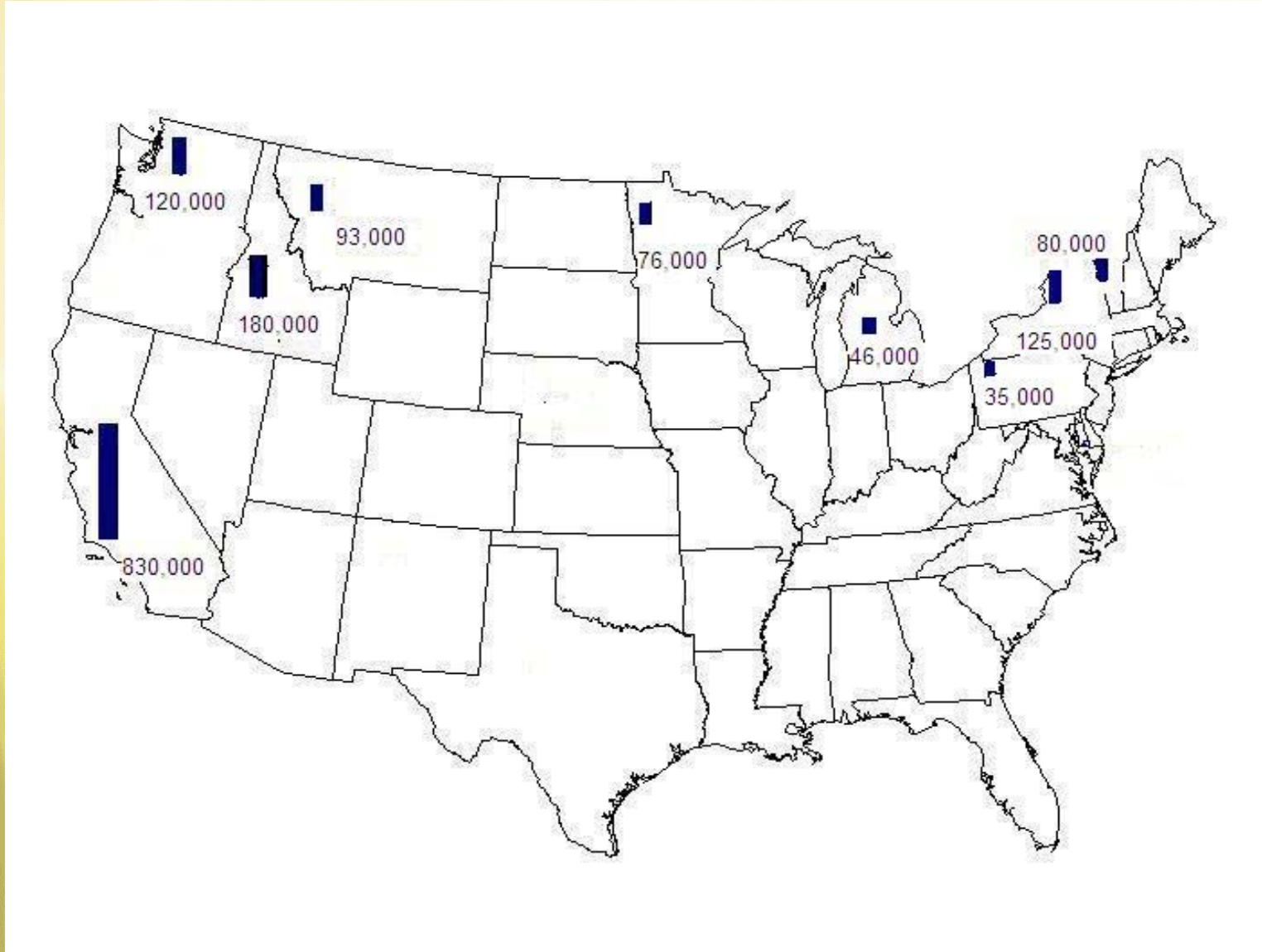
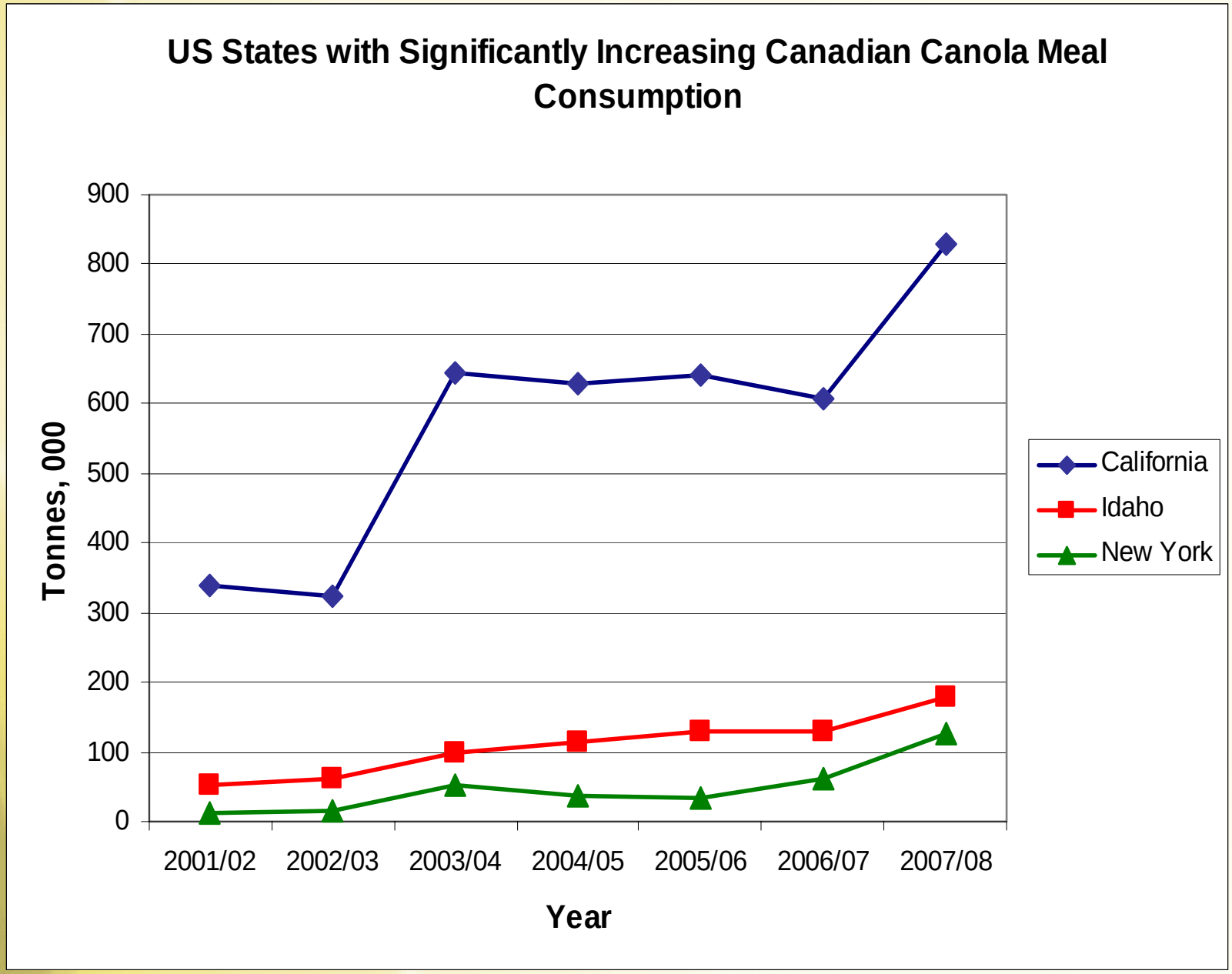
Canola Council of Canada


Canadian Canola Meal Usage
Tonnes, 000
3000
2500
2000
1500
1000
500
0
96/97
97/98
98/99
99/00
00/01
01/02
02/03
03/04
04/05
05/06
06/07
07/08
Year
Canada
U.S.
Other

U.S. states using Canadian canola meal (>35,000t) in 2007/08. Ag Commodity Research 2008.




US States with Significantly Increasing Canadian Canola Meal Consumption
Tonnes, 000
900
800
700
600
500
400
300
200
100
0
2001/02
2002/03
2003/04
2004/05
2005/06
2006/07
2007/08
Year
California
Idaho
New York

Salmonella in Canadian canola meal disrupts exports to the United States

FDA crackdown on salmonella in early 2009

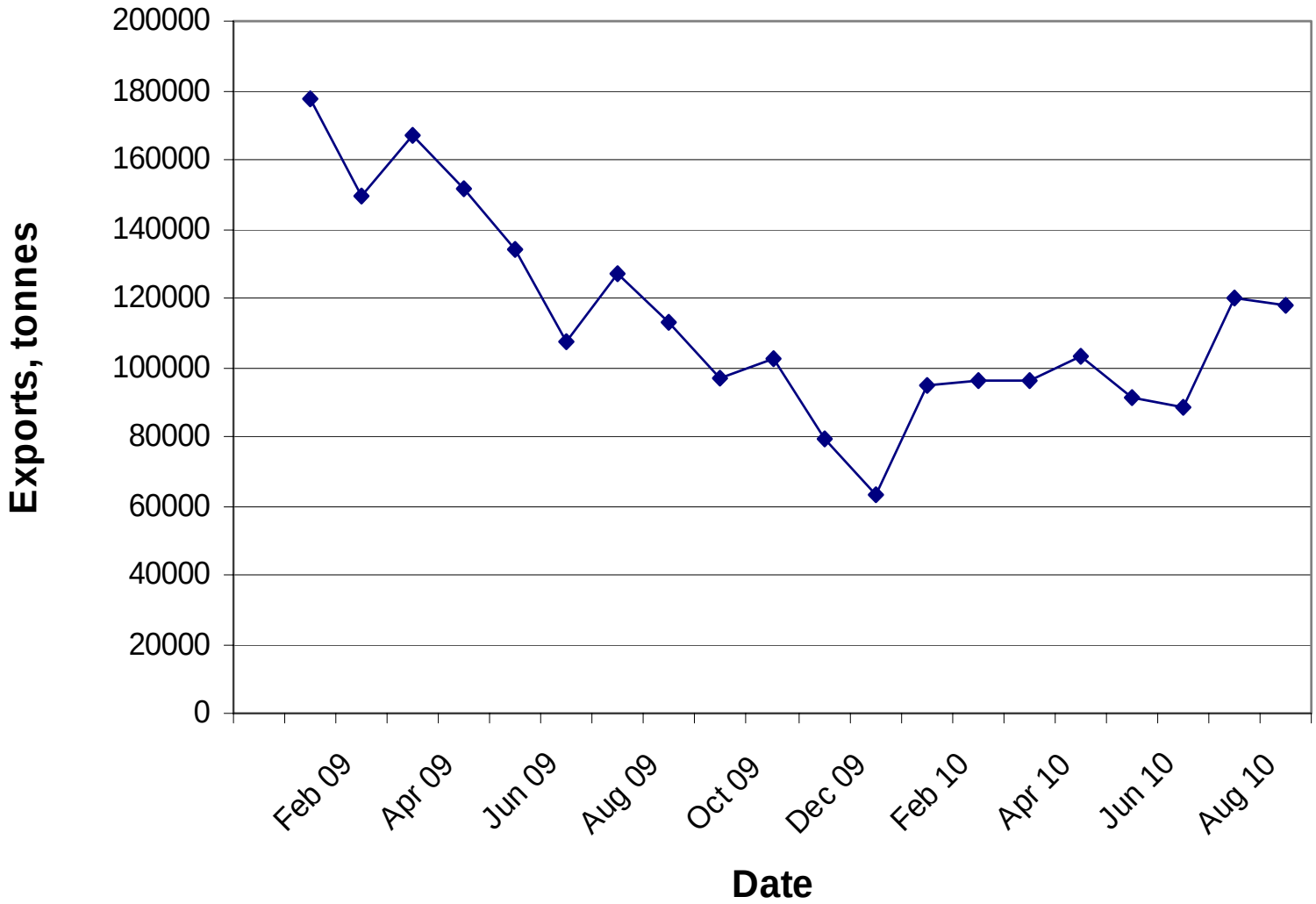
Seven Canadian crush plants were placed on Import Alert due to presence of non-specific salmonella contamination

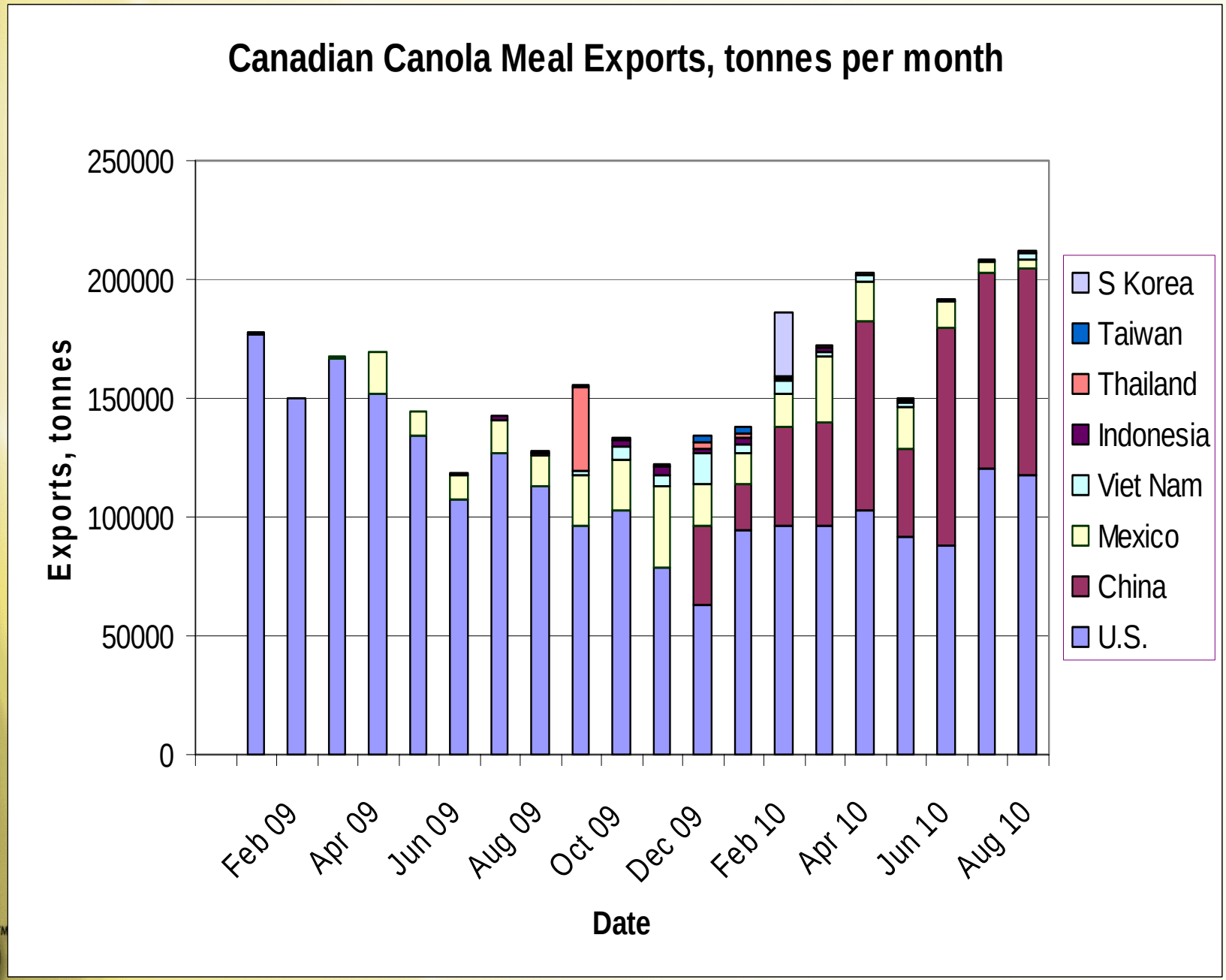
Exports went from 1.8 million tonnes in 2007/08 to 1.1 million tonnes in 2009/10

Hardship on US dairy industry – estimated $30/t higher feed cost in California

Alternative markets for Canadian canola meal developed

Canadian canola meal exports to the U.S. since January 2009, tonnes per month




Canadian Canola Meal Exports, tonnes per month
Exports, tonnes
250000
200000
150000
100000
50000
0
Feb 09
Apr 09
Jun 09
Aug 09
Oct 09
Dec 09
Feb 10
Apr 10
Jun 10
Aug 10
Date
S Korea
Taiwan
Thailand
Indonesia
Viet Nam
Mexico
China
U.S.

Salmonella in Canadian canola meal disrupts exports to the United States

Hope for resolution?

Four crush plants have been removed from Import Alert

September 2010 – FDA introduced new Compliance Policy Guide for inspectors regarding salmonella in animal feed:

- differentiate between pet food and animal feed
- identify serotype and emphasize enforcement when identified pathogenic serotypes are found
- recognize that heat treatment of feed and feed ingredients can control salmonella

Represents progress towards FDA's "risk ranking" based "Animal Feed Safety System"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Paired comparisons* of research studies of milk production of dairy cows fed canola meal versus soybean meal**.

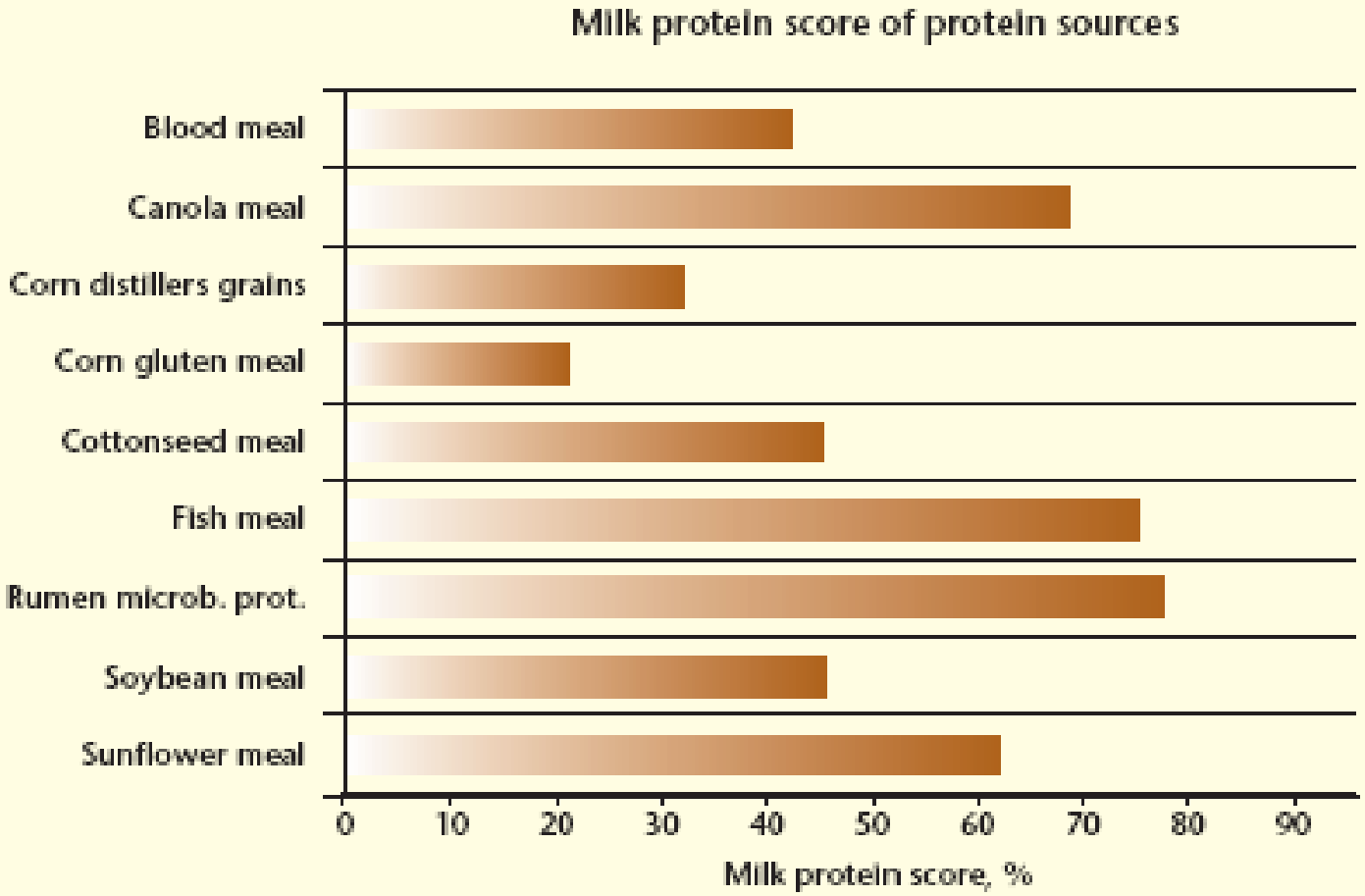
Control	Canola meal
26.4a kg milk/day	27.5b kg milk/day

*Data set: 22 studies published between 1975 and 2008. Criteria for inclusion of studies in paired comparisons was information on milk production, feed intake and diet composition. Within each study, control and canola meal test diets were iso-nitrogenous and iso-caloric. Dietary variation between studies in canola meal levels and grain and forage base was allowed.

**Most control diets used soybean meal, however some diets were based on cottonseed meal or distillers grains or lupins.

a,b Students T test $P<0.0001$

Figure 1 Milk protein score of common feed ingredients for dairy cattle (Schingoethe, 1991)



Milk production of dairy cows fed corn distillers grains – canola meal combinations, where 0, 1/3, 2/3 and all of the supplemental protein came from each protein source. Mulrooney et al., 2008.

Parameter	DDGS	1/3 CM	2/3 CM	CM
CM, % DM	0	2.4	4.6	6.6
DDGS, % DM	10.4	6.7	3.2	0
DMI, kg/day	25.1	25.9	25.4	25.2
Milk, kg/day	34.3	34.5	35.8	35.2

U.S. dairy cow numbers and Canadian canola meal markets in some key U.S. dairy states in 2008 and projected for 2015 (tonnes).

State	Dairy Cows	Meal 2008	Meal 2015
California	1,780,000	830,000	1,100,000
Washington	237,000	120,000	200,000
Idaho	488,000	180,000	200,000
Montana	85,000	93,000	100,000
Vermont	141,000	80,000	80,000
Minnesota	450,000	76,000	80,000
New York	638,000	125,000	150,000
Wisconsin	1,243,000	16,000	200,000
Pennsylvania	554,000	35,000	50,000
New Mexico	355,000	3,000	100,000
Texas	335,000	15,000	100,000
Michigan	320,000	46,000	50,000
Arizona	173,000	3,000	50,000
Oregon	118,000	33,000	35,000
Other		144,000	105,000
Total		1,799,000	2,600,000

Relative economic value of canola meal to high protein soybean meal in least cost animal feeds

Animal type	Relative value
Layer chicken	65% - 75%
Broiler chicken	55% - 70%
Pig starter	60% - 65%
Hog grower/finisher	65% - 75%
Gestating sow	65% - 75%
Lactating sow	60% - 70%
Dairy	70% - 85%

Canadian canola industry goals for 2015

Element	2006	2015 Target
Meal	2000 kcal/kg energy content (poultry)	10% increase (2200 kcal/kg) (90% of soybean meal)

Increasing the energy content of canola meal for swine and poultry by 10% can increase its value by a similar amount.

Increasing the energy content of canola meal

Workshop meeting held in Saskatoon in September 2007

Bring together Canadian academic and industry nutritionists and canola breeders and processors

Identify research gaps and market needs:

- Dairy market will be saturated
- Need to conduct research on increasing energy value

Objective to increase Poultry Metabolizable Energy 10% by 2015

Increasing the energy content of canola meal

Possible methods of increasing the bio- available energy content of canola meal:

Reduce fibre (and other low-energy components) of canola through **breeding.** Energy increase of 5%-7% currently possible.

- Thinner hulls (yellow seed – napus, juncea)
- Easier dehulling
- Larger seed size
- Altered carbohydrate composition

Increase canola meal energy levels through **processing** (dehulling, temperature control). Energy increase of 5% currently possible.

Use digestive **enzymes** in feeds to increase energy levels. Energy increase of 5%-10% currently possible (?).

Canola meal components

Component, as is	Canola Meal	Soybean Meal	Canola meal % soybean meal
Swine DE, kcal/kg	3100	3650	85
Poultry ME, kcal/kg	2000	2500	80
Crude Fibre, %	11.5	3	380
ADF, %	19	5	380
NDF, %	27	7	380
Lignin	8	1	800
Cellulose	5	5	100
Starch + Sugars	14	16	88
Oligosaccharides	3	3	100
Other polysaccharides	15	12	125

Breeding to increase the energy content of canola meal

Focus on following areas:

- reduce lignin content
- reduce polyphenol content in embryo
- increase energy rich components – free sugars and protein
- look at canola structural aspects to set fibre reduction targets (maintain seed viability)
- clarification of the important fibre measurements
- increasing seed size and reducing hull adherence were considered but there was no consensus within the group on the effectiveness of this strategy

Processing to increase the energy content of canola meal

Focus on following areas:

- modify DT processing while controlling glucosinolate levels
- better control of canola meal particle size and density
- reduce add back of screenings
- designer canola meal for different species
- conduct engineering study on alternative processing to better release fibre (physical, chemical and biological) and to make it more available for enzyme action

Using **enzymes** to increase the energy content of canola meal

Focus on following areas:

- target NSP digestibility as having greatest potential improvement

- look at crushing plant processing and feed mill processing options in order to prepare canola meal for enzyme action (mechanical, soaking)

Factorial study to increase the energy content of canola meal

It was agreed that we need to look at the potential cumulative effects of making changes in breeding, processing and enzymes to determine if existing technology could help us achieve the 10% metabolizable energy increase objective. Therefore it was determined that a factorial experiment was indicated as a first step:

- 3 types of canola classes (black napus, yellow napus, canola quality juncea)
- 2 processing conditions (conventional and light toasting desolventization)
- 2 enzyme treatments (with and without a multi-substrate enzyme combination).

Canola meal from different canola classes and processing

Canola Meal Research – Projects related to increasing metabolizable energy levels

- Preparation of high digestibility canola meals from regular canola and yellow seeded canola (POS Pilot Plant)
- Estimation of the net energy content of six samples of canola meal in growing pigs (Prairie Swine Centre)
- A new, high energy canola meal for poultry and swine: The effect of yellow seed coat, processing and enzyme supplementation (University of Manitoba)
- Evaluation of yellow seeded canola products for poultry (Nova Scotia Agricultural College)

Nutrient composition of different canola meals.

Nutrient (dry matter basis)	Black Napus	Canola Juncea	Yellow Napus
Crude protein, %	43.9	47.5	49.8
Oil, %	1.8	1.7	1.7
Crude fibre, %	9.6	6.9	6.1
Neutral detergent fibre, %	21.8	16.2	14.7
Acid detergent fibre, %	16.6	11.8	9.9
Sucrose, %	8.9	9.2	10.2
NSP's, %	17.6	18.9	16.0
- NSP Arabinose, %	5.2	5.6	5.2
- NSP Glucose, %	3.6	4.7	2.7
Lignin, %	7.1	3.9	3.7

Nutrient composition of different canola meals for swine (Prairie Swine Centre)

Meal type	NE, kcal/kg dm	% Increase over Black
Black napus	2490	
Canola juncea	2585	3.8
Yellow napus	2730	9.6
Regular toasted	2607	
Light toasted	2590	-0.7

AMEn of different canola meals for poultry (Nova Scotia Agricultural College)

Meal type	AMEn, kcal/kg dm	% Increase
Black napus	2391	
Canola juncea	2443	2.2
Yellow napus	2725	14.0
Regular toasted	2553	
Light toasted	2486	-2.6
No enzyme	2479	
Plus enzyme	2560	3.3

Broiler chicken performance for different canola meals (University of Manitoba)

Meal type	BW gain day 4-18, g	Feed/Gain
Black napus – regular toasted	428	1.33
Black napus – light toasted	372	1.40
Canola juncea – regular toasted	416	1.38
Canola juncea – light toasted	393	1.42
Yellow napus – regular toasted	432	1.33
Yellow napus – light toasted	361	1.43

Broiler chicken performance for different canola meals (University of Manitoba)

Meal type	BW gain day 4-18, g	Feed/Gain
Black napus	400	1.36
Canola juncea	405	1.40
Yellow napus	396	1.38
Regular toasted	425	1.35
Light toasted	375	1.42

Glucosinolate content and myrosinase activity in different canola meals

Meal type	Glucosinolates, umole/g	Myrosinase activity, U/g
Black napus – regular toasted	24.8	0.1
Black napus – light toasted	32.2	0.8
Canola juncea – regular toasted	13.6	0
Canola juncea – light toasted	21.2	0.3
Yellow napus – regular toasted	15.8	0.1
Yellow napus – light toasted	20.2	1.1

Glucosinolate content and myrosinase activity in different canola meals

Meal type	Glucosinolates, umole/g	Myrosinase activity, U/g
Black napus	30.7	0.5
Canola juncea	18.8	0.2
Yellow napus	20.0	0.6
Regular toasted	21.0	0.1
Light toasted	25.3	0.7

Conclusions

- Canola type has the largest influence on energy content. Yellow hull canola types have lower fibre contents. The higher energy in yellow hull canola is likely due to a combination of higher protein and higher levels of digestible sugars (higher sucrose).

- Vacuum desolventization followed by light toasting showed no advantage over regular toasting. This may in part be due to small differences in processing temperatures and ineffective deactivation of myrosinase enzyme resulting in higher levels of glucosinolates.

- The use of carbohydrase enzymes was somewhat effective, especially for canola juncea. This may be due to higher levels of soluble non-starch polysaccharides in canola juncea (to be verified).

Next Steps

Follow-up studies: part of Canola Council application for AAFC Agri-Science Cluster

Canola Meal Research

High inclusion Levels of Regular and High Energy Canola Meal in Animal Feeds

- Objective is to address the issues associated with high canola meal feed inclusion levels such as: anti-nutrients, inefficient nitrogen utilization and effects on carcass composition, and to demonstrate that high energy canola meal can effectively be used at very high inclusion levels in swine and poultry feeds.

- Multi-institution co-ordinated series of studies to fully investigate very high dietary inclusion levels of both regular and high energy meal. The work will take place at the University of Alberta, University of Manitoba, Nova Scotia Agricultural College and AAFC Lethbridge.

Total cost of the project is $1,932,000.

Canola Meal Research

Improving Carbohydrate Composition of Canola Meal to Increase Energy Content.

- Objective is to determine what the important energy yielding and energy detracting carbohydrate components of canola meal are with the objective of providing information to canola breeders to develop high energy canola varieties.

- Some aspects: fully characterize the carbohydrate content of different types of canola and their inter-relationships, set targets for carbohydrate alteration, produce and evaluate (with and without enzymes) small quantities of promising high energy canola meals.

- Research will take place at AAFC Saskatoon and the University of Manitoba.

Total cost of the project is $609,000.

Canola Meal Research

Maximize Use of Canola Meal in Dairy Feeds

- Objective is to determine information about canola meal amino acid utilization efficiency for milk production under a variety of feeding regimes. Information will be provided to feed industry nutritionists so that canola meal can be accurately formulated into dairy cow diets.

- Research is multi-institutional and will take place at the University of Saskatchewan, University of California Davis, South Dakota State University, University of Wisconsin, and AAFC Lennoxville.

-Total cost of the project is $1,851,000.

Thank you