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Canola Meal Research Meeting

Saskatoon, SK
September 27 - 28, 2007

Report by Dave Hickling, November 2007

Summary

An industry meeting was held in Saskatoon on September 27-28, 2007 with approximately 50 participants from the canola industry, research institutions and the Canadian feed industry. The focus was on discussion of research priorities on the use of canola meal in animal feed. Furthermore, the focus was on conventional canola meal with some discussion of expeller (high fat) canola meal and canola protein concentrates. There was little discussion on the feeding of full-fat canola seed given that feeding whole canola is only economically feasible when it is downgraded due to quality problems. Also, there was no discussion of industrial uses of canola meal (fuel, fertilizer, building materials, fermentation feedstock) since all of these applications currently are lower value than animal feed.

The background to the discussion is that canola meal production in Canada is expected to increase from 2 million tonnes to 4 million tonnes over the next 4-8 years as domestic crush capacity increases. This will put increasing pressure on the value of canola meal in its primary market (feeding dairy cattle). The Canadian canola industry has recognized this challenge and has made it a priority to increase canola meal metabolizable energy for poultry by at least 10% in order to maintain its value when it becomes primarily used in monogastric feeds.

Three objectives were set at the start of the meeting.

1. Discuss and recommend research needed to increase the energy value of canola meal.
2. Discuss and recommend research needed to increase canola meal inclusion levels in animal feed.
3. Discuss and recommend research into non-traditional animal feed uses.

The meeting achieved these objectives in that:

1. There was discussion and some consensus on research needed to increase energy in canola meal to increase its value and use in swine and poultry feeds. There were three presentations on increasing canola meal energy using 1. breeding, 2. processing and 3. enzymes. The large group was broken into three workshop groups to further discuss opportunities in each of these areas. It is known that modest to moderate increases in energy of canola meal can be accomplished by altering processing (reducing temperature and moisture especially at the desolventizer/toaster stage), breeding (yellow seeded canola which has lower fibre levels) and enzymes (multi-substrate enzyme cocktails). It is not clear what the interactive and cumulative effects of these three possibilities are, therefore a factorial approach to looking at processing, breeding and enzymes is indicated as an early research requirement.

2. The challenges of feeding high inclusion levels of canola meal (high protein levels, anti-nutrient concerns) were identified.
3. Aquaculture was identified as a non-traditional feed use for canola meal. Beef cattle feeding was discussed but concluded to not be a high priority, high value use of canola meal.
4. As well, the meeting identified collaborative research opportunities and additional sources of research funding.

In the area of increasing energy levels, the key recommendation is to determine methods to decrease fibre levels and/or increase fibre digestibility. There was a common consensus that we need to "bust open" the fibre in canola meal in order to enhance digestibility. This could be accomplished by physical, chemical and biological means. A key area of research coming out of this meeting will be to look at the best processing and enzyme methods to break open fibre. This will be followed by breeding research objectives targeted to increase fibre digestibility. Increasing the residual oil content in canola meal (via expeller processing rather than solvent extraction) can increase canola meal energy to the point where it has higher value in swine and poultry feeds, however the extra value is not enough to compensate for the decrease in oil yield at the processing plant.

Another key issue relates to higher dietary inclusion levels of canola meal. Concerns about both excessive excretion of nitrogen and phosphorus at high canola meal dietary inclusion levels were discussed along with potential limitations of canola meal inclusion due to anti-nutrients. Some targeted research on high inclusion levels in swine diets will be undertaken due to concerns with pigs on excretion and tolerance of glucosinolates were identified.

The potential of feeding canola meal to alternative species such as beef and fish was discussed. There are economic limitations in feeding beef – canola meal appears to offer little extra benefit over distillers' grains, which is a lower priced feed source. There are opportunities to feed canola meal to various aquaculture feeds. It is currently fed to lower value fish such as carp, tilapia and catfish and for these species there is limited opportunity to increase value. For high value aquaculture species such as shrimp and salmon, effective feeding requires the manufacture of a canola protein concentrate which can serve as a fish meal replacement. There are certainly opportunities in this area and some companies are undertaking R&D. Given the potential, the industry should also undertake some economic and biological research on feeding canola meal in aquaculture diets.

A set of research projects is presented in the appropriate section towards the end of this paper.

Canola Meal Research Meeting
Sheraton Cavalier Hotel - Saskatoon
Agenda

Thursday, September 27		Speaker
13:30	**Welcome and overview** Canola meal competitive situation and CCC goals	Dr. Dave Hickling, Canola Council of Canada
13:50	**Canadian animal feed industry perspective** What the feed industry wants from canola meal	Dr. Arnold Pierce, Preferred Animal Nutrition Services
14:15	**Efforts to increase canola meal energy content for monogastrics**	
	Breeding canola for higher energy (yellow seed) Progress to date in genetic improvements in canola meal energy contact	Ms. JoAnne-Relf-Eckstein, AAFC
	Processing canola for higher energy Increasing energy using current processing technology	Dr. Dave Hickling, CCC
	Adding enzymes to increase energy Progress to date using enzymes with a view to potential Developments	Dr. Bogdan Slominski, University of Manitoba
15:15	**Refreshment Break**	
15:45	**Workshop on research and development required to increase canola meal energy**	
17:00	**Results of workshop**	
17:15	**Implications of feeding high dietary inclusion levels of canola meal** High protein diets and their impact on the animal and the environment Discussion of required research to manage high protein	Dr. Ruurd Zijlstra, University of Alberta
18:00	**Reception**	
18:30	**Buffet Dinner**	

Canola Meal Research Meeting
Agenda

Friday, September 28		Speaker
08:30	**Breakfast (Continental)**	
09:00	**Reducing anti-nutrient levels in canola meal** The long term potential (Designing Oilseeds for Tomorrow's Markets)	Dr. Randall Weselake, University of Alberta
09:30	**Canola meal value in our strongest market – dairy cattle** Understanding the nutritional value of canola meal and how it can be enhanced.	Dr. Tim Mutsvangwa, University of Saskatchewan
10:00	**Refreshment Break**	
10:30	**Increasing canola meal value in "under used" species**	
	Beef What needs to happen to use more canola meal in beef feeds	Dr. John McKinnon, University of Saskatchewan
	Aquaculture The benefits and limitations of canola meal in aqua-feeds and opportunities to improve canola meal value	Dr. Murray Drew, University of Saskatchewan
	Canola Protein Concentrates The production and use of high-valued canola protein concentrates	Dr. David Maenz Chief Scientific Officer MCN Bioproducts Inc
11:30	**Discussion and summary** Discussion of research required to meet canola meal improvement objectives	
12:00	**Adjourn and Lunch**	

Participant List

Last Name	First Name	Organization	Location
Canola Industry			
Coleman	Barry	NCGA	Bismark
Combres	Steve	ADM	Lloydminster
Funke	Kelly	CCC	Winnipeg
Galloway	Woody	Bunge	Oakville
Gingera	Greg	Pioneer Hi-Bred	Saskatoon
Hayes	Laurie	SCDC	Saskatoon
Hickling	Dave	CCC	Winnipeg
Hunter	Robert	CCC	Winnipeg
Kolla	Francis	Canbra	Lethbridge
Kubik	Tom	Dow Agro-Sciences	Saskatoon
Marchand	Jennifer	Cargill	Saskatoon
Potts	Derek	Viterra	Saskatoon
Ross	Bill	MCGA	Winnipeg
Teffaine	Robert	Associated Proteins	St. Agathe
Theunissen	Danie	Monsanto	Winnipeg
Toma	Ward	ACPC	Edmonton
Waschuk	Annette	Cargill	Winnipeg
Research Institutions			
Anderson	Derek	Nova Scotia Ag College	Truro
Bekkaoui	Faouzi	PBI	Saskatoon
Christenson	Dave	U Sask	Saskatoon
Classen	Hank	U Sask	Saskatoon
Downey	Keith	AAFC	Saskatoon
Drew	Murray	U Sask	Saskatoon
Freidt	Wolfgang	U Giessen	Germany
Guenter	Bill	U Man	Winnipeg
Leterme	Pascal	PSC	Saskatoon
Maenz	David	MCN	Saskatoon
McKinnon	John	U Sask	Saskatoon
Mutsvangwa	Tim	U Sask	Saskatoon
Nyachoti	Martin	U Man	Winnipeg
Parker	Jeff	Genome Alberta	Calgary
Patience	John	PSC	Saskatoon
Relf-Ekstein	Jo Anne	AAFC	Saskatoon
Slominski	Bogdan	U Man	Winnipeg
St. Remy	Ann	AAFC	Lacombe
Wanasundara	Jani	AAFC	Saskatoon
Weselake	Randall	U Alberta	Edmonton
Wright	Scott	U Sask	Saskatoon
Zijlstra	Ruurd	U Alberta	Edmonton
Feed Industry			
Charles	Rod	Masterfeeds	Lethbridge
Cossette	Raylene	Unifeed	Lethbridge
Fairburn	Shawn	New-Life Feeds	Saskatoon
Fischer	Nancy	Unifeed	Olds
Huber	Stephanie	New-Life Feeds	Saskatoon
Johnston	Amy	Prairie Orchard Farms	Winnipeg
Klinger	Sharon	Co-op Feeds	Saskatoon
Pierce	Arnold	Preferred Animal Nutrition	Calgary
Pouteaux	Vic	Landmark Feeds	Calgary
Preston	Julie	Unifeed	Saskatoon
Schalm	Mike	Nutri-Health	Red Deer
Serrano	Juan	Co-op Feeds	Saskatoon
Young	Malachy	Gowans Feed Service	Alberta

Presentation summaries

The overview presentation by Dr. Dave Hickling focused on the CCC's 2015 objective to increase metabolizable energy by 10%. The potential implications of increased canola meal supply on utilization in premium (dairy) versus lower value (poultry, hog) feeds and the expected downward pressure on canola meal prices was discussed.

The Canadian animal feed industry perspective by Dr. Arnold Pierce focused on the value of a consistent (low variation) product. He emphasized that the current value of canola meal is restricted by lower amino acid digestibility and higher fibre – especially true for monogastrics. Dr. Pierce highlighted the trends in feeding where protein will be less expensive and energy (especially from carbohydrate) will become more expensive. The feed industry wants:

- no surprises – safe and consistent
- increased energy and amino acid digestibility for monogastrics
- increased fibre digestibility and bypass protein for ruminants.

The presentation on breeding canola for higher energy by Ms. Jo Anne Relf-Ekstein focused on the work on breeding yellow napus and canola quality juncea which have much thinner hulls than black napus resulting in lower crude fibre levels (7% vs 12%) primarily due to lower lignin levels (<2%). The level of oil and protein in the seed are both higher by concentration. The metabolizable energy for poultry of yellow napus and canola quality juncea is approximately 6% higher than black napus.

The presentation on processing canola for high energy by Dr. Dave Hickling looked at dehulling and "high oil" canola meal, but focused on reducing moisture and temperature in the desolventizer/toaster phase whereby amino acid digestibility could potentially be increased by 13% points. The effect of "gentle" desolventization on increasing metabolizable energy levels is unknown but is likely in the area of 6%.

The presentation on using enzymes to increase canola energy by Dr. Bogdan Slominski focused on research work conducted on poultry. Digestibility improvements to date have been limited due to difficulties in digesting canola meal non-starch polysaccharides (encapsulate nutrients, associated with enzyme resistant proteins).

The presentation on feeding high dietary inclusion levels of canola meal by Dr. Ruurd Zijlstra focused on the effects of high dietary protein on: feed efficiency and animal performance, carcass and meat quality, animal health and nutient excretion management in the environment. It is expected that animal performance, health and meat quality issues can be solved. Environmental concerns may be more problematic.

The presentation on anti-nutrient levels in canola and the DOTM project by Dr. Randall Weselake focused on the structure of the DOTM research program and how different genetic techniques can be used to enhance canola meal value and to reduce anti-nutrient levels. DOTM could serve as an opportunity for a coordinated effort to improve canola meal.

The presentation on feeding canola meal to dairy cattle by Dr. Tim Mutsvangwa focused on recent research at the University of Saskatchewan which is attempting to elucidate canola meal nitrogen metabolism by the dairy cow. There was also discussion on how to enhance canola meal nitrogen utilization in dairy cows by recapturing N as microbial crude protein and/or rumen protection of canola meal protein.

The presentation on feeding canola meal to beef cattle by Dr. John McKinnon focused on the economics of feeding canola meal versus other protein sources (notably DDGs) in different sectors of the beef industry. He concluded that wheat DDGs offered equivalent nutritional value at lower cost compared to canola meal when fed to growing and finishing cattle. There is some indication that canola meal could provide extra value in pasture supplementation and pre/post calving supplementation.

The presentation on feeding canola meal to aquaculture by Dr. Murray Drew focused on comparing canola meal to canola protein concentrate in feeding different aquaculture species. There is value in reducing fibre levels to increase protein and energy digestibility.

The presentation on canola protein concentrates by Dr. David Maenz focused on the value of these concentrates as a fish meal replacement in aquaculture diets as well as other specialty feeds requiring high quality protein.

Workshop Results and Research Priorities on Increasing Energy

The key conclusions of the breeding group were to focus on the following areas:

1. reduce lignin content
2. reduce polyphenol content in embryo
3. increase energy rich components – free sugars and protein
4. look at canola structural aspects to set fibre reduction targets (maintain seed viability)
5. 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

The key conclusions of the processing group were to focus on the following areas:

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

The key conclusions of the enzyme group were to focus on the following areas:

1. target NSP digestibility as having greatest potential improvement
2. look at crushing plant processing and feed mill processing options in order to prepare canola meal for enzyme action (mechanical, soaking)

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 is was determined that a factorial experiment was indicated as a first step: 3 types of canola (black napus, yellow napus, canola quality juncea) X 2 processing conditions (conventional and non-toasted desolventization) X 2 enzyme treatments (with and without a multi-substrate enzyme combination).

Other Research Priorities

There were several areas of research identified (in addition to increasing the energy value of canola meal), however two stood out as potentially having a greater impact on canola meal value over the long term:

1. understanding how to feed high inclusion levels of canola meal in swine and poultry diets
   - how to reduce issues related to feed efficiency and carcass (meat) quality
   - anti-nutrient level tolerances – especially glucosinolates
2. understanding the key attributes of canola meal for aquaculture diets.

Next Steps – Research Projects and Collaborations

Some initial collaborations and projects are already underway.

1. The breeding X processing X enzyme experiment is in the initial stages. Approximately 2.5 tonnes of each seed type were processed at the POS Pilot plant in Saskatoon during early November using two types of desolventizing: conventional desolventizer/toaster and low temperature vacuum drying. The six samples of canola meal from this processing will be tested with and without enzymes in broiler and layer chickens in a collaborative research project at Nova Scotia Agricultural College under the direction of Dr. Derek Anderson. Samples will also be sent to the University of Manitoba for testing (enzymes, nutrient digestibility, differential fibre analysis) under the direction of Dr. Bodgan Slominski. These samples will also be tested for swine digestible and net energy at the Prairie Swine Centre under the direction of Dr. Pascal Leterme.

2. Pending the initial results of these studies, an engineering study on alternate methods of processing canola meal will be commissioned to look at potential cost-effective ways to “bust open” canola meal fibre.

3. There will be discussion with partners in the DOTM project about the potential changes to the carbohydrate structure of canola (e.g. cell wall structure and thickness). This research will focus on changes that can be achieved through genetics which will increase the energy value of canola meal. The research will also attempt to provide a more fundamental understanding of the nutritional value of the various components and substrates in canola meal.

4. Discussion will be initiated with the University of Alberta (Dr. Ruurd Zijlstra) to undertake studies on feeding high inclusion levels of canola meal to pigs.

5. Aquaculture. Some initial discussions on potential research will be held with Canadian scientists.

6. A survey of the nutrient content of commercial canola meal from Canadian crushing plants is proposed. It has been over 10 years since a systematic survey was conducted. The results would be compared with results of a similar survey in Australia and the samples would be calibrated with NIR analysis. There is currently discussion with potential collaborative partners about this survey.

The funding and structure of this research is still under consideration. Some funding for 2008 from the Canola Council and the three prairie canola producer organizations has been confirmed. As well, a number of other collaborative funded projects (Nova Scotia project, DOTM) have been identified. The Canadian canola industry already has a research structure in place in the form of the Canola Product Research Fund (CPRF). The CPRF could be used as an administrative vehicle for this work.