ANNEX

China Canola Meal Dairy Feeding Trials

Background

Canola meal is globally regarded as a premium feed ingredient in dairy cattle feeds due to its superior amino acid profile and its ability to increase milk production. In some instances, research has demonstrated an average one liter per cow per day increase in milk production when canola meal replaces other protein sources such as soybean meal and cottonseed meal in dairy cow rations. This is well recognized by commercial dairy operations in North America and Europe which are the primary users of canola meal. There is untapped potential in China to gain the same benefits of using canola meal in their expanding dairy industry.

The Canola Council of Canada (CCC) previously conducted two canola meal feeding trials in China; in 2006 at Sanyuan Dairy in Beijing and in 2009 at Inner Mongolia Agricultural University. The purpose of the feeding trials was to demonstrate to the Chinese commercial dairy industry that canola meal has high value in dairy feeds in contrast with their negative experience feeding high glucosinolates rapeseed meal. In both feed trials there was an increase in milk production of 1.5 liters and 0.8 liters per cow per day, respectively. With these initial promising results it was decided to expand to larger scale canola meal dairy demonstration feeding trials to demonstrate that canola meal is a high value protein ingredient for the greater Chinese dairy industry. The trials would also provide confidence to the dairy nutritionists and overall dairy industry on how to best use canola meal in feeding programs and allow the industry to move towards wider commercial use of canola meal all while gaining the benefits that other countries have achieved in feeding canola meal to dairy cattle. The canola meal demonstration feeding trials were supported by funds of the Canola Council of Canada and Agriculture and Agri-Food Canada's Canola Market Access Plan (CMAP). The canola meal demonstration feeding trials were supported by the Canola Council of Canada's Canola Market Access Plan (CMAP), with funding provided by Agriculture and Agri-Food Canada's Agricultural Flexibility Fund.

Project Description and Results

These recent trials were conducted in China in 2010-2011. Most of the major Chinese dairy companies participated in the trials. The companies selected for the trials represent over 70% of the milk production in China through company owned dairy farms and/or independent dairy producer relationships with the milk processing portion of their business. The companies participating in the trials and regions were:

Sanyuan Dairy – Beijing

Bright Dairy – Shanghai

Weigang Dairy – Nanjing, Jiangsu Province

Yili Dairy – Inner Mongolia Province

Mengniu Dairy – Inner Mongolia Province

Various regions of China were chosen to hold the trials such that the value of canola meal could be demonstrated over a number of dairy feed and feed ingredient selections, management, environment, and economic situations. The protocols for the feeding trials varied between the companies in order to address their individual situation and needs. In order to increase the number of cows on test, the farms selected to conduct the trials were large and mostly modern operations. Over 3000 cows were on trial over the five farms. The treatments were designed such that moderate to high dietary inclusion levels of canola meal would illustrate the high palatability of canola meal for dairy cows – unlike the situation with the high glucosinolate rapeseed meal where use is limited due to its bitter taste. In most of the trials, canola meal was used in combination or as a partial replacement of soybean meal. Additional studies were conducted at China Agricultural University to determine technical information on canola meal such as its overall nutrient profile and rumen degradability. The feeding trials were coordinated through the CCC's dairy nutrition consultant in China, Dr. Ruojun Wang, with support from the participating dairy companies, universities, and government.

Feed Trial Results – Individual Farms

In four out of five feeding trials there was a numerical increase in milk production from feeding canola meal. In all feeding trials, there were apparent nutritional and/or financial benefits from feeding canola meal.

Sanyuan Dairy – Beijing

There were a total of 352 cows on trial over two 28 day test periods: early lactation (140 days at start) and mid lactation (191 days at start). The control diet was based on corn, corn silage, alfalfa hay and soybean meal. Canola meal was substituted for soybean meal in the test diet at a level of 6.5%. The dry matter intake of the cows was 26 kg/day and the intake of canola meal was therefore 1.7 kg/cow/day. Milk production on the control and canola meal diets was 37.2 versus 37.1 and 35.9 versus 35.6 kg/cow/day in the early and mid-lactation periods respectively. On average for the farm, the control diet cows had a milk production of 36.6 kg/cow/day and the canola meal diet cows had a milk production of 36.4 kg/cow/day. This difference of 0.2 kg/cow/day was not statistically significant. There were no differences in milk composition between the control and canola meal diets.

Bright Dairy – Shanghai

There were a total of 325 cows on trial in a 2 month cross over design. The control diet was based on corn, barley, corn silage, barley silage, alfalfa hay soybean meal and corn DDGS. Canola meal was substituted for soybean meal in the test diet at a level of 4.5%. The dry matter intake of the cows was 22 kg/day and the intake of canola meal was therefore 1.0 kg/cow/day. There was a difference in lactation days at the start of the trial: cows in the control group were 74 days in lactation and cows in the experimental group were 104 days in lactation. This resulted in a milk production difference at the start of the trial of 35.8 versus 33.7 kg/cow/day for the control and canola meal groups respectively. The use of the cross over design helped correct for the initial differences in milk production. In the control group, milk production started at 35.8 kg/cow/day and fell to 34.2 kg per cow per day at the end of one month. After switching this group to canola meal, milk production increased to 34.5 kg/cow/day at the end of one more month. In the experimental (canola meal) group, milk

production started at 33.7 kg/cow/day and increased to 34.1 kg/cow/day at the end of one month. After switching this group to soybean meal, milk production fell to 33.0 kg/cow/day. Therefore, the milk production of the control diet fed cows was 33.6 kg/cow/day and the milk production of the canola meal diet fed cows was 34.2 kg/cow/day – an increase of 0.6 kg/cow/day. There were no differences in milk composition.

Weigang Dairy – Nanjing, Jiangsu Province

There were a total of 320 cows on trial in a 3 month cross-over design of two six week test periods. The control diet was based on corn, barley, corn silage, alfalfa hay, soybean meal and corn DDGS. Canola meal was substituted for soybean meal in the test diet at a level of 3.7%. The dry matter intake of the cows was 19 kg/day and the intake of canola meal was therefore 0.7 kg/cow/day. The average milk production of the control diet fed cows was **36.6** kg/cow/day and the average milk production of the canola meal diet fed cows was **36.9** kg/day. The only difference in milk composition was in levels of MUN (milk urea nitrogen). The MUN level in the control diet cow milk was 21.7 mg/dl versus 18.8 mg/dl in the milk of the canola meal fed cows. This indicates that there was a higher protein utilization efficiency for canola meal than for soybean meal. The study also looked at feed intake and found that the total feed consumption was the same on both control and canola meal diets.

Yili Dairy – Inner Mongolia Province

There were a total of 1700 cows (500 on a control diet and 1200 on a canola meal diet) on trial for an 80 day test period, with no cross-over. The control diet was based on corn, barley, corn silage, alfalfa hay, wet brewers grains, wheat bran, sunflower meal and soybean meal. Canola meal was substituted for soybean meal in the test diet at a level of 5.0%. The dry matter intake of the cows was 20 kg/day and the intake of canola meal was therefore 1.0 kg/cow/day. The average milk production of the control diet fed cows was 24.4 kg/cow/day and the average milk production of the canola meal diet fed cows was 25.4 kg/cow/day, an increase of 1.0 kg/cow/day on the canola meal diets. There was no difference in milk composition.

Mengniu Dairy – Inner Mongolia Province

There were a total of 330 cows on trial for a 45 day test period. The cows were split into 3 groups: a control group, an medium canola meal group (50% protein ingredient replacement) and a high canola meal group (100% protein ingredient replacement). The control diet was based on corn, corn silage, alfalfa hay, corn DDGS, cottonseed meal and soybean meal. Canola meal was included in the diet as a substitute for soybean meal and cottonseed meal at 5% and 10%. The dry matter intake of the cows was 24.5 kg/day and the intake of canola meal was therefore 1.2 and 2.4 kg/cow/day in the medium and high canola meal diets respectively. The average milk production of the control diet fed cows was 34.3 kg/cow/day and the average milk production of the medium canola meal diet fed cows was 35.5 kg/cow/day and the average milk production of the high canola meal diets was 35.4 kg/cow/day, an increase of 1.2 kg/cow/day on the canola meal diets compared to the control. There was no difference in milk composition.

Feed Trial Results – Combined Farms

The combined results of the five canola meal feeding trials are shown in Table 1.

Table 1. Combined milk production results of China canola meal dairy feeding trials.

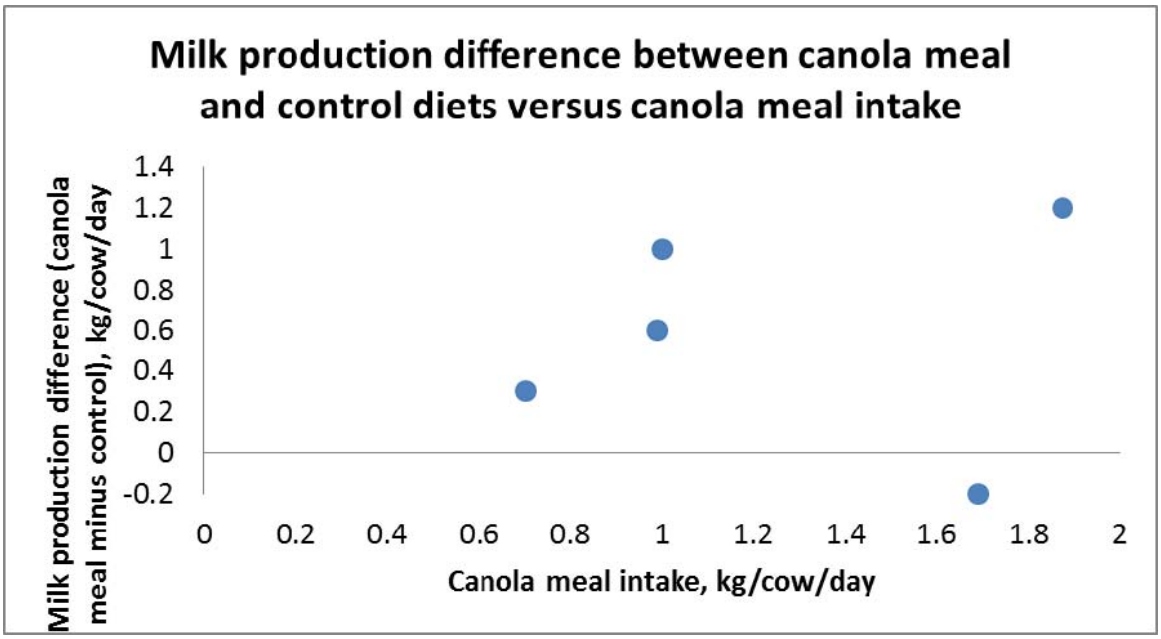
Dairy Farm	Control milk, kg/cow/day	Canola meal milk, kg/cow/day	CM – control milk, kg/cow/day
Sanyuan	36.6	36.4	-0.2
Bright	33.6	34.2	0.6
Weigang	36.6	36.9	0.3
Yili	24.4	25.4	1.0
Mengniu	34.3	35.5	1.2
Average	**33.1a**	**33.7b**	**0.6**

a,b paired T test $P<0.05$

The results show an average increase in milk production of 0.6 kg/cow/day when canola meal is substituted for soybean meal and cottonseed meal in Chinese dairy rations. There is considerable variability in milk production response between farms and one farm (Sanyuan) had a numerical (nonsignificant) decrease in milk production on the canola meal diets. The results of these trials are similar to the experience in North America.

Figure 1 looks at the relationship between canola meal intake and higher milk production. Even though the data is limited (5 farms), there is evidence of increasing milk production with increasing dietary levels of canola meal. This is consistent with the results of meta-analysis on North American and European feeding trials.

Figure 1. China canola meal dairy feeding trials: milk production difference between canola meal and control diets versus canola meal intake.


Milk production difference between canola meal and control diets versus canola meal intake
Milk production difference (canola meal minus control), kg/cow/day
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Canola meal intake, kg/cow/day