Canola meal research roundup

Essi Evans for *Progressive Dairy*

AT A GLANCE

Canola meal research continues to look at increasing DMI, milk yield and sustainability.

The U.S. Dairy Forage Research Center bridges the gap between fundamental research and providing information that can be applied by the dairy industry. The ability of forage to support milk production depends on the grains and vegetable proteins that go along with it. One goal of the center is to reduce the use of purchased protein and improve the conversion of feed protein to milk protein. In that regard, the center has been extensively investigating canola meal as an alternative to soybean meal to optimize forage utilization.

This research is currently under the direction of Dr. Kenneth Kalscheur. Kalscheur's interest in canola meal began before he assumed his current position with the Dairy Forage Research Center in 2014. During his tenure as a professor at South Dakota State University, Kalscheur's research showed that when canola meal replaced corn distillers' grains, milk production was improved and the ability to use canola meal efficiently was greater compared to other protein sources. Furthermore, canola meal matched the needs of the cow better than did soybean meal and provided a greater rumen-undegraded protein (RUP) value on a percentage basis compared to soybean meal (**Table 1**). Indeed, RUP could be supplied using less protein when canola meal replaced soybean meal.

Research conducted by Kalscheur demonstrated the importance of the amino acid profile and greater RUP of canola meal in meeting the amino acid needs of the high-producing dairy cow but also recognized the need for additional research in determining how canola meal can be utilized better in dairy cow diets.

When Kalscheur joined the center, he noted that there had been many studies evaluating canola meal in mid-lactation cows, and there was a wealth of information describing the nutrient composition of the meal. There were three areas where additional information was needed:

- Impact of canola meal on early-lactation performance
- Sustainability of canola meal
- Long-term canola meal utilization studies

TABLE 1 Canola meal versus soybean meal nutrient composition

Item	Canola meal	Soybean meal
Crude protein (%)	41.7	51.1
RUP (% of crude protein)	41.1	31.0
RUP digestibility (%)	74.8	94.5

Early lactation

The first feeding trial was conducted in uncharted waters, as there were no prior trials to determine an inclusion level and protein percentage for the diets. Kalscheur's research team decided to test diets at two levels of protein with each feed ingredient (**Table 2**).

The diets were provided for the first 16 weeks of lactation beginning just after calving, a long period of time for a research trial. Cows fed diets containing canola meal had a 0.85-kilogram (1.87-pound) increase in dry matter intake (DMI) compared to cows fed diets containing soybean meal.

This resulted in a 4-kilogram (8.8-pound) increase in energy-corrected milk for cows fed the same diets. Milk production was greater for cows fed diets containing canola meal compared to cows fed soybean meal at both protein levels. There were no differences in feed efficiency between the two protein sources; however, there was a trend for lower milk urea nitrogen for cows fed canola meal compared to soybean meal.

This encouraged Kalscheur to conduct a follow-up study to determine if inclusion of canola meal during the close-up dry period impacted performance during early lactation. The research found the provision of canola meal prepartum resulted in a 5.5% increase in DMI during the close-up dry period, but it did not affect milk production during the subsequent lactation.

The early-lactation diets were formulated to provide 17% crude protein. All dietary ingredients were the same, and canola meal (13.5% of the diet) was substituted for 9.9% soybean meal and 3.6% soybean hulls. Similar to the first trial, milk yield was 1.9 kilograms (4.2 pounds), and energy-corrected milk yield was 1.6 kilograms (3.5 pounds) greater when canola meal was provided in the diets. These results confirmed that canola meal is an effective protein source in early lactation.

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Sustainability of canola meal

A preliminary trial was conducted to measure methane output by mid-lactation cows provided with the diets shown in **Table 3**. Cows were housed in environmental chambers that allowed methane to be measured. Methane production,

TABLE 2 Performance of cows given diets with either soybean meal or canola meal at two levels of protein

	Diets			
	16% protein		18% protein	
Item	Soybean meal	Canola meal	Soybean meal	Canola meal
Soybean meal (%)	8.9		14.5	
Canola meal (%)		11.9		19.4
Corn silage (%)	39.6	39.6	39.6	39.6
Alfalfa haylage (%)	15.4	15.4	15.4	15.4
DM intake (DMI), kg/d	24.6	26.1	25.4	25.6
Energy-corrected milk (ECM), kg/d	53.1	57.4	54.1	57.8
Feed efficiency (ECM/DMI)	2.2	2.2	2.2	2.3
MUN (mg/dL)	10.0	9.6	12.9	12.2

TABLE 3 Evaluation of methane output by cows given diets with either soybean meal or canola meal at two levels of protein

	Diets			
	16% protein		18% protein	
Item	Soybean meal	Canola meal	Soybean meal	Canola meal
Soybean meal (%)	8.9		14.5	
Canola meal (%)		11.9		19.4
Corn silage (%)	39.6	39.6	39.6	39.6
Alfalfa haylage (%)	15.4	15.4	15.4	15.4
Methane (g/day)	507.0	528.0	538.0	466.0
Methane/DMI (g/kg)	19.0	19.5	20.5	18.1
Methane/fat-corrected milk (g/kg)	9.9	9.4	9.5	8.2

measured as grams per kilogram of energy-corrected milk, was less when cows were fed diets formulated with canola meal. Follow-up research is planned to confirm these findings.

Long-term studies

Feeding experiments are expensive and time-consuming to conduct, so many studies are conducted for three to four weeks to determine differences between diets. These short-term studies may not be long enough to determine if the differences in performance persist throughout the lactation.

Furthermore, it was not known if cows with high and low residual feed intakes responded differently to protein sources (soybean meal and canola meal) with different amino acid profiles. Cows with high residual feed intake are less feed efficient than those with low residual feed intake.

Therefore, a 10-week study was conducted to determine if cows with high and low residual feed intakes responded differently when provided diets formulated with the two protein sources.

The mid-lactation diets contained 60% forage. The control diet provided 11.7% soybean meal and 3.8% soybean hulls, and these two ingredients were replaced with 15.5% canola meal for the experimental diet. As expected, cows with high residual feed intake ate the most feed. However, this was not influenced by the source of supplemental protein in the diet.

The surprising element to the study was that the cows given the canola meal diet had a greater persistency of milk production. This difference in milk production between the two treatment groups increased in favour of canola meal as the experiment progressed.

Knowledge of how to best use available ingredients is critical to improve economic and environmental sustainability of dairy operations. Results from these experiments have added to the understanding of how canola meal differs from soybean meal as a protein source in diets for lactating dairy cattle.