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Use of Alaska-Grown Whole-Seed Canola In Dairy Cattle Diets: Year 1

KIRSTEN RANDALL
Dairy Laboratory Assistant
Palmer Research Center, Agricultural and Forestry Experiment Station

STEPHEN M. DOFING
Associate Professor of Agronomy
Palmer Research Center, Agricultural and Forestry Experiment Station

DONALD J. BRAINARD
Herder Supervisor
Palmer Research Center, Agricultural and Forestry Experiment Station

INTRODUCTION

Alaska's northern climate excludes the production of several crops which have served as traditional dairy cattle feeds in the contiguous United States. Because of this, Alaska's dairy producers must import large quantities of soybean meal and fat supplements to maintain a high level of productivity. Canola, which refers to rapeseed with negligible levels of undesirable glucosinolate and erucic acid, can be grown successfully in Alaska (Knight, 1991) and offers potential as a substitute for soybean meal and high-energy supplements in dairy cattle diets. Canola meal, the by-product of the canola seed after oil is extracted, is widely used in Canada (Canola Council of Canada, 1985). Using locally grown canola in feeds could reduce transportation-related costs for the dairy producer and create a market for a crop which can be grown and used locally in a value-added process using existing facilities and equipment.

This study evaluated the use of whole canola seed to replace both a portion of the soybean meal and the imported fat supplements or alternative tallow used in dairy cattle diets. Whole canola seed is a good source of crude protein (20%), and the oil in the canola seed (45%) could provide a source of additional energy to early-lactation, high-producing cows, which are normally not able to consume enough energy to meet their requirements for milk production.

MATERIALS AND METHODS

This progress report covers the results from the first-year feeding trial conducted at the Agricultural and Forestry Experiment Station's (AFES) dairy barn in Palmer, Alaska. The main objective of this trial was to determine the production response of early-lactation dairy cows to diets containing various levels of whole canola seed. The canola used was grown by Dennis Green of Delta Junction. He used standard canola production practices for Alaska (Knight, 1991). The canola contained 18.5% crude protein, and 46.4% crude fat; it also contained acceptably low levels of erucic acid (0.21%) and glucosinolate (20.8 umol/g).

Thirty-six cows were blocked by calving date, age, and previous lactation production (or Predicted Transmitting Ability for Milk for heifers), and then assigned randomly within blocks to one of four diets. There were nine cows per diet (six cows and three heifers). Table 1 shows the dietary formulations used: a control diet containing no canola, a two-pound, a four-pound and a six-pound canola per cow per day ration, all based on an estimated dry matter consumption of 45 pounds a day. Feeding these amounts of canola resulted in 0, 4, 8, and 12% canola respectively in the total diet dry matter. Diets were not balanced to be isocaloric, but were balanced to contain about 17.5% crude protein on a total dry matter basis with a forage to concentrate ratio of

42:58. Chemical composition of the feeds is given in Table 2.

The trial ran from January 1992 to February 1993. Cows started the trial their third week postpartum and continued through their 15th week. All cows were fed the control diet during their third week and were fed their assigned experiment diet from weeks four to 15. Data obtained during week three were used to adjust genetic differences in milk production among cows. These adjustments were applied to milk production during weeks four through 15.

Cows were housed in group free-stalls; an automated Calan® gate system allowed individual feeding. A total mixed ration was weighed and mixed by a mechanized mixer cart. Daily feed intake after weigh backs was recorded for each cow. Forage and concentrate rations were collected weekly and combined into monthly samples for testing. Milk weights were recorded daily, and weekly milk samples were tested for fat, protein and total solids. Animals were weighed at the beginning and end of the experiment and twice more during the experiment.

Results

Table 3 gives the results of the trial. The four-pound-canola diet milk production was comparable to that of the non-canola diet, although milk production for both the two and six-pound diets was significantly lower. Milk production corrected to a 4% milk fat basis (4% FCM) was significantly higher for the four pound diet, as was the solids-corrected milk (SCM) production. Efficiency of milk production, measured as pounds of milk produced per pound of dry feed consumed, was best for the two-pound canola diet. Cows on the higher canola rations consumed significantly more feed than cows on the control ration, lowering their lactational efficiency.

Discussion and Conclusions

Calculation of income over feed cost is shown in Table 4. Income was calculated using the adjusted milk price and average milk production for each diet. Feed costs are given on an as-fed basis; the silage cost is an estimate based on hay prices. Net income is best for the non-canola diet because of the greater amount of feed consumed by cows on the higher canola diets. However, results associated with dry matter intake are considered questionable at this time, and further investigations are underway. Results indicate cows found the four-pound and six-pound canola diets palatable, but feed refusal seemed to be a problem with the AFES trial's two-pound diet, as evidenced by the low dry matter intake. Cows on the two-pound canola diet produced significantly more milk than cows on the six-pound canola diet and maintained weight better than the cows on the non-canola diet while apparently consuming significantly less feed.

Based on the results of this trial, recommendations for feeding whole canola seed are three-to-four pounds of canola per cow per day, or 6 to 8% of the total diet dry matter; however, this recommendation is based on only one year of research. It should be noted that, as with any other plant, growing conditions might affect the quality of the canola and its performance in a dietary ration. Also, the diets compared in this study differed in other ingredients besides canola. Soybean and barley quantities were adjusted to maintain comparable crude protein levels. Therefore, the results of this study cannot be attributed solely to the amount of canola in the diets. The results obtained should, however, be representative of what to expect when using the dietary formulations presented here.

References

Canola Council of Canada. 1985. *Feeding with Canola Meal.* Publ. No. 85.

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Disclaimer

TABLE 1. *INGREDIENT CONTENT OF PELLETED CONCENTRATE MIXES.*

Ingredient	Concentrate Mix[1] (lbs/ton) 0	2	4	6
Barley	1070	1009	939	820
Corn	207	207	207	207
Soybean meal	432	393	357	336
Salmon meal	104	104	104	104
Canola seed	—	138	276	414
Fat (tallow)	69	31	—	—
Molasses	35	35	35	35
Limestone	45	45	45	45
TM salt	15	15	15	15
Magnesium oxide	5	5	4	4
Dicalcium phosphate	3	2	—	—
Potassium sulfate	9	10	12	14
Vitamin premix[2]	5	5	5	5
Selenium[3]	1	1	1	1

[1]Diets formulated to provide 0, 2, 4, or 6 pounds of canola per cow per day.
[2]Contains 2 million IU of Vitamin A per pound, 1.6 million IU Vitamin D per pound and 5,000 IU Vitamin E per pound.
[3]Contains 600 parts per million Se.

TABLE 2. *COMPOSITION OF CONCENTRATE MIXES AND BROME SILAGE.*

Component, %	Concentrate Mix 0	2	4	6	Brome Silage
Dry Matter	87.80	87.60	87.50	88.10	38.70
Percentage of dry matter					
Organic Matter	90.80	90.80	91.00	90.90	92.90
Crude Protein	23.04	21.18	21.35	21.31	14.15
Neutral Detergent Fiber	13.53	13.89	14.15	13.60	57.60
Acid Detergent Fiber	5.48	5.95	6.43	6.44	32.23
Ether Extract	5.88	6.28	6.38	10.36	4.69
Phosphorus	0.62	0.60	0.59	0.62	0.24
Potassium	1.15	1.09	1.09	1.10	1.64
Calcium	1.64	1.56	1.52	1.58	0.46
Magnesium	0.38	0.37	0.35	0.37	0.21
Est. IVDMD	90.00	90.00	89.00	89.00	60.00
Est. TDN	96.00	95.00	95.00	95.00	60.00
Est. ME	1.61	1.59	1.58	1.58	0.97
Est. NEL	1.14	1.14	1.12	1.12	0.63

TABLE 3. *RESPONSE OF COWS FED DIETS CONTAINING 0, 2, 4 OR 6 POUNDS OF CANOLA PER COW PER DAY.*

	Concentrate Mix				
Item	0	2	4	6	LSD[1]
Milk[2]	89.40	86.50	90.50	83.80	1.90
Fat[3]	3.06	3.18	3.08	3.17	0.11
Fat[2]	2.70	2.71	2.80	2.61	0.09
Protein[3]	2.84	2.67	2.83	2.81	0.05
Solids, not fat[3]	8.52	8.75	8.98	8.85	0.08
Total solids[3]	11.61	11.92	12.11	12.03	0.14
4% Fat Corr. Milk[2]	76.20	75.30	78.10	72.80	1.80
Solids Corr. Milk[2]	76.50	76.50	80.80	74.40	1.70
Dry matter intake[2]	41.20	39.50	44.60	44.90	1.70
Milk/dry matter intake	2.23	2.32	2.08	2.04	0.10
FCM/dry matter intake	1.91	2.03	1.79	1.81	0.09
SCM/dry matter intake	1.92	2.05	1.85	1.85	0.09
Body weight (BW)[2]	1290.00	1276.00	1287.00	1279.00	—
BW change[2]	-3.00	35.00	59.00	42.00	46.00
DM intake, % of BW	3.14	3.16	3.41	3.47	0.23

[1]Least Significant Difference. Differences of at least this amount are considered statistically different (P=0.05).

[2]Pounds.

[3]Percent.

TABLE 4. *INCOME OVER FEED COSTS.*

	Diet[1]			
Item	0	2	4	6
Milk price/cwt[2]	19.52	19.72	19.55	19.70
Milk income/day	17.45	17.06	17.69	16.51
Feed cost/day[3]	5.61	5.47	6.14	6.14
Income over feed cost/day	11.84	11.59	11.55	10.37

[1]Diets formulated to provide 0, 2, 4 or 6 lb. canola/cow/day.

[2]Base price $19.^{75}$/cwt adjusted for .164/cwt fat differential below 3.2% fat.

[3]Concentrate costs: O @ \$289 per ton; 2 @ $294.^{80}$ per ton; 4 @ $292.^{60}$ per ton; 6 @ $291.^{40}$ per ton. Canola seed: \$200 per ton (included in concentrate costs). Forage costs estimated at \$70 per ton.