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BRONOWSKI AND SPAN RAPESEED MEAL AS PROTEIN SUPPLEMENTS FOR LACTATING DAIRY COWS

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Research with Canadian RSM in the late 1960's indicated that ad lib consumption of grain was reduced by adding 12-14 % Canadian RSM to the grain mixture (INGALLS et al., 1968) and that adding 25-30 % RSM to the grain in place of SBM mixture reduced milk production (WALDERN, 1973). Plant breeders developed new varieties of rapeseed which were low in glucosinolates (Bronowski) and low in erucic acid (Span).

Three short term experiments were carried out to examine Bronowski and Span RSM as protein sources for dairy cows.

Experiment 1. The objective of this experiment was to compare Bronowski and Commercial RSM to soybean meal in dairy rations. Eight lactating cows 1-2 months post partum were used in two 4 x 4 latin square designs. The grain mixture which included some coarsely ground hay (Table 1) was fed free choice from 08.00 hr to 16.00 hr and corn silage (32 % DM, with 10 lbs urea/ton) was fed ad libitum from 16.00 to 7.00 hrs. Rapeseed meal made up 14 % of the grain mix or 11.9 % of the grain - ground hay mix. Experimental periods were five weeks in duration with data being collected during the last three weeks of each period. Milk was sampled weekly for butterfat, protein and solid not fat (SNF). Silage and grain mixtures were sampled weekly. Rumen samples were collected by stomach tube after four weeks on test for volatile fatty acids (VFA's) and ammonia (NH_3) analyses at about 14.00 hr. Fecal samples were collected twice daily at 08.00 and 16.00 hr (Monday - Friday) during the fifth week of each test period for the determination of digestion coefficients of dry matter (DM), crude protein (CP) and acid detergent fibre (ADF).

As in previous trials (INGALLS et al., 1968) adding 14 % commercial RSM to the grain mixture resulted in reduced grain consumption ($P < 0.05$) with little change in milk production. Adding Bronowski RSM had no significant ($P > 0.05$) effect on grain consumption. A combination of Bronowski and urea (total urea = 24 % of N intake) depressed ($P < 0.05$) grain intake compared to the SBM ration. The concentration of rumen ammonia, total VFAs and molar percentages of VFA's were not significantly ($P > 0.05$) affected by treatment. Total ration dry matter and protein digestibility was not different ($P > 0.05$) among treatments.

Experiment 2. A second experiment was conducted to examine the use of higher levels of Bronowski RSM in dairy rations. Eight lactating dairy cows in two 4 x 4 latin squares were fed a barley silage and grain mixture (40 % silage: 60 % grain on DM basis) free choice. Bronowski RSM was added as 0, 10, 17 and 24 % of the grain rations which contained 1 % urea (Table 1). All cows received 2 kg of hay daily at 7.00 hr. Silage and

Table 1: Ingredients and Chemical Composition of Experimental Rations

Item	Experiment 1				Experiment 2				Experiment 3					
	RSM	Bron.	Soy	Bron+ Urea	Levels of Bronowski 0	10	17	24	Soy	RSM	Mol.	RSM Pell.	Flavor***	Span
Ingredients (kg)														
Barley	510	510	533	575	543	520	503	490	625	580	580	580	579	580
Oats	170	170	169	170	200	200	200	200	200	200	200	200	200	200
Commercial RSM	119	-	-	-	-	-	-	-	-	190	190	190	190	-
Bronowski RSM	-	119	-	42	-	100	170	240	-	-	-	-	-	-
Span RSM	-	-	-	-	-	-	-	-	-	-	-	-	-	190
Soybean meal	-	-	95	-	187	110	57	-	145	-	-	-	-	-
Urea	-	-	-	9	10	10	10	10	-	-	-	-	-	-
Molasses	-	-	-	-	25	25	25	25	-	-	30	-	-	-
Rock Phos.	13	13	14	14	10	10	10	10	10	10	10	10	10	10
Limestone	9	9	9	9	15	15	15	15	10	10	10	10	10	10
Trace Mineral Salt	4	4	4	4	5	5	5	5	5	5	5	5	5	5
Ground Hay	170	170	169	170	-	-	-	-	-	-	-	-	-	-
Premix	7*	7	7	8	5**	5	5	5	5**	5	5	5	5	5
Composition (% DM)														
Crude Protein	14.2	14.8	14.7	14.8	20.8	22.1	22.7	23.9	16.8	16.3	16.0	15.4	16.6	16.7
Acid Det. Fiber	13.7	14.5	12.9	12.8	7.3	9.0	10.2	11.7	7.8	10.2	10.3	11.2	11.0	10.7
Ca	1.1	1.2	1.1	1.1	0.9	1.1	1.1	1.1	-	-	-	-	-	-
Phos.	.8	.7	.7	.7	.6	.7	.7	.8	-	-	-	-	-	-
Ether Extract	-	-	-	-	2.6	2.8	2.9	3.0	2.3	2.6	2.5	2.8	2.6	2.4

* 4,400,000 IU Vit. A - 440,000 IU Vit. D - 44,000 IU Vit. E and 1 kg of elemental sulfur with the exception of 2 kg of elemental sulfur in the Bronowski - urea ration.

** 4,400,000 IU Vit. A - 440,000 IU Vit. D - 22,000 IU Vit. E.

*** 227 g of dry Supersweet Dairy Nectar - Flavor Corporation of America.

Table 2: Influence of feeding a Bronowski ration in place of Commercial RSM or Soybean meal rations on feed intake, milk production, rumen metabolism and ration digestibility

Item	Treatments			
	Commercial RSM	Bronowski RSM	Soybean Meal	Bronowski Urea
Dry matter intake				
Silage (kg/day)	7.6	7.2	8.0	8.0
Grain-hay mix (kg/day)	8.3^{c}	8.9^{ab}	9.4^{a}	8.6^{bc}
% Body Wt.	2.86	2.92	3.15	3.0
Production				
Milk (kg/day)	21.0	21.6	22.1	21.4
FCM (kg/day)	19.1	19.6	20.1	19.4
Butterfat (%)	3.34	3.41	3.42	3.46
Protein (%)	3.29	3.33	3.41	3.28
SNF (%)	8.37	8.38	8.52	8.39
Rumen metabolism				
NH_3 (mg N/100 ml)	5.2	6.1	6.9	5.4
Total VFA's (mmoles/L)	58	72	75	81
VFA's (molar %)				
Acetic acid	59.4	58.4	61.6	58.3
Propionic acid	20.4	24.1	20.1	24.5
Butyric acid	13.9	13.1	13.5	12.7
Isobutyric acid	0.88	0.80	0.85	0.75
Valeric acid	3.6	2.4	2.3	2.2
Isovaleric acid	1.8	1.2	1.7	1.5
Ration Digestibility				
Dry matter (%)	74.2	72.7	75.4	74.0
Crude Protein (%)	73.8	73.5	74.6	74.3
Acid Detergent fiber (%)	49.7	45.2	52.5	47.3

abc - Means with different letters are significantly different ($P < 0.05$)

Table 3: Effect of feeding high levels of Bronowski RSM on feed intake, milk production, milk composition and nitrogen retention

Item	Levels of Bronowski RSM			
	0	10	17	24
		%		
Intake (Dry Matter)				
Grain (kg/day)	10.3	10.8	9.9	10.8
Silage (kg/day)	7.2	7.5	6.9	7.7
Total Roughage (kg/day)	8.9	9.2	8.6	9.2
Production				
Milk (kg/day)	23.0	23.5	23.2	24.4
FCM (kg/day)	21.1	21.4	21.2	22.5
Butterfat (%)	3.50	3.45	3.59	3.58
Protein (%)	3.48	3.53	3.40	3.42
SNF (%)	8.26	8.33	8.28	8.28
Ration Digestibility and Nitrogen Balance				
Dry Matter (%)	62.9	65.5	63.5	62.3
Energy (%)	62.3	65.3	64.0	62.0
Crude Protein (%)	70.2	74.8	72.0	71.2
Fecal N (% intake)	29.8	25.2	29.0	28.8
Urinary N (% intake)	43.4	40.7	39.2	34.7
N retention (% intake)	26.8	34.1	32.8	36.5

grain mixtures were fed at 11.00 and 16.00 hrs free choice. Weigh backs of the silage and grain mixes were taken in the morning for each cow. Weekly feed samples were taken during each test period for analysis. Two weekly (Monday and Wednesday) milk samples were taken from each cow for butterfat, protein and SNF determinations. Rumen fluid samples were collected for VFA's and NH_3 analysis at the end of each period. Fecal and urine samples were collected from four cows during the last week of each period for digestibility and N balance determinations. Nitrogen in the feed, feces and urine was determined according to Kjeldahl method (AOAC 1965). Dry matter in all the feed samples was determined by drying at 70° C in a forced air oven to constant weight.

The inclusion of Bronowski RSM in the grain mix for dairy cows at levels of 0, 10, 17 and 24 % did not affect feed consumption. Milk production and milk composition were not different among treatments. Apparent protein digestibility of the rations and nitrogen retention was not different ($P > 0.05$) among treatments. These two experiments indicate that plant breeders have made significant steps in the improvement of rapeseed meal for use in dairy rations.

Experiment 3. This experiment was conducted to examine possible methods of reducing the palatability problem of commercial RSM and to compare the ad lib consumption of a Span RSM containing ration with a soybean meal supplemented ration. Six dairy cows were used in a 6 x 6 latin sqaure design and fed the grain rations containing 19 % commercial RSM, 19 % span or 14.5 % SBM (table 1) along with chopped hay free choice throughout the experiment. Three of the grain mixes containing 19 % commercial RSM were either mixed with 3 % cane molasses, feed flavor (Supersweet Dairy Nectar - Flavor Corporation of America) or pelleted. All the cows were adjusted to free choice grain in self feeders using a general dairy concentrate (grain mixture) before the start of the experiment. Each test period was 21 days duration. Daily feed consumption was recorded for each cow during the experimental period. Weekly milk and feed samples were collected during the experiment. Feed samples were dried at 70° C in a forced air oven for DM determination and composited for DM, either extract, ADF and CP analysis. Butterfat, protein and SNF were determined on the milk samples.

Consumption of grain was not different ($P > 0.05$) among treatments (table 4). However, consumption of the commercial RSM ration tended to be less than that of the SBM ration. The addition of molasses, feed flavor and pelleting of the commercial RSM tended to result in increased intake. Consumption of the Span RSM ration was not different ($P > 0.05$) from the other treatments. The commercial RSM ration resulted in reduced milk production compared to the SBM or the Span ration. In 8 experiments with RSM in dairy rations this is the only time I have found a significant ($P < 0.05$) reduction in milk production. The SBM and the pelleted commercial RSM ration resulted in lower ($P < 0.05$) butterfat test compared to the other rations. The fiber level was low for all treatments but somewhat lower for cows consuming the SMB ration.

Table 4: Effect of pelleting, adding molasses or feed flavor to commercial RSM and Span RSM on ad libitum grain consumption and milk yield of dairy cows

Item	Treatments					
	SBM	RSM	RSM Molasses	RSM Pelleted	RSM Flavor	Span RSM
Intake (Dry Matter)						
Grain (kg/day)	12.3	10.9	11.5	11.4	11.4	11.3
Hay (kg/day)	5.2	6.2	6.2	5.3	6.3	6.9
Total (kg/day)	17.5^{ab}	17.1^{bc}	17.7^{ab}	16.6^{c}	17.6^{ab}	18.2^{a}
Production						
Milk (kg/day)	25.1^{a}	21.6^{b}	24.3^{ab}	22.6^{ab}	25.8^{a}	24.8^{a}
FCM (kg/day)	20.1^{ab}	18.8^{b}	21.6^{a}	17.7^{b}	22.5^{a}	22.2^{a}
Butterfat (%)	2.76^{b}	3.17^{a}	3.28^{a}	2.70^{b}	3.24^{a}	3.44^{a}
Protein (%)	3.83	3.69	3.65	3.81	3.74	3.82
SNF (%)	8.91	8.71	8.70	8.79	8.78	8.99

abc - Means with different letters are different ($P < 0.05$)

Summary

1. Bronowski RSM a low glucosinolate meal can be used in dairy concentrates at levels higher than the present recommended levels of 10 % without reducing feed consumption or milk production.
2. These data would suggest that Span RSM, a low erucic acid variety, can be used in dairy rations with results at least equal to commercial RSM.

Literature Cited

1. INGALLS, J. R., M. E. SEALE and J. A. McKIRDY (1968): Effect of rapeseed meal and urea on ad libitum consumption of grain ration by dairy cows. Can. J. Anim. Sci. 48, 437-442
2. WALDERN, D. E. (1973): Rapeseed meal versus soybean meal as the only protein supplement for lactating cows fed corn silage roughage rations. Can. J. Anim. Sci. 53, 107-112