EVALUATION OF DRY COW OPTIMIZER PRODUCT IN MODERATE-ENERGY DRY COW DIETS: PERFORMANCE & METABOLISM

Introduction

Moderate energy, high fiber dry cow diets have gained popularity in recent years as a practical method to prevent prepartum energy overconsumption. Wheat straw is considered the “gold standard” for dilution of energy density in these diets, but may not always be available. Consequently, alternative forages such as grass hay should be evaluated for use in moderate energy, high fiber dry cow diets.

Field experience has shown that using a molasses-based liquid supplement to replace dry supplements in moderate-energy dry cow diets improves palatability, fiber digestion, and dry matter intake, while reducing ration separation. Based on field success, a Custom QLF Dry Cow Optimizer was utilized in a university trial to evaluate the effects of forage source and supplement type on cow performance and metabolism in a research setting. Custom QLF Dry Cow Optimizer is a molasses-based liquid feed which delivers sugar, protein (urea), calcium, trace minerals, and vitamins into a dry cow TMR.

Materials & Methods

Sixty multiparous Holstein and crossbred cows, balanced by 305ME and parity, were used in a 2 × 2 factorial design prepartum (forage: wheat straw vs. grass hay and supplemental CHO source: corn vs. molasses-based liquid feed) for a combination of four prepartum treatments and two postpartum treatments:

# Cows	Prepartum	Postpartum
15	Wheat Straw TMR + Corn-Based Dry Feed (WSDF)	Lactation TMR + Corn Based Dry Feed (DF)
15	Wheat Straw TMR + Dry Cow Optimizer (WSLF)	Lactation TMR + Dry Cow Optimizer (LF)
15	Grass hay TMR + Corn -Based Dry Feed (GHDF)	Lactation TMR + Corn Based Dry Feed (DF)
15	Grass Hay TMR + Dry Cow Optimizer (GHLF)	Lactation TMR + Dry Cow Optimizer (LF)

Wheat Straw or grass hay was fed at 30% of prepartum DM; all diets were formulated using CPM Dairy 3.0.8. Prepartum diets were formulated to meet nutrient needs of a 1433 lb cow at 280 days in gestation. Dry period dietary treatments started at 42 d prepartum. After calving, cows were fed one of two diets (formulated to support 88 lb/day of 3.5% FCM) through 56 days postpartum. A Custom QLF Dry Cow Optimizer was fed for the entire experimental period targeting 3 lb/day as-fed intake in formulated diets.

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Overall Conclusions

- All cows ate well during the dry period, and transitioned smoothly into lactation.
- QLF Dry Cow Optimizer products can be fed in the prepartum and early postpartum periods with no detrimental effects on cow performance or health.
- Supplementation with molasses-based liquid supplements during the prepartum period may help prepare cows metabolically for lactation energy demands.
- Cows receiving QLF Custom Dry Cow Optimizer supplement in the early postpartum period had increased milk efficiency in early lactation.
- Custom QLF Dry Cow Optimizer improved postpartum TMR particle distribution to reduce fine particles and increase the amount of material on the top 2 screens of the PSPS. Presenting cows with a more optimal particle distribution helps reduce risk of suboptimal rumen pH, to enhance rumen efficiency.

Research Supplement Nutrient Profiles (As-Fed Basis):

Item	Unit	Dry Supplement	QLF Supplement
Dry Matter	%	89.5	63
Crude Protein	%	28.5	20
ECP-NPN	%	22.8	17
Sugar	%	--	24
Starch	%	38.5	--
Calcium	%	5.3	3.7
Potassium	%	3.3	2.2
Phosphorus	%	0.6	0.45
Magnesium	%	1.0	.67
Sulfur	%	1.95	1.3
Zinc	PPM	765	530
Manganese	PPM	570	400
Copper	PPM	174	122
Selenium	IU/lb	4.95	3.5
Vitamin A	IU/lb	71,429	50,000
Vitamin D	IU/lb	14,286	10,000
Vitamin E	IU/lb	715	500
Feeding Rate	Lb/d	2.1	3

Reference:
Litherland, N. B., D. N. L. da Silva, W. P. Hansen, L. Davis, S. Emanuele, and H. Blalock. 2013. Effects of prepartum controlled-energy wheat straw and grass hay diets supplemented with starch or sugar on periparturient dairy cow performance and lipid metabolism. J. Dairy Sci. 96:3050-3063 & J. Dairy Sci. 96:4078.

Table 1: Diet Ingredients, % of DM

	Prepartum				Postpartum	
	WSDF	WSLF	GHDF	GHLF	DF	LF
Wheat Straw, chopped	30.0	30.0	0	0	0.0	0.0
Grass hay,chopped	0	0	30.0	30.0	0.0	0.0
Corn silage (Proc.)	39.4	39.4	47.6	47.6	30.0	30.0
Alfalfa hay, chopped	9.1	9.1	9.1	9.1	18.0	18.0
Dry corn, ground	4.2	4.2	0.0	0.0	27.0	27.0
Soybean meal, 48%	11.0	11.0	7.0	7.0	5.0	5.0
Cust. Dry Cow Optimizer	0	6.3	0	6.3	0.0	3.8
Corn-based dry mix	6.3	0	6.3	0	3.8	0
Lactation protein mix	0	0	0	0	16.5	16.5
Particle Distribution, % of as-fed particles in Penn State Particle Separator screens						
>0.75”	11.4	13.0	20.3	20.3	5.7	6.4
0.74”-0.31”	43.6	46.1	39.9	41.8	30.0	31.5
0.30”-0.05”	33.6	31.0	27.9	27.8	41.4	40.8
<0.05”	11.3	9.9	11.9	10.0	22.8	21.3

The corn-based supplement and Dry Cow Optimizer liquid feed were designed to vary only in carbohydrate (starch vs. sugar) and used similar macro and micro-nutrient ingredients and supplemental levels to provide a finished diet with equal mineral and vitamin composition. Supplement nutrient composition is listed on the back page.

In prepartum diets, DCAD was purposely unaltered. The Custom Dry Cow Optimizer contained magnesium oxide, ammonium sulfate, and magnesium sulfate, and the corn-based dry supplement provided similar amounts of magnesium and sulfur so predictions of DCAD were nearly identical between prepartum treatments within forage type, as shown in the table below.

Table 2: Diet Nutrient Composition, % of DM

	Prepartum				Postpartum	
	WSDF	WSLF	GHDF	GHLF	DF	LF
Dry Matter	54.8	53.9	54.6	53.8	55.8	55.3
Crude Protein	12.5	12.7	13.8	13.9	17.7	17.8
RDP, % of DM	9.4	9.8	10.4	10.7	10.0	10.2
NE_l, Mcal/lb	0.66	0.66	0.71	0.71	0.79	0.80
NDF	42.2	41.8	37.8	37.4	29.7	29.4
Starch	20.1	18.7	20.1	18.7	23.2	22.6
Sugar	3.6	6.3	5.1	7.9	4.3	5.9
Calcium	0.67	0.68	0.74	0.75	0.86	0.87
Potassium	1.40	1.41	1.90	1.90	1.45	1.46
Magnesium	0.29	0.29	0.30	0.30	0.33	0.33
DCAD, meq/100 g	12.8	11.0	25.4	23.6	27.87	26.83

Wheat Straw

Grass Hay

Corn-Based Dry Supplement

QLF Custom Dry Cow Optimizer

Prepartum Results

	Treatment							
	Wheat Straw		Grass Hay			*P*-value		
Variable	DF	LF	DF	LF	SEM	F	S	Week
DMI, lb/d	29.5	29.8	32.6	30.0	2.0	0.29	0.29	0.25
DMI, % of BW	2.0	1.9	2.1	2.0	0.1	0.20	0.34	0.25
NE_l Intake, Mcal/d	20.3	19.5	23.5	21.7	1.4	0.05	0.33	0.55
Energy Balance, Mcal/d	5.4	4.8	8.6	7.1	1.6	0.06	0.45	0.77
Starch Intake, lb/d	6.0	5.5	6.6	5.5	0.4	0.30	0.02	0.25
Sugar Intake, lb/d	1.1	1.8	1.8	2.4	0.2	<0.01	<0.01	0.45
Serum NEFA µEq/L	88.6	176.9	92.1	129.5	20.6	0.27	<0.01	(Day) <0.01
Liver Triacylglycerol %	0.31	0.53	0.37	0.60	0.1	0.57	0.06	--

Prepartum dry matter intake was not different between treatments. Energy intake and balance was increased for grass hay-fed cows, possibly due to a faster rate of NDF digestibility for grass hay, improving passage rate and reducing rumen fill compared to wheat straw. Cows receiving the molasses-based liquid feed consumed 0.7 lb/day supplemental sugar, and had greater sugar intake than corn-supplemented cows. LF-supplemented had higher NEFA and liver triacylglycerol, increasing metabolic preparation (via fat mobilization) for the upcoming lactation. Serum NEFA and liver triacylglycerol values for all treatments are considered normal for prepartum cows.

Postpartum Results

	Treatment							
	Wheat Straw		Grass Hay			*P*-value		
Variable	DF	LF	DF	LF	SEM	F	S	Week
DMI, lb/d	47.0	39.0	46.0	42.6	2.2	0.53	<0.01	<0.01
DMI, % of BW	3.2	3.1	3.4	3.2	0.1	0.33	0.26	<0.01
NE_l Intake, Mcal/d	37.1	31.2	36.4	32.8	1.9	0.8	0.01	<0.01
Energy Balance, Mcal/d	-5.2	-8.4	-3.6	-9.3	1.0	0.86	0.01	<0.01
Starch Intake, lb/d	10.6	9.3	10.6	9.7	0.4	0.50	0.01	<0.01
Sugar Intake, lb/d	2.0	2.4	2.0	2.4	0.1	0.37	<0.01	<0.01
Serum NEFA µEq/L	368.6	415.0	466.7	543.2	44.5	0.01	0.16	<0.01
Liver Triacylglycerol %	4.7	5.4	4.6	7.0	0.9	0.38	0.09	<0.01
3.5% FCM, lb/d	101.7	98.8	97.5	97.7	4.0	0.51	0.75	<0.01
Dairy Efficiency (3.5% FCM/DMI)	2.2	2.6	2.1	2.4	0.1	0.15	<0.01	<0.01

Dry matter intake was lower for LF-supplemented cows postpartum, but DMI as a % of BW was not different between treatments. Energy balance was lower, while NEFA and Liver Triacylglycerol % tended to be higher for LF-supplemented cows, indicating that cows were metabolically responding to support equivalent milk production to DF cows. NEFA and liver triacylglycerol levels for all cows were typical of cows transitioning normally into lactation. 3.5% FCM was not different between treatments, causing Dairy Efficiency (FCM/DMI) to be significantly higher (P <0.01) for LF-supplemented cows.

Supplement form (dry or liquid) had significant effects on particle distribution at put-down for postpartum diets. In the early lactation diet, Custom QLF Dry Cow Optimizer increased proportion of particles on the top screen of PSPS (P<0.001), and tended to increase proportion of particles on the second screen (0.74” – 0.31”) (P=0.09). The mass of particles 0.30” to 0.05” was similar between treatments, and LF reduced the proportion of particles <0.05” (P<0.001) compared to DF. These improvements in particle distribution are likely due to the liquid feed agglomerating small particles to larger ones, and to differences in physical form of the supplement (liquid feed vs. dry feed). Sorting activity for small TMR particles (<0.31”) lowers rumen pH and increases pH range (DeVries et al., 2008). Reducing the proportion of fines in TMR has the benefit of providing cows less opportunity to sort for those particles, reducing the risk of suboptimal rumen pH and the resulting negative effects on feed utilization. In a field survey, Overton et al. (2008) demonstrated that the amount of particles 0.74” to 0.31” and <0.31” in length has a significant relationship to herd milk fat %. This research demonstrates that a molasses-based liquid supplement reduces the amount of fines in the TMR and agglomerates small particles to larger ones, increasing the amount of material > 0.31” in the TMR particle distribution.