USE OF MOLASSES AS A VEHICLE FOR LIQUID SUPPLEMENTATION OF NUTRIENTS IN TOTAL MIXED DAIRY RATIONS

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INTRODUCTION

Liquid as a carrier for nutrients is being used on several dairy farms today and use may be expanded in the future. A decision to use a liquid should involve 1) advantages of liquids and 2) methods of using liquids.

ADVANTAGES OF LIQUIDS

Separation of ingredients in a mix is a constant concern in dairy rations. A dry mineral mix with ingredients of different particle size may separate in storage and handling. A liquid mix may be more uniform and not separate in storage and handling.

Separation can also be a problem in the total mixed ration (TMR) fed to dairy animals. A mix made of dry ingredients usually is not a good mix as placed in the feed bunk and as eaten by the animal. This problem can be corrected by adding liquids to give a 60-65% dry matter mix.

Storage and mixing loss can be expensive due to wind. Commodity bins may have dry ingredients removed by wind. Another source of loss to the wind can be loading of the dry ingredients into the mixer with a front end loader. Liquids stored in a tank can prevent these wind losses.

Accuracy of weighing determines the ration that will be fed to the animals. A front end loader may be the cause of too large or too small addition of a critical ingredient in the ration. A switch on a pump for a liquid gives the operator more control over amounts added and, thus, more accuracy.

Feed intake is one of the most important factors in high milk production. Liquids have been used in grain-supplement mixes to reduce dust and improve intake. Taste and physical nature of the TMR are important to dry matter intake on the dairy. An ingredient that is a good source of nutrients may not be consumed unless it is "covered up" by a palatable liquid.

Free choice feeding for dry cows and heifers on pasture can reduce labor costs . Liquids have been used as the carrier for free choice feeding.

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METHODS OF USING LIQUIDS

Total mixed rations fed to lactating dairy cows may have all ingredients inventoried on the dairy with the exception of a 1 to 2 pound vitamin mineral and buffer mix. A dependable source of this critical mix can be a problem. A feeding comparison was made on a Texas dairy to determine if all vitamins, minerals and buffers could be added in a liquid carrier.

A herd of 662 lactating Holstein cows was divided into two equal groups. One group of 331 head received vitamins, minerals and buffers in a liquid supplement added at the rate of three pounds per head daily in a TMR. A second group of 331 head received equal nutrients in the form of a dry supplement mix added to the TMR.

Each group of animals was divided into three strings for feeding as follows:

Highest Production	- <60 days in milk
	- Total 140 head
Medium Production	- Total 140 head
Low Production	- >280 days in milk or low Production
	- Total number minus 280 head

Daily feed consumption was recorded for each string of animals within each group.

Milk production was determined for each animal in string two on day 1, 14, and 28 for both liquid and dry mineral groups. A milk sample for each animal in string two of each of three milkings was collected on day 1, 14, and 28 with fat, protein and somatic cell count determined by the DHIA Lab at Texas A&M.

Blood samples were obtained on day 1 and 28 for 20 animals for analysis of calcium, phosphorous, magnesium, sodium and copper.

TMR composition was determined weekly for liquid and dry mineral diets by sampling twice each week and forwarding to the New York DHI Lab. Commodities and supplements used in the TMR in order of addition were: corn hominy feed, dried brewers grains, chopped alfalfa hay, whole cotton seed, chopped coastal hay, soy hulls, 44% soybean meal, rice bran, supplement package (liquid or dry) and nonfermentative brewers liquid yeast. The TMR was calculated to equal or exceed NRC requirements.

Analytical results of the TMR demonstrated that liquid supplement can be used as a carrier for the minerals, vitamins and buffers in a TMR.

COMPOSITION OF TMR(100% DM)

	%								ppm			
	Dry Matter	Crude Protein	Ca	P	Mg	S	K	Na	Fe	Zn	Cu	Mn
Calculated	65	18.0	0.90	0.55	0.35	0.21	1.30	0.35	237	61	25	83
Dry Supplement	64	18.4	0.91	0.50	0.32	0.23	1.43	0.31	353	81	17	95
Liquid Supplement	62	18.8	1.00	0.51	0.36	0.26	1.41	0.25	378	93	20	100

Total dry matter intake on a group basis was recorded daily for the animals on each TMR by feed fed minus feed removed from the bunk. Dry matter intake for the four weeks was higher with liquid (42.1 pounds per head daily vs. 40.0).

Milk production was more persistent on the liquid supplement decreasing 1.2 pounds per head daily compared to a 3 pound daily decrease for dry supplement. Milk fat and protein percentage increased for the liquid supplement for days 14 and 28 when compared to day one of the trial.

Daily Milk Production and Composition

	Dry			Liquid		
	Day		Change	Day		Change
	1	14 & 28 avg.		1	14 & 28 avg.	
Milk/lbs	48.1	45.1	-3	45.2	44.0	-1.2
Fat, %	4.1	3.5	-0.6	3.4	3.5	+0.1
Prot., %	3.1	3.4	-0.3	2.9	3.5	+0.6

Blood calcium increased from 9.18 to 9.41 mg% on the liquid supplement diet whereas it remained constant from day 1 to day 28 on the dry mineral diet. Blood phosphorous increased on both dry and liquid diets in the period from day 1 to 28. Sodium decreased on both liquid and dry diets. Blood copper was maintained on the liquid diet while it decreased on the dry ration.

Blood Mineral Composition

	Dry		Liquid	
	Day		Day	
	1	28	1	28
Ca, mg %	9.18	9.17	9.18	9.41
P, mg %	5.70	6.51	5.54	6.43
Mg, mg/dl	1.88	1.80	2.04	2.13
Na, mg/dl	140.6	126.2	140.7	123.8
Cu, ppm	0.64	0.478	0.630	0.624

These results demonstrate that a liquid carrier can be used to carry vitamins, minerals and buffers for lactating dairy cows.

The addition of selected bacteria may be of value to lactating dairy cows. Liquids provide a method of maintaining and adding bacteria to rations. A trial was conducted to compare performance of a ration with Lactobacillus acidophilus added in a molasses carrier. Two groups of lactating dairy cows (156 head per group) were selected from 800 head. The treatment group received two pounds per head daily of molasses with Lactobacillus acidophilus incorporated in the molasses. The control group received two pounds of molasses in an equivalent TMR. Rations were prepared to meet or exceed NRC requirements.

Milk production as daily pounds per head was higher for the ration with Lactobacillus acidophilus at the end of 21 days on the ration.

Milk Production,lbs/head/day

Day	Control	Treatment
1	75.4	75.8
21	62.5	67.9
Change	-12.9	-7.9

Energy is one of the limitations for higher milk production. Many cows do not receive adequate energy within the limitations of dry matter intake in the most concentrated ration made of usual feed commodities. A solution is to add a more concentrated energy source in the form of fat. Molasses is being used currently as a carrier for fat in the range of 10-30% fat. The addition of the molasses-fat mix to a TMR provides some of the needed energy for higher production. Addition of fat without molasses requires a heated tank while the molasses-fat blend has been used in Texas without heating.

Protein balance for dairy rations considers protein to be used in the rumen as well as so-called "by-pass protein" that becomes available in the lower tract. Two ingredients with by-pass value are blood meal and feather meal. Blends of these two unpalatable feed ingredients with molasses are used in TMR's to obtain by-pass protein. Palatability has not been a problem with the molasses blends.

Dairy heifers on pasture need supplemental feeding for optimum body weight gain. A trial with 160 head of Holstein heifers (average body weight 638 pounds) demonstrated the value of a liquid supplement to reduce labor and feed cost. A grain mix fed at 4 pounds per head daily was compared with liquid supplement consumed free choice from a lick tank or from an open tank.

Average daily gain was comparable for the three methods of feeding on fescue pasture from May to October. Labor and supplement cost was lowest with liquid supplement free choice.

Supplement on Pasture

	Grain	Lick Tank	Open Tank
Lbs./hd/day	4	3.3	2.6
ADG, lbs	1.5	1.6	1.4
Supplement Cost, $	44.22	27.97	24.11
Labor Cost, $	34.05	4.15	4.59
Total Supplement-Labor costs, $	78.27	32.12	28.70

SUMMARY AND CONCLUSIONS

Molasses as a carrier offers the following advantages in a TMR for dairy cattle:

1) Uniform mix without separation due to particle size in vitamin, mineral and buffer supplements
2) Reduced separation of TMR in bunk
3) No storage loss due to wind
4) Improved accuracy of weighing into TMR
5) "Covers" unpalatable ingredients

Methods of using molasses have included:

1) Satisfactory carrier for vitamin, minerals and buffer supplement
2) Good media for addition of Lactobacillus acidophilus to TMR
3) Blending molasses with fat to increase energy concentration of TMR
4) Blending molasses with by-pass protein for unpalatable ingredients
5) Free choice feeding of heifers on pasture