Torula Yeast in Dairy Cattle Rations

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The information available concerning the effect of yeast in dairy rations on the quantity and composition of milk produced is quite limited and somewhat contradictory.

Tangl and Szarka (1947) reported experiments involving more than 100 cows in which feeding 5 g of fresh yeast per cow daily did not affect milk yield but increased the fat test of milk as much as 0.8% in some cases. On the other hand, feeding of dried yeast had no effect on the fat test. Renz (1954) and Renz and Koch (1956) reported that the butterfat content of the milk was increased when cows were fed 50 g per head daily of a yeast concentrate, "Astoral." Burroughs (1957) reported that the addition of Torula yeast to a supplement containing urea and stilbestrol increased the daily gains of beef steers.

Norton (1945) found that neither the fat test nor total milk production was increased as a result of feeding up to 80 g of live bakers' yeast per cow daily. More recently, Lassiter *et al* (1958) reported that grain rations containing 1% of a live yeast culture had no significant effect on the production of 4% fat-corrected-milk (FCM), butterfat test or feed consumption of dairy cows. Digestibility of crude protein and ether extract were significantly decreased upon inclusion of the yeast in the ration, and the cows receiving this supplement gained less weight than those receiving the control ration. Similarly, Jordan and Ward (1959) found that a live yeast culture added as 2% of the grain ration had no significant effect on the milk production or butterfat test of Holstein cows. In an *in vitro* study, live yeast cultures increased gas production when cellulose was used as the substrate or when no substrate was added to rumen fluid. Gas production was not increased when the cultures were added to a substrate of alfalfa or alfalfa and grain.

The investigation reported herein was conducted to obtain information regarding the effect of rations containing Torula yeast on the quantity and composition of milk produced by dairy cows.

The research reported herein was done under project 1030.

Experimental Procedure

Experiment 1

Twelve Holstein cows were used to evaluate the effect on milk production of adding 50 g of dried Torula yeast[1] per day to a grain ration which contained milo, oats, wheat bran, and cottonseed meal. The cows were paired on the basis of stage of lactation and level of production before assignment to two treatment groups. Grain was fed according to Morrison's standard for cows on pasture, with the amount allotted to each pair being based on their average production. Milk production was recorded twice daily and samples were taken periodically for determination of fat content.

Experiment 2

A double-reversal trial involving 16 Ayrshire cows was conducted to determine whether substitution of Torula yeast for one-half of the cottonseed meal in the concentrate ration would have any effect on milk production. Each cow was started on experiment four weeks after calving. Grain was allotted according to Morrison's feeding standard for cows not on pasture and receiving 2 lb. of hay equivalent per 100 lb. body weight. Thereafter, the amount of grain for each cow was reduced at the rate of 10% every four weeks with changes being made only before and after each experimental period.

The experimental periods were of four weeks duration and a two-week adjustment period was allowed between the treatment periods. The feed containing Torula yeast (Table 1) was introduced gradually over

Table 1.—Composition of grain rations fed to Ayrshire cows in Experiment 2

Ingredient	Ration 1	Ration 2
	Pounds	
Milo, ground	300	300
Oats, ground	100	100
Wheat bran	100	100
Cottonseed meal	100	50
Torula yeast feed	0	50
Salt	6	6
Total	606	606

[1] The dried Torula yeast was furnished by the Red Star Yeast & Products Co., Milwaukee, Wis., through the courtesy of G. R. Christensen.

a period of three days in an effort to prevent refusal of this grain mixture by the higher producing cows. Milk production was recorded twice daily and samples were taken weekly for butterfat tests.

Experiment 3

Four Holstein cows were used to evaluate the effect of different levels of Torula yeast in the grain ration on the production of volatile fatty acids in the rumen. Records for milk production were also maintained. Four grain mixtures (Table 2) containing 0.0, 8.3, 16.7 and 25.0% of Torula yeast, respectively, were compared. A 4 x 4 Latin square design with 10-day periods was employed and rumen samples were taken by stomach tube four hours after feeding on the tenth day of each period. Each cow was fed a sufficient quantity of grain and roughage (alfalfa hay and sorghum silage) to meet Morrison's minimum nutrient requirements. The grain and roughage were allotted in each case in a 40 to 60 ratio (grain : hay equivalent).

Table 2.—Composition of grain mixtures containing different levels of Torula yeast—Experiment 3.

Ingredient	Ration 1	Ration 2	Ration 3	Ration 4
		Pounds		
Milo, ground	300	300	300	300
Oats, ground	100	100	100	100
Wheat bran	50	50	50	50
Torula yeast feed	0	50	100	150
Cottonseed meal	150	100	50	0
Salt	6	6	6	6
Total	606	606	606	606

Results and Discussion

The addition of 50 g of Torula yeast to the ration of Holstein cows had no significant effect on milk yield. During the 45-day trial the average total production of 4% FCM was 1041 and 1098 lb. per cow for the control and yeast groups, respectively. Likewise, the fat content of the milk from cows of the two groups was not significantly different.

Replacement of one-half of the cottonseed meal in the grain ration with Torula yeast had no statistically significant effect on the milk production of Ayrshire cows when expressed either in terms of actual

production or 4% fat-corrected-milk. The average production of 4% FCM was 38.6 lb. per cow per day during periods when the yeast ration was fed, while the corresponding production during periods when the control ration was fed was 37.8 lb. per cow per day. Moreover, the ration containing the Torula yeast was unpalatable for some cows, particularly those producing a large quantity of milk and receiving a large grain allowance.

The proportions of the different volatile fatty acids in the rumen fluid of the cows receiving rations containing different levels of Torula yeast were quite similar (Table 3). In fact, there were only slight

Table 3.—Average molar percentage of volatile fatty acids in the rumen fluid of cows fed Torula yeast rations

Level of yeast feed in ration (Percent)	Molar percent of indicated volatile fatty acid*:		
	Acetic	Propionic	Butyric & higher
0	62.1	16.6	21.3
8.3	61.1	15.8	23.1
16.7	62.8	15.5	21.7
25.0	61.9	15.8	22.3

* Differences among rations not statistically significant ($P > 0.25$)

variations from the over-all average molar percentages of 62.0, 15.9 and 22.1 for acetic, propionic and butyric acids, respectively. A close relationship has been shown to exist between the proportion of volatile fatty acids in the rumen and the fat content of milk produced by dairy cows in that a decrease in the relative amount of acetic acid with a corresponding increase in propionic acid results in a lower fat test (Ensor *et al.*, 1959).

Since the proportion of volatile fatty acids was not changed by the addition of Torula yeast to the ration in Experiment 3, a significant change in the fat content of the milk would not be expected. Observations made on the amount of milk produced and the fat content thereof revealed no significant differences among the four rations with respect to these criteria (Table 4). Although the average fat test was lower for the periods when the cows were receiving the ration containing 25% Torula yeast, there was considerable variability among cows on all the rations so that this lower value is not of any real significance.

Table 4.—Milk production of cows fed rations having different levels of Torula yeast feed

Level of yeast feed in ration (Percent)	Avg. fat content of milk on last day of experimental period (pct.)	Avg. production of milk (lb./day) Entire 10-day period	Last 3 days of period*
0	4.7	23.4	24.3
8.3	4.7	23.8	24.6
16.7	4.9	24.1	23.8
25.0	4.0	23.1	23.1

* Differences among rations not statistically significant ($P > 0.25$)

Summary

Observations were made on the production of milk by Holstein and Ayrshire cows when different levels of Torula yeast were included in the ration. Neither total production of milk nor the fat content thereof was significantly affected by the addition of the dried yeast to the grain mixture. Moreover, the rations containing the Torula yeast were not readily consumed by some of the high-producing cows receiving a large grain allowance.

Different levels of Torula yeast feed in the ration had no observable effect on the proportion of volatile fatty acids present in the rumen four hours after feeding at the end of the 10-day feeding periods.

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Approximate Analysis of Dried Torula Yeast, U.S.P.

Vitamins	Micrograms per gram	Amino Acids	percent*
Thiamine (B_1)	>120	Alanine	3.4
Riboflavin (B_2)	> 40	Arginine	5.4
Niacin	>300	Aspartic acid	4.5
Pyridoxine HCl (B_6)	30	Cystine	0.6
Para-Amino-benzoic acid	15	Clutamic acid	15.0
d-calcium pantothenate	110	Glycine	4.9
Choline chloride	3500	Histidine	1.9
Inositol	4000	Isoleucine	5.3
Cobalamine (B_{12})	0.001	Leucine	7.0
Biotin	0.8	Lysine	6.7
Folinic acid	70	Methionine	1.1
		Phenylalanine	4.3
Minerals	**percent**	Proline	3.5
Calcium	0.9	Serine	5.4
Iron	0.2	Threonine	5.4
Magnesium	0.2	Tryptophane	1.2
Phosphorus	1.7	Tyrosine	3.3
Sulfur	0.7	Valine	6.2
Zinc	0.1		
Potassium	2.1		
Sodium	0.0015		
	Milligrams per pound		
Cobalt	<1		
Copper	4	Moisture:	<7%
Iodine	1.5	Ash:	<8%
Lead	<1	Bacterial Count	<7500/g.
Manganese	15	Mold Count	<50/g.
Nickel	<1	Protein	>50% (avg. 56%)

* Average values expressed as percent of yeast protein.