



Manipulating Milk Composition

1. The effect of feeding high concentrate rations

In response to premiums paid for high fat milk, hundreds of research trials have been conducted to look at methods of increasing production while maintaining high milk fat percent. However, under the present payment system, most Alberta milk producers can increase income by shipping higher volumes of lower fat milk. The introduction of MSQ skim-off has further increased interest in lowering fat tests.

It is commonly believed that fat tests lower than about 3.2% are the result of feeding programs that will inevitably compromise cow health and longevity. However, current research and producer experience suggest that it may be possible to feed cows for lower fat tests without sacrificing animal health. The critical factors may be the use of Total Mixed Rations (TMRs) and the inclusion of buffers to counteract the effects of feeding high concentrate rations.

We have recently completed a series of feeding trials with the following objectives :

- 1 Increase production, reduce milk fat test and raise milk protein test by feeding high concentrate rations without compromising cow health;
- 2 Determine the effectiveness of dietary buffers in maintaining healthy rumens in cows fed high concentrate rations.

We fed two TMRs to cows that were in either early (64-122 DIM) or late lactation (220-257 DIM). The control ration was a typical 50:50 mix of forage and concentrate. A high concentrate ration was 25% forage, 75% concentrate. To test the effect of buffer, 1.2% sodium bicarbonate was included in the rations fed to half of the cows on each concentrate level. A summary of the experimental design is given in table 1.

Early lactation cows

Here's what we found with the early lactation cows (see figure 1) :

- When we fed the high concentrate ration with no buffer in early lactation, there was no change in milk production or fat test, compared with the control ration with no buffer. However, milk protein test rose from 3.1% to 3.3%.
- Adding buffer to the early lactation 25:75 ration increased milk production by 4.6 kg over the no-buffer 25:75 ration. The buffered 25:75 ration also produced a higher fat test (3.2% vs 2.4%) and a lower protein test (3.1% vs 3.3%) than the same ration with no buffer. But milk component levels on the buffered 25:75 ration were no different than those on the 50:50 ration with no buffer.

The observation that milk production did not increase on the 25:75 ration with no buffer was probably due to depressed rumen pH resulting from the high concentrate level. This would also explain the increased production when buffer was added to this ration. The buffer likely stabilized rumen pH but , at the same time, it eliminated the milk fat depression we were hoping to achieve.

Late lactation cows

Feeding these rations to late lactation cows produced the following results (see figure 1) :

- Milk yields were similar on all rations;
- The high concentrate ration with no buffer caused milk fat test to drop to 2.9% from 4.2% on the no-buffer 50:50 ration.
- Adding buffer to the 25:75 ration returned fat test to 4.1%.

	TMR FORAGE:CONC	BUFFER LEVEL (%)
EARLY LACTATION COWS		
A	50 : 50	0
B	50 : 50	1.6
C	25 : 75	0
D	25 : 75	1.6
LATE LACTATION COWS		
E	50 : 50	0
F	50 : 50	1.6
G	25 : 75	0
H	25 : 75	1.6

Table 1 : Experimental design. Two cows were fed each of the 8 different rations.

- Milk protein test remained unchanged from the no-buffer 50:50 ration when we increased the concentrate to 25:75 or added buffer to the high concentrate ration.

The absence of a milk yield response to the higher concentrate ration was typical for late lactation cows. The observation that buffer had no effect on milk yield suggests that rumen pH was not as severely depressed as it was in the early lactation cows.

Conclusions

Based on the results of this experiment, we can draw the following conclusions :

- Raising ration concentrate level from 50% to 75% may not increase milk yield in either early or late lactation .
- In early lactation, high concentrate rations have no effect on milk fat test but may increase milk protein content.
- In late lactation, high concentrate rations can be used to depress milk fat test although they have no effect on milk protein.
- In early lactation, adding buffer to high concentrate rations may increase milk production by alleviating a depression in rumen pH.
- Adding buffer to high concentrate rations negates the effect that those rations have on milk component levels.

Cows were fed each of these rations for three week periods. Although we observed no evidence that the high concentrate rations compromised rumen health, we cannot recommend feeding similar rations for more than a month or so because of their possible long-term effects.

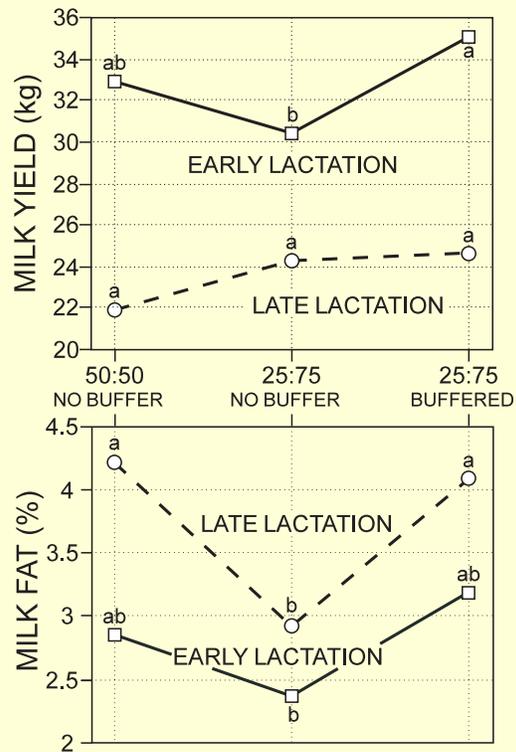


Figure 1 : Effects on milk yield and milk fat test of increasing ration concentrate level from 50 to 75% and of adding buffer to a 75% concentrate ration. Points on the same line having different letters are significantly different from one another ($p < 0.05$) as explained below.

How to interpret research results ...

The interpretation of research results is based on statistical tests of *significance*. In the trial described here, there are many sources of variation which can affect cow responses to each ration. What we want to know is whether the observed differences in response are due to the combined effects of these sources of variation or primarily to the rations we are testing. Statistical testing allows us to answer this question.

Using the early lactation milk yields shown above as an example, the 25:75 ration appeared to produce less milk than the 50:50 ration. However, the statistical test determined that the difference was only due to normal variation and was, therefore, *not significant*. But adding buffer to the 25:75 ration produced a *significant* increase in milk yield compared with the 50:50 ration. In this case, significance implies that the probability that the difference was not due to the buffer is less than 5%. In the language of statistics, the probability (p) is less than 5% (0.05).

John Kennelly,
project leader