



Evaluating Commercial California Dairy Rations

1. Ration, Behavior, Rumen pH, and Milk Production

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The dairy industry in California has been expanding, and continues to expand, at a steady rate. In addition, the milk production levels of the cows have increased steadily, even as the average size of California dairy herds has increased.

Little emphasis has been placed on evaluating changes in the types, and levels, of feedstuffs in the rations fed to California dairy cows, although it seems clear that inclusion levels of alfalfa hay have been falling as inclusion levels of cereal and corn silages have been increasing. In addition, by-products of the vegetable, nut, brewing, citrus and milling industries have been tending to increase as the inclusion levels of grains have tended to decrease. These changes suggest that rations for California dairy cows may have become more reliant on slowly fermenting structural carbohydrates and less reliant on rapidly fermenting carbohydrates such as starches. Nevertheless, there seems to be a common perception that rumen acidosis (i.e., low rumen pH associated with high dietary levels of rapidly fermenting carbohydrates) is a problem that has been increasing in severity in California herds, such that it is contributing to laminitis and negatively impacting herd productivity.

The objective of this study, from which the data in the article is derived, was to provide information on relationships between nutritional characteristics of rations, cow behavior, and productive performance of cows on commercial dairies in California. This article examines aspects cow weight and condition, cow behavior, rumen fermentation. Another article (posted in July 1999) examines the nutritional evaluation of the diets.

Process

Four commercial dairies in the Chino, Tulare, Modesto and Petaluma areas of California were selected for evaluation. Dairies were selected that had sizes, rations and performance levels that were judged to be relatively typical of other dairies in their areas.

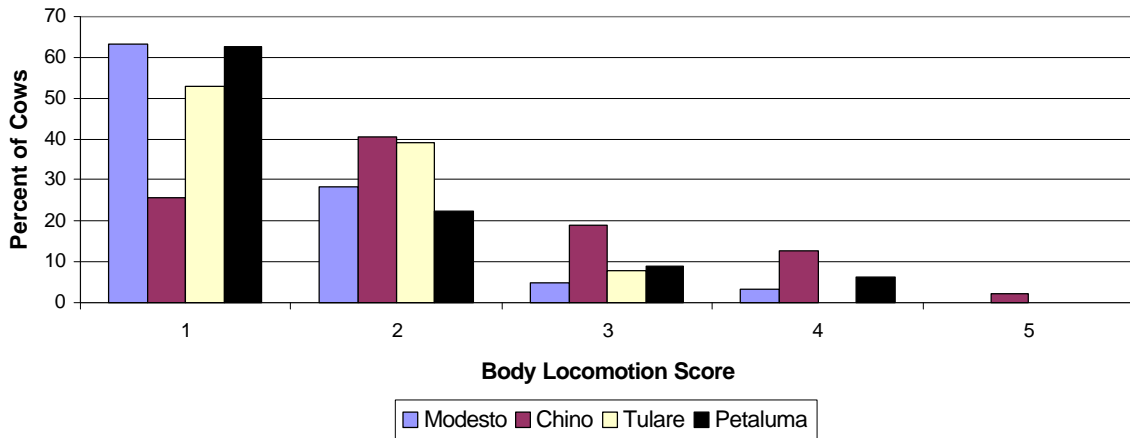
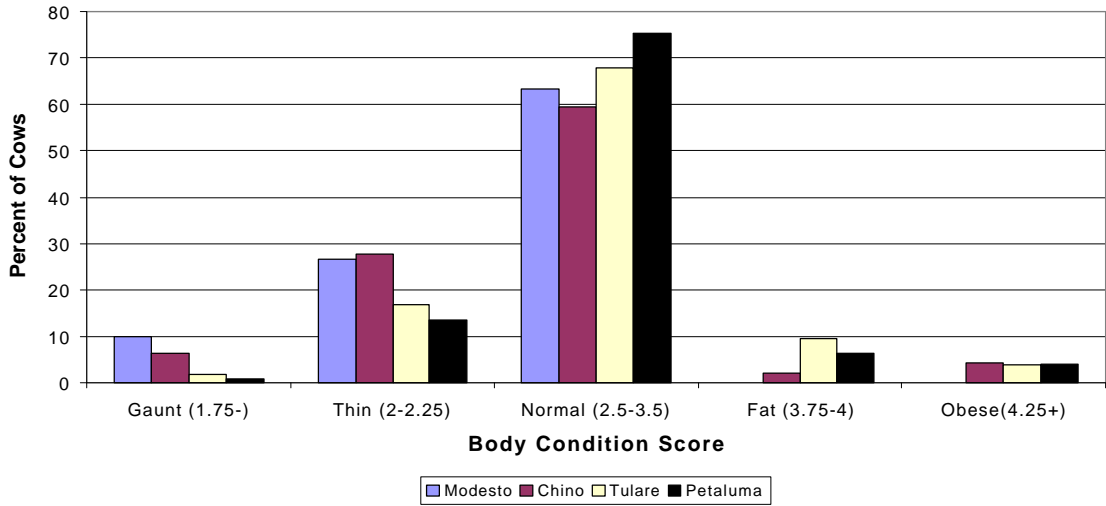
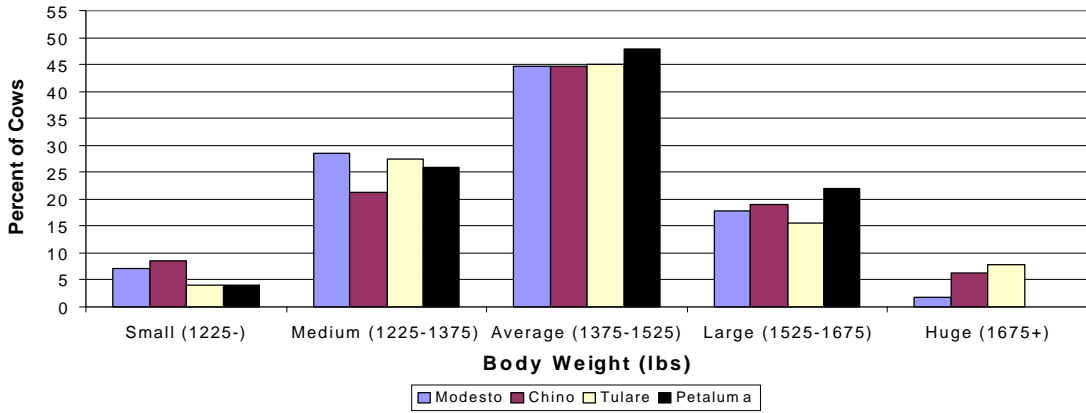
Over a single 24 hour period, between mid-August and early September 1998 and immediately after a DHIA test on each dairy, a high string on each dairy was evaluated. Animal behavior (% of cows eating, lying down and ruminating each hour), rumen fermentation (pH, ammonia N on 6 different cows at 6 h intervals; high string only), and parameters of body status (body weight (BW) by girth tape, body condition score (BCS) by visual assessment and body locomotion score (BLS) by visual assessment) were all determined. Dry matter (DM) intake as well as composition of the DM were also determined. In addition, milk production and composition was determined from DHIA records. Daily temperatures and humidities were also recorded hourly on all dairies for each target string of cows.

The data collected was used to better understand the way that the cows responded to hot temperatures in terms of both behavior and performance. The data was also used as input to a whole cow computer model to identify nutritional opportunities within the ration as well as evaluate the accuracy of the model itself (see part 2 in July 1999).

The cows in Tulare were fed at about 7:00, 12:00, 16:00 and 19:30 h, those in Petaluma were fed at about 7:00 and 16:30 h, those in Modesto were fed at about 6:45 and 15:00 h, and those in Chino were fed at about 5:30 and 15:45 h. The Petaluma cows were also fed some grain in the parlor. The cows in Tulare were milked at about 8:00, 16:00 and 23:30 h, those in Petaluma were milked at about 2:00 and 13:30 h, those in Modesto were milked at about 3:00 and 15:00 h, and those in Chino were milked at 1:00 and 12:30 h.

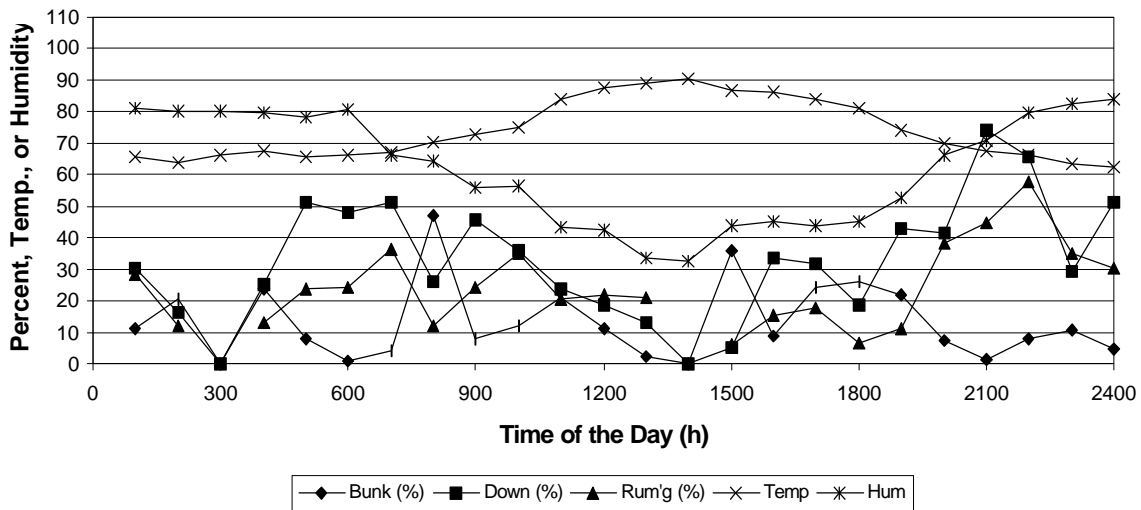
Observations

Body Parameters: The 1450 pound cow commonly assumed by nutritional professionals was alive and well in the high strings of all of the dairies examined. However over 50% of the cows on all of the dairies fell outside of the 1450 \pm 75 lbs (Figure below). Between 60 and 75% of all cows fell within 3 \pm 0.5 BCS units, although there were up to 10% of cows below 1.75 and 5% of cows above 4.25 BCS units (Figure). Such extreme BCS values are generally accepted to be undesirable in high strings. Body locomotion score (BLS) is a visual measure of the difficulty with which cows walk. Scored on a five point scale, BLS values of 1 or 2 describe cows not considered to be lame, 3 describes sub-clinically lame cows, and BLS values of 4 or 5 describe clinically lame cows. The high strings examined had between 65 and 85% of cows scored as either BLS 1 or 2 (see Figure). Incidences of BLS 4 and 5 were low.

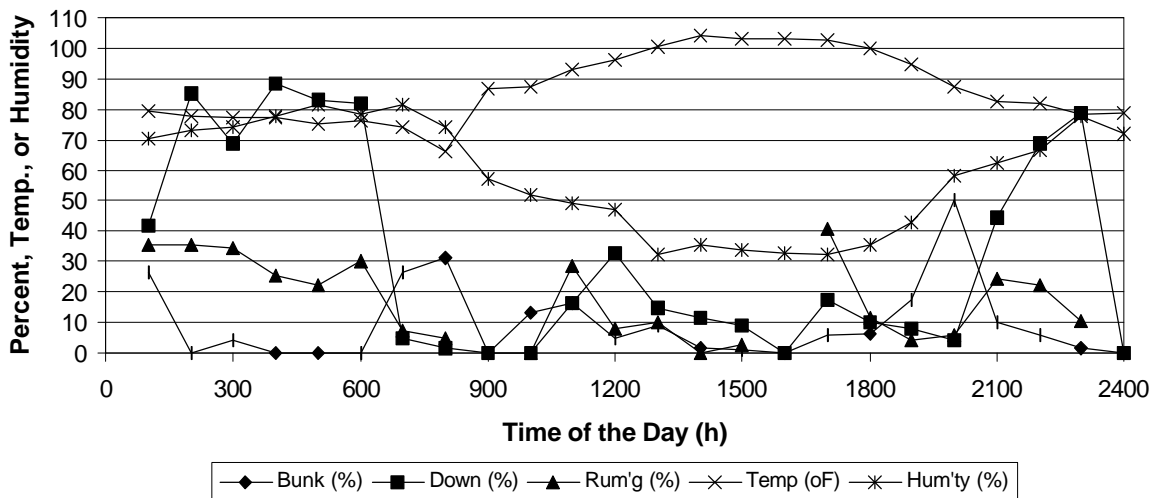


Behavior: The temperatures and humidities, as well as the behavior of the cows in the high strings, of the Tulare and Petaluma dairies are in the figures below. Similar patterns were recorded for the Modesto and Chino high strings. The maximum temperature in Tulare was higher than in Petaluma (104 vs. 90.5°F) as was the night minimum (74.0 vs. 62.4°F), although the minimum (about 33%) and maximum (about 83%) humidities were similar between dairies. Cow behavior patterns responded to temperature patterns throughout the day, as well as feeding and milking times. On average, cows only spent 9.6 (Tulare) or 13.4% (Petaluma) of their time eating, about 32.5% of their time lying down and 17.3 (Tulare) or 24.4% (Petaluma) of their time ruminating. A desirable behavior is assumed to be about $\frac{1}{3}$ eating and $\frac{1}{3}$ ruminating.

Petaluma Area Dairy Ranch

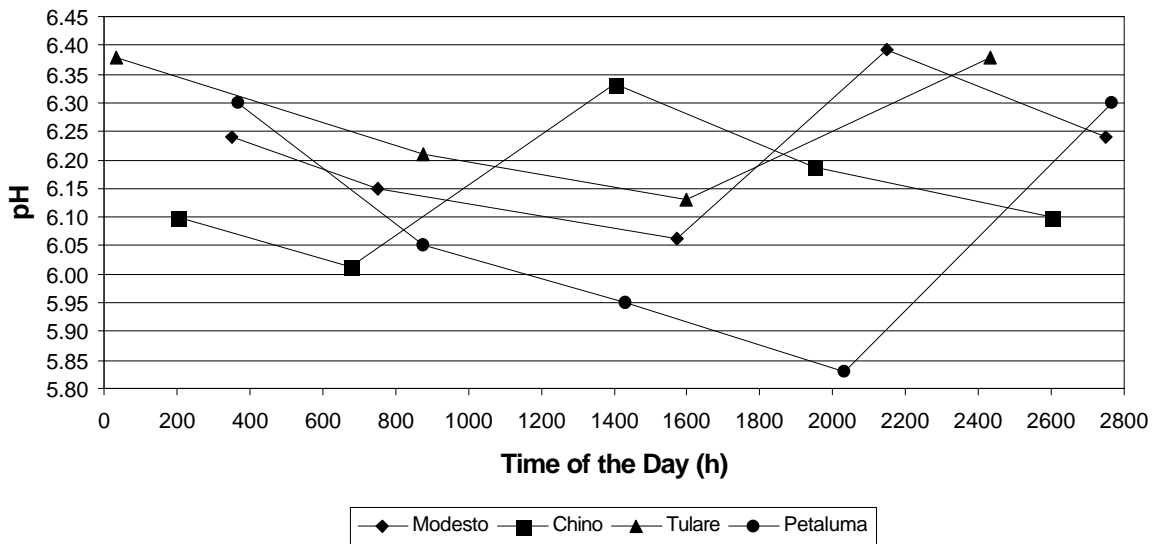


Tulare Area Dairy Ranch

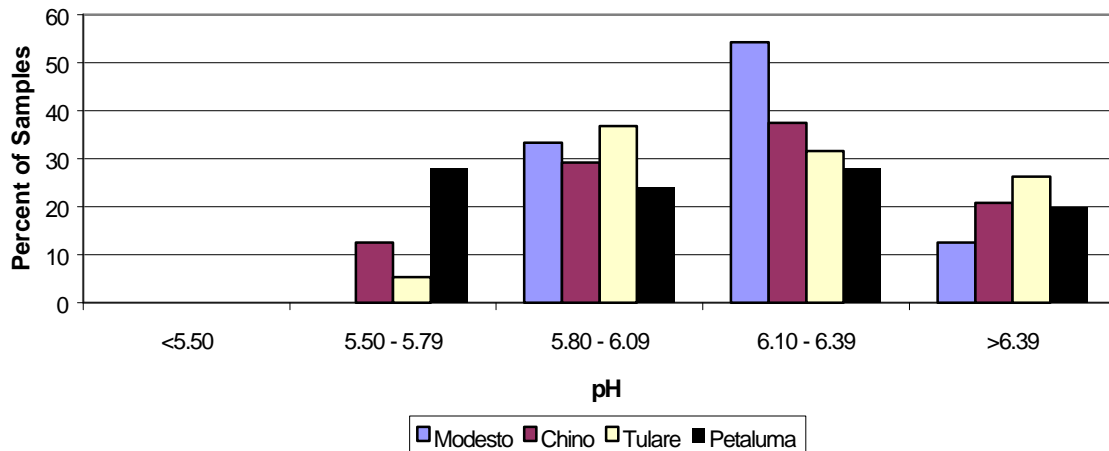


Rumen pH. The daily patterns in rumen pH as well as the pH ranges in the individual rumen samples are below. All dairies showed a single maximum and a single minimum pH value during the day. Such daily patterns in pH are commonly observed in lactating dairy cows. The optimum pH value for rumen function is generally accepted to be between about 5.8 and 6.8, with values between 5.5 and 5.8 potentially interfering with rumen function whereas values below 5.5 are considered to represent acidotic conditions sufficient to impair rumen function. Over all dairies, rumen pH values were moderate, with average values ranging between 6.03 (Petaluma) to 6.24 (Tulare). There were no recorded rumen pH values below 5.5 on any cow on any dairy at any time.

All Ranch Daily pH Patterns

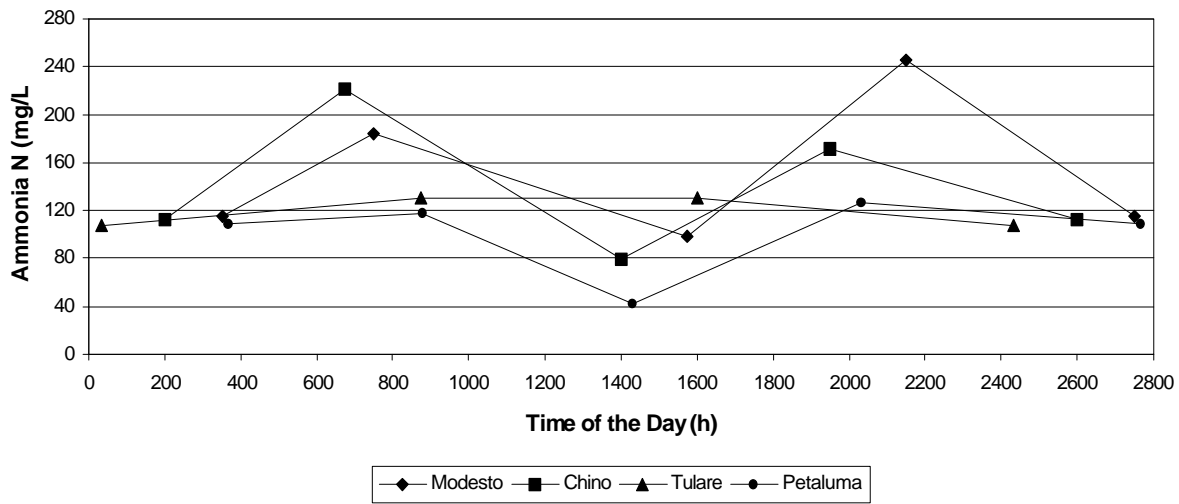


All Ranch pH Ranges

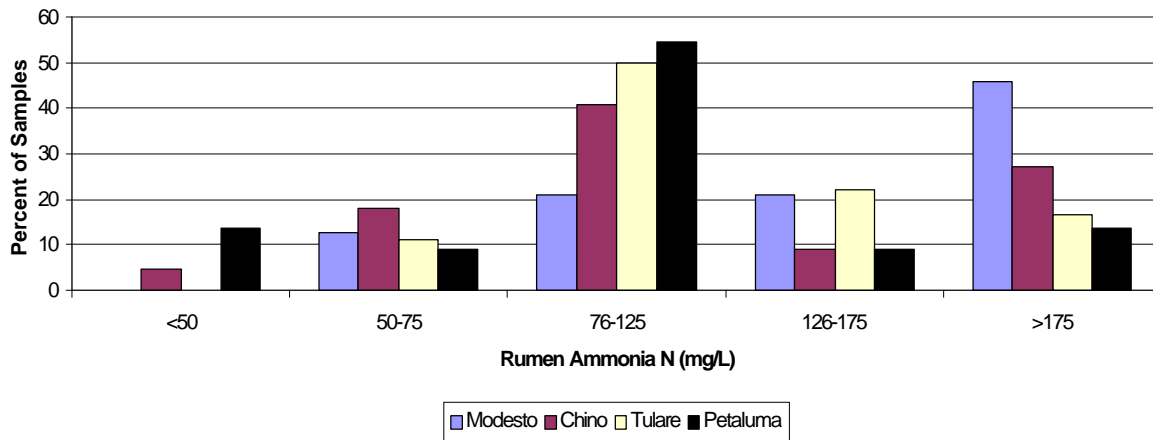


Rumen Ammonia N. The daily patterns in rumen ammonia N, as well as the ranges in the individual rumen samples are below. All dairies showed a single maximum and a single minimum ammonia N value during the day, with the exception of Tulare where values were stable throughout the day. Similar daily patterns in rumen ammonia N are commonly observed in lactating dairy cows. The optimum ammonia N value for rumen function is between about 75 and 175 mg/L, with values below 75 and above 175 potentially reducing rumen function. In addition, values above 175 mg/L indicate inefficient use of dietary N and excess N will be excreted in urine. Over all dairies, rumen ammonia N values were highly variable, with average values ranging between 99 (Petaluma) to 123 (Tulare) to 160 mg/L (Tulare). There were numerous individual rumen samples with ammonia N concentrations both below and, more commonly, above the ideal range.

All Ranch Daily Ammonia N Patterns



All Ranch Rumen Ammonia N Ranges



Summary

Body weights of cows in high strings were similar among dairies, in the 1450 lb range that is often assumed, although there was considerable variation around that mean on all dairies. Body condition scores varied widely among dairies, although the bulk of cows in all dairies fell in the desired range of 2.5 to 3.5. Body locomotion scores, a measure of walking difficulty, was generally low on all dairies, indicating little hoof and leg pain.

Behavior of cows in high strings of commercial dairies in hot weather conditions in Petaluma and Tulare were influenced by within day temperature and humidity patterns. In addition, the time that the cows spend eating and ruminating was lower than expected, and probably lower than desirable. Both dairies could probably have increased DM intake by increasing the comfort of the cows, perhaps, specifically during times of the day that rumination would be expected to occur.

There is no evidence from this study that acidosis was a problem on any of the four dairies examined to the extent that it would be expected to increase the incidence of laminitis or negatively impact performance. In contrast, rumen ammonia nitrogen levels were, in general, highly variable both among and within dairies. There were specific times of the day that level of ammonia N may have been so low, or so high, as to negatively effect rumen function. In addition, the high levels on some dairies would be expected to be associated with higher than necessary excretion of N in urine.

A complete report of this project is available by request from the author.

Acknowledgements

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