

HAY-FEEDING METHODS AND HAY TYPE ON LACTATING DAIRY COW PERFORMANCE

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INTRODUCTION

Many dairymen in Florida like to get some hay into their lactating cow diets primarily to maintain milk fat percentages. Methods of doing so vary from dairy to dairy. Some dairymen offer hay in large, round bales while others chop it and mix it in the ration. Some incorporate estimated daily intakes of hay from large, round bales into the ration while others ignore the nutrients provided in the hay when formulating the ration. The question as to the profitability of whether to feed a very high quality hay (e.g., alfalfa) or the best possible locally-grown hay (e.g., bermudagrass) is currently of great interest. With this in mind, the following objectives were set:

1. to evaluate currently used methods of hay feeding with their respective methods of ration balancing, and
2. to compare the feeding of limited amounts of alfalfa hay or cubes to bermudagrass for cows in early lactation.

EXPERIMENTAL METHODS

Forty Holstein cows in at least their second lactation, were assigned randomly at calving to one of five dietary treatments. The five diets were the following:

1. Long bermudagrass hay (BHL1) fed separately from a totally mixed ration (TMR). The TMR was formulated to be deficient in nutrients as provided by 7 pounds of hay (as-fed). Therefore the cow must consume approximately 7 pounds of hay daily to receive a balanced diet. This treatment represents that situation where dairymen allow cows the opportunity to balance their own rations by selecting to eat hay or TMR based on their preference.
2. Long bermudagrass hay fed separately from a TMR (BHL2). The TMR was balanced for all nutrients. Consumption of any hay resulted in a dietary dilution of crude protein and energy and a dietary concentration of fiber. This treatment represents that situation where dairymen maintain large, round bales of hay for cows housed on pastures already provided with ad libitum amounts of properly formulated TMR.

3. Chopped bermudagrass hay mixed into TMR at 14% of diet (BHC).
4. Chopped alfalfa hay mixed into TMR at 14% of diet (AHC).
5. Alfalfa cubes mixed into TMR at 14% of diet (AC).

For treatments 3, 4, and 5, the manager is dictating how much hay the cow will consume rather than allowing the cow to "decide."

The TMR was corn silage based and offered ad libitum. Bermudagrass hay was weighed into nylon nets having large openings between strands and only placed next to TMR of cows designated to receive long hay. This allowed actual measurement of individual cow intake of the hay. All cows received their treatments for the first 77 days of lactation. Dry matter intakes and milk yields were measured daily. Milk compositions and body weights were measured weekly. The milk yield during the first 60 days of each cow's previous lactation was used as a covariate adjustment for milk production and dry matter intake data of this experiment.

RESULTS

Table 1 contains the nutrient composition of the forages fed. The bermudagrass was very high quality having a crude protein (CP) content of 15.9% and a neutral detergent fiber (NDF) content of only 68.5%. While the mean CP content of the alfalfa hay was a respectable 19.1%, the net energy of lactation (NEL) was mediocre, only .58 Mcal/lb, due to its high fiber content. The alfalfa cubes were of excellent quality, averaging 19.9% CP and .66 Mcal NEL/lb. The ingredient composition of the five diets are in Table 2.

Certain feedstuffs were kept as constant as possible. Dried distillers grains and soybean meal were fed at a 2:1 ratio in all dietary treatments. Whole

TABLE 1. Chemical composition of bermudagrass hay, alfalfa hay, and alfalfa cubes fed to lactating dairy cows.

| <u>Chemical</u> | <u>Bermudagrass</u> | <u>Alfalfa Hay</u> | <u>Alfalfa Cubes</u> |
|-------------------------------------|----------------------------|--------------------|----------------------|
| | ----- (% dry matter) ----- | | |
| Crude protein | 15.9 | 19.1 | 19.9 |
| Neutral detergent fiber | 68.5 | 51.7 | 41.7 |
| Acid detergent fiber | 31.4 | 39.4 | 29.9 |
| Calcium | .42 | 1.07 | 1.63 |
| Phosphorus | .31 | .31 | .24 |
| Net energy of lactation, Mcal/lb | .54 | .58 | .66 |

TABLE 2. Ingredient composition of experimental diets as formulated.

| Ingredient | Diet | | | | |
|-------------------------|----------------------------|--------|--------|--------|--------|
| | BHL1 | BHL2 | BHC | AHC | AC |
| | ----- (% dry matter) ----- | | | | |
| Bermudagrass hay | 14.69 | - | 14.69 | - | - |
| Alfalfa hay | - | - | - | 14.69 | - |
| Alfalfa cubes | - | - | - | - | 14.69 |
| Corn silage | 27.81 | 45.00 | 27.81 | 31.62 | 36.53 |
| Ground corn | 17.42 | 10.00 | 17.42 | 15.80 | 11.54 |
| Dried distillers grains | 14.51 | 17.51 | 14.51 | 13.34 | 13.10 |
| Soybean meal | 7.28 | 8.71 | 7.28 | 6.70 | 6.53 |
| Whole cottonseed | 14.69 | 14.69 | 14.69 | 14.69 | 14.69 |
| Calcium carbonate | 1.30 | .76 | 1.30 | .97 | .65 |
| Dicalcium phosphate | .48 | 1.26 | .48 | .51 | .61 |
| Sodium bicarbonate | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Trace mineral salt | .46 | .46 | .46 | .46 | .46 |
| Magnesium oxide | .10 | .10 | .10 | .10 | .05 |
| Potassium chloride | .25 | .50 | .25 | .11 | .14 |
| Vitamins A and D | .01 | .01 | .01 | .01 | .01 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

cottonseed was included at a constant concentration resulting in a daily intake of 6 pounds per head. Corn and corn silage were adjusted to balance the diets to equal energy basis. Diets were formulated to .776 Mcal/lb, 18% CP, 22.9 to 25.7% acid detergent fiber (ADF), .80% calcium, .50% phosphorus, .32% magnesium, and 1.38% potassium.

Because cows on treatments BHL1 and BHL2 had the opportunity to selectively consume amounts of TMR and long hay at their discretion, the ingredient composition of the diet consumed differed from that which was formulated. Table 3 shows the ingredient composition of the diets as the cows consumed them. Treatments BHC, AH, and AC remained unchanged as the cows were only offered ingredients as TMR's. Cows which needed to consume hay in order to have a properly balanced diet (BHL1), ate about 60% of that needed. Cows which received a well balanced diet (BHL2) and needed no hay, ate nearly 9% of their diet as hay. Cows receiving diet AC also were selective in that alfalfa cubes rolled away from the other feed ingredients upon feeding. Cows tended to prefer the TMR to the cubes. As a result, cubes made up only 11% of the diet rather than the planned 14.7%.

TABLE 3. Ingredient composition of experimental diets as influenced by cow's selection.

| <u>Ingredient</u> | <u>Diet</u> | | | | |
|-------------------------|--------------------------|-------------|------------|------------|-----------|
| | <u>BHL1</u> | <u>BHL2</u> | <u>BHC</u> | <u>AHC</u> | <u>AC</u> |
| | -----(% dry matter)----- | | | | |
| Bermudagrass hay | 8.39 | 8.64 | 14.69 | - | - |
| Alfalfa hay | - | - | - | 14.69 | - |
| Alfalfa cubes | - | - | - | - | 11.06 |
| Corn silage | 29.86 | 41.11 | 27.81 | 31.62 | 38.06 |
| Ground corn | 18.71 | 9.14 | 17.42 | 15.80 | 12.04 |
| Dried distillers grains | 15.59 | 16.00 | 14.51 | 13.34 | 13.66 |
| Soybean meal | 7.8 | 7.96 | 7.28 | 6.70 | 6.82 |
| Whole cottonseed | 15.78 | 13.42 | 14.69 | 14.69 | 15.32 |
| Calcium carbonate | 1.39 | .6 | 1.30 | .97 | .68 |
| Dicalcium phosphate | .51 | 1.15 | .48 | .51 | .63 |
| Sodium bicarbonate | 1.07 | .91 | 1.00 | 1.00 | 1.04 |
| Trace mineral salt | .49 | .42 | .46 | .46 | .48 |
| Magnesium oxide | .11 | .09 | .10 | .10 | .05 |
| Potassium chloride | .27 | .46 | .25 | .11 | .15 |
| Vitamins A and D | .01 | .01 | .01 | .01 | .01 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Intakes of TMR's, long hay, and alfalfa cubes by cows on each of the five treatments are shown in Table 4. Intakes ranged from 40.5 to 46.5 lb/day with no statistical difference among treatments. Dry matter intakes expressed as a percent of body weights ranged from 3.25 to 3.69%. Although no differences were observed, cows tended to consume the alfalfa hay diet to a greater extent than the other diets.

When long hay was fed separately (BHL1 and BLH2), cows consumed about the same amount of hay, 3.5 to 3.9 lb of DM/day, regardless of the make-up of their diet. This indicates that cows will consume some hay if it is made available to them regardless of nutrient needs. In other words, they have little nutritional savvy. Cows on diet BHL1 needed to consume 6.3 lb/day but only consumed 3.9 lb/day. Thus they consumed a diet much higher in energy than needed. By consuming 3.5 lb of hay/day, cows on diet BHL2 were substituting a lower quality feed (bermudagrass hay) for higher quality feedstuffs (TMR).

Ration balancing is very difficult when cows are given hay ad libitum in addition to a TMR ad libitum because wide variation from cow to cow in hay intake occurs. Average hay intake by each cow on diets BHL1 and BHL2 is shown in Tables 5a,b. The variability in voluntary hay intake among cows

TABLE 4. Dry matter intakes of dietary treatments by lactating dairy cows.

| <u>Treatment</u> | <u>TMR</u> (lb/d) | <u>Hay or</u> <u>Cubes</u> (lb/d) | <u>Total</u> <u>DMI</u> (lb/d) | <u>Total</u> <u>DMI</u> (% BW) |
|-------------------------------|----------------------|---|--------------------------------------|--------------------------------------|
| Long Berm.--Unbalanced (BHL1) | 42.6 | 3.9 | 46.5 | 3.45 |
| Long Berm.--Balanced (BHL2) | 37.0 | 3.5 | 40.5 | 3.30 |
| Chopped Bermudagrass (BHC) | 41.2 | — | 41.2 | 3.25 |
| Chopped Alfalfa Hay (AHC) | 42.9 | — | 42.9 | 3.69 |
| Alfalfa Cubes (AC) | 36.2 | 4.5 | 40.7 | 3.30 |

needing more fiber in their diet was less than that of cows already receiving a fiber-adequate diet (coefficient of variability of 13 vs. 34%). Therefore, this difficulty of ration balancing is reduced when fiber in the field is needed to help balance the diet. Providing large, round bales of hay to cows already receiving a balanced diet is questionable.

Figure 1 shows changes in the voluntary intake of bermudagrass hay and alfalfa cubes over the 11 weeks of lactation. During week 1, cows needing fiber were eating about 2.5 times more hay than those not needing fiber. After week 1, intake of hay was similar between treatments BHL1 and BHL2. Cows appeared to adjust to the alfalfa cubes in their diets in that cube consumption increased from 2.7 pounds at week 1 to 4.9 pounds by week 6. But cube intake never increased to the desired amount of 6.3 lb/day.

Average yield of milk during the first 11 weeks of lactation ranged from 56.2 to 65.0 lbs/day (Table 6). Yields were not different from one another ($P > .05$). Cows appeared to be depressed in milk fat as milk fat percentages ranged from 3.00 to 3.20. Cows receiving the least fiber (BHL1) had the lowest milk fat percent while those consuming the most NDF (BHC) had the highest milk fat percent. Yield of 4% fat-corrected milk (FCM) was not different among treatments. Cows receiving alfalfa in their diets tended to produce more FCM. Efficiency of production (lb of FCM/ lb of DM intake) tended to be better when all feedstuffs were fed as TMR's rather than when hay was fed separately.

Apparent profitability of each dietary treatment is shown in Table 7. Because DM intakes and milk yields were not different among treatments, profitability differences are not given with a high degree of confidence. Milk was priced at \$14/cwt with \$.17 per .1% change from 3.5% milk fat differential. Feed prices (\$/ton, as-is) were corn at 118, distillers dried grains at 160, soybean meal at 280, whole cottonseed at 170, bermudagrass hay at 90, alfalfa hay at 165, and alfalfa cubes at 160. Corn silage was priced at \$35/wet ton. Diets fed as TMR's showed the highest income over feed costs with alfalfa diets appearing the most profitable.

SUMMARY

- Cows voluntarily ate the same amount of long bermudagrass hay regardless of fiber status of their diet. Cows will eat long hay if offered to them so no long hay should be provided to cows if those cows are fed a well balanced diet ad libitum.
- Formulating the correct amount of forage into the TMR rather than allowing voluntary consumption of forage tended to improve 1) efficiency of production and 2) income over feed costs.
- Diets containing alfalfa hay or cubes appeared to be more profitable than diets containing bermudagrass hay. Feed costs were lower for diet containing chopped bermudagrass hay but milk income also was lower.

TABLE 5a. Voluntary intake of bermudagrass hay by cows consuming a fiber-deficient diet (BHL1).

| <u>Cow</u> | <u>Hay Intake</u> (lb/d) |
|----------------------------|-----------------------------|
| 11 | 3.9 |
| 1038 | 4.1 |
| 1112 | 3.1 |
| 1154 | 3.7 |
| 1165 | 3.5 |
| 1198 | 4.0 |
| 1340 | 3.9 |
| 9648 | <u>4.6</u> |
| Mean | 3.9±.5 |
| Coefficient of variability | .5/3.9=13% |

TABLE 5b. Voluntary intake of bermudagrass hay by cows consuming a fiber-adequate diet (BHL2).

| <u>Cow</u> | <u>Hay Intake</u> (lb/d) |
|----------------------------|-----------------------------|
| 1145 | 3.1 |
| 1323 | 1.7 |
| 1367 | 2.8 |
| 3593 | 5.0 |
| 3620 | 4.1 |
| 9073 | <u>4.0</u> |
| Mean | 3.5±1.2 |
| Coefficient of variability | 1.2/3.5=34% |

TABLE 6. Lactation performance of dairy cows fed bermudagrass or alfalfa in different management systems.

| <u>Treatment</u> | <u>Milk Yield</u> (lb/day) | <u>Fat</u> (%) | <u>4% FCM</u> (lb/day) | <u>Efficiency</u> (FCM/DMI) |
|-------------------------------|-------------------------------|-------------------|---------------------------|--------------------------------|
| Long Berm.--Unbalanced (BHL1) | 64.2 | 3.00 | 52.1 | 1.18 |
| Long Berm.--Balanced (BHL2) | 56.2 | 3.15 | 47.2 | 1.14 |
| Chopped Bermudagrass (BHC) | 59.8 | 3.20 | 50.4 | 1.28 |
| Chopped Alfalfa Hay (AHC) | 64.7 | 3.14 | 522.7 | 1.30 |
| Alfalfa Cubes (AC) | 65.0 | 3.15 | 53.7 | 1.41 |

TABLE 7. Apparent profitability of dietary treatments.

| <u>Treatment</u> | <u>Milk</u> <u>Income</u> (\$/cow/d) | <u>Feed</u> <u>Costs</u> (\$/cow/d) | <u>IOFC</u> ¹ (\$/cow/d) |
|-------------------------------|--|---|--|
| Long Berm.--Unbalanced (BHL1) | 8.44 | 3.62 | 4.82 |
| Long Berm.--Balanced (BHL2) | 7.53 | 3.11 | 4.42 |
| Chopped Bermudagrass (BHC) | 8.07 | 3.11 | 4.96 |
| Chopped Alfalfa Hay (AHC) | 8.66 | 3.48 | 5.18 |
| Alfalfa Cubes (AC) | 8.71 | 3.24 | 5.47 |

¹Income over feed costs.

VOLUNTARY INTAKE OF HAY OR CUBES BY COW FED ADEQUATE OR INADEQUATE FIBER DIETS

