

## Different Forage Sources in TMR After Weaning

Al Kertz, PhD, DIPL ACAN

ANDHIL LLC

St. Louis, MO 63122

[andhil@swbell.net](mailto:andhil@swbell.net)

[www.andhil.com](http://www.andhil.com)

A previous Penn State study (Mitchell et al., 2020) was reviewed (Kertz 2021) to evaluate at what age it may be best to introduce a TMR (total mixed ration) to post weaned calves. This next Penn State study (Mitchel and Heinrichs 2020a) was a reasonable next step to evaluate different sources of forage for post weaned calves. Forty-five postweaned Holstein calves (36 female and 9 male) beginning at 7 through 16 weeks were used in the growth phase. Another 12 male calves were used in a separate digestibility trial with these same dietary treatments. They had been previously weaned after 6 weeks.

The diets consisted of a texturized grower and either 20% alfalfa haylage, 24.5% corn silage, or 11.3% coarse chopped grass hay with the balance coming from the starter. The TMR (total mixed ration) was formulated to contain equal amounts of forage NDF ( $8 \pm 0.5\%$ ) on a DM basis. Alfalfa haylage analyzed (DM basis) 39.6% DM, 23.5% CP, 35.2% ADF, 42.8% NDF, 0.4% starch, and 10.5% ash; corn silage averaged 42.3% DM, 7.8% CP, 17.5% ADF, 32.2% NDF, 39.8% starch, and 3.5% ash; and grass hay analyzed 89.5% DM, 10.0% CP, 40.3% ADF, 67.3% NDF, 1.5% starch, and 5.7% ash. There was also a yeast source added to each of these 3 TMRs in a 2 x 3 study design, but yeast essentially had no effects so I will ignore that treatment category.

All calves had been previously weaned at the end of 6 weeks of age, a texturized starter continued to be fed ad libitum along with the assigned forage fed separately for weeks 7 to 9 before going on TMR treatments from 9 to 16 weeks of age. The grower intake was limited to 5.5 lb daily, but with forage available ad libitum. All calves had been housed in separate calf hutches until 9 weeks of age when they were moved into a mechanically ventilated barn from 9 to 16 weeks of age and bedded with shavings as needed. For digestion trials, calves were moved into another barn for total fecal collection at 11 and 15 weeks of age for 4 days and rumen sampling over the last 24 hours of each sample period. Empty body weight gain (EWBG) was estimated using the classic study of Jahn and Chandler (1976).

Daily gain (**Table**) was significantly lowest for the grass hay treatment, but it was still okay for the desirable range of 1.8 to 2.0 lb for Holstein dairy heifers. The same pattern was also evident for empty body weight gain (EBWG) projection (Jahn and Chandler 1976). Hip width increase did not vary by treatment. Dry matter intake (DMI) decreased significantly for the grass hay treatment and that was mainly due to decreased grass hay intake. Since the grower was fed in a TMR for all treatments, this difference is a bit puzzling. Authors suggested that this may have been due to NDF characteristics of the grass hay passing more slowly through the rumen. The grass hay TMR did have the greatest NDF and ADF digestibilities among treatments, and its starch digestibility was greater than the alfalfa hay TMR.

Rumen pH did not differ among treatments, but it also was quite variable. Total VFAs were greatest among TMRs, acetate was lowest for the corn silage TMR, propionic was lowest for alfalfa hay TMR, and butyrate and the acetate:propionate ratio were greatest for alfalfa and lowest for corn silage TMRs.

**Table.**

<b>Treatments</b>	<b>Alfalfa haylage</b>	<b>Corn silage</b>	<b>Grass hay</b>	<b>SEM</b>
<b>Initial weight, lb</b>	144.0	143.9	141.7	6.67
<b>ADG, lb</b>	2.10	2.21	1.95	0.09
<b>EBWG, lb</b>	1.83	1.98	1.70	0.09
<b>Initial hip width, inch</b>	7.91	7.93	7.39	0.13
<b>Hip growth, inch</b>	2.38	2.42	2.39	0.16
<b>DMI, lb/day</b>	6.45	6.39	5.90	0.26
<b>Forage</b>	1.92	1.71	1.17	0.15
<b>Grower</b>	4.58	4.65	4.72	0.13
<b>Feed efficiency</b>	0.35	0.37	0.36	0.02
<b>Digestibility %</b>				
<b>Dry matter</b>	69.9	74.1	73.0	2.59
<b>NDF</b>	55.2	46.6	59.9	6.22
<b>ADF</b>	55.4	41.1	57.2	4.25
<b>Starch</b>	88.2	94.2	93.3	2.90
<b>Rumen Samples</b>				
<b>pH</b>	6.19	6.25	6.32	0.16
<b>Total VFA, mM</b>	113.1	92.1	92.7	5.70
<b>Acetate, %</b>	57.5	49.7	56.5	3.52
<b>Propionate, %</b>	23.7	25.0	26.8	4.15
<b>Butyrate, %</b>	12.8	8.5	10.4	1.09
<b>Acetate:propionate</b>	2.72	1.48	2.49	0.52

In a subsequent study (Mitchell and Heinrichs 2020b), similar size and age Holstein calves as in Mitchell et al., (2020) were fed TMRs with increasing grass hay at 10, 17.5, or 25%. Dry matter intake decreased linearly while daily gains were 2.27, 2.03, and 1.76 lb. NDF and ADF % digestibilities tended to be greater with 25% grass hay TMR, most especially compared to 10% grass hay TMR. The lowest daily gain of 1.76 lb with 25% grass hay indicates this level of grass hay may be too high for calves under 16 weeks of age. This would especially be true when grass hay would be lower in quality than the (DM basis) 16% CP, 66% NDF, and 34.7% ADF in this study. Unfortunately, grass hay is often poorer in quality than that.

I generally recommend avoiding extremes in forages fed to dairy heifers. Those extremes are only corn silage as the forage because it is high in energy and low in CP which can lead to more easily fattening, and only grass hay because it often is low in CP and energy and quite variable. Blends of forages such as alfalfa haylage/corn silage, grass hay/corn silage, or alfalfa/grass hay are best. These blends balance each other more nutritionally and allow better balancing for nutrients and DMI. At one time, heifers were the forgotten animals on a dairy farm, and often literally assigned to the “back 40 acres”. That variable and often poor pasture resulted in poorly grown heifers. Then the other extreme occurred when corn silage became prevalent. It was often fed free choice to heifers, which led to low protein and too much energy. The result was fat heifers which experienced the “fat-cow syndrome” and associated calving and metabolic problems. As dairy farms grew better forages for their milking cows, those forages were also often fed free choice in TMRs to heifers. That often-exceeded heifers’ energy needs. So poor quality roughages such as straw or poor-quality grass hay was blended into TMRs to still

allow them to be fed free choice. Heifer feeding programs need to be as fine-tuned as milking cow rations, or heifers may be impaired for life.

### **The Bottom Line**

Among alfalfa haylage, corn silage, and grass hay forages evaluated in TMRs balanced for equal forage NDF contribution for Holstein heifers from 9 to 16 weeks of age, all were suitable. In fact, the grass hay TMR resulted in a daily gain within the desirable range of 1.8 to 2.0 lb while the other 2 TMRS resulted in 2.1 to 2.2 lb daily gains. Heifer TMRs need to be as balanced with forage/roughage sources and for nutrient content as they are for milking cows.

### **References**

Jahn, E. and J. T. Chandler. 1976. Performance and nutrient requirements of calves fed varying percentages of protein and fiber. *J. Anim. Sci.* 42: 724-735.

Mitchell, L. K. and A. J. Heinrichs. 2020a. Effects of feeding various forages and live yeast culture on weaned dairy calf intake, growth, nutrient digestibility, and rumen fermentation. *J. Dairy Sci.* 103:8880-8897.

Mitchell, L. K. and A. J. Heinrichs. 2020b. Increasing grass hay inclusion level on weaned dairy calf growth, intake, digestibility, and ruminal fermentation. *J. Dairy Sci.* 103:9012-9023.

Mitchell, L. K., C. M. Jones, and A. J. Heinrichs. 2020. Effect of converting weaned dairy calves from a component-fed diet to a total mixed ration on growth and nutrient digestibility. *J. Dairy Sci.* 103:6190-6199.