# Increasing the feeding value of rice straw


**PROJECT LEADER:**

Josh Davy

1754 Walnut Street
Red Bluff, CA 96080
(530) 527-3101

jsdavy@ucanr.edu

**PRINCIPAL UC INVESTIGATORS**

Peter Robinson - UCD Dept. of Animal Science Extension Nutritionist

Morgan Doran - UCCE Livestock Advisor, Yolo, Solano and Napa

Roger Ingram - UCCE Livestock Advisor, Placer and Nevada

Betsy Karle –UCCE Dairy Advisor, Glenn and Tehama


**BACKGROUND**

Feeding of dry rice straw to cattle has a widespread view of being a marginal forage source. Much of the decline in straw quality has been found to occur during the drying process post-harvest. UC research in 2013/14 found that feeding wet straw baled directly behind the rice harvester at >50% moisture fed very well and was subsequently referred to as “strawledge”. Unfortunately strawledge proved difficult to handle 30 days post baling as the stacks quickly began to slump and became difficult to handle. In addition, harvest timing can be difficult. For example, small amounts of rain make it nearly impossible for a baler and harrow bed to enter the field directly behind the rice harvester. This is particularly concerning as the wet product must be wrapped or covered quickly to prevent mold formation.

In the 2015/16 season the Rice Research Board allowed the research team the opportunity to evaluate efforts to increase the quality and palatability of straw baled at a lower moisture content of 15-25%, which would be much easier to handle, but would be expected to have lost some nutritional quality during drydown. Our original intent had been to harvest the straw at a higher moisture percentage, however, this was not fully possible and turned out to create a good research opportunity.

**METHODS**

The straw was allowed to dry on the field for one day after harvest making it possible to be flail chopped. All treatments were flail chopped on day 2 and baled the following morning with dew moisture. The chopped straw was raked into rows for baling and the two spray treatments were applied directly ahead of the baler. The photo below depicts the molasses/VS-3 combination treatment being applied ahead of the baler.

The four treatments were:

1. Control
2. Positive control: Ammoniation (2% of DM)
3. VS-3 inoculation at the time of baling – 1 g/ton of straw
4. Molasses (50:50 blend) and VS-3

Immediately after baling the straw was hauled out the field with a harrow bed and stacked adjacent to the field to create the four treatment stacks. Each stack was wrapped air tight. The following morning the ammonia treatment was applied at a rate of 2% based on the weight of the straw in the stack. The treatments were allowed to cure for 30 d to facilitate absorption of ammonia throughout the stack. After 30 d, all four treatments were hauled to the Sierra Foothill Research and Extension Center in Brown's Valley.

We used the small feedlot at the research station to implement the four feeding treatments. Each treatment pen had 10 cattle and was repeated for a total of 80 head of yearling steers. A grain ration to accommodate straw quality was balanced to assume a 1 lb/d gain if straw consumption was at expected levels. The ration included:

Flaked or rolled corn = 84% - 5.6 lbs/hd/d
Cottonseed = 15% - 1 lbs/hd/d
Calcium carbonate = 0.7% - 0.05 lbs/hd/d
Total grain ration of 6.65 lbs/hd/d

Consumption and waste of rice straw was tracked and the cattle were run through the chute every 30 d to record body weight BW), body condition score (BCS), hip height (HH) and withers width (WW). The original plan to feed for 60 d was extended to 90 d due to positive results.

**RESULTS**

Cattle feeding results are in the table and figure below. The BCS of cattle was not affected by any treatment, but nominally by days on feed although overall BCS was constant. Likewise, HH was unaffected by treatment, which means cattle gained height at about the same rate regardless of diet. Hip width, measured as cm/30 d was affected by treatment. Though all treatments began at equal HW, the ammoniated treatment had a 0.30 to 0.40 cm/30 d over the all other treatments. These measures translated to ammoniated treatment increases in cattle 2D frame over all other treatments as well.

When evaluated on the most universal economic metric the ammoniated treatment resulted in substantial increases in cattle average daily BW gain. Cattle in the ammoniated treatment gained around ½ lb more per day than the treatments, most of which occurred in the final 30 d. This is a significant difference in BW gain for this treatment over the control.

Though not significantly different, the bacteria treatment tended to have higher values for HW, 2D frame, and average daily BW gain. This treatment had previously resulted in significantly higher BW gain over other treatments when evaluating high moisture strawledge in the 2013/14 study. It is likely that this treatment did not repeat the highly significant improvement in performance over the Control in this experiment due to the straw being much lower in moisture content (i.e., 50% vs 20%, respectively).

**TREATMENT ECONOMICS**

We valued the cost of the control straw product at $38.50/ton to purchase baled. Though the bacterial treatment only added $0.89/ton and the molasses $0.36/ton, we do not recommend these treatments for dry straw based on the results. In contrast, the ammonia treatment added $17.25/ton to the cost of the straw, but resulted in substantially better cattle performance. As ammoniation brings the total product cost to $55.75, during moderate to high hay price years this would be a very good option as a range supplement for cattle. Even with depressed beef cattle prices over the past few years, this additional cost would be recouped and lead to increased options for cattle feeders.

**ACKNOWLEDGEMENTS**

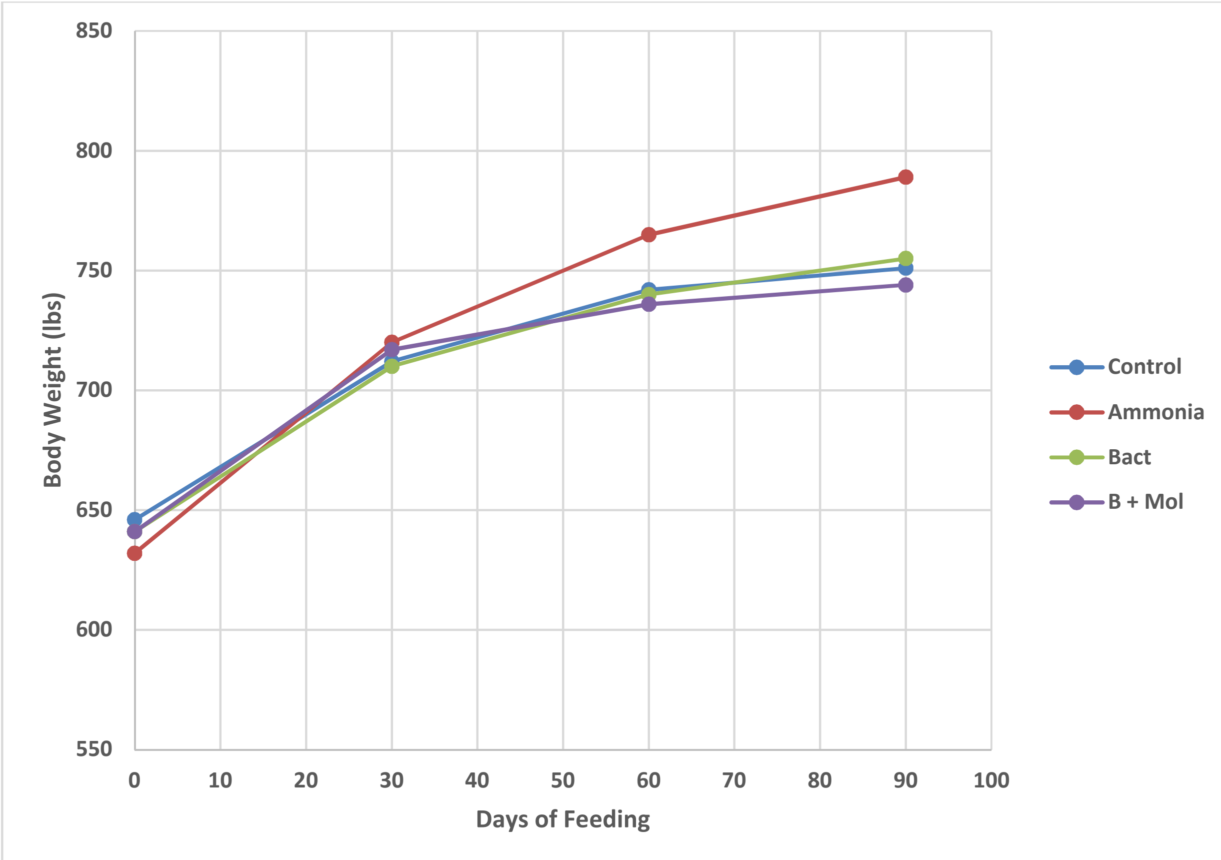
The research team graciously thanks the rice research board for supporting this ongoing research. We would also like to thank our cooperators the LaGrande and Parker families. Without their efforts in supporting this research it would not be possible!

**Effects of Rice Straw on Growth Aspects of the Cattle.**

| | Treatment | | | | Days of Feeding | | | | P | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Control | Ammonia | Bact | B + Mol | 30 | 60 | 90 | SEM | Trt | Days | T*D |
| Body weight | | | | | | | | | | | |
| start (lbs) | 646 | 632 | 641 | 642 | - | - | - | 24.9 | 0.78 | - | - |
| during feeding (lbs) | 735 | 758 | 735 | 732 | 715 | 746 | 760 | 10.8 | 0.30 | <0.01 | <0.01[x] |
| change during feeding (lbs/d) | 1.09[b] | 1.66[a] | 1.20[b] | 1.05[b] | 2.26[a] | 1.00[b] | 0.50[c] | 0.076 | <0.01 | <0.01 | 0.43 |
| Body Condition Score | | | | | | | | | | | |
| start (units) | 4.96 | 4.97 | 5.02 | 4.98 | - | - | - | 0.051 | 0.17 | - | - |
| during feeding (units) | 5.00 | 5.02 | 5.03 | 4.99 | 5.05[a] | 4.98[b] | 4.99[b] | 0.012 | 0.18 | <0.01 | 0.98 |
| change during feeding (units/30 d) | 0.01 | 0.01 | -0.01 | 0.00 | 0.07[a] | -0.07 c | 0.01[b] | 0.007 | 0.32 | <0.01 | 0.98 |
| Hip Width | | | | | | | | | | | |
| start (cm) | 40.2 | 39.7 | 40.1 | 40.1 | - | - | - | 0.88 | 0.73 | - | - |
| during feeding (cm) | 41.5 | 41.9 | 41.9 | 41.5 | 40.5[c] | 41.6[b] | 43.0[a] | 0.30 | 0.60 | <0.01 | 0.12 |
| change during feeding (cm/30 d) | 0.90[b] | 1.30[a] | 1.00 | 0.90[b] | 0.4[b] | 1.1[a] | 1.5[a] | 0.08 | <0.01 | <0.01 | 0.10 |
| Tailhead Height | | | | | | | | | | | |
| start (cm) | 120.2 | 119.4 | 119.9 | 119.8 | - | - | - | 1.65 | 0.86 | - | - |
| during feeding (cm) | 123.6 | 123.6 | 123.9 | 123.5 | 122.2[c] | 123.6[b] | 125.1[a] | 0.57 | 0.98 | <0.01 | 0.33 |
| change during feeding (cm/30 d) | 1.6 | 1.9 | 1.7 | 1.7 | 2.1[a] | 1.5[b] | 1.6 | 0.15 | 0.52 | 0.05 | 0.20 |
| 2D Frame | | | | | | | | | | | |
| start ($cm^2$) | 4839 | 4739 | 4801 | 4795 | - | - | - | 139.7 | 0.65 | - | - |
| during feeding ($cm^2$) | 5128 | 5183 | 5186 | 5127 | 4941[c] | 5144[b] | 5381[a] | 51.1 | 0.74 | <0.01 | 0.31 |
| change during feeding ($cm^2$/30 d) | 177[b] | 234[a] | 200[b] | 179[b] | 150[b] | 205[a] | 237[a] | 13.2 | <0.01 | <0.01 | 0.23 |

[a,b,c] - values on the same line within 'Treatment' or 'Days of Feeding' differ (P<0.05).

[x] - The BW of the ammnia straw fed cattle was higher than all other groups at the end of the study only (P<0.05).




**Note: Ammonia differs from all others (P<0.05) at 90 days, but not at any other days (although it is close at 60 days)**