

**ANNUAL REPORT
COMPREHENSIVE RESEARCH ON RICE**
January 1, 2000 - December 31, 2000

PROJECT TITLE: Rice Straw Utilization by Cattle

PROJECT LEADER:

Glenn Nader - Butte/Sutter/Yuba Livestock Farm Advisor (530) 822-7515
142-A Garden Hwy. Yuba City, Ca. 95991 ganader@ucdavis.edu

PRINCIPAL INVESTIGATORS:

Glenn Nader - Butte/Sutter/Yuba Livestock Farm Advisor
Cass Mutters - Butte County Rice Farm Advisor
Dr. Peter Robinson - Department of Animal Science Extension Nutritionist

COOPERATORS:

Henry Smith, Smith Ranch, Browns Valley, Ca.
Doug Wheeler, Wheeler Ranch, Biggs, Ca.
John LaNevave, Mol Mix Liquid Supplements
California Air Resources Board

LEVEL OF 2000 FUNDING: \$10,000

OBJECTIVES:

To research the utilization of rice straw by beef cattle.

1. Commercial production of rice straw silage/haylage production.
2. In field grazing of rice straw.

EXPERIMENTS CONDUCTED:

Objective I - Rice Haylage

Four hundred and fifty tons of rice straw haylage were produced from September to October 27, 2000 using a New Holland 648 round baler and wrapped in plastic within 24 hours. The haylage was allowed to ensile for 30 days. The research study will start on January 9, 2001 and is designed to evaluate the intake, gain, and health performance of bred beef cows at the Smith Ranch 20 miles east of Marysville.

Assignment and Diets

Bred cows, approximately 48, will be selected based upon similarity of stage of pregnancy as well as body size and conformation. Twelve cows will be randomly assigned to one of four pens on the Smith Ranch on a Monday and fed a common rice silage for three days. Cows will not be fed on the fourth day (Thursday) and all cows will be individually weighed and body condition scored on the morning of the fifth day (Friday). Based upon their body weights and body condition scores, cows will be ranked and ten will be allocated to each of the four experimental pens. Eight cows will be eliminated from the study.

Experimental Design

The study is designed as an incomplete 4 x 4 Latin square with four periods of 20 days each. All cows in each pen will be fed the same rice straw according to the design in the Table.

Measurements

Feed Intake: Rice straw silage and 250 pound Garino Diamond-Lix 20% protein supplement (All natural) or supplement blocks will be weighed prior to placement in the pens or feeders and recorded to sheets prepared for each pen. All rice haylages will be sampled within two days of ensiling and after 30 days of ensiling, at the end of the second experimental period of the feeding study, and analyzed for their complete nutrient profile.

Cow Measures: Cows will be weighed individually and body condition scored after a 24 hour fast at the beginning of the study and at the end of each experimental period.

Cow Health: Whole blood and serum samples will be taken from a subset of five animals per treatment and submitted to the California Food Safety & Animal Health Laboratory for a trace mineral panel.

Data Analysis

The performance of the cows (i.e., weight gain, feed intake, feed efficiency, health) will be computed by pen and statistically analyzed as a 4 x 4 Latin square to determine if differences between treatments are real (i.e., statistically significant).

Table. Design of the Study.

Pen	Period			
	1	2	3	4
1	M202	Koshi	<i>Koshi</i>	401(TP)
2	<i>Koshi</i>	M202	401(TP)	Koshi
3	Koshi	401(TP)	M202	401(WP)
4	401(TP)	401(WP)	Koshi	<i>Koshi</i>

Note: Koshi in italics are fill periods for missing M202 and 401.

SUMMARY OF 2000 RESEARCH ON RICE STRAW HAYLAGE

Results of this study will be used to document intake, gain, and health performance of bred cows fed rice straw silage on a commercial beef ranch in California. In addition, the impact three varieties of rice straw and one harvesting technique, within one variety will be determined. This information will be shared with other ranchers through articles in trade magazines and a field day.

Economic Analysis of Rice Straw Haylage

Haylage is about 60% moisture and most straw bales are range from 12 to 16% moisture. The costs of production are based on the 900 bales that were produced for research. The cost of round baling production and wrapping averaged \$10 per bale roadside. Most field reports put the cost of large standard baled straw bale production at \$25/ton roadside. If the relative value of haylage is compared to dry straw bales at 15% moisture, the cost per ton would average \$44.44. The per acre costs for removal will range from \$32.22 (2900 lbs. straw @ \$10/ 900 lb. bale) to \$128.88 (11,600 lbs. of straw @ \$10/ 900 lb. bale) depending on the tonnage of straw produced per acre. The purchase cost of all the haylage equipment is \$41,000. The 1999 studies showed a daily intake of 36 lbs./hd./day or 14.6 lbs./hd./day on 100% dry matter basis. These are intakes that could never be attained with dry bale straw production. There is a potential for improved forage quality attributes that will be calculated at the end of this year's study. The haylage costs are higher than the traditional large bale straw production, but the forage value and palatability increase may cover the additional costs.

Objective II. - Grazing Straw

At the Wheeler Ranch in Biggs, California beef cattle of different stages of lactation and pregnancy grazed in a stripper harvested rice field to determine if grazing could be use as the cheaper form of removal and incorporation. An electric fence was placed on the boundary of the 22 acres and around each check providing four pastures. The pasture sizes were 7, 6, 5, and 4 acres. The rice straw will be sprayed with Mol Mix 33 a molasses/urea product to increase palatability and digestion. Attempts to apply the material though the sprayer Tee Jet nozzles were unsuccessful. The product required application with a hand gun. On September 24, twenty-four fall calving beef cows were introduced into rice field. On September 26 twenty-seven spring calving cows and two bred cows were brought in. The nutrient value of the rice straw was as follows: Protein- 4.6% and Acid Detergent Fiber-50.2%. Two weeks into the study the cows began to losses weight. Visual observation of the plants indicated that the supplement was no longer on the plant and had either washed off in the rain or volatilized. A liquid supplement trough was brought in and the cattle were supplemented with the Mol Mix 33% in the traditional fashion. Cattle's feces and hair coats returned to normal in three days after introduction of the supplement. Fecal samples were taken at three points in the grazing and sent to Texas A&M GAIN Laboratory for Near Infrared (NIR) analysis. After forty-three days of grazing in three checks the cattle were removed due to the rice producer's concern about compaction of the ground by the cows.

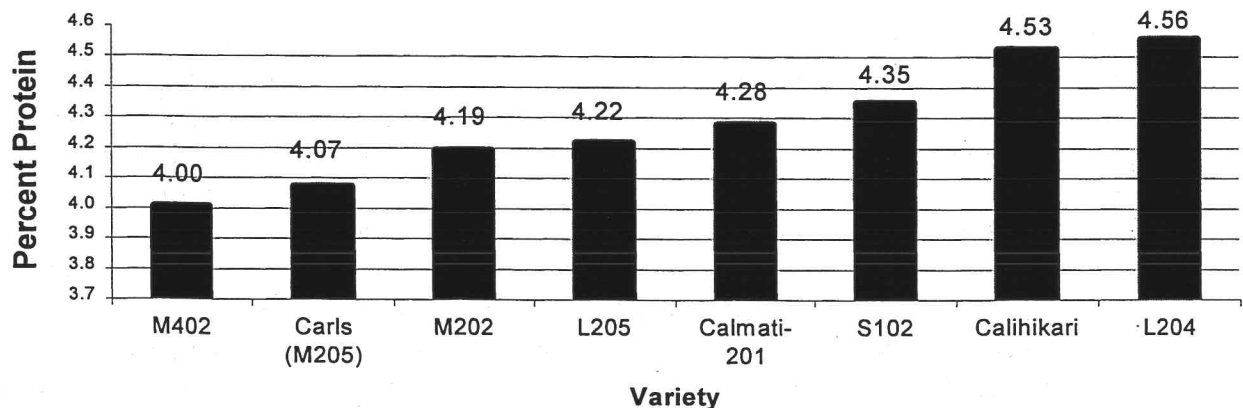
Economic Analysis

The capital expenditure cost of an electric fence was \$54/acre. The high cost is mainly attributable to the small size of the research. This material has a 3 to 7 year life. The cost of the supplement application was \$23/acre. Once the cows were placed on a liquid supplement tank the cost per head per day was \$.21.

PUBLICATIONS:**Does Rice Variety Make a Difference in Straw Quality?***By Glenn Nader, Cass Mutters, and Dustin Flavell*

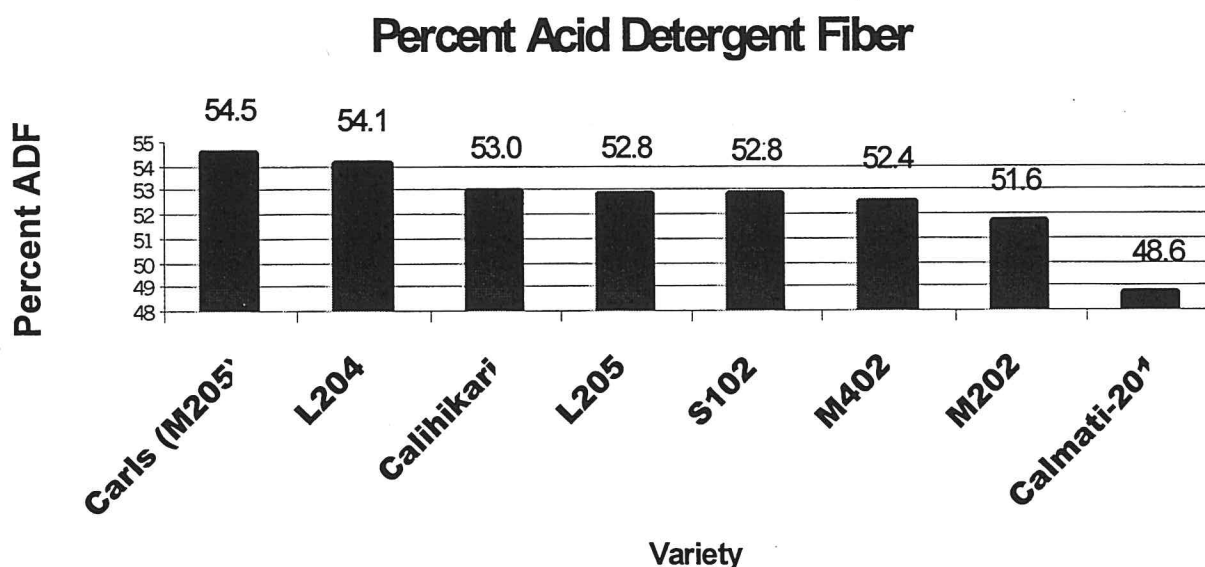
Field studies have revealed a large degree of variation in the nutritional quality of rice straw. Last year straw was harvested from a variety research project of Butte County Rice Farm Advisor Cass Mutters at the Rice Research Station at Biggs. The study investigated eight varieties. The plot size was 10' by 20' replicated four times in different blocks totaling 192 plots. Along with the traditional grain production information the straw was collected one day after combining and air dried analyzed by the University ANR Laboratory.

Field wisdom is that Akita straw was and is the best variety to use for livestock feed. (See Nader and Dye 1999). Protein and digestibility are the two parameters that are important in nutritional evaluation.

Percent Protein by Variety

A dry or non lactating cows requires a diet that consists of seven percent protein. Other feeds would still be required to balance the protein requirements. Calihikari and L204 are about a half percent higher in the protein levels. This could be attributed to plant physiological state at harvest or how the plant partitions nitrogen.

The fiber was determined by using the process of Acid Detergent Fiber (ADF). The lower the value the more digestible or usable by the animal. This indicates the portion of the plant that consists of cellulose, lignin and variable amounts of silica. ADF is the best predictor of forage digestible dry matter and digestible energy. It was surprising to see M202 on the lower or more digestible of the group. Calmati 201 separated greatly from the rest of the varieties, and since digestibility is one of the limiting factors of the use of rice straw, this is a very significant difference.



The data were again collected in the 2000 at two different locations (Yuba City and Chico). There is a concern that the different stage of maturity at harvest may be influencing the forage value of each variety. That point will be reviewed in the study of the two year-three location data.

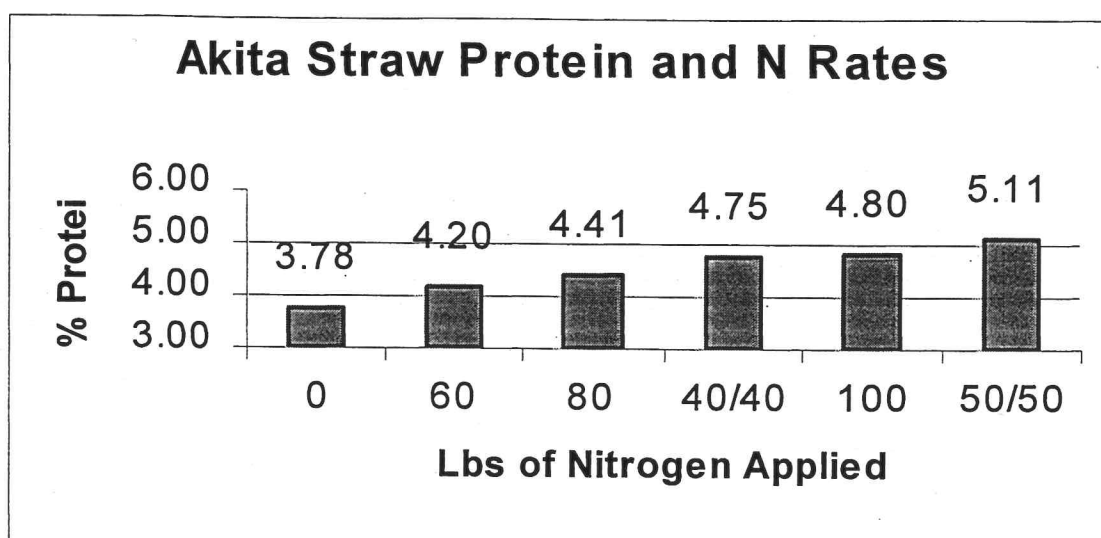
Fertility Management and Rice Straw Forage Quality

By Glenn Nader, Cass Mutters, and Dustin Flavell

Two Akita fertility management locations had both grain and straw data collected. The six different fertilization treatments were as follows:

<u>Treatment</u>	<u>Basal</u>	<u>Panicle Initiation</u>
1	0	0
2	60	0
3	80	0
4	40	40
5	100	0
6	50	50

They were repeated four times in a complete randomized block design. Akita has long been thought to be one of the better straws for livestock feed, due to grain retention and straw structure. The straw protein had a direct and significant response to nitrogen applied. The split applications were even more efficient in the conversion of nitrogen applied to straw protein.



The Acid Detergent Fiber increased with the amount of nitrogen. No fertilization treatment had the best or lowest fiber percent. The fertilization plots had no difference in the ADF.

Lbs. of Nitrogen	% ADF	Homogeneous groups at the .05 level
0	44.5	a
60	46.6	b
80	47.6	bc
40/40	47.6	bc
100	47.8	bc
50/50	48.3	c

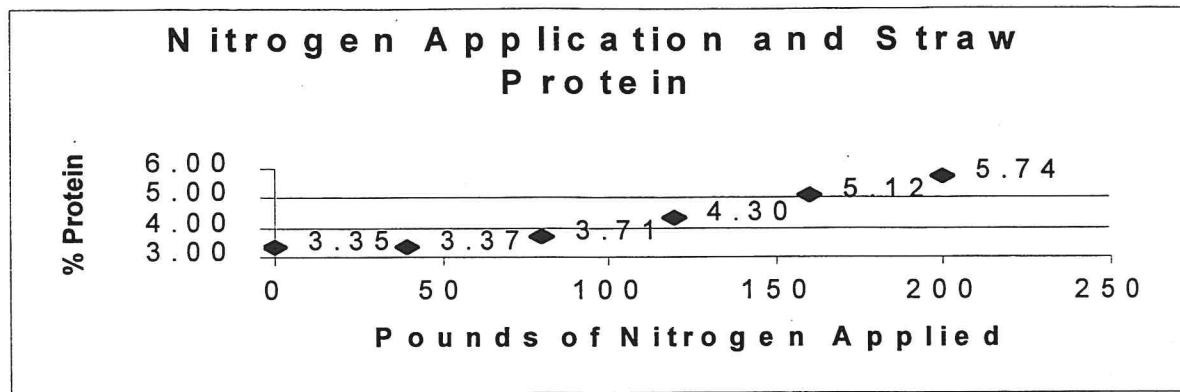
The ADF values did vary by location.

Pleasant Grove	46.2
Biggs	48.0

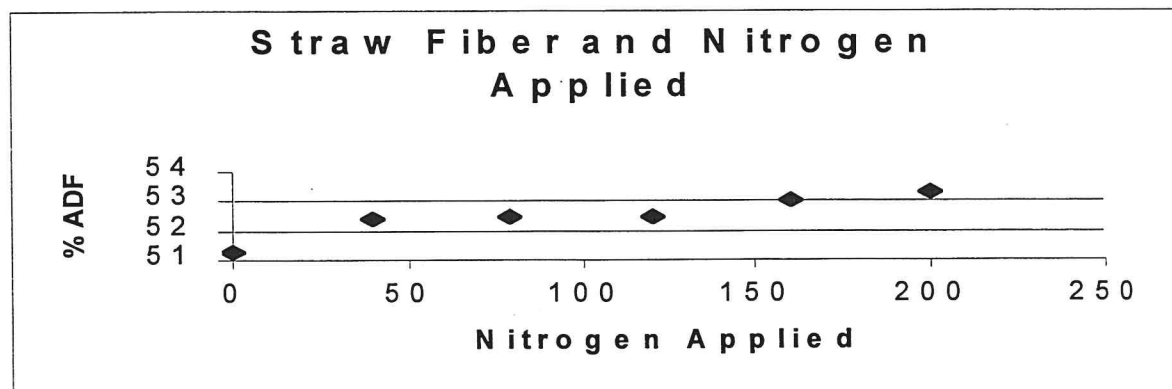
There were no differences in silica content due to nitrogen application.

The Rice Research station plot also studied the response of eight different rice varieties(M202, Carls M205, 402, L204, L205, S102, Calmati-201, and Calihikari) straw quality to six different levels on nitrogen fertilization management (0 to 200 pounds) was studied at the Rice Research Station at Biggs

The response in straw protein quality of these eight varieties to the nitrogen fertilizer was similar to Akita, with a 2.39% difference due to treatment.



ADF increased with the amount of nitrogen applied. Straw silica levels were not affected by the fertilization.



SUMMARY OF CURRENT YEARS WORK:

Rice straw haylage use as cattle feed will depend on the value of the ensile process. The cost is more than traditional dry baling so this year cattle weight gain data will need to show an increase in quality for it to be commercialized. The grazing of stripper harvested straw would require supplementation of non lactating cows. Frost or dry conditions will decrease the forage value of the plant. The variability of the straw forage quality is a problem for the use of rice straw as cattle feed. Here are the items that were published for livestock producers to evaluate rice straw forage quality.

Actions to evaluate the straw

Laboratory test for feed value (crude protein, crude fiber, and silica or ash)

Look for grain retention in the heads

Sample for mold

Questions to ask the grower

What Rice Variety is it? (Akita, M401, Calmati tend to have better feed quality)

Type of harvester? (The rotary tends to chop the straw in shorter pieces)

Was the straw cut above the water line?

How many days after harvest was it baled? (The longer straw is in the field lowers the palatability)