

**ANNUAL REPORT
COMPREHENSIVE RESEARCH ON RICE**
January 1, 2002 - December 31, 2002

PROJECT TITLE: Defining the Forage Variability in Rice Straw

PROJECT LEADER:

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

PRINCIPAL INVESTIGATORS:

Glenn Nader - Butte/Sutter/Yuba Livestock Farm Advisor
Peter Robinson - Department of Animal Science Extension Nutritionist
Dan Drake - Siskiyou County Livestock Advisor
Larry Forero - Shasta County Livestock Advisor
Girma Getachew - UCD Dept. of Animal Science Nutritionist

COOPERATORS:

The following 21 rice operators from five counties provided samples and filled out survey forms:

Colusa County

Derrick Ash
Gene Beauchamp
Jerry Maltby
Larry LaGrande
Leo LaGrande
Francis Hickel
Ron Lee
Van Brothers

Glenn County

Joe Carrancho
Greg Massa
Herb Holzapfel
Lee McCorkle
John McCracken
Ed Owens
Jon Swaner
George Swaner

Butte County

Biggs Farming Group
Paul Cummings
Bill Johnson

Yuba County

Albert Kibbe

Yolo County

Joe Heidrick Farms

LEVEL OF 2002 FUNDING: \$16,730

OBJECTIVES:

1. Define variability of rice straw forage values.
 - A. Rice straw samples were collected from 39 rice straw stacks.
 - B. Rice growers filled out survey forms on agronomic practices for each field.
 - C. Wet chemistry and biological analysis were conducted to determine forage quality.
 - D. The forage quality lab tests results will be correlated with the agronomic practices.

2. Define the impact of high manganese in rice straw on cattle.
 - A. Samples from objective 1 were also be analyzed for manganese.
 - B. Feed high manganese rice straw to cattle for 90 days.
 - C. Compare cow micronutrient status on Day 0 and 90 of feeding using liver biopsy samples.

3. Develop a peer reviewed publication that explains how to correctly produce and feed rice straw.

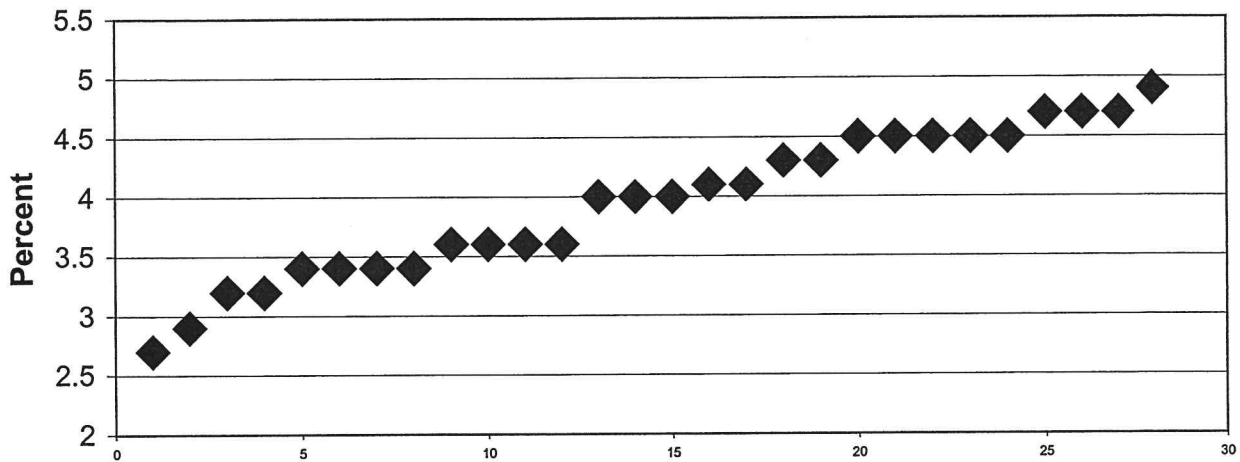
EXPERIMENTS CONDUCTED:

Objective I - Defining variability of forage values.

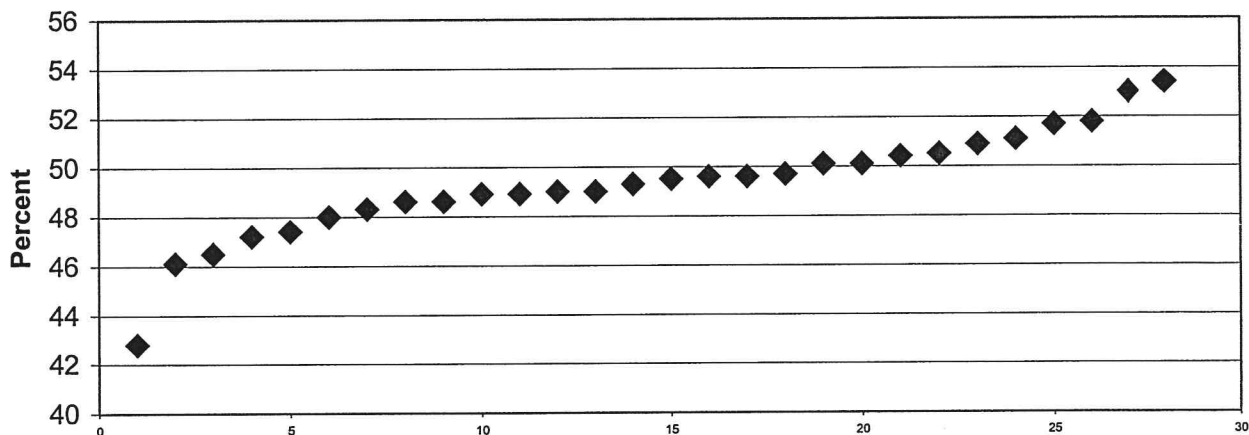
Surveys of 39 rice straw stacks were conducted to define the reasons for the variability of forage quality. Core samples were collected using a Penn State probe and analyzed by University of California Animal Science Department, Monarch and J&L Laboratories. The wet chemistry included total nitrogen protein by Kjeldahl analysis that is used to calculate crude protein, fiber content determinations by Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF), fat content by Ether Extract (EE) and dry matter determination by oven drying at 105 degrees. The biological evaluation predicts the energetic value of rice straw was conducted at the UC Dept. of Animal Science. The data from the variability study are not available at the time of this report.

In addition to the original objective of defining the variability, there was an interest at the same time to demonstrate the ease of obtaining powerful information for sales and proper feeding of rice straw through laboratory data based decisions. It was determined during the study that the two goals were not going to be compatible, due to extended the sampling period of seven weeks. The variability study required that the samples be held and run all at one time with the same reagent and staff to reduce the laboratory variability. Thus, 28 samples were double sampled on stacks of straw that were being considered for sale and sent in four groups to Monarch Laboratory in Chico, California. Samples were tested for crude protein, acid detergent fiber (ADF) and moisture content. This allowed for quicker response to growers needs to sell the straw with the knowledge of its forage quality. The graphs below show the data from Monarch Laboratory and the variability of protein (2.7 to 4.9) and ADF (43.8 to 53.8).

Rice Straw Protein - 2002



Rice Straw ADF - 2002



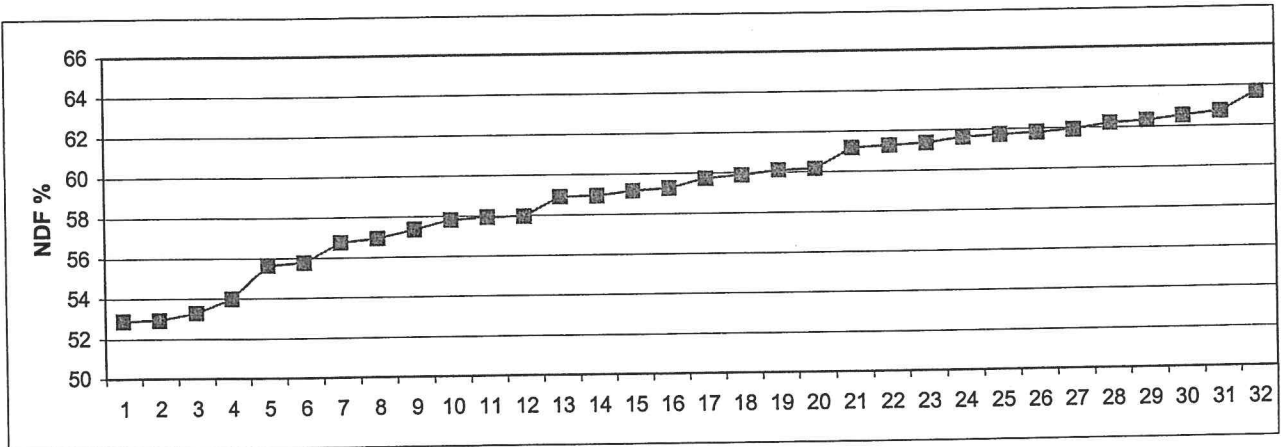
This data again illustrated to growers and cattlemen that not all rice straw should be fed to cattle. In 2001, Glenn Nader established guidelines for purchasing rice straw for feeding to cattle. The intent of these guidelines were to decrease the variability of the performance of cattle fed rice straw by making sure only the best forage quality product is used. This will help erase the negative stigma of past failures in feeding rice straw to cattle. The guidelines are as follows:

<u>Lab Test</u>	<u>Minimums</u>
•Crude Protein	4.5 or higher
•Fiber (ADF)	50 or lower

Only 25 percent of these 28 samples met these guidelines. There were three samples that should not be fed to cows and should be diverted to erosion control use, as the high ADF results indicate a very slow breakdown of the straw. The variability of these 28 samples further indicates the need to test for market definition to make sure the straw goes to the market that it is best suited based on its chemical characteristics. The protein levels were lower this year than last year. This could indicate that there is a year affect on forage quality.

The UC Animal Science Department at the time of the report had conducted Neutral Detergent Fiber (NDF) analysis on 32 of the 39 samples. The results can be seen in the graph below. There was a variation of 11% in these samples that indicate a great difference in the forage quality.

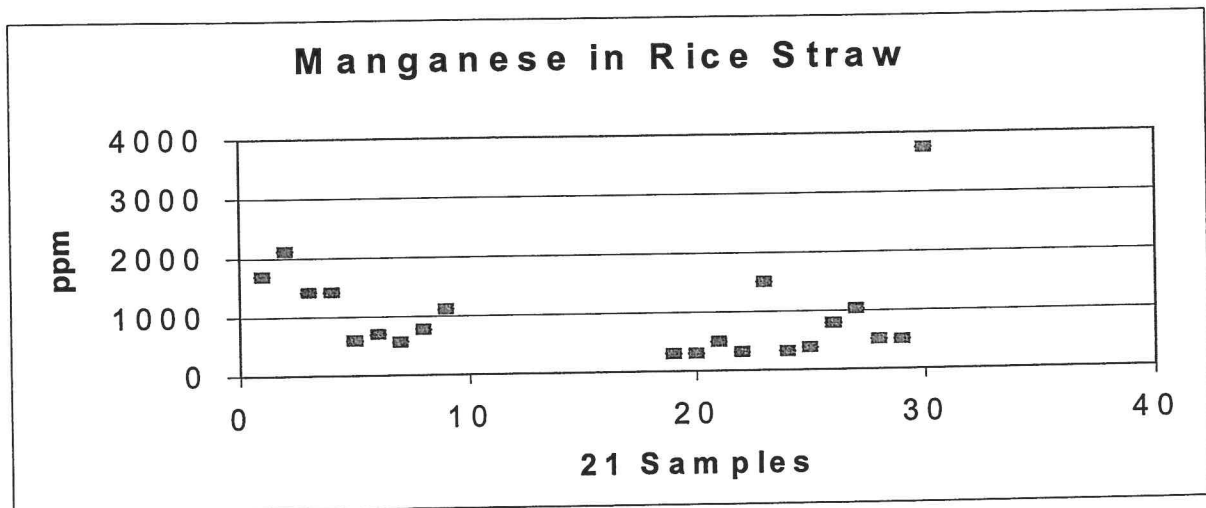
Variation in NDF Content of Rice Straw Samples



The results of this objective will be received from both Laboratories in January. At that time the forage quality will be compared to the survey of agronomic practices to identify correlated factors impacting the quality. These will be used to develop a guideline of fields that should be considered as straw for cattle feeding. The data will also be studied to develop a standardized laboratory testing procedure for rice straw forage quality similar to the Western States Alfalfa ADF/TDN equation that has been a great success in marketing alfalfa based on predictable cattle performance when fed.

Objective 2 - Defining the impact of high Manganese of rice straw on cattle.

Previous years sampling had shown a manganese levels in some rice straws that were very high. One study found that when sampling twenty-one different rice straws, that one third of the samples proved to have high levels of manganese. Eight of these twenty-one samples showed to have over 1,000 ppm of manganese, which is considered to be possibly toxic to the animal.

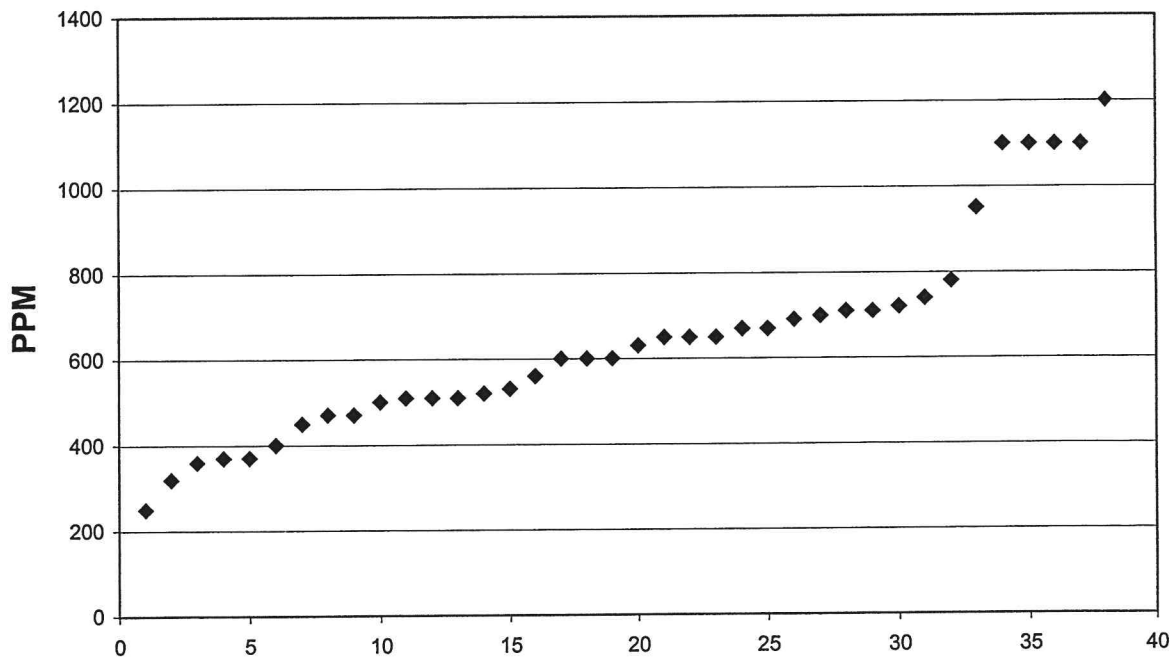


Therefore, with this knowledge from twenty-one samples there was a need for further research to address the manganese in rice straw to determine if there is a problem.

Manganese is not highly absorbed by the cattle, but when high levels of it are present in a feed and the animal consumes abundant amounts it can decrease the absorption of copper. This decrease in copper then affects the animal's metabolism and can cause such problems as; weight loss, diarrhea, neurological impacts, and bone fractures. In addition, although limited research describes that cattle are able to tolerate relatively high levels of manganese before adverse affects occur, manganese is still estimated toxic if the animal receives more than 1,000 ppm (National Academy of Science, Nutrient Requirements of Dairy Cattle, Fifth revised edition, 1978). After the animal receives a higher amount of manganese, its body will no longer continue to absorb this nutrient. If the high manganese in rice straw is a problem, it can simply be addressed by avoiding feeding those lots with high manganese or providing a copper supplement.

The manganese levels of this year's study varied greatly and can be seen in the graph below.

Rice Straw Manganese Levels - 2002



Five tons of the highest and lowest manganese rice straws were purchased from the survey producers. Starting in January 2003, twelve non-lactating beef cows will be divided into three

groups and will be fed chopped roughages as followed for 90 days at the U.C. Sierra Foothill Research and Extension Center:

Group 1 - 50% low quality oat hay and 50% alfalfa

Group 2 - 50% rice straw (300 ppm manganese) and 50% alfalfa

Group 3 - 50% rice straw (1100 ppm manganese) and 50% alfalfa

All animals will have liver biopsies taken at day 0, 30, and 90 by UC Vet Med Extension Specialist, Dr. John Maas. These samples will have a complete micronutrient panel including copper and manganese analyzed at the UCD School of Veterinary Medicine.

Objective 3- Developed a peer reviewed publication that explains the how to correctly produce and feed rice straw.

U.C. Livestock Farm Advisors Dan Drake, Larry Forero and Glenn Nader developed an 18-page publication on "Feeding Rice Straw." It is based on four years of Rice Research Board funded research and a survey of 10 ranches feeding rice straw in Northeastern California during the 2001 drought. The objective of the publication was to use the existing knowledge base to instruct rice growers how to properly select and bale rice straw and cattle producers how to evaluate feeding it. The publication took extensive time to develop and complete the University peer review process. A web based version of the UC publication can be found at this web site <http://anrcatalog.ucdavis.edu/pdf/8079.pdf>

Also 1000 color copies were printed for the non-web connected rice and cattle producers. These have been distributed at cattlemen and rice grower meetings, and sent to livestock supplement companies, straw cooperatives, and government agencies. The information was also presented at the California Air Resources Board Rice Straw Expo as two shorter publications. These two publications can be seen at the following web site <http://faculty.engineering.ucdavis.edu/bjenkins/>

Garino Livestock Supplement Co. also used the information to develop a cattle supplement specifically for rice straw. They have now released 007 rice straw supplement.

SUMMARY OF CURRENT YEARS WORK:

The 2002 results further identify a high degree of variability in rice straw forage quality. For rice straw sales to increase, improved market definition needs to occur. Defining the field practices that have a tendency for improved forage quality and baling those fields or testing the baled straw and directing it to the market that best suits the customer's needs are two ways of cattle feed market definition. From this years work, a better understanding of the forage quality laboratory procedures that can best predict the animal performance will be developed. The keys to the successful feeding of rice straw to cattle are the general tenets of good animal nutrition. They are as follows:

1. Test the straw - (Know what you are buying)
2. Determine the cows nutritional requirements - (lactation, pregnancy, etc.)
3. Supplement to balance the ration to the cows needs by using hay, supplements or allow the cows to loose weight.
4. Evaluate the cost of the ration.

If these four items are conducted, feeding rice straw can be a positive experience for both the rice grower and the cattlemen.