ANNUAL REPORT
COMPREHENSIVE RESEARCH ON RICE
Jan. 1, 2003 to Dec. 31, 2003

PROJECT TITLE: : Geographic and Environmental Factors Affecting Rice Milling Quality and Yield.

PROJECT LEADERS:
Randall Mutters, Farm Advisor UCCE Butte Co.
James Thompson, Extension Specialist Biological & Ag. Engineering, UCD

PRINCIPAL INVESTIGATORS:
Richard Plant, Agronomy & Range Science, UCD
Jerry Knutson, Development Engineer, Biological & Agricultural Engrg, UCD
Mike Hair, Postgraduate researcher, UCCE/UCD

COOPERATORS:
David Jones, Farmers Rice Cooperative, Sacramento, CA
Kent McKenzie, Research Experiment Station, Biggs, CA

LEVEL OF 2003 FUNDING:
$ 23,890

OBJECTIVES AND EXPERIMENTS
Investigate the crop-environmental interactions affecting head yields at a range of soil and grain moisture levels under controlled field conditions.

A plot at the Rice Research Station was divided into three sections that could each be separately drained. The entire plot was planted with Kokuho Rose medium grain rice and each plot was subjected to identical cultural practices. Although a 20' section on the north end of the early drained section received extra nitrogen fertilizer by accident. The plots were drained on September 12 (early), 18 (normal) or 26 (late) and harvested on September 30, October 6, 13, and 16. Each plot was hand harvested in 6 to 8 locations and threshed with a small plot thresher. Rice moisture for each harvest location (HMC) was determined with a single grain moisture meter (Kett) and head rice yield (HRY) was determined by the California Department of Food & Agriculture Grain Quality Inspection Lab using USDA-FGIS procedures.

The early drained section generally had lower HRY than the other two sections, figure 1. Head rice yield was low for the first harvest of the late drained plot because the rice was not fully mature in about half of the harvest locations as indicated by low total rice quality. The HRY loss for the early drained plot was greatest at the last two harvest times where it was almost 10 pounds/cwt lower compared with the normal and late drain sections. The differences were associated with higher HMC for the normal and late drained plots, figure 2. Soil moisture was also higher for the normal and late drained sections compared with the early drain section, figure 3.

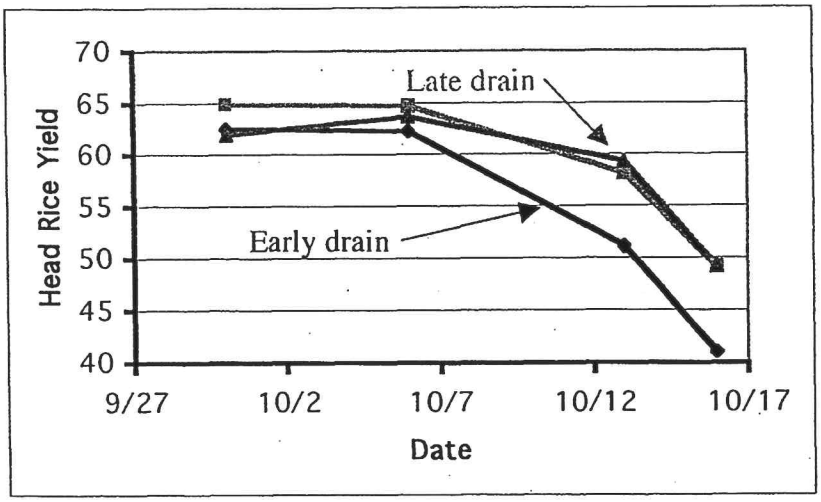

Figure 1. Effect of drain time and harvest date on head rice yield

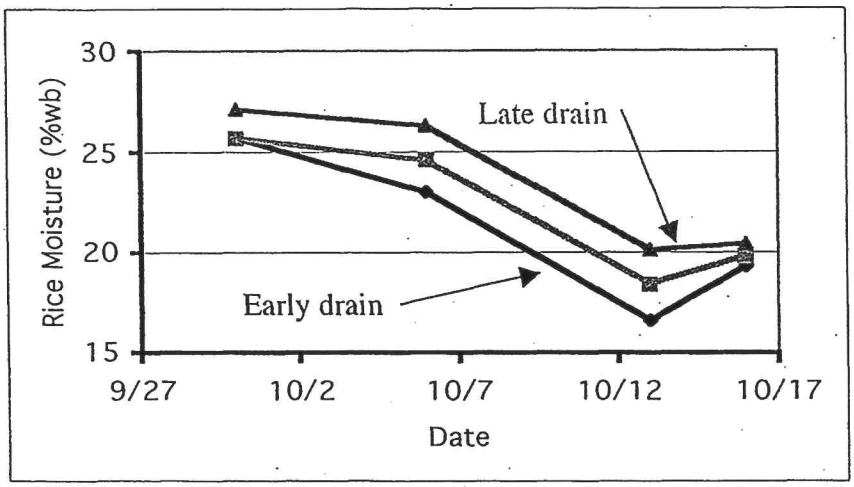

Figure 2. Average paddy moisture at harvest for each drain time section

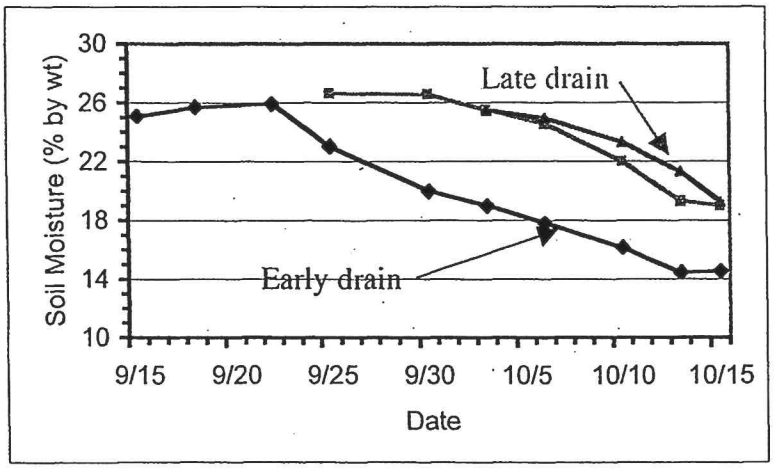

Figure 3. Soil moisture for three drain time sections

When HRY is graphed against HMC there is no difference in the drain time treatments for a given harvest date. The HRY for the individual harvest locations pooled across the three sections form smooth curves with harvest locations in the later drained plots having higher HMC and generally higher HRY, figure 4. However there are significant differences in the location of the points for each harvest date due to a combination of HMC and meteorological conditions. Before October 9 the weather was calm and the rice was exposed to dew for 10 – 15 hours per day. During this period average paddy moisture dropped quite slowly. From October 9 through Oct 14 there were two periods of north wind and significant dew was present for only one night. Average moisture dropped about 7 percentage points during these few days. The typical pattern of calm conditions and dew resumed after Oct 14 and moisture increased slightly. The rice harvested on October 6 high HRYs, with all harvest locations having relatively high HMCs. Rice harvested on Oct 13 showed a straight line decrease in HRY as HMC decreased but the regression line fell in a region of generally high HRY. Even harvest locations with HMCs less then 14% had HRYs near 50lbs/cwt. Rice harvested on 10-16, after the wind stopped and the dew returned, had much lower HRY than the harvest three days earlier, in spite of generally higher harvest moistures. Harvest locations with lowest HRYs dropped to nearly 35 lbs/cwt. The dry north wind conditions allowed the rice to dry with relatively little quality loss. The calm conditions and dew after the wind stopped caused a HMC increase and a significant reduction in HRY.

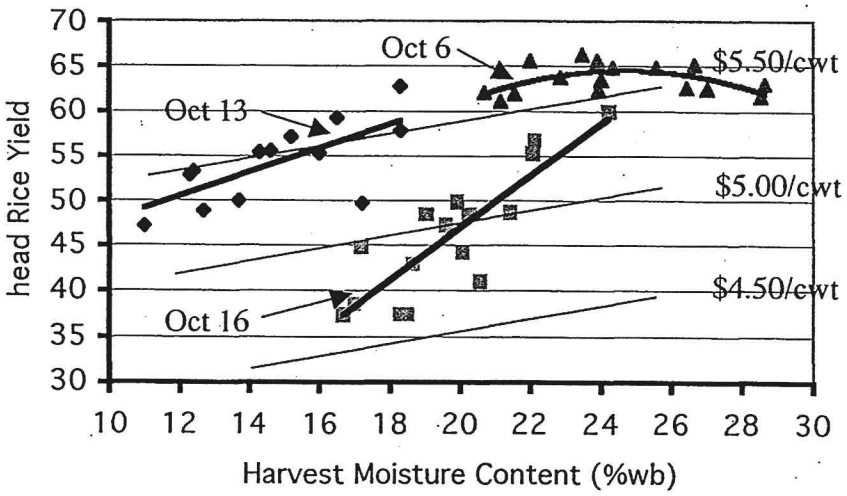

Figure 4. Relationship between paddy rice moisture at harvest and head rice yield for three harvest dates. Diagonal lines represent grower return based on a loan rate of $9.70 for whole kernels and $5.40 for broken kernels minus typical drying costs.

The HRY loss appeared to be associated with rehydration of rice after it had dried below a threshold-moisture content of about 16%. Averaging across all harvest locations, the weight of broken kernels represented 51% of the weight of kernels less than 16% moisture on the 10-13 harvest date. But after the wind stopped and dew returned, on the 10-16 harvest, broken kernels represented 97% of the weight of kernels less than 16% moisture. Windy conditions without dew at night allow paddy rice kernels to dry below

16% moisture with limited damage. During conditions with dew, kernels that have dried below 16% moisture will be fissured by rehydration.

Growers receive more dollar return for their rice during a windy period because of the high HRYs and because the rice is harvested at lower moistures and costs less to dry. On 10-13 many of the harvest locations had a grower return near $5.50/cwt. After the calm conditions and dew returned on 10-16 only rice harvested near 24% moisture had a return near $5.50. Many of the harvest locations had a return near $5.00/cwt and the driest locations resulted in a return of $4.75/cwt.

The practical implications of these observations are that harvest should proceed at maximum possible rates during dry meteorological conditions. Growers receive the greatest value for their crop under these conditions and millers will receive high quality paddy rice. After return of dew forming conditions, HRY loss can be minimized by keeping rice moisture high with practices such as late draining of portions of large fields and insuring adequate harvesting capacity.

SUMMARY OF 1999 RESEARCH BY OBJECTIVE:
Investigate the crop-environmental interactions affecting head yields at a range of soil and grain moisture levels under controlled field conditions.

A controlled field experiment showed that head rice yield (HRY) can be kept high even at low harvest moistures if the rice is not subjected to rehydration from dew. North wind conditions in the Valley cause rapid rice drying in the field and prevent dew formation, allowing rice to be harvested with HRYs above 55 lb/cwt with rice moistures in the range of 16 to 18%. These conditions produce rice with a high value and low drying cost. After the windy conditions stop and dew returns, the harvest moistures must be kept above 22 to 24% to maintain HRYs above 55%. These observations support the concept that head rice loss is caused by rehydration of kernels that have dried below 16% moisture.

PUBLICATIONS AND REPORTS:
None

CONCISE GENERAL SUMARY OF CURRENT YEAR'S RESULTS:
(see Summary section)