

COMPREHENSIVE RESEARCH ON RICE  
ANNUAL REPORT

January 1, 1983 - December 31, 1983

PROJECT TITLE: Varietal improvement for better root systems to lower water use, reduce lodging, and improve nutritional efficiency in California rice culture

PROJECT LEADER AND PRINCIPAL UC INVESTIGATORS: Ivan Buddenhagen  
Gene Lester

Collaborators and Cooperators: J. E. Hill  
J. N. Rutger (Report prepared by  
Rutger, see note below)  
W. F. Lehman

NOTE: Due to insufficient funding for his proposed objectives, Dr. Buddenhagen elected not to use funds awarded to this project, and generously made his genetic materials, which were already planted, available to Rutger. On August 11, 1983, Rutger and D. W. Rains, Chairman, Department of Agronomy and Range Science, proposed that these 1983 RB-5 funds be reallocated as follows:

\$3,000 - to Rutger's project (RB-3) for evaluation of Dr. Buddenhagen's materials in 1983.

\$7,000 - to be carried over into 1984 and added to Rutger's 1984 RB-3 request, for the purpose of carrying on further evaluations of the materials from Dr. Buddenhagen.

LEVEL OF 1983 FUNDING: \$10,000 (only \$2,000 spent; see explanation in SUMMARY...below)

ORIGINAL OBJECTIVES OF PROPOSED RESEARCH (Buddenhagen)

1. Evaluate the best rices found in 1982, plus new introductions, for performance under overhead irrigation utilizing a line source sprinkler which enables upland performance to be judged under a water regime ranging from no stress to high stress.

2. Determine water use levels for the highest yield levels for a range of the best adapted materials and determine yield levels with the same materials grown under lowland flooded conditions.

3. Widen the genetic base of rices for California by incorporating genes from stress-resistant rainfed and upland rices. These could contribute tolerance to soil stresses of various types, including micronutrient imbalances on alkaline, acid and saline soils, drought and greater efficiency in zinc and phosphorus use, etc.

4. Improve root systems and stem strength of existing cultivars through crossing with upland rices. (Upland rices generally have thicker and longer roots and larger and stronger stems than typical flooded rices). Together these characteristics should provide greater lodging resistance.

Note: The material developed through the specific objectives above is to be provided to California rice breeders and any others requesting it, for their use in varietal development.

5. Develop screening methods for detecting plants with improved water and ion uptake under suboptimal soil and water conditions. Methods are needed for detecting segregants (and mutants) with improved or changed membrane function in relation to ion uptake and exclusion.

6. Determine major differences between upland, stress-resistant rainfed and lowland rice root systems and their performance under lowland and upland conditions. (Needed to understand what specific characteristics can be usefully extracted to improve lowland rice).

#### MODIFIED OBJECTIVE (Rutger):

To characterize 1000-seed weight, heading date, and height of the approximately 340 genetic lines Dr. Buddenhagen made available to Rutger during the summer. These lines include upland rice and other exotic materials from Africa and South America as well as Asia. The fact that these lines produced seed in the cool Davis environment in 1982, combined with their diverse genetic backgrounds and differing grain types, makes them useful for broadening the germplasm base for California rice.

#### SUMMARY OF 1983 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

Dr. Buddenhagen planted some 340 lines, identified in his 1982 research as being potentially useful in California, at the Rice Research Facility at Davis. When Rutger assumed principal responsibilities for these lines in August, it was decided only to pursue the modified objective. Thus RB-5 funds were expended only for the modified objective.

Considerable variability in 1,000-seed weight was evident in these materials, which ranged from 11 to 44 grams, (compared to about 26 grams for the California check, M-101 (Figure 1). About 300 lines, which headed in less than 115 days (Figure 2), are within the maturity range which can be readily studied in the field in California. Correlation between 1000-seed weight and days to heading was very small ( $r = -0.18$ ). About one third of these lines were semidwarf, while the rest were tall.

The large-seeded and other lines in this experiment are of particular interest as donor parents for a genetic-male-sterile-facilitated crossing program. Therefore a 1984 proposal will be made, as part of project RB-3, to use these lines in a crossing program with genetic male sterile M-101.

Because of the late start, only about \$2,000 of RB-5 funds will be expended in 1983.

#### PUBLICATIONS OR REPORTS:

Manuscript prepared from 1982 work: "Drought Stress and Tissue Carbohydrate Levels in Rice", G. E. Lester and I. W. Buddenhagen.

#### CONCISE GENERAL SUMMARY OR CURRENT YEAR'S RESULTS:

Due to insufficient funding for his proposed objectives, Dr. Buddenhagen elected not to use funds awarded to this project, and instead made the genetic materials available to Rutgers. Rutgers then conducted a preliminary study to characterize heading date, 1000-seed weight, and height of these materials.

Some 340 lines, including upland rice and other exotic materials from Africa and South America as well as Asia, were harvested. In 1984 these lines will be used as pollen parents in a genetic male-sterile-facilitated crossing program, in order to introgress useful germplasm into the California background.

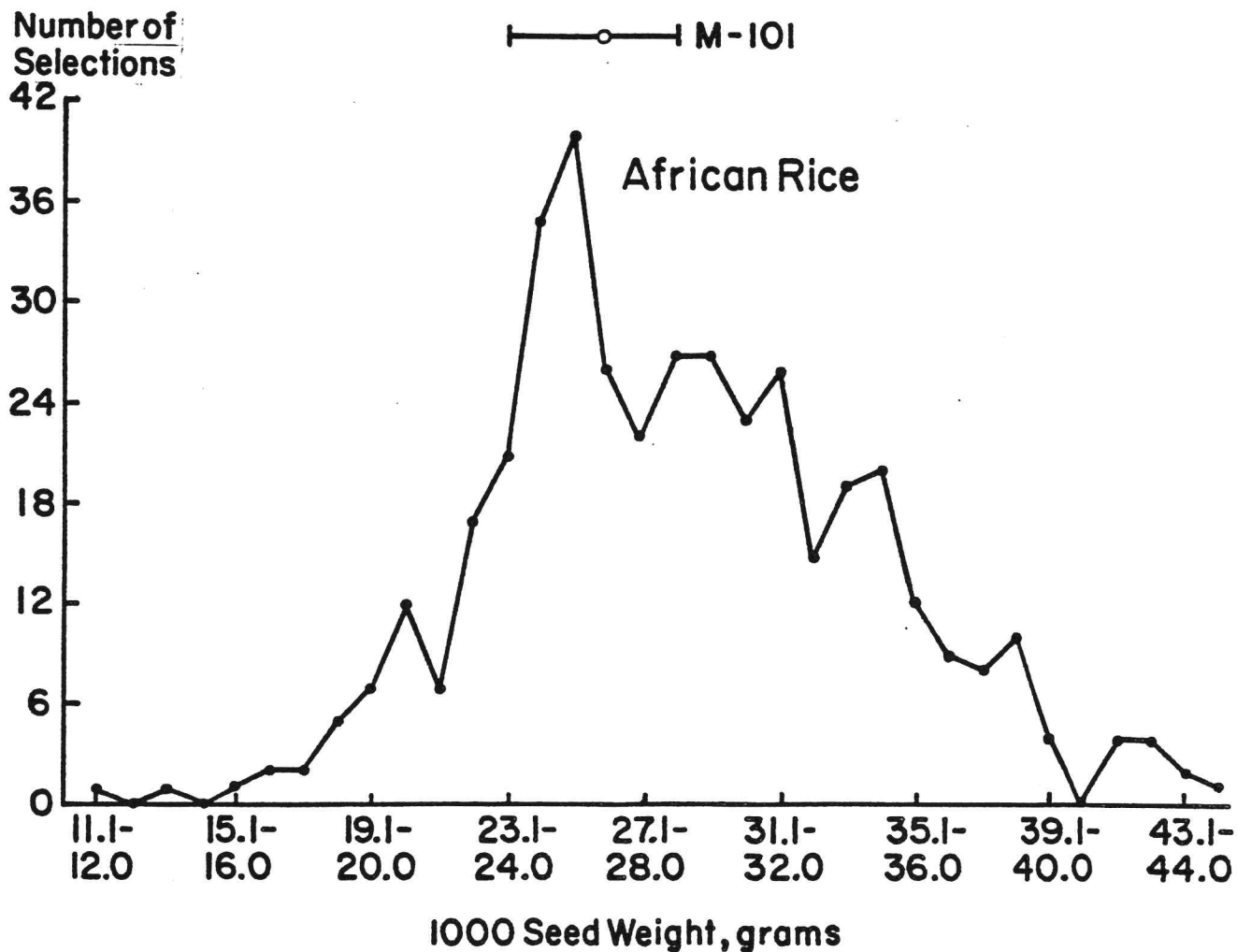


Figure 1. Distribution of 1,000 seed weight in some 340 upland rice and other exotic materials from Africa, South America, and Asia.

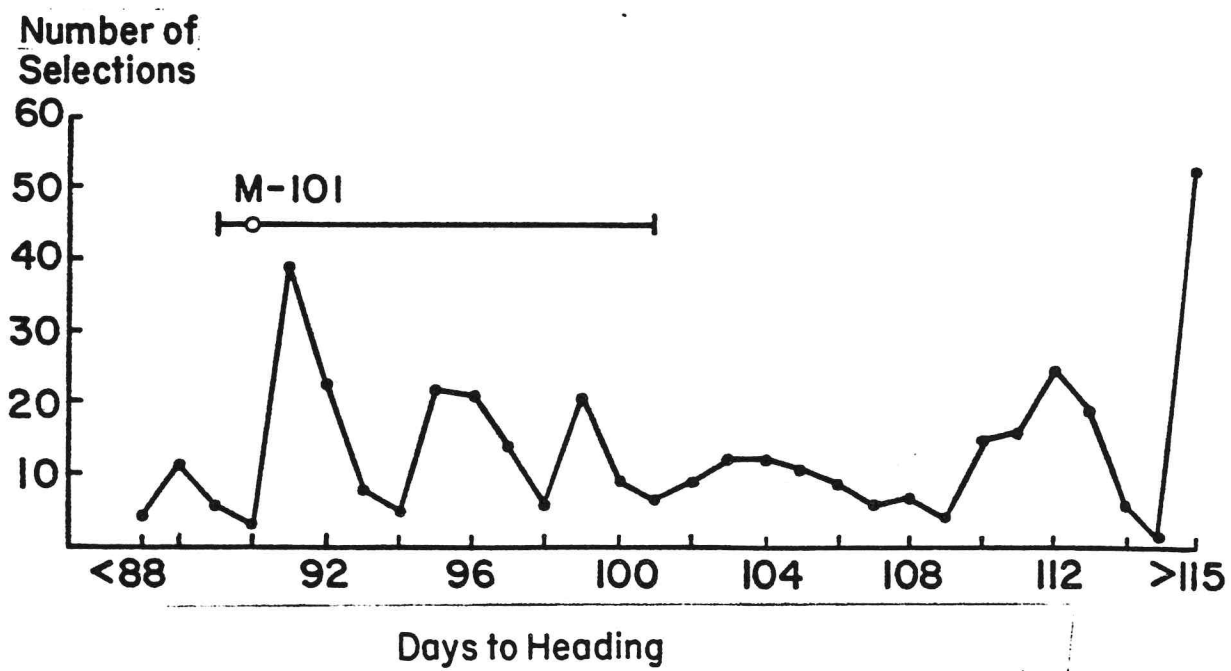


Figure 2. Distribution of days to heading in some 340 upland rice and other exotic materials from Africa, South America, and Asia.