

ISN/70324 OCT 25 1974

UNITED STATES GOVERNMENT

# Memorandum

PDAECLIS

TO : See Distribution

DATE: October 24, 1974

FROM : TA/AGR, Leon F. Hesser *LH*

000197

SUBJECT: Project Appraisal Report (PAR) Sorghum Improvement,  
Purdue University

Attached is a copy of the recent Project Appraisal Report that was developed for the project with Purdue University titled, "Inheritance and Improvement of Protein Quality and Content of Sorghum Bicolor" under AID contract csd-1175. This report gives a view of the trend of accomplishment of this project.

It is distributed for your information.

## DISTRIBUTION

- AA/TA, (BEO)
- TA/PM
- TA/RIG
- TA/AGR, R. Holmes
- S. Litzenberger
- R. Desrosiers
- G. Baird

- ✓ TA/N,
- ✓ Asia/Tech
- AFR/DP
- LA/DR/RD
- SA/TD/RD
- Purdue (Desrosiers)
- SER/CM/COD
- AID/REF. Center - 2



PROJECT APPRAISAL REPORT (PAR)

PAGE 1

1. PROJECT NO. AID/csd/1175		2. PAR FOR PERIOD: 8/27/73 TO 10/1/74		3. COUNTRY Worldwide		4. PAR SERIAL NO.	
5. PROJECT TITLE Inheritance and Improvement of Protein Quality and Content of <u>Sorghum Bicolor</u> (L) Moench - Purdue Research Foundation, Contract AID-csd-1175							
6. PROJECT DURATION: Began FY _____ Ends FY _____			7. DATE LATEST PROP		8. DATE LATEST PIP		9. DATE PRIOR PAR Sep 2 1973
10. U.S. FUNDING		a. Cumulative Obligation Thru Prior FY: \$		b. Current FY Estimated Budget: \$		c. Estimated Budget to completion After Current FY: \$	
11. KEY ACTION AGENTS (Contractor, Participating Agency or Voluntary Agency)							
a. NAME Purdue Research Foundation						b. CONTRACT, PASA OR VOL. AG. NO. 921 0452 AID/csd/1175	

I. NEW ACTIONS PROPOSED AND REQUESTED AS A RESULT OF THIS EVALUATION

A. ACTION	B. LIST OF ACTIONS	C. PROPOSED ACTION COMPLETION DATE
Purdue	Submission of current annual report	1 Dec 1974
Purdue	Submit proposal for a new contract to continue the work of Contract csd/1175, with emphasis on the incorporation of genes for high protein and high lysine into types having broad adaptation, good agronomic character and acceptable grain types; to establish an evaluation program with cooperators in as many areas as possible; to intensify the study of the role of tannins and how to eliminate their deleterious effect on the nutritive quality of the grain and, simultaneously, to explore means of reducing bird damage in low-tannin sorghum.	1 Nov 1974
Purdue	Prepare, jointly with the maize research project, a proposal for a Basic Ordering Agreement.	1 Nov 1974
AID	Recommend to other AID research contracts the sorghum project's <u>Research Progress Report</u> as a rapid means of dissemination of research information in advance of formal journal publication.	1 Nov 1974

D. REPLANNING REQUIRES							E. DATE OF MISSION REVIEW	
REVISED OR NEW:	<input type="checkbox"/> PROP	<input type="checkbox"/> PIP	<input type="checkbox"/> PRO AG	<input type="checkbox"/> PIO/T	<input type="checkbox"/> PIO/C	<input type="checkbox"/> PIO/P		
PROJECT MANAGER: TYPED NAME, SIGNED INITIALS AND DATE Russell Desrosiers <i>RD</i> 10 Oct 1974				MISSION DIRECTOR: TYPED NAME, SIGNED INITIALS AND DATE Leon F. Hesser <i>LH</i> 10/21/74				

Narrative re Inheritance and Improvement of Protein Quality and Content  
of Sorghum Bicolor (L) Moench - Purdue Research Foundation,  
Contract AID-csd-1175

The sorghum research program is progressing in a satisfactory manner. Progress towards the achievement of the original objectives of the project is very good, as shown below.

1. Identify Sorghum Lines with Improved Protein Quality and Quantity Utilizing Both Chemical and Biological Methods.

Excellent progress has been made towards the achievement of this objective.

Uniform yield trials of sets of 21 selected lines, plus three commercial hybrids as controls, have been sent to cooperators around the world and to several locations in the United States. Entries in these trials have been chosen for protein yield, potential, diversity of phenotypes, origin, and potential for adaptation to various environments with a range of height and length of growing season. This program, started in 1972, is now entering its fourth year and has revealed a number of lines which maintain a consistently high level of protein in different environments and lines which display wide adaptability. These selections of wide adaptability are potentially useful as normal phenotypes which can be improved by introduction of the high lysine character.

A search of the world sorghum collection for high lysine mutants has revealed two which possess a soft endosperm characteristic resembling that of the Opaque-2 gene in maize. In addition, an attempt has been made to induce high-lysine mutants by chemical means. This has resulted in several additional mutants, at least one of which looks promising for high-lysine. A further search is being prosecuted, using the recently developed ninhydrin test for free amino acids, for high-lysine mutants having a hard endosperm, rather than the more typical soft endosperm. Because the ninhydrin test can be used rapidly in the field, this search was carried to Ethiopia where a considerable collection was made of promising types. These have been established in India at ICRISAT and in Lebanon at ALAD where they are under study. The collection could not be brought into the United States because of the presence of smut spores on the seed.

In addition to the high lysine mutations, sugary, waxy, and high amylose mutations similar to the corresponding mutations in maize have been found.

The effect of the high-lysine mutants, and their value in the diet of monogastric animals, have been verified by chemical and biological methods using isonitrogenous feeding experiments on weanling rats.

2. Identify the Chemical Nature and Composition of the Protein Fractions of Selected Sorghum Genotypes and Correlate the Grain Fraction Composition with Nutritional Quality.

The shift in amino acid pattern for the soft endosperm, high-lysine mutants is comparable to that in the Opaque-2 mutant in maize. Lysine, arginine, aspartic acid, glycine and tryptophan are consistently higher. Rat-feeding experiments demonstrate that the high-lysine sorghum is superior to normal sorghum in feeding value and equal to Opaque-2 maize.

3. Ascertain the Role of Various Chemical Components of Sorghum Grain such as Polyphenols (Tannins), Protein Quality and Carbohydrate Availability in Monogastric Animal Nutrition.

The determination of the role of tannins in their effect on the nutritive quality of sorghum is one of the more spectacular achievements of the project. Tannins have been shown to tie up and render unavailable the protein present in the grain. This has been conclusively demonstrated by nutrition experiments with rats and chicks. The addition of methionine has been shown to overcome the tannin effect with chicks but not with rats and will not overcome the effect of added commercial tannins. The methionine is not, in this instance, acting as an amino acid. The tannin forms a complex with the protein, rendering it unusable by the animal. To correct this to a level of nutritional effectiveness for the animal, a quantity of complete protein would have to be added. It is believed that the tannins may interfere with more than protein digestion. This problem is still under study.

4. Determine the Mechanism of Inheritance of High Nutritional Quality and Develop Breeding Methods and Materials Including Populations with Improved Biological Quality for Potential Utilization in Developing Countries.

The high-lysine mutations thus far studied seem to be controlled by a single recessive gene, with the exception of

4.

P-721, one of the chemically induced mutations, which is a partial dominant and segregates in a 1-1 ratio, as contrasted with the 3-1 segregation ratio of the single recessive. The development and testing of tropical and temperate populations containing these genes is in progress.

5. Disseminate Research Information and Germplasm with Superior Nutritional Quality for Utilization in the LDCs.

Excellent cooperation is maintained with other U. S. institutions working on sorghum and with ICRISAT, ALAD and other regional and national programs in the LDCs.

The discovery of high-lysine genes in sorghum has attracted considerable attention and requests for seed are constantly being received.

Research results are regularly published in a series of journal articles. In addition, a Research Progress Report is being released annually by the project, in addition to the annual report. This publication, which contains technical papers in their entirety and is a vehicle for the rapid, pre-publication, release of research results, has been well received and is now published in an edition of 1200 and distributed worldwide. This is an interesting and very useful innovation of the project which should be recommended to the other AID-sponsored research projects.

The project has eight graduate students in training at the present time.

An International Sorghum Workshop, organized in cooperation with the University of Nebraska, Texas A&M University and the University of Puerto Rico is scheduled to be held at Mayaguez, Puerto Rico in January of 1975.