

9310471-80  
PD-AAC-804

13p

**COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION**

AGENCY FOR INTERNATIONAL DEVELOPMENT NEGOTIATED CONTRACT NO. AID/ta-C-1093

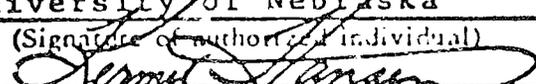
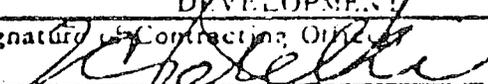
NEGOTIATED PURSUANT TO THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED, AND EXECUTIVE ORDER 11223	TOTAL ESTIMATED CONTRACT COST \$958,500 (See Articles V and VII)
CONTRACT FOR: Improvement of Nutritional Quality of Wheat PROJECT NO: 931-17-130-471-73	CONTRACTOR (Name and Address) Board of Regents NAME University of Nebraska College of Agriculture
ISSUING OFFICE (Name and Address) Agency for International Development Office of Contract Management Central Operations Division Washington, D. C. 20523	STREET ADDRESS Lincoln, Nebraska 68503 CITY, STATE, AND ZIP CODE
ADMINISTRATION BY CM/COD/TAB	COGNIZANT SCIENTIFIC/TECHNICAL OFFICE TA/AGR
MAIL VOUCHERS (Original and 3 copies) TO: Agency for International Development Office of Financial Management Washington, D. C. 20523	ACCOUNTING AND APPROPRIATION DATA PROJECT NO. 931-17-130-471-73-3147565 APPROPRIATION NO. 72-1141004 ALLOTMENT NO. 454-31-099-00-22-41
EFFECTIVE DATE MAY 21 1974	ESTIMATED COMPLETION DATE March 31, 1977

The United States of America, hereinafter called the Government, represented by the Contracting Officer executing this Contract, and the Contractor, an educational institution chartered by the State of Nebraska with its principal office in Lincoln, Nebraska, agree that the Contractor shall perform all the services set forth in the attached Schedule, for the consideration stated therein. The rights and obligations of the parties to this contract shall be subject to and governed by the Schedule and the General Provisions. To the extent of any inconsistency between the Schedule and the General Provisions and any specifications or other provisions which are made a part of this contract, by reference or otherwise, the Schedule or the General Provisions shall control. To the extent of any inconsistency between the Schedule and the General Provisions, the Schedule shall control.

CERTIFIED A TRUE COPY THIS

21<sup>st</sup> DAY OF June, 1974  
 BY Denise Colburn

This Contract consists of this Cover Page, the Table of Contents, and the Schedule consisting of \_\_\_\_\_ pages, the General Provisions (Form AID 1420-23C), dated 9-73, and Additional General Provisions (Form AID 1420-23D dated 9-73).

NAME OF CONTRACTOR Board of Regents of the University of Nebraska BY (Signature of authorized individual)  TYPED OR PRINTED NAME Kermit Hansen TITLE Chairman DATE May 31, 1974	UNITED STATES OF AMERICA AGENCY FOR INTERNATIONAL DEVELOPMENT BY (Signature of Contracting Officer)  TYPED OR PRINTED NAME V. C. Perelli CONTRACTING OFFICER DATE May 1974
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**SCHEDULE**  
**COST REIMBURSEMENT CONTRACT WITH**  
**AN EDUCATIONAL INSTITUTION**

**TABLE OF CONTENTS**

**SCHEDULE**

The Schedule, on pages 1 through 11, consists of this Table of Contents and the following Articles:

- Article I - Statement of Work
- Article II - Key Personnel
- Article III - Changes in Research Methods, Procedures, Objectives, or Phenomena Under Study
- Article IV - Period of Contract Services
- Article V - Estimated Contract Cost and Financing
- Article VI - Budget
- Article VII - Advance Understanding on Payment of Fixed Amount for Administrative Expenses in Lieu of Overhead
- Article VIII - Anticipatory Costs
- Article IX - Special Provisions
- Article X - Modifications to the General Provisions and/or Additional General Provisions

**GENERAL PROVISIONS**

1. The General Provisions applicable to this contract consist of form AID 1420-23C entitled "General Provisions - Cost Reimbursement Contract with an Educational Institution," dated 9-73, which includes provisions 1 through 37; and form AID 1420-23D entitled "Additional General Provisions - Cost Reimbursement Contract with an Educational Institution," dated 9-73, which includes provisions 1 through 18.

## SCHEDULE

### ARTICLE I - Statement of Work

A. Objectives - The purpose of this contract is to continue the research project previously accomplished under Contract No. AID/csd-1208. The principal objective of this project is to develop improved varieties of wheat having superior protein content and quality adapted to use in the LDCs.

B. Scope of Work - For a period as hereinafter set forth in the Schedule, the Contractor shall make available and employ its research and development facilities and personnel to develop and improve the nutritional quality of wheat through increased protein content and improved amino acid balance.

Contractor's project activities will be international in scope. There will be emphasis on breeding and field activities to make wheat better nutritionally. Field activities will concentrate on selection and evaluation of productive winter wheat varieties with broad adaptation and high nutritional value. Laboratory activities will emphasize analytical information on breeding populations and development of effective techniques and procedures for efficient and rapid selection of wheats with improved nutritional quality.

Contractor's International Winter Wheat Performance Nursery will be maintained and utilized as an effective vehicle for worldwide evaluation of new nutritionally improved wheat varieties. Acquisition of more complete data on environmental and soil factors by nursery cooperators will be encouraged to enable development of

performance prediction equations and increase the value of the nursery.

Established genetic sources of high protein and/or high lysine in wheat will be utilized in new hybrid combinations to achieve higher levels of these nutritionally important traits in productive widely adapted wheat varieties. Mass genetic re-combinations in selected composites of wheats with unusual and useful nutritional traits will be achieved with continued use of chemical male gametocides. Rapid and effective screening methods for identification of nutritionally superior wheats, including the use of key enzymes of protein synthesis in the wheat plant, will be sought.

Contractor will organize international workshops and conferences as appropriate for wheat cooperators from developing countries to aid in the dissemination of new useful information from the project research and to promote effective utilization of new materials. A Latin American Winter Wheat Workshop will be planned in 1974 and a second International Winter Wheat Conference in Eastern Europe is anticipated for 1975.

New potentially useful wheat stocks from the Nebraska research program will be systematically disseminated to developing countries for evaluation and use. Contractor will maintain cooperation and effective communications with wheat researchers in international organizations and in developing countries by frequent on-site visits by project personnel.

Contractor will conduct small animal and human bioassays on new wheat materials emanating from the project to firmly establish

their relationship to one another and the validity of chemical laboratory analyses of protein and lysine as an indication of nutritional value in wheat.

The site or sites of the high protein and/or high lysine effects in the wheat kernel will be established by kernel fractionation studies. Such information is necessary to project the contributions of high protein and high lysine wheats to the nutritional status of people in countries employing different wheat milling and processing systems.

The Contractor's wheat research team will provide laboratory and field training to wheat technicians from developing countries as the need arises and circumstances permit.

New and useful research information developed under this contract will be promptly disseminated via appropriate reports and publications.

C. Plan of Work (April 1, 1974 to March 31, 1975) -

1. Continue the International Winter Wheat Performance Nursery and Preliminary Nursery to identify varieties with superior performance and adaptation characteristics. Obtain analytical data for protein and lysine on all samples and subject selected samples to a nutritional evaluation.

2. Continue protein and lysine analyses of promising hybrid populations to identify lines with superior protein and amino acid properties.

3. Test the influence of environment and wheat production practices on the nutritional value of wheat.

4. Identify differences in kernel components and protein fractions of varieties differing in protein and amino acid composition.
5. Make new hybrid combinations to achieve improved levels and/or combinations of protein and lysine.
6. Determine the most effective selection criteria for identification of wheat varieties with the highest nutritional value and potential for breeding purposes.
7. Continue the use of mouse feeding to identify samples which exhibit differences in protein value.
8. Organize feeding study on wheat to determine the usefulness and relationship of such test animals as the mouse, rat, chick, and humans for measuring the nutritional value of wheat.
9. Make available to developing countries wheat varieties and lines with improved productivity and nutritional value.
10. Exchange genetic stocks, experimental lines, and research information with other organizations engaged in international agricultural activities, such as CIMMYT, FAO, IAEA, Oregon State University, and Purdue University to insure most rapid progress in the nutritional improvement of wheat.
11. Continue the enforced hybridization program in wheat involving the use of chemical male gametocides to accelerate the development of genetic re-combinations with superior protein levels and composition.
12. Compare the influence of nutrition on high and low

13. Determine lysine availability and protein digestibility using available new procedures.

14. Screen diploid wheats in the World Collection for protein and lysine differences.

15. Screen and select individual segregating wheat seedlings for key enzymes of protein synthesis.

16. Evaluate levels of in vivo and in vitro nitrate reduction of selected wheats.

17. Make on-site inspections of IWWP nurseries and consult with AID Mission, FAO, and CIMMYT personnel in developing countries.

18. Study interaction of surfactants and growth regulators in protein metabolism of wheat.

19. Publish research results.

D. Reports - Contractor will provide 100 copies of the following reports:

1. Research Annual Report which will be submitted in accordance with the format (Guidelines for Preparation of the Research Annual Report) attached hereto and made a part hereof.

2. Mimeographed annual preliminary report on International Winter Wheat Performance Nurseries results.

3. Printed annual final report on International Winter Wheat Performance Nurseries results.

4. Research Bulletins containing research results to be submitted on an interim basis as deemed appropriate.

ARTICLE II - Key Personnel

A. The key personnel which the Contractor shall furnish for the performance of this contract are as follows:

Key Personnel:

V. Johnson

P. Mattern

B. The personnel specified above are considered to be essential to the work being performed hereunder. Prior to making any change in the key personnel, the Contractor shall notify the Contracting Officer reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on the program. The listing of key personnel may, with the consent of the contracting parties, be amended from time to time during the course of the contract to either add or delete personnel, as appropriate.

ARTICLE III - Changes in Research Methods, Procedures, Objectives Or Phenomena Under Study -

A. The Contractor may change the methods and procedures employed in performing the research without making special reports on proposed actions or obtaining A.I.D. approval. However, significant changes in methods or procedures shall be reported to the Government in periodic or final technical reports. In the event the methodology or experiment is stated as a specific objective of the research work, any changes to either fall within the scope of paragraph B. below.

B. The stated objectives of the research effort shall not be changed, except with the prior approval of the Contracting Officer.

C. The phenomenon or phenomena under study i.e., the broad category of research, shall not be changed except with the prior approval of the Contracting Officer.

ARTICLE IV - Period of Contract Services

The effective date of this Contract is the execution date by the Contracting Officer, and the estimated completion date of work, including final report(s), under this Contract is March 31, 1977.

ARTICLE V - Estimated Contract Cost and Financing

The Contractor will be reimbursed for the costs incurred by him in performing services hereunder in accordance with the applicable provisions of the Schedule and the General Provisions, subject to the following limitation made in respect thereto:

A. Total A.I.D. dollar funds available for payment and allotted to this Contract. See the clause of the General Provisions entitled "Limitation of Funds" and the article of the Schedule entitled "Budget".

\$319,500

B. Estimated additional funds which may be provided, if funds are available. See the clause of the General Provisions entitled "Limitation of Funds" and the article of the Schedule entitled "Budget".

\$639,000

Total Estimated Contract Cost

\$958,500

ARTICLE VI - Budget

<u>Line Item No.</u>	<u>Funds Available (i.e., Obligated)</u> <u>From: 4/1/74</u> <u>To: 3/31/75</u>	<u>Estimated Additional Cost to Completion</u> <u>From: 4/1/75</u> <u>To: 3/31/77</u>	<u>Total Estimated Contract Costs</u>
1. Direct Salaries and Wages:			
a. Professionals	\$58,000	\$86,677	\$144,677
b. Non-professionals	111,900	243,745	355,645
	<u>\$169,900</u>	<u>\$330,422</u>	<u>\$500,322</u>
2. Fringe Benefits	14,000	31,500	45,500
3. Equipment	5,000	10,000	15,000
4. Materials and Supplies	6,600	15,078	21,678
5. Small Animals and Analytical Laboratory Charges	22,500	45,000	67,500
6. Computer Charges	2,500	5,000	7,500
7. Yuma, Arizona Nursery Charges	6,000	12,000	18,000
8. Shipping seed for International Nurseries	5,000	12,000	17,000
9. Publication Costs	10,000	15,000	25,000
10. Travel & Transportation (including subsistence)	<u>4,000</u>	<u>15,000</u>	<u>19,000</u>
/ TOTAL ESTIMATED DIRECT COSTS	\$245,500	\$491,000	\$736,500
11. Fixed Amount for Administrative Expense	74,000	148,000	222,000
GRAND TOTAL	\$319,500	639,000	\$958,500

The "Funds Available" column represents the total funds authorized to be expended by the Contractor during the period indicated (see the article of the Schedule entitled "Estimated Contract Cost and Financing" and the clause of the General Provisions entitled "Limitation of Funds"). Total contract expenditures shall not exceed the grand total of the funds available.

Within the grand total, the Contractor may adjust individual Line Item amounts up to 15% with the exception of Line Item No. 11. Any Line Item adjustment in excess of 15% shall require written Contracting Officer approval.

The Contractor also agrees to furnish data which the Contracting Officer may request on costs expended or accrued under the Contract in support of the budget information provided herein.

ARTICLE VII - Advance Understanding on Payment of Fixed Amount For Administrative Expenses In Lieu Of Overhead

The parties agree on the following advance understanding:

1. The allowable direct costs of this contract have been identified in Line Item 1 through 10, inclusive, of the Budget contained in Schedule Article VI. All other costs incurred by the Contractor for the performance of this contract are considered to be indirect costs.

2. In lieu of reimbursement for indirect costs allocable to the performance of this contract, the Contractor shall be paid the following fixed non-accountable amounts:

First Year	-	\$ 74,000
Second Year	-	74,000
Third Year	-	<u>74,000</u>
		\$222,000

3. Payment of the amounts specified in 2 above shall be made in installments equal to the ratio of vouchered allowable direct costs to the total estimated direct costs.

4. The amounts shown for the second and third years in paragraph 2

ARTICLE VIII - Anticipatory Costs

The allowable cost of performance of this Contract shall include all allowable costs which have been incurred by the Contractor in anticipation of this contract on or after April 1, 1974, but prior to the execution date hereof, and which, if incurred after the date of this Contract would have been considered as items of allowable and allocable costs, provided, however, that such anticipatory costs shall not exceed \$50,000 unless such amount is subsequently increased in writing by the Contracting Officer.

ARTICLE IX - Special Provision

Prior to making any visits to LDCs, the Contractor will review his plans with TA/AGR, Contractor will keep AID Missions in countries to be visited fully informed of proposed visits, ask them to provide any advice they wish regarding timing and content of the visits and to participate if they desire, and will inform the Missions of the outcome of consultations. Contractor will make his own appointments and logistics arrangements directly. Upon completion of any project funded travel, a copy of the trip report will be provided to the TA/AGR Project Manager. The report format will be established jointly by the Contractor and the Project Manager.

ARTICLE X - Modifications To The General Provisions And/Or Additional General Provisions

The following modifications have been made to the General

Provisions which form a part of this contract.

1. In accordance with paragraph (a) of Additional General Provision No. 3, entitled "Personnel", whereunder the Contractor may not send individuals outside of the United States to perform work under the contract without the prior written approval of the Contracting Officer, the Contracting Officer does, hereby, provide said approval for those individuals required to travel outside the United States; provided however, that concurrence with the assignment and/or travel of any and all said individuals outside the United States is obtained, in writing, from the Cognizant Technical Office of A.I.D. prior to their assignment and/or travel abroad.

This approval by the Contracting Officer, shall not apply to any other clause or provision of this Contract which specifically requires Contracting Officer approval.

UNITED STATES GOVERNMENT

# Memorandum

9310471-9  
PO-AAC-804

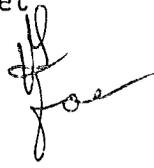
38

U

TO : TA/PM, Mr. Alfred Bisset

DATE: March 27, 1974

FROM : TA/AGR, Omer J. Kelley



SUBJECT: BOA - Improvement of the Nutritional Quality of Wheat through Increased Protein Content and Improved Amino Acid Balance

This memorandum forwards the subject PIO/T request for a BOA with the University of Nebraska for a period of 12 months, 4/1/74 - 3/31/75. This Basic Ordering Agreement should serve as a mechanism whereby the University of Nebraska will furnish technical assistance to AID, upon request from AID/W or AID missions. The specifics of such requests should be implemented in the form of Task Orders under this Basic Ordering Agreement.

When this PIO/T is signed, please have a copy forwarded to TA/AGR Program Office.

Enclosures: a/s



*Extra*

AID 1350-1X (7-71)	DEPARTMENT OF STATE AGENCY FOR INTERNATIONAL DEVELOPMENT	1. Cooperating Country Worldwide	Page 1 of Pages
		2. PIO/T No. 931-17-130-471	3. <input type="checkbox"/> Original or Amendment No. _____
PIO/T	PROJECT IMPLEMENTATION ORDER/TECHNICAL SERVICES	4. Project/Activity No. and Title Improv. of the Nutritional Quality of Wheat through Increased Protein Content & Improv. Amino Acid Balance	

DISTRIBUTION	5. Appropriation Symbol	6.A. Allotment Symbol and Charge	6.B. Funds Allotted to: <input type="checkbox"/> A.I.D./W <input type="checkbox"/> Mission		
	7. Obligation Status <input type="checkbox"/> Administrative Reservation <input type="checkbox"/> Implementing Document		8. Funding Period (Mo., Day, Yr.) From _____ To _____		
	9.A. Services to Start (Mo., Day, Yr.) Between <u>4/1/74</u> and _____		9.B. Completion date of Services (Mo., Day, Yr.)		
	10.A. Type of Action <input type="checkbox"/> A.I.D. Contract <input type="checkbox"/> Cooperating Country Contract <input type="checkbox"/> Participating Agency Service Agreement <input checked="" type="checkbox"/> Other Basic Ordering Agr.				
	10.B. Authorized Agent AID/W				

Estimated Financing		(1)	(2)	(3)	(4)
		Previous Total	Increase	Decrease	Total to Date
\$1.00-					
11. Maximum A.I.D. Financing	A. Dollars				
	B. U.S.-Owned Local Currency				
12. Cooperating Country Contributions	A. Counterpart				
	B. Other				

13. Mission References

14. Instructions to Authorized Agent  
 This PIO/T requests the AID Contracting Office to negotiate the terms and conditions of a Basic Ordering Agreement with the University of Nebraska for a period of 12 months, 4/1/74-3/31/75. This Basic Ordering Agreement should serve as a mechanism whereby the University of Nebraska will furnish technical assistance to AID, upon request from AID/W or AID missions. The specifics of such requests should be implemented in the form of Task Orders under this Basic Ordering Agreement. The nature and kinds of technical services that the contractor might provide are detailed in the attached Scope of Technical Services.

TA-BOA-1137      TA-C-1093

15. Clearances - Show Office Symbol, Signature and Date for all Necessary Clearances.

A. The specifications in the scope of work are technically adequate R. Lesrosier, TA/AGR <i>[Signature]</i> Date: 3/27/74	B. Funds for the services requested are available
C. The scope of work lies within the purview of the initiating and approved Agency Programs G.J. Kelley, TA/AGR <i>[Signature]</i> Date: 3/26/74	D. <i>[Signature]</i> R. Lindsay, TA/PM Date: 4/2/74
E. R. Holmes, TA/AGR <i>[Signature]</i> Date: 3/26/74	F. M. Mozynski, TA/PM <i>[Signature]</i> Date: 4/8/74

16. For the cooperating country: The terms and conditions set forth herein are hereby agreed to	17. For the Agency for International Development <i>[Signature]</i> Signature: A. Basset Title: Deputy Director, TA/PM	18. Date of Signature
Signature and date: _____		
Title: _____		

## Scope of Technical Services

The contractor will provide a number of technical services. Services may include but not be limited to:

1. Providing leadership and technical assistance for existing wheat breeding and production programs aimed at the early identification and utilization of high-yielding winter wheat varieties with improved nutritional quality in a double-cropping system with rice.
2. Providing technical leadership and assistance to the development and improvement of existing wheat quality laboratories as effective integrated service facilities for the continuing agronomic and nutritional improvement of wheat.
3. Assessing the need for nutritional studies involving wheat, nutritional problems related to wheat consumption, and initiate appropriate field studies and demonstrations designed to promote varieties, practices, and utilization of wheat that would enhance the nutritional status of people.
4. Undertaking training and educational activities to improve capabilities of local technicians in promoting wheat improvement and improved nutrition, and to improve their understanding of problems and their effectiveness in dealing with them.
5. Providing any technical assistance needed for seed production, commercial production, storage, distribution, milling and utilization.
6. An advance team determining the acceptability of University activities aimed at nutritional improvement of wheat to the governments and international organizations engaged in wheat improvement.
7. Assignment of a technician to one of the wheat research centers-- to supervise the flow of Nebraska wheat stocks to the region, local evaluation of such stocks, and appropriate laboratory analyses.
8. Identifying nutritional problems associated with wheat consumption in the region and devising and conducting appropriate field and laboratory activities designed to improve the nutritional status of the people.

Reporting requirements will be specified by requesting missions. University of Nebraska could provide expertise that anyone in AID could tap for surveys, technical advice/assistance, recommend actions, reports, etc. Each Task Order would be filled on a case-by-case basis.

AID 1350-1X  
(7-71)  
  
PIO/T

DEPARTMENT STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT  
  
PROJECT IMPLEMENTATION  
ORDER/TECHNICAL  
SERVICES

1. Cooperating Country  
TA/Bureau 32.500  
2. PIO/T No.  
931-17-130-471md3  
4. Project/Activity No. and Title  
Genetic Improvement of Productivity and  
Nutritional Quality of Wheat

Page 1 of 7 Pages  
3.  Original or Amendment No. 9310471-10  
PD-ARC-804  
18p

DISTRIBUTION

5. Appropriation Symbol  
72-11X1023  
6.A. Allotment Symbol and Charge  
402-31-099-00-22-64  
6.B. Funds Allotted to:  
 A.I.D./W  Mission  
7. Obligation Status  
 Administrative Reservation  Implementing Document  
8. Funding Period (Mo., Day, Yr.)  
From 7/1/75 To 3/31/76  
9.A. Services to Start (Mo., Day, Yr.)  
Between 7/1/75 and ---  
9.B. Completion date of Services  
(Mo., Day, Yr.) 3/31/78  
10.A. Type of Action  
 A.I.D. Contract  Cooperating Country Contract  Participating Agency Service Agreement  Other  
10.B. Authorized Agent  
AID/W

Estimated Financing		(1) Previous Total	(2) Increase	(3) Decrease	(4) Total to Date
\$1.00-					
11. Maximum A.I.D. Financing	A. Dollars		208,000		208,000
	B. U.S.-Owned Local Currency				FUNDS RESERVED BY
12. Cooperating Country Contributions	A. Counterpart				POSTED 7/31/75
	B. Other				SERVICES

13. Mission  
References

14. Instructions to Authorized Agent  
This PIO/T authorizes the Contract Office to amend the present contract No. AID/ta-c-1093 by adding to the scope of work, providing funds for the increase in services requested and extend the completion date for an additional year. The proposed plan of work for the additional research is shown in Block 19B and continuation sheet. A budget estimate is given in Attachment I totaling \$208,000. Other provisions of the existing contract remain the same.  
  
The RAC Meeting of May 8-9, 1975 approved a three-year extension of this research project from 4/1/75 to 3/31/78 including the increase in funding and the amplified scope of work.

15. Clearances - Show Office Symbol, Signature and Date for all Necessary Clearances.

A. The specifications in the scope of work are technically adequate  
TA/AGR, RDesrosiers Date: 7/11/75  
TA/AGR, W. H. Garman Date: 7/11/75  
B. Funds for the services requested are available  
TA/RES, MRehcigl Date: 7/11/75  
C. The scope of work lies within the purview of the initiating and approved Agency Programs  
TA/AGR, CSaird Date: 7/11/75  
TA/AGR, LFesser Date: 7/11/75  
D.  
TA/PPU/PPA, CMolfetto Date: 7/11/75  
E.  
TA/AGR, RHolmes Date: 7/11/75  
F.  
TA/PN, MMozyński Date: 7/11/75

16. For the cooperating country: The terms and conditions set forth herein are hereby agreed to  
  
Signature and date:  
  
Title:

17. For the Agency for International Development  
  
Signature: John Gunnig  
Chief, PRODUCTION and ANALYSIS DIVISIONS and (TA/PPU/PPA)

18. Date of Signature  
7/31/75

AID 1350-1X 19-701	Cooperating Country TA/Bureau	PIO/T No.	Page 2 of 7 Pages
PIO/T	Project Activity No. and Title Genetic Improvement of Productivity and Nutritional Quality of Wheat		

SCOPE OF WORK

19. Scope of Technical Services

A. Objective for which the Technical Services are to be Used To find means of improving the performance and yield of the wheat plant so that it will perform with the greatest possible efficiency in terms of energy consumption per unit of grain yield. To achieve this the contractor will:

1. Identify agronomically and nutritionally superior broadly adapted winter wheat varieties and study the influence of soil and environmental factors on yield and quality of the varieties in the International Winter Wheat Performance Nursery;
2. Study the roles of nitrogen metabolism and photosynthetic efficiency in increased productivity and improved nutritional value of wheat to enable improved efficiency of selection for these complex traits; and
3. Determine the potential and limitations of nitrogen-fixing microorganisms for increased nitrogen utilization by wheat and enhancement of its productivity and nutritional value by means of studies of associative symbiotic nitrogen fixation.

B. Description (Continuation Sheet)

C. Technicians (1) (a) Number (b) Specialized Field (c) Grade and or Salary (d) Duration of Assignment (Man-Months)

N/A

(2) Duty Post and Duration of Technicians' Services

N/A

(3) Language requirements

N/A

(4) Access to Classified Information

N/A

(5) Dependents

Will

Will Not

Be Permitted to Accompany Technician

N/A

D. Financing of Technical Services

(1) By AID - \$ 118,146

(2) By Cooperating Country -



AID J350-1X  
(8-70)

Cooperating Country

PIO/T No.

Page 4 of 7 Pages

PIO/T

TA/Bureau

Project Activity No. and Title

Genetic Improvement of Productivity and Nutritional Quality of Wheat

22. Reports by Contractor or Participating Agency (Indicate type, content and format of reports required, including language to be used if other than English, frequency or timing of reports, and any special requirements)

- A. Semiannual fiscal reports - 5 copies
- B. Annual report of research progress - 35 copies

23. Background Information (Additional information useful to Authorized Agent and Prospective Contractors or Participating Agency; if necessary cross reference Block 19.C(4) above.)

N/A

24. Relationship of Contractor or Participating Agency to Cooperating Country and to AID

N/A

A. Relationships and Responsibilities

B. Cooperating Country Liaison Official

C. AID Liaison Officials

CONTINUATION  
SHEET

FORM SYMBOL

PIO/T

DEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT Worksheet  Issuance

PAGE 5 OF 7 PAGES

1. Cooperating County  
TA/Bureau

2.a. Code No.

2.b. Effective Date

2.c. Amendment  
 Original OR No: \_\_\_\_\_

TITLE OF FORM

Project Implementation Order/  
Technical Services

3. Project/Activity No. and Title

Genetic Improvement of Productivity and  
Nutritional Quality of WheatIndicate block  
numbers.  
19 B

Use this form to complete the information required in any block of a PIO or PA PR form.

Description1. Influence of Soil and Environment.

Comprehensive study of the influence of soil and environmental factors on the yield and quality of varieties in the MWPN will be undertaken at selected nursery sites. Soil chemical and physical factors that may influence yield and quality of wheat will be measured and correlated with performance, quality, and plant analysis data to uncover useful relationships and interactions between varieties and production factors that would provide a sound basis for continued improvements in yield and quality.

2. Nitrogen Metabolism and Photosynthetic Efficiency.a. Nitrogen Metabolism

Identify wheats that are most efficient in taking up and reducing nitrate under optimal and suboptimal nitrate environments and elucidate the processes involved using established techniques for measuring nitrate content and nitrate reductase activity in leaf and stem tissue.

Identify wheats capable of synthesizing large amounts of vegetative protein.

Identify wheats with greatest capacity for translocating large amounts of vegetative protein to the grain for final protein synthesis using newly developed instrumentation for measurement of true protein in vegetative tissue and in the grain.

b. Plant Loss of Nitrogen

Maximum utilization of available soil nitrogen by the wheat plant is essential. Measurements of plant nitrogen frequently suggest unexplained losses of nitrogen from the plant system.

Research will be initiated to determine how, when, and where nitrogen escapes from the wheat plant and what factors influence the magnitude of this loss. Special transparent, gas-tight chambers will be constructed to maintain environ-

CONTINUATION  
SHEET

FORM SYMBOL

PIO/T

DEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT

TITLE OF FORM

Project Implementation Order/  
Technical Services Worksheet Issuance

PAGE 6 OF 7 PAGES

1. Cooperating County  
TA/Bureau

2.a. Code No.

2.b. Effective Date

2.c. Amendment  
 Original OR No: \_\_\_\_\_3. Project/Activity No. and Title  
Genetic Improvement of Productivity and  
Nutritional Quality of WheatIndicate block  
numbers.  
19 B

Use this form to complete the information required in any block of a PIO or PA/PR form.

## 2. (Cont.)

c. Photosynthetic Efficiency

Characterize photosynthetically active radiation (visible light) interception efficiency and distribution patterns by wheat canopies that vary phenotypically and utilize this information for more efficient genetic selection of productive new wheats and development improved management systems.

Evaluate photosynthetic efficiency as influenced by different combinations of day-night temperature effects on night-respiration and the balance between photosynthesis and photo-respiration during the day.

Investigate wheat plant senescence in relation to phytohormone changes to establish the opportunity for extending the period of active photosynthesis in the wheat plant to make it more productive.

3. Associative Symbiotic Nitrogen Fixation

Associative symbiotic nitrogen-fixing relationships between specific microorganisms and cereal grasses have been demonstrated by Dr. Dobereiner in Brazil. They have the potential for being extremely important in the nitrogen utilization of wheat and enhancement of its productivity and nutritional value.

Samples consisting of roots of the various wheat species and forms plus the surrounding soil will be collected throughout Nebraska and surrounding states initially and from wheat production sites in developing countries, as opportunity permits in the 1975 crop season. Samples will be assayed for acetylene reduction (nitrogenase activity).

Wherever feasible, the assays will be done in situ because of the sensitivity of nitrogenase activity to environmental changes. Greenhouse experiments will be included to extend the research.

When and if positive samples are found, location (intra or extra cellular), identity, and efficiency ( $N_2$  fixed/carbon source consumed) of the nitrogen-fixing microorganism(s) will be determined.

CONTINUATION  
SHEETDEPARTMENT OF STATE  
AGENCY FOR  
INTERNATIONAL DEVELOPMENT Worksheet  Issuance

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19B

3. (Cont.)

Close communication in the form of sharing of information and biological material, will be established and maintained with Dr. Dobereiner and coworkers. Dr. Dobereiner will be invited to the University of Nebraska for a 2-week period at an appropriate time in 1975 for consultation and information exchange.

21D

(Cont.)

A progress report will be submitted at the end of two years with special emphasis on the contribution and further potential of the genetic and plant breeding phases, followed by revision of the project with AID technical staff to reflect the required modifications.

BUDGET SUMMARY

Technicians	\$30,080	
Research Associates	26,750	
Graduate Assistants	9,000	
Student Labor	8,000	
Payroll Costs	4,816	
Travel	13,500	
Supplies, Maintenance, and Publications	18,300	
Shipping Samples	1,000	
Growth Chambers	28,500	
Proposed Gas Collection Chambers	25,000	
Drying Oven	500	
Foliage Grinder	500	
Protein Analyzer	13,000	
Colorimeter (probe type)	<u>2,700</u>	
	TOTAL	\$181,646
Fixed Fee, Administrative Costs	<u>26,000</u>	
	GRAND TOTAL	\$207,646

BUDGET DETAIL

1. Influence of Soil and Environment (R. Olson)

Materials and Equipment for Field Operations	\$ 2,000
Maintenance, Laboratory Analyses, and Supplies	5,000
Travel	<u>8,000</u>

\$15,000

2. Physiology

a. Nitrogen Metabolism (L. Klepper)

Technician	\$10,000
Student Labor	<u>5,000</u>

\$15,000

Payroll Costs	\$ <u>1,477</u>	1,477
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Equipment. Drying Oven	\$ 500
Foliage Grinder	500
Protein Analyzer	13,000
Colorimeter (probe type)	2,700
Growth Chamber	6,000
Supplies, Maintenance, and Publications	4,500
Travel	<u>1,000</u>

\$28,200

\$44,677

b. Nitrogen Loss (G. Peterson and D. Sander)

Research Associate	14,000
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Payroll Costs	819
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Proposed Gas Collecting Chambers	\$25,000
Supplies	1,000
Travel	<u>1,000</u>

\$41,819

Budget (cont.)

c. Photosynthetic Efficiency (M. Clegg)

Technician	\$10,000	
Graduate Assistants	9,000	
Student Labor	<u>3,000</u>	\$22,000
Payroll Costs		1,287
Growth Chambers	\$22,500	
Maintenance, Supplies, and Publications	1,500	
Travel	<u>1,000</u>	<u>25,000</u>
		\$48,287

3. Symbiotic Nitrogen Fixation (R. Klucas and A. Vidaver)

Research Associate	\$12,750	
Technician	<u>10,080</u>	\$22,830
Payroll Costs		1,233
Maintenance, Supplies	\$4,000	
Shipping Samples	1,000	
Publications	300	
Travel	<u>2,500</u>	<u>7,800</u>
		\$31,863
TOTAL		\$181,646
Fixed Fee, Administrative Costs		<u>26,000</u>
GRAND TOTAL		\$207,646

(Dr. Jack Montgomery, Acting Chairman)

Genetic Improvement of Productivity and  
Nutritional Quality of Wheat - University of  
Nebraska

Dr. Whitney, Chairman of the Subcommittee composed of Drs. Milner, M. Peterson, and Ruttan, reported as follows:

For some ten years, AID has supported the wheat improvement project at the University of Nebraska with cooperation of the USDA. While the overall goal is to develop high-quality, high-yielding wheat adaptable to numerous environments, AID has supported the expansion of research on nutritive quality. In terms of the December 1973 RAC review recommendations of goals as (1) heritable sources of high protein, (2) heritable sources of lysine, and (3) successful combinations with cultivars of acceptable characteristics, the project has been successful. The present review committee is in full agreement that the project has been productive. Encouraging progress has been made on all of the original objectives, and solid contributions to both the food problem and to science have been documented. Over 50 publications have resulted. International conferences in Turkey (1972), Brazil (1974) and Yugoslavia (1975) do much to stimulate interest and promote research world-wide, including developing countries.

The extension proposal contains 7 objectives: (1) genetics and plant breeding, (2) chemical and physical characterization of high-protein and high-lysine lines, (3) international evaluation of breeding, (4) study nitrogen metabolism and photosynthetic efficiency increasing productivity and nutritional value of wheat, (5) potential and limitations of N-fixation

microorganisms for increased nitrogen utilization by wheat, (6) publishing of nutritional data in hand, and (7) strengthen wheat research in LDCs.

(Administrator Parker and Dr. Curtis Farrar joined the RAC proceedings.)

Issues concerning the new proposal: (1) How much further should the genetic and plant breeding phase and the associated extension programs and adaptive activities be carried? (2) What priority should be given to the basic research activities involving the "physiological processes that contribute to improved nutritional value and productivity of wheat including nitrogen metabolism, photosynthetic efficiency, and associative symbiotic nitrogen fixation?"

Little data has been presented that speaks to the utilization of the research results and materials in LDCs. AID's goal is to stimulate world-wide production of high quality wheat wherever produced in order to meet the food needs and especially to help the developing countries to meet their own needs. It would be preferable for LDC scientists to choose their own germ plasm and select varieties adapted to their specific environments. Since improved lines are presently available, RAC should consider whether the breeding component should be phased downward in favor of stepped up breeding efforts in the LDCs.

Physiological process research can be classified largely as "basic research". RAC should address itself to the question of expansion of the research in the physiological and nitrogen fixing areanas as proposed and, if positive, whether it should be done solely at Nebraska with its extensive background in wheat research or at other institutions as well

Dr. Milner quoted from his letter to the Subcommittee Chairman:

Clearly this project has been productive and successful by any criterion which AID applies to such activities. In view of this success he raised the question whether it is not indeed time to bring the AID involvement to a logical conclusion, at least as far as the breeding and extension aspects are concerned. He referenced the earlier RAC conclusions along this line with reference to the maize and sorghum projects. The remaining aspect of emphasis on basic physiological processes has taken too long for recognition. He then referenced the initiation of work at Nebraska in 1966 on Atlas 66. At that time a proposal for a second and parallel project more fundamental in character aimed at studying the intermediary metabolism of Atlas 66 in order to determine why and how it was able to transform soil nitrogen into grain protein so much more efficiently than other wheat species. At that time a proposal to do essentially what the present proposal intends was considered to be too far removed from production agriculture to merit support. This loss of time in supporting work on basic mechanisms is regretted. RAC should consider whether it is not indeed time to phase out the breeding and extension components of this project while at the same time stimulating and expanding the biochemical and physiological nitrogen fixation aspects. If the decision is yes, then the next question is, "Where in addition to Nebraska should such work be supported?" Additionally, when does one terminate an unusually successful and productive project? What is the AID philosophy? We know how to handle unsuccessful projects, but not how to program limited research funds towards competitive demands for support when a major effort has met its objectives. Secondly, can we develop a straightforward decision

process to an appropriate balance between basic and applied work?

This is a basic policy question.

Dr. Ruttan stated his support for the subcommittee position. In his role of work for the RAC he has studied the general problem of an appropriate policy for the support of basic, or supportive, research. The assessment of the potential payoff of basic work may need the best judgment of a group of leading experts to guide program decisions. AID should make a careful assessment of where it wants to go before commitment to this project.

Dr. Whitney reviewed selected comments of Dr. M Peterson's letter as a member of the subcommittee. After noting the accomplishments of the project, he commented that after 10 years he believed that this project has served its usefulness. Other objectives are proposed. The proposed extension should not be approved. Many of the performance nurseries are located in non-developing countries. If AID believes it is in their interest to support the basic research studies, there are others more qualified to do this research. The work proposed involves a long program and major funding. He suggested giving a year or two for an orderly phase out, providing help and development for first rate national programs, turning the international nurseries over to CIMMYT, and building alternate proposal plans more narrowly defined.

Dr. Schweigert commended the subcommittee analysis, and raised a question whether yield figures referred to food availability with protein availability second. Also are wheat processing characteristics and experts involved in this project?

Dr. Leon Hesser, TA/AGR, commented on the important issue of relative emphasis on basic versus applied research as this has been discussed within the Agency. There is a need to look ahead, possibly 20 years, with the recognition of the steadily diminishing stock of basic knowledge. A focus on basic research in the U.S. would complement the problem requirements posed by the International Centers. However, there is some need for a reasonable expectation of payoff for effort within the short-term future. At present the ratio of emphasis for planning purposes is approximately 25% basic and 75% applied.

Dr. Guy Baird, TA/AGR, outlined how this project focuses attention on the role of U.S. institutions on major research problems of LDC agriculture. How best can the resources of developed countries be used to help meet the needs of developing countries to develop their own research capabilities? Consider first, LDC institutions, second, International Centers, and third, U.S. institutions. There is need for the supportive applied research carried out at International Centers as in the case of CIMMYT on spring wheat. There is no equivalent International Center for winter wheat research, and Nebraska performs this function. International Centers look to the U.S. universities for basic research. Nebraska is more deeply staffed than a Center, but there may be a developing need for seeking out more sources for the conduct of basic research. He argued strongly for the continued commitment to support the Nebraska role in the winter wheat program. Dr. Long commented on the role of basic research to the effect that this is not a matter of trade-offs, but rather is intimately related to association with applied

problems. To cut it off is to invite drifting of the activities from potential applications. Dr. Desrosiers pointed out that a 5% increase in the amount of protein is effectively an increase of 35 to 40% increase in the protein content of the grain, and a .6% increase in lysine means a 20% increase in lysine as a percentage of protein.

(Dr. Smuckler returned to take the Chair.)

Dr. Schweigert commented that in answer to his questions he had been advised (1) that the yields were equivalent, so that there is an advantage to the nutritionally superior wheat, and (2) that the Department of Home Economics provides technical assistance on processing characteristics of wheat, that tests are being run in Peru by Dr. Graham on nutritional value, and that there are differences depending on the variety and the use of whole wheat or white flour.

Dr. Whitney in preparation to offering a motion made the following comments for the record but not as a part of the motion to follow. The project should give increased attention to getting existing and new high-protein, high-lysine materials now in the pipeline into the hands of LDC breeders and other research personnel; research in LDCs for variety development be encouraged and that assistance be given to developing strong national programs; that the soil-environmental interactions with varieties in selected International Winter Wheat Nurseries be developed as a basis for transferring information on

lines to other areas; that the project should continue to be involved with the International Wheat Nurseries and maintain the analytical service laboratories for their own and cooperatively provided lines; and that major attention be given mainly to nitrogen metabolism studies because of experience and capability in Nebraska. Parenthetically, if the nitrogen fixing aspects and the photosynthetic phases are considered to be of high priority, separate individual projects might be the best way to proceed.

Motion: That the project be approved for the 3 year period with the recommendation that (1) the photosynthesis aspect and the associated nitrogen fixing aspect be deleted, (2) a progress report be submitted at the end of 2 years, with the special emphasis on the contribution and further potential of the genetic and plant breeding phases, and (3) the project be revised with AID technical staff to reflect these modifications.

Moved by Dr. Whitney

Seconded by Dr. Milner

There was general discussion on the implication of the deletion of the special research with respect to its continuation as a separate project, financial implications, relations with an applied program, inconsistency with AID's interests, limitation to the wheat program, and a need for field testing network capability.

Dr. Adams proposed an amendment to delete the (1) part of the motion. This would return the motion to approval of the original proposal.

Seconded by Dr. Merrill. Vote; unanimous approval. Dr. Whitney agreed to the deletion of the (3) part of the motion since revision is no longer relevant.

Vote: unanimous approval.

Dr. Milner suggested as an agenda item for the June policy meeting:

- (1) Definition of the concept of a successful project, and how long do you carry it on? and
- (2) How do you define basic research in terms of AID needs?